The Quality of Brailled Instructional Materials Produced in Texas Public Schools

Tina S. Herzberg and Laura M. Stough

Abstract: This study analyzed the quality of brailled instructional materials transcribed by 40 public school personnel. The authors calculated the correlation of the certification status of the personnel and the average amount of time spent transcribing per week with the total number of transcription errors. The findings suggest that students who read braille may receive instructional materials that are not equal in quality to those received by their sighted peers.

Federal legislation supports the use of high-quality braille materials for students who are visually impaired (that is, those who are blind or have low vision). The Individuals with Disabilities Education Act (IDEA) first required that literacy instruction in braille be considered for all students who are visually impaired. The 2004 amendments to IDEA also mandated the adoption of the National Instructional Materials Accessibility Standard, a standard to be used in the United States by textbook publishers in the preparation of electronic files so that they are more easily converted into accessible formats, including braille. Although IDEA did not detail how instructional materials should be prepared or delivered by public schools, it required that all students with disabilities be given a free, appropriate public education in the least restrictive environment. For the 5,600 students who read braille across the United States to access the general education curriculum, they must have access to legible and coherent materials (American Printing House for the Blind, n.d.).

Other efforts in the United States and legislation at the state level have supported the use of high-quality braille materials with students who are visually impaired. From the late 1980s to 2002, 32 states passed "braille bills" in response to the growing decline in braille literacy skills among students with visual impairments (Koenig & Holbrook, 2000; Wall & Corn, 2002). These bills were instituted as a result of pressure from consumer and advocacy groups that sought to guarantee that students who are legally blind received appropriate assessment and instruction in braille (Ryles, 1996). Professionals in the field of visual impairment also developed the National Agenda for the Education of Children and Youths with Visual Impairments, Including Those with Multiple Disabilities in 1995. The seventh goal of the National Agenda called for the timely provision of appropriate media, including materials in braille (Corn, Hatlen, Huebner, Ryan, & Siller, 1995; Huebner, Merk-Adam, Stryker, & Wolffe, 2004). These efforts

appear to have been limited in advancing students' achievement in reading. Preliminary results from the five-year longitudinal Alphabetic Braille and Contracted Braille Study (hereafter the ABC Braille Study) indicated that about half the elementary students in the United States read at their grade levels (Wormsley et al., 2008). Similarly, Wall and Corn (2004) reported that only 70% of public school students in Texas who were braille readers were reading at their grade levels.

A few studies have investigated the quality of brailled materials. Corn and Wall (2002) asked respondents to rate the quality of braille materials produced in their state. Although they did not formally define "quality," they specified that *quality* included the components of both formatting and accuracy. Thirty-two respondents from 40 states indicated that the quality of brailled materials in their states was either good or excellent, while respondents from 7 states reported that the quality of their braille materials was fair or poor. However, a direct examination of these materials was not made to ascertain if these perceptions indeed reflected the actual quality of braille materials used in these states.

The study presented here was a part of a larger project that focused on braille transcribing by public school personnel in Texas (Herzberg, 2006). A survey was conducted of the demographic characteristics of braille transcribers and how print materials were transcribed into braille by school districts (Herzberg & Stough, 2007). A variety of school personnel were found to transcribe a wide assortment of instructional materials, including classroom tests, teacher-produced worksheets, ancillaries, and nonstate-adopted text-

books. Training experiences varied greatly, and few individuals were found to be certified by the Library of Congress, National Library Service for the Blind and Physically Handicapped (NLS) (Herzberg & Stough, 2007).

The purpose of this study was to gather information about the quality of instructional materials that are transcribed into braille by public school personnel. It is essential that brailled instructional materials are of high quality because approximately 70% of students with visual impairments are educated in general education classrooms (U.S. Department of Education, 2002). Materials that are transcribed inaccurately are not equal in quality to those received by sighted students and may ultimately affect the literacy outcomes of students who read braille.

The first study used an in-depth error analysis on the braille transcription of print instructional materials. A focus group of skilled teachers then reviewed the transcriptions and assessed the legibility and readability of these transcribed materials. Two primary questions were addressed: (1) How accurate was the braille transcription of the printed materials? and (2) How did the quality of the braille transcription affect the readability of these materials?

Study 1

PARTICIPANTS

Approval to conduct the research was obtained from the Institutional Review Board at Texas A&M University. Participants were recruited in late fall 2005 through an e-mail message forwarded to educational centers throughout Texas by

personnel of the regional service center. To be eligible, participants had to transcribe instructional materials, not textbooks, regularly for students in Texas public schools or at the Texas School for the Blind and Visually Impaired. Individuals who produced textbooks were excluded from the sample since braille textbooks are provided to individual students by the Texas Education Agency, and there is a mechanism in place to review the quality of these textbooks.

Fifty-five volunteers responded to the e-mail message and were sent a study packet that contained an informed consent form, instructions, two print worksheets to be transcribed into braille, a demographic questionnaire, and a return envelope. Background information, such as resources used to complete transcriptions and certification status, was also requested in the demographic questionnaire. Upon receipt of a packet, each participant and his or her transcriptions were assigned a code number.

Of the 55 packets, 80% ($n = 44$) were returned; all contained signed informed consent forms from the potential participants. Data from 3 of these packets were not included in the database or analyzed because these individuals did not meet the criteria required for participation. Another potential participant submitted the questionnaire, but did not include a transcription to be analyzed. The data from these potential participants were not included in the database.

PROCEDURES

We reviewed a variety of teacher-produced materials at the upper elementary and middle public school levels before selecting a worksheet to be tran-

scribed by the participants. The worksheet was created by a public school teacher and had been used in a fourth-grade general education classroom. The selected worksheet included a title, instructions, a short reading passage, and 5 questions to be transcribed. The worksheet included 235 words and required the usage of a heading, italics, and 178 contractions and short form words. We estimated that the transcription would take 10 to 15 minutes to complete. The participants were given two weeks to return their transcribed worksheets.

Of the 40 participants, 39 were female with a mean of 9.03 years of experience. The job titles of the participants varied: 30% ($n = 12$) were braillists, 25% ($n = 10$) were teachers of students with visual impairments, 20% ($n = 8$) were transcribers, 12.5% ($n = 5$) were dually certified teachers of students with visual impairments and orientation and mobility specialists, 7.5% ($n = 3$) were paraeducators, and 1 each was a library assistant and an instructional aide. Twenty percent ($n = 8$) were certified as literary braille transcribers by NLS, and 80% ($n = 32$) were not. None of the participants reported that he or she was certified by NLS in the Nemeth code, braille music, or proofreading. It is interesting that of the 8 participants who were certified by NLS in literary braille, 3 reported that they were transcribers, 4 reported that they were braillists, and 1 reported that she was an instructional aide. The term *braillist* may be unique to Texas; in other states, terms like *transcriber* or *teaching assistant* may be more commonly used to describe personnel in comparable positions.

The participants were asked, given a 40-hour workweek, how much time they

spent transcribing print materials into braille each week. Nine participants provided a range of time, rather than an estimate. These responses were averaged using the low and high number of hours that they provided. Of the 38 participants who answered this question, the time spent transcribing braille each week ranged from .5 hour to 40 hours, with a mean of 20.4 hours. In general, the teachers of students with visual impairments and dually certified personnel reported that they spent less time each week transcribing than did the transcribers, braillists, and paraeducators.

Only 5 participants (4 teachers and 1 braillist) reported that they used a Perkins braillewriter to complete the transcriptions; the remaining 35 participants used braille-translation computer software programs, such as Duxbury, MegaDots, and Braille2000. In addition, the time spent transcribing each worksheet ranged from 5 minutes to 60 minutes, with a mean of 23.1 minutes.

To develop a rubric for scoring purposes, the selected worksheet was sent to five certified transcribers who worked at either a state agency, a regional service center, or a nationally recognized braille-transcribing entity. These transcriptions were then used by the researcher (the first author) to develop a scoring rubric for the transcriptions, which was closely aligned with the NLS scoring system (Risjord, Wilkinson, & Stark, 2000). The researcher and the certified proofreader then reviewed the scoring rubric together. Both were certified by NLS and were familiar with the literary braille code, as well as the rules for braille formatting outlined in *Braille Formats: Principles of Print to Braille Transcription* (Braille

Authority of North America, 1997). They collaboratively scored a sample transcription to test the tool. One transcription from a participant was read sentence by sentence, and both the researcher and the proofreader agreed each time when an error was located. The remaining 39 transcriptions were then independently reviewed by both the researcher and the proofreader. To review the internal consistency between the two raters, Cronbach's alpha was determined. The reliability of the two raters on all the transcriptions was .99, and the agreement ratios ranged from 92% to 100% for the individual transcriptions.

There is no universally accepted standard of quality in braille transcribing or a standard of transcribing accuracy that ensures readability. The two certifying bodies, NLS and the National Braille Association, use different evaluation tools and grading procedures. The National Braille Association uses an 8–10-page examination for braille formatting certification, and NLS requires the completion of a 35-page manuscript of a book for literary braille certification (Damm, 2006; Risjord et al., 2000). Since the grading procedures used by these two certifying agencies differ greatly, no preset standard of quality was established in this study. However, we used the convention of assigning one point for each error and then summed the total number of errors to produce an overall individual score for each participant.

The error analysis used by the researcher and proofreader was similar to the NLS scoring system (Risjord et al., 2000) in that each of the following was considered an error: (1) letters and text that were inserted, repeated, or omitted;

Table 1
Accuracy of the first set of transcriptions.

Range of errors	Number	Percentage
0	5	12.5
1–10	11	27.5
11–20	11	27.5
21–30	10	25.0
31–38	3	7.5

(2) contractions that were omitted or misused; (3) characters or contractions that were misbrailled; (4) words that were divided incorrectly; (5) spacing errors or irregularities; (6) formatting errors or irregularities; (7) punctuation or composition signs that were omitted or inserted incorrectly; and (8) detectable erasures. If the same error, such as a missed contraction, occurred repeatedly, it was counted each time. Accuracy was thus measured by the total number of errors on the transcription. The researcher later reviewed the transcriptions to determine if particular errors occurred frequently.

RESULTS

The accuracy of the transcription of the worksheets was measured by the number of total errors (see Table 1). Accuracy on the first worksheet ranged from 0 errors to 38 errors, with a mean of 14.6 errors and a standard deviation of 11.367. The three most common errors were the addition or deletion of a word or character, inconsistent formatting, and the omission or incorrect use of composition signs.

To strengthen the internal validity of the error analysis, the 40 participants were asked to transcribe a second, similar worksheet into braille. Identical code numbers were used for the participants, so we could compare the accuracy of the two selections to determine if the transcription

of the first passage reliably depicted the transcribers' skills. The second worksheet included 205 words, and an accurate transcription of the worksheet required the usage of a heading, italics, and 179 contractions and short-form words (see Table 2 for the accuracy of these transcriptions). Accuracy for the participants ranged from 0 mistakes to 45 mistakes with a mean of 13.9 mistakes and a standard deviation of 11.0.

The correlation between the scores on the transcriptions was .78. A reliability analysis between the transcriptions in the form of a Pearson's product-moment correlation coefficient was determined to be .836. According to Hinkle, Wiersma, and Jurs (1998), a correlation coefficient between .70 and 1.0 may be interpreted as a high positive correlation. Thus, it was determined that the first transcription realistically depicted the transcribers' skills.

The mean number of cumulative errors in both transcriptions for certified transcribers was 13.75, with a range of 0 to 36 errors. In contrast, the mean number of errors for noncertified transcribers was 32.16, with a range of 2 to 80 errors, resulting in a statistically significant difference ($t = 2.839, p < .05$) between the two groups.

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Table 2
Accuracy of the second set of transcriptions.

Range of errors	Number	Percentage
0	3	7.5
1–10	16	40.0
11–20	10	25.0
21–30	8	20.0
31–39	2	5.0
40–45	1	2.5

personnel reported that they spent less time each week transcribing than did the transcribers, braillists, or paraprofessionals. A Pearson-product moment correlation was computed to determine the strength of the relationship between time spent transcribing each week and the accuracy of the two transcriptions. The correlation between time spent and accuracy was $r = -0.572$, which equates to $r^2 = .3272$. This analysis indicated that there was a moderate correlation among the number of errors on the transcriptions and time spent each week transcribing. Thus, more time spent transcribing each week was correlated with fewer errors on the transcriptions.

Study 2

PARTICIPANTS

To select participants with experience in both teaching braille and transcribing print materials into braille, we used a purposive sampling strategy. With this technique, the researcher selects "a sample from which the most can be learned" (Merriam, 2001, p. 61). Four criteria were used in establishing eligibility for participation in the focus group: five or more years of experience teaching students with visual impairments, knowledge of the literary braille code, recommendation by a consultant of a regional service center, and current responsibility for either teaching a student who reads braille or transcribing materials into braille. Experienced teachers would be familiar with how errors in braille could affect instruction and learning.

The participants for the focus group were recruited from a variety of rural, suburban, and urban districts across

Texas. A total of five teachers of students with visual impairments participated in the focus group. These five participants had a mean of 27 years of teaching experience, ranging from 18 to 42 years. All the participants had bachelor's degrees, and 3 had master's degrees. None of the participants was certified in literary braille or in the Nemeth code by NLS. Together, the participants taught a total of six students who read braille and were in the 1st grade to the 10th grade; they spent a collective mean of six hours per week transcribing materials into braille for these students. Three of the teachers indicated that they were assisted in the transcription of materials for their students.

PROCEDURES

A focus group session consisting of the five teachers generated data to supplement the quantitative findings on the quality of transcriptions and to explore the possible impact of errors in transcribing on students' learning. After the transcriptions were received, the researcher read the transcriptions character by character and then wrote the corresponding print translation in longhand directly above each braille line. These annotated transcriptions were used to facilitate the focus group discussion.

After the teachers arrived for the focus group session, the researcher discussed the purpose of the session, shared guidelines for participation, and collected background information. The teachers were then asked to review a subset of the braille transcriptions, along with the accompanying annotated print translations. During the review, the teachers were invited to take notes and share their impressions.

The session was semistructured, and the researcher asked seven questions that were designed to determine if the meaning of the text was changed because of errors and how irregular or inconsistent formatting might affect the readability of the text for students. The teachers appeared to be comfortable throughout the 90-minute session in that they laughed informally with each other, often nodded their heads in agreement, and voluntarily shared experiences with one another. Additional probes and questions were asked during the session to solicit more details, examples, and clarification as needed. The researcher took notes throughout the session, and the session was recorded so that a verbatim transcription could be used in the analysis.

The teachers reviewed a subset of the braille transcriptions from Study 1 and the accompanying written translations. The six transcriptions that they viewed ranged in accuracy from 0 errors to 28 errors. To provide a representative sample of the transcriptions to the focus group members, the researcher selected transcriptions on the basis of percentile: one each at the 10th error percentile, the 25th error percentile, the 50th percentile, the 75th percentile, and the 90th percentile, as well as one transcription that did not contain any errors. The transcription with no errors proved to be particularly useful in providing a model of accuracy for the group members and facilitated the comparison of transcriptions and patterns of errors.

RESULTS

The primary intent of the focus group session was to provide feedback on the legibility and readability of the transcrip-

tions submitted by the participants. During the focus group, the five teachers discussed the impact of the errors on students' learning and provided plausible explanations of how and why the errors had been made. The data revealed little difference of opinion among the participants: usually the difference was a matter of degree, not a true difference in perception or experience.

The researcher analyzed the data by reviewing the transcriptions question by question, looking for themes both within and among the questions (Krueger, 1998). During this process of carefully reviewing the transcriptions, each response was coded. Afterward, similar meaning units within and among the responses were grouped into categories. The data were then examined for relationships and patterns in the categories and organized into subthemes and two broad themes.

To increase the validity of the results, the teachers were e-mailed a copy of the results of the analysis and asked if the results accurately represented their comments and perceptions. They were given one week to complete this review. Four of the five teachers responded; they thought that the results were an accurate reflection of their perceptions and experiences.

After reviewing the transcriptions, the five participants agreed that the quality of the transcriptions varied greatly. They overwhelmingly believed that a large number of errors in transcribing could affect the learning of students, especially young, struggling, and beginning students. The elaborations of the teachers repeatedly illustrated how errors in transcribing could affect the readability of materials, as well as how students learn to read. For example, one teacher reviewed a

transcription that contained several omitted words and letters at the end of lines because of what appeared to be a misalignment of the margins on the braille embosser. She believed that a young child would not know what some of the words were supposed to be.

The teachers' comments often connected readability and learning. The teachers pointed out that if students are struggling to read and comprehend the materials because of transcribing errors, then they would have more difficulty learning content, using contractions in their own writing, spelling words correctly, and building effective test-taking skills. They thought that materials with transcribing errors often serve as a less-than-positive model for students and would affect the students' willingness to proofread their own assignments and writing.

Reading comprehension and legibility were not the only areas of concern for the focus group members. The prevalent feeling of the teachers was that consistent exposure to errors, such as were displayed in some of the transcriptions they reviewed, would negatively affect the overall academic performance of students. Specifically, these types of errors would have a negative impact on such areas as spelling, test-taking skills in connection with the statewide assessment, and learning and consistently using braille contractions.

Discussion

The quality of the transcriptions varied greatly. Five transcriptions contained no errors at all, and eight contained four or fewer errors. The majority of transcriptions, however, contained a variety of

contraction errors, misspelled words, misbrailled characters, omissions of letters or words, insertions of additional letters in words, detectable erasures, and formatting errors.

Some of the transcriptions contained serious errors that could prevent legibility for students who read braille. During the focus group session, one teacher had such difficulty reading a transcription containing 28 errors that she requested a print copy of the worksheet. Students who are learning to read cannot be expected to learn easily from materials that contain a substantial number of errors. Even if students are able to use context clues to decode what was transcribed, they may have difficulty comprehending what they are reading. Braille transcriptions containing multiple errors per page could have a negative impact on the ease and pace of reading.

NLS certification status was linked to transcribing. The noncertified participants submitted transcriptions with a mean of 32 errors, whereas the certified participants submitted transcriptions with a mean of 13 errors. This difference may be explained by NLS's rigorous requirements for literary braille certification. Literary braille certification requires the submission of a 35-page manuscript and the completion of a correspondence course that covers all braille contractions and rules. These measures provide intensive practice in both transcribing and proofreading.

Regardless of how long the participants had been in their current positions, the number of hours of practice and their job roles predicted their skills in transcribing. School staff members who were primarily assigned to provide instruction to students

may only intermittently transcribe materials for students and thus lose their skill in transcribing over time. The opposite may also be true. If personnel are primarily assigned to preparing materials, they will have continuing opportunities to update and maintain their braille skills and adequate time to use resources and proof-read. As Allman and Holbrook (1999) noted, ongoing practice could also decrease the time needed to transcribe materials, and continued practice leads to fewer errors and improved quality.

RECOMMENDATIONS

On the basis of the existing, though limited, research about the quality of braille transcriptions and the results of this study, we recommend the following:

1. Explore the hypothesis that students who read braille receive instructional materials that are not equal in quality to those received by sighted students.
2. Develop a formal definition of quality in braille transcribing.
3. Develop formal standards for braille proficiency for university teacher preparation programs.
4. Encourage public schools to hire braille transcribers who are certified by NLS or an equivalent entity, when possible, if they will be responsible for preparing brailled instructional materials.
5. Provide increased, coordinated opportunities for paraprofessionals and transcribers to receive appropriate training in the braille code, formatting, proof-reading, and how to use embossers and braille-translation computer software programs when transcribing materials.
6. Provide continuing opportunities for teachers of students with visual im-

pairments to update and maintain their braille skills throughout their careers.

7. Directly explore the quality of other types of brailled instructional materials produced by school personnel, including math, science, tactile graphics, and music.

LIMITATIONS

This project had three primary limitations. First, the participants were volunteers for the project instead of randomly sampled individuals. Second, because the items that were transcribed did not include all the contractions and rules possible in braille, the analysis of these transcripts may not be the expression of the true range of the participants' transcribing abilities and skills. Third, the number of participants who were certified was small, which limited our ability to compare the errors produced by those who were certified with those who were not. However, we did find a significant difference in the total number of errors produced by those who were certified and those who were not.

Conclusion

The results of this investigation suggest that students in public schools may receive brailled materials that vary greatly in terms of quality. Some of the brailled materials that we examined contained errors that could greatly affect their legibility and readability for young or beginning students, as well as the pace and ease of reading for older, more experienced readers. Teachers in the focus group also believed that these errors in transcribing would negatively affect the academic performance of braille readers. As West (2005) suggested, it is time to encourage

educators to improve services, assessments, and educational materials for students who read braille.

Perhaps what is most important is that the findings supported our hypothesis that braille readers receive instructional materials that are not equal in quality to those received by other students. In contrast, print materials that are given to sighted students rarely, if ever, contain a significant amount of errors. One can imagine the response of sighted students, teachers, parents, and administrators if sighted students received materials with misspelled words, detectable erasures, or omissions of words at the ends of lines.

The seventh goal of the National Agenda states that “access to developmental and educational services will include an assurance that textbooks and instructional materials are available to students in the appropriate media and at the same time as their sighted peers” (Huebner et al., 2004, p. 6). The quality of transcripts that were analyzed in this study suggests that students who are visually impaired have inequitable access to instructional materials. It is hoped that this study will also serve as an illustration of how errors in braille may affect legibility, academic performance, and access to the general education curriculum for students with visual impairments.

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