

## Braille Literacy Skills: An Analysis of the Concept of Spelling

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**Abstract:** This article analyzes the braille spelling errors of 16 Greek students who are blind. More specifically, it explores the types of spelling errors, the students' attitudes toward spelling, and the relationship between spelling and reading strategies.

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The development of literacy for all persons constitutes the cornerstone of education. Literacy has been in the center of national concern, and its context and content have been explored by educators, policy makers, and the mass media (Rex, 1989). A common definition of *literacy* is the ability to read and write at such a level as to be able to meet daily living needs. "Literacy is a continuum from basic reading and writing skills all the way up to various technical literacies" (Troughton, 1992, p. 14). In essence, the acquisition of literacy skills provides all the prerequisites for achievement in many areas of life, from school to employment (Koenig & Holbrook, 2000).

Literacy skills are equally significant for individuals who are visually impaired (that is, those who are blind or have low vision). The development of literacy by children who use braille and print is approximately the same (McCall, 1999). What may differ is the way in which sighted students and those with visual impairments construe the world and develop literacy skills (Argyropoulos, 2002; Cromer, 1973; Koenig & Holbrook, 2000).

Spelling is a developmental process and consists of stages that are compatible with students' understanding of letter-sound relationships (Beers, 2003; Templeton, 2002). These letter-sound relationships become more meaningful to students as their

understanding increases. According to Beers (2003), there are five stages of spelling, and students progress at different rates. Spelling is a more difficult task for students who are blind because they have to learn to read and write signs, abbreviations, and contractions and need to memorize the full spelling of words in order to reproduce them (Arter, 1997). There is evidence that children who are visually impaired are more likely to have difficulty achieving the levels of accuracy in spelling of their sighted peers (McCall, 1999). Sighted children are exposed to a wide variety of stimulating and colorfully illustrated books, newspapers, and magazines, as well as to advertising on billboards, television, buses, and products in stores, whereas children who are visually impaired generally are not (McCall, 1999). Arter (1997) noted that many students who are blind have particular difficulty learning to spell accurately because of a number of factors, such as the lack of incidental exposure to the written word from an early age. Sighted children have the images of many words imprinted on their memories, and many young sighted children learn to read and write before they enter school, whereas children who are blind typically do not. As a result of this early exposure, sighted children are able to achieve higher levels of accuracy in spelling compared with their visually impaired peers. Nevertheless, many techniques are used to improve the spelling of children with visual impairments, such as the use of dictated stories (Lamb, 1996; Koenig & Holbrook, 2000).

Greek braille is a code that requires most words to be spelled out in their entirety. It does not have many abbreviations or contractions, as does contracted braille in English. The only contracted types that appear in Greek braille are seven diphthongs (combinations of two vowels, such as alpha plus iota) that occur frequently in the Greek language. In addition, Greek braille characters do not carry accents, and the reader who is blind must know where the accents need to be placed (Centrum voor Wiskunde en Informatica, 2006). Since Greek braille does not use contractions, they have no bearing on spelling.

According to Beers (2003), the improvement of spelling implies the improvement of word recognition, which, in turn, helps students with the decoding process and hence comprehension. As a result, spelling is one of the components of literacy that plays an important role in students' learning and understanding.

Spungin (1996) investigated issues of braille illiteracy and the possible reasons for it. She argued that the decline in braille usage may be seen as result of negative attitudes toward blindness and braille and the increased emphasis on the use of residual vision and of technological advances, especially speech output as a substitute for braille (see also Miller, 1999; Spungin, 1989; Troughton, 1992). Sullivan (1996) pointed out that assistive technology may benefit people with visual impairments (for example, the audio output of a computer is typically faster than its braille output), but the cultivation of literacy skills may be delayed significantly by use of audio output rather than braille, and illiteracy may increase.

A number of other researchers have also found that the decline in the use of braille may be germane to the increase in the use of technological advances but underscored that this issue is more complex and should be investigated within the larger context of the field of blindness. For example, the decline in the use of braille may be related to the inadequacy of teachers in teaching braille or in using new computer technologies (Allman, 1998; Amato, 2002; Arter & Layton, 2000; Fellenius, 1999; Knowlton & Berger, 1999).

This article focuses on the way in which students who are blind comprehend the concept of spelling and does not present comparisons between sighted and blind students. There is evidence that students who are visually impaired make a slow start with spelling and, as a result, find it more difficult than do sighted students to develop mental patterns of words (Arter, 1997; Arter & Mason, 1994). The comparative approach evaluates the abilities and characteristics of children who are visually impaired

largely in comparison to those of sighted children, often in relation to chronological age. As a result, a "developmental lag theory" (Warren, 1994, p. 4) was developed that implicitly considers blindness to be a deficit. Warren argued that this approach, which emphasizes chronological age and visual status, tends to draw researchers' attention away from the variables of cognitive development of children who are blind on which the research should focus, so that an alternative approach should be sought.

This article presents a detailed qualitative and quantitative mapping of the spelling errors made by the blind students we studied and categorizes these errors. It also correlates the nature of these errors to students' comprehension and attitudes and proposes ways to confront the decline in the use of braille. The aims of the study presented here were to analyze the types of spelling errors the students made, the students' attitudes toward spelling, and the relationship between spelling and the students' reading strategies.

## **Method**

The participants were 16 students, aged 11 to 18, who attended the same special school in Athens, Greece (the Centre for Education and Rehabilitation of the Blind). Of the 16, 4 (aged 11–12) were attending elementary school, 5 (aged 14–16) were attending high school, and 7 (aged 16–18) were attending the lyceum (college). All the students used braille and, according to their files, had no other additional disabilities. A classroom was selected for the researcher to work with the students without disrupting their daily programs. Each student was interviewed and audiotaped and wrote a text in braille in a 20–30-minute session. The experimental design was divided into two parts: semistructured interviews and experiments.

The semistructured interviews were exploratory and focused on the students' preferences with respect to the way in which they

read (aural reading or tactile or braille reading), as well as on the students' concepts and attitudes toward spelling. In addition, the interviewer explained the purpose of the experiment and the process itself.

After the interview, each student listened to an aural presentation of a text in Greek (stimulus material), presented by the researcher. The text was a comprehensible extract from a textbook with a simple structure that is used in the first grade of high school in Greece and is approved by the Ministry of Education and the Pedagogical Institute. The subject of the extract was home economics and contained a variety of simple words of all kinds (including verbs, nouns, and adjectives) (Lesson 1.7, p. 35, 71 words). Next, the researcher read the text again slowly and asked the student to write it down in braille. The whole procedure was driven by the researcher, and, in the end, all the students' dictations were selected and analyzed by the researchers according to a classification system (discussed next). This method of taking notes of dictated material is probably the most frequently used in classrooms (Tindal & Marston, 1990).

The analysis of the data was based on categories of spelling errors. According to Tindal and Marston (1990, p. 194), to categorize "spelling error patterns[,] a classification system is necessary to organize word types and students' responses." We developed a classification system that met the peculiarities of the Greek language. The spelling-error pattern used in the study was a synthesis of other similar patterns (Kotoulas & Padeliadou, 1999; Papapavlou & Yiakoumetti, 1999; Tindal & Marston, 1990) and consisted of two broad categories: phonological-type (PT) errors and nonphonological-type (NPT) errors. The NPT errors were divided into two subcategories: historical-type (HT) errors and morphological-type (MT) errors (Kotoulas & Padeliadou, 1999; Papapavlou & Yiakoumetti, 1999).

PT errors are those that change the acoustical image of the word (such as *fin* for *fine*). They can be organized into many subtypes,

such as the omission of needed letters, the addition of unneeded letters, the reversal of whole words, the addition of syllables, and the omission of syllables (see [Box 1](#) for a list of all the categories). In contrast, NPT errors do not alter the auditory representation of the word (for instance, *night* for *knight*); instead, these errors differ from the correct spelling of the word in terms of the historical evolution of the language (HT) and common spelling rules (MT) (Beers, 2003).

To avoid HT errors, students have to memorize the structure of the words as the words appear in textbooks (for example, to link two or more words, groups, or clauses, one uses *and*, not *an* or *end*), whereas to avoid MT errors, students need to memorize spelling rules and apply them in their spelling tasks (such as rules for adding prefixes, for plurals, and for suffixes). These rules usually refer to the middle or latter parts of words (Beers, 2003). Nevertheless, all error systems should not constitute strict structures because they rely on the assumption that students' responses can be placed in categories and thus that one can expect frequent modifications in spelling-error patterns (Tindal & Marston, 1990).

In line with common practice, the literature review, and internal tests that were conducted by the research team, we arrived at three spelling-error patterns: PT errors (Category A), HT errors (Category B1), and MT errors (Category B2). Categories B1 and B2 were components of the NPT errors (see [Box 1](#)). Category A was divided into nine subcategories. The issue of accent marks is discussed separately. In modern Greek, an accent is a short line that is written above certain letters (vowels) and indicates the way these letters are pronounced.

## Results

### ANALYSIS OF THE SEMISTRUCTURED INTERVIEWS

The four elementary school students preferred to read their homework in braille, rather than to listen to prerecorded study

materials. However, there was an increase in the use of audiotapes by the high school and lyceum students. The high school and lyceum students underscored this pattern by making such comments as "braille helps us to comprehend and remember better than does listening to the same subject from a tape, but unfortunately braille takes more time than a tape. We usually don't have much time to read all our homework in braille. The school is so demanding." They mentioned that the demands of tests forced them to use prerecorded study materials in conjunction with braille.

The high school students also raised the issue of "verbalism" or parroting (speaking without understanding) when studying from tapes. All the students thought that reading braille is a kind of communication with the paper and consequently with the writer and that this feeling helped them to conceptualize better the content of the subject they were studying.

In answer to the question, "What does the term *spelling* mean to you?" the students raised many interesting issues. Their comments included the following: "Spelling is when you don't make mistakes and therefore people are not laughing at you"; "Spelling is when we write the words as they are"; "Spelling is when we write words not as a part of a task, but as part of everyday life"; "Spelling is a set of specific regulations like math, two times three always equals six"; "Spelling is the letters and the grammar"; and "Spelling is the correct order of the letters in the words."

These answers provided evidence about the approach that students at this specific school used in dealing with spelling. Not only did the students consider spelling to be the correct order of letters in words, but they gave its meaning social and emotional dimensions--social dimensions, because they distinguished between spelling in school and spelling in everyday life, and emotional dimensions, because they thought that spelling made them feel secure and acceptable in a schooled society.

Nevertheless, few students had an accurate concept of spelling embedded in the context of the phonological or nonphonological types.

Most students agreed that the issue of spelling is important, but there was a peculiarity with respect to their reasoning. The following are some of their comments: "It is important to write correctly because people can understand you easier"; "I suppose that it is important, but it's hard for me to write correctly when I'm writing fast"; "Spelling helps you to find out easily who knows and who does not know"; "When you know how to write, then you have more chances to find a job"; and "I think it is one of the basic qualifications for finding a job."

Most of the students underlined the usefulness of spelling when they agreed that "to know how to write is an indispensable qualification for finding a proper job." The lyceum students and half the high school students were unanimous in endorsing this perspective, while the elementary school students mentioned the aesthetics of spelling and the acceptance that is usually received by a schooled society. Hence, the students' comments converged on the issue of employment, and the students considered spelling and employment to be mutually dependent.

## **ANALYSIS OF THE EXPERIMENTS**

The results of the experiments addressed comparisons of the performance of the students at the three levels of education (elementary school, high school, and lyceum). As we mentioned in the introductory section, the purpose of this study was not to compare the performances of sighted and blind students. Rather, the purpose was to investigate blind students' understanding of spelling, to clarify the type of errors the students made, and to correlate the data with the data that were obtained from the semistructured interviews, drawing further implications.

### ***PT errors***

As [Table 1](#) indicates, few errors were made by any group of students. The elementary school students made more PT errors than did the high school and lyceum students. We found that the percentage of errors in the subcategories addition of letters (AL), letter substitution (LS), and syllable substitution (SS) did not decrease as the age of the students increased. In addition, the students' written responses in braille were at high level of accuracy in terms of the phonological type.

[Table 2](#) presents the means and standard deviations for the PT errors of the three groups of students. In total, the absolute value of the variance was larger in the performance of the lyceum students for the subcategories AL, LS, and SS than for the students in high school. That is, the dispersion of the errors in these subcategories was larger in the lyceum than in high school.

### *NPT errors*

The frequency of NPT errors--both HT and MT--was higher among the elementary school students (16.9 and 11.6, respectively) than among the high school students (both 3.9) and the lyceum students (5 and 2.4, respectively). One explanation may be that the elementary school students had less experience with spelling rules than did the other two groups. What bears more analysis is that the lyceum students' written responses in braille contained more HT errors than did those of the high school students--a result that we did not expect to find. Perhaps there is an internal positive relationship between HT errors and the students' memorization. As we mentioned earlier, HT spelling is based on the evolution of language, and, as a result, students have to memorize the structure of words as they appear in textbooks, whereas MT spelling is based on rules, which students apply again and again in their spelling tasks. One possible explanation of the finding is that because of their "heavy daily program," the lyceum students mainly used audiotapes for study to save time and hence did not remember the spelling of all the words, whereas MT spelling is based on rules, so the students could

correct their spelling via deductive reasoning (an average score of 3.9 for the high school students' MT errors versus 2.4 for the lyceum students' MT errors). Another external factor that might have had an impact on the lyceum students' performances is that textbooks were not available for all subjects.

[Table 3](#) contains statistical information on the analysis of NPT errors. It is interesting to note that the value of the standard deviation for the HT errors by the lyceum students is nearly double the value of the standard deviation for these errors by the high school students, which means that the dispersion of these errors among the lyceum students is much bigger than the corresponding dispersion among the high school students. Educators need to take this finding into account and apply alternative teaching methods and strategies to minimize this phenomenon.

## Discussion

The purpose of the experiments was to classify blind students' spelling errors so as to map them. The classification system we adopted appeared to be able to categorize errors into phonological and nonphonological types that met the peculiarities of the Greek language (see Method). We thought that it was essential to use a classification system that served the purposes of the subaim of identifying and organizing the students' errors. Nevertheless, this research should be thought of as a beginning way to look at categorizing spelling because of the small sample of participants (16 students). Although a small sample may not give strong evidence to classify the students' spelling errors into categories, it may provide some evidence about the applicability of this theory and insights into the strategies that blind students use in written braille and the students' attitudes toward spelling.

As we mentioned in the Results section, the students' performance was highly accurate, and the students made few PT errors, which clarified that they did not have specific learning difficulties

(Tindal & Marston, 1990) or specific problems in transferring what they heard from the researcher (dictation) to the paper (braille).

However, the most important finding was that the lyceum students made more PT and HT errors than did the high school students. The semistructured interviews revealed that because of their heavy workload and to save time, the lyceum students read acoustically; as a result, the images of the words and the most common spelling rules began to fade. It seems that information obtained by tactile exploration when reading braille is more stimulating than is information obtained by aural reading. According to Millar (1997), touch is an intersensory process, since all the receptors and cerebral areas cooperate in such a way as to converge to create tactile perception. The parameters of tactile perception, in turn, form a multidimensional system that leads to a cognitive outcome.

This finding also reveals the critical role that haptic stimulation plays when students read and write braille. Haptic stimulation consolidates the images of the words, which lead to the formulation of haptic memory (memory by touch). These memories constitute intellectual structures called schemata (Wadsworth, 1989). Therefore, it can be argued that the increase in aural reading by students who are blind may minimize the degree of consolidation of the schemata. Besides, research has shown that there is a strong relationship between phonological awareness and the accuracy of braille reading or more general braille literacy skills (Gillon & Young, 2002).

Our findings seem to converge with Sullivan's (1996) and with those of researchers who have studied the decline in the use of braille (see, for example, Miller, 1999; Spungin, 1989, 1996; Sullivan, 1996; Troughton, 1992), but further research is needed because tactile characters are relatively complicated to decode (Pring, 1984).

Another finding was that the students at all levels of education

did not use accents when writing braille because, they said, their teachers had told them not to do so in order to save space when writing braille; according to the students, the lack of accents did not imply any confusion in the comprehension of the content. Of course, the latter was the students' assumption, so further research is needed to determine the impact on students' written performances of using or not using any type of accent. This issue may fall in the general context of the complexity of braille (Greaney & Reason, 2000), and it seems reasonable to conduct more research in this area, since every language has different braille codes and levels of contractions (for instance, there is no contracted braille in the Greek language).

With regard to the students' attitudes toward spelling, all the students considered spelling to be important in their everyday lives, including employment. Nevertheless, the issue of spelling created anxieties because they did not have much experience in its usage and reasoning. The students' responses in the interviews indicated their belief that they are more accepted by society when they know how to read and write correctly, and almost all of them underlined the usefulness of spelling in such comments as "to know how to write is an indispensable qualification for finding a proper job." Such comments indicated that, to the students, spelling has social and cultural elements.

## **Conclusion**

With such little data, it is impossible to draw firm conclusions. However, we believe that there is a need to promote programs that link the importance of developing braille literacy skills with employment and hence with independence and happiness. We thought that categorizing spelling errors may enable teachers to conceptualize the nature and characteristics of these errors, and, as a result, teachers will implement effective supplementary direct instruction and ongoing assessments. The categorization of spelling errors may also lead to the need to change the curriculum and adapt it more to the needs of students who are blind, rather

than follow a rigid instructional form. Hence, teachers must be assertive in requesting braille materials (Rex, 1989) and provide direct instruction in braille and other compensatory literacy skills (Amato, 2002; Arter & Layton, 2000; Koenig & Holbrook, 2000). Specialized skills, such as visual efficiency, tactile readiness, and the use of literacy tools (braille and technological devices), also need to be addressed; these skills are essential prerequisites for youths to face challenges in the transition from school to adult life (Wolffe, 2003).

One limitation of this study, as was mentioned earlier, was the small sample. Thus, there is a need for further research with a larger number of participants that will test the validity of error mapping and the need to supplement the error-classification system that we developed by adding the issue of the accent. Further research is also needed on patterns of spelling errors and inconsistencies in students' errors in different periods of their schooling in conjunction with the decline in the use of braille and the increase in braille illiteracy. One current issue that the study underscored was the impact of the excessive use of assistive technology, such as screen readers in combination with braille displays, on the development of literacy skills of students who are blind. Finally, there is a need for studies that will yield a better understanding of the role of social and cultural contexts on blind children's perceptions of such issues as braille, literacy skills, and employment.

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