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Analysis of Writings of Fourth-Grade Turkish-Speaking Students with Low Vision in Terms of Legibility and Spelling Errors

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Abstract

The purpose of this descriptive study is to analyze the writings of fourth-grade Turkish-speaking students with low vision in terms of legibility and spelling errors. The study is a general survey design and used the criterion sampling method. The study group consisted of 32 students with low vision. A Multidimensional Legibility Scale was used to evaluate students' writing legibility. The researcher developed a Spelling Error Evaluation Form to determine the spelling errors. The Mann-Whitney U test and a descriptive analysis were performed to analyze the study data. The findings of the study reveal that fourth-grade students' writings with low vision were generally not legible or were legible at a moderate level. In terms of spelling errors, it was observed that fourth-grade students with low vision made the most errors in letters, words, and spelling. Typing the letter smaller/larger than the relevant range was the most frequent, and suffix (*-ki*) was the least misspelled. It was observed that fourth-grade students' legibility and spelling error scores with low vision did not differ according to the variables of gender, school type, and braille. Also, a significant and negative correlation between spelling errors and legibility scores was found. The findings are discussed within the framework of the relevant literature and presented some suggestions for future measures and research.

Keywords:

Students with Low Vision, Legibility, Spelling Error, Visual Impairment, Special Education

Introduction

Visual impairment is considered an umbrella term that includes people with low vision and those visually impaired (blind) (Kreuzer, 2007). This concept is incorporated in the last version of the International Classification of Diseases (ICD-11) under visual impairment. It is classified as follows: mild visual impairment, moderate visual impairment, severe visual impairment, and total visual impairment (blindness) (World Health Organization [WHO], 2020). The concept of low vision is also considered a general category within visual impairment. Visual impairment is common in society and there are approximately 285 million people

visually impaired worldwide, most of whom are low vision (WHO, 2012).

In Turkey, students with low vision receive education either in inclusive environments where they attend with peers with normal vision or at schools for the visually impaired, which have been opened for visually impaired students (Yilmaz, 2020). Therefore, the aims and achievements that students will gain are the same. As the scope of the research is the writing skills, when the curriculum applied to the students is examined (Ministry of National Education [MONE], 2019), we encounter different writing acquisitions. For example, the students are expected to acquire skills such as writing letters and numbers especially in the first four years of the program. Using capital letters and punctuation marks in appropriate places, leaving appropriate spaces, writing numbers, question marks, and suffix abbreviation correctly are among the skills they are supposed to learn. However, the study findings reveal that the students encounter several skills-related problems with writing.

Low vision is a visual impairment that limits the independent display of actions or tasks associated with seeing in daily life (Verezen, 2009). In educational terms, it is defined as the ability of an individual to read printed materials written in large or standard font size with the help of magnifying glasses (Safak, 2009). In this respect, many students diagnosed with low vision encounter various problems in their daily lives and academic environments. For example, they may have difficulties reading, writing, orientation, and mobility, or performing tasks related to the use of vision, such as shopping and technology (Macnaughton et al., 2019). Students with low vision have difficulty in basic academic skills such as writing skills. Students with low vision have two literacy tool options: printed (standard) materials and braille (Holbrook, 2009). In other words, students with low vision can sometimes use braille and sometimes large font materials based on their vision and individual needs (Yalcin, 2020).

Markowitz (2006) claimed that handwriting might be challenging for students with low vision. McCall (1999) stated that students with low vision may have massive, irregular, and inconsistent letter structures and have difficulty leaving equal space between words and writing in a straight line and especially when the teacher shows the shapes of the letters. It reveals the problems experienced by students with low vision in writing. A study by Harris-Brown et al. (2015) also showed that the font size of students with low vision varies. They cannot write straight, and there are irregularities between letters and words and spaces. Harley et al. (1997) explained that students with low vision make different spelling errors. Examples of such mistakes are unequal letter spacing, combined spelling of words, difficulty in line straightness, inconsistency in letters, differences in size and slope in letters, omitting words, not non-compliance with to margins.

Some situations that students with low vision have may negatively affect their writing. In other words, there may be many reasons why students with low vision have difficulty in proper and good handwriting, and these may result from several factors. For example, motor skills (fine motor), visual factors (visual field), and mechanical (kinaesthetic knowledge) difficulties (Arter et al., 1996; Kaiser et al., 2009; McCall, 1999) are some of these factors. Due to these situations, students with low vision may show inadequacy in writing skills, which is considered an academic skill (Aki et al., 2008). Successful writing depends on students' writing speed and legibility (Atasavun Uysal & Duger, 2012). Studies highlighted that students with low vision spend more time writing and have lower average scores than their peers with normal vision (Aki et al., 2008). In a study by Atasavun Uysal and Duger (2012), no significant difference in the legibility scores of students with low vision after literacy education was observed. According to Graham et al. (1998), when students focus on fast writing, they can ignore the importance and legibility of an essay. Harris-Brown et al. (2015) reported that the handwriting legibility of students with low vision does not differ from their peers with normal vision. In contrast, Atasavun Uysal & Aki (2012) found that the legibility of students' writing with low vision and students with normal vision differed significantly. They also reported a significant relationship between legibility and visual-motor coordination. However, the research literature has limited studies investigating the writing skills of students with low vision, especially when they read and write in Turkish. These studies examined the relationship between kinesthetic sensory and writing performance (Aki et al., 2008) and writing skills and visual-motor control (Atasavun Uysal & Aki, 2012), the suitability of the literacy tool (Tiryaki, 2012), the effect of literacy education on font type and font size (Atasavun Uysal & Duger, 2012), the impact of writing preparation material (Kirac, 2003), teaching legible handwriting (Safak, 2011), handwriting kinematics, and factors affecting the pencil holding position (Guven, 2020) and written expression skills (Aslan, 2020; Aslan & Cakmak, 2020). However, in terms of legbility and spelling errors, no studies have addressed the students' writings with low vision. Students with low vision may encounter certain problems in their writing skills. In this context, we should determine the situations of students with low vision regarding their writing skills.

The purpose of the study

This study aimed to fill the gap in the literature, based on the lack of research, and analyze the students' writings with low vision from legibility and spelling errors. The study provides examples for teachers working with students with low vision in a topic where

the writings of students with low vision are locally and universally integrated. Considering studies on students' legibility and spelling errors with low vision are limited, the results of the study would provide useful information to educators (special education teachers) and families. Moreover, analyzing spelling errors will provide a rich source of information in shedding light on specific difficulties students encounter in writing process (Protopapas et al., 2013). This study aims to analyze the writings of fourth-grade Turkish-speaking students with low vision in terms of legibility and spelling errors. Hence, the research aims to seek answers to the following research questions:

1. What is the legibility for the texts of fourth-grade students with low vision?

    1.1. Do the legibility scores of fourth-grade students with low vision differ by *gender*, *school type*, and *braille*?

2. What are the spelling errors made by fourth-grade students with low vision?

    2.1 Do the spelling errors of fourth-grade students with low vision differ by *gender*, *school type*, and *braille*?

3. Is there a relationship between legibility scores and spelling error scores of fourth-grade students with low vision?

Method

Research Design

A screening study is a research approach to describe a past or present situation (Karasar, 2000). Screening studies allow the investigation process to be performed without deteriorating natural conditions or making a changing environment. In this study, the researcher used the legibility scale to examine students' writing with low vision and developed an evaluation form to determine spelling errors. In addition, analysis of differences and correlation calculations were performed in terms of the variables of *gender*, *school type*, and *braille* for both conditions.

Study Group

The study group consists of 32 Turkish-speaking students diagnosed with low vision. The students with low vision in the study group were selected from the students in primary schools and inclusive classes for the visually impaired in Ankara, the capital city of Turkey. To determine the participants, the criterion sampling method was used. (Buyukozturk et al., 2011; Patton, 2014; Yildirim & Simsek, 2006). In accordance with this approach the following inclusion criteria were employed: i) Attending the fourth grade, ii) Having a health board report regarding the vision status and not having any additional disabilities (hearing loss, mental disability, etc.), iii) Having functional vision skills at a medium or good level according to Gazi Functional Vision Assessment Tool (Safak et al., 2013) and iv) Using printed (standard) materials according to the Literacy Tool Assessment (Tiryaki, 2012). The demographic characteristics of students with low vision in the study group are given in Table 1.

Table 1

Demographic Characteristics of Study Group

Variables	Categories	*f*	%
Gender	Male	18	56.3
	Female	14	43.7
School Type	Schools for the Visually Impaired	19	59.4
	Inclusive Environments	13	40.6
Braille	Yes	17	53.1
	No	15	46.9
Functional Vision Skills	Medium Level	21	65.6
	Good Level	11	34.4

Data Collection Tools

Multidimensional Legibility Scale and Spelling Error Evaluation Form were used as data collection tools in the study.

The purpose of using The Multidimensional Legibility Scale was to evaluate the legibility of the students' writings. Yildiz & Ates (2007) developed the scale, and Gok & Bas (2020) adapted it to basic vertical writing. The scale consists of the following five sub-dimensions: letter slope, spacing, size, shape, and line straightness. The scale was developed according to the analytical evaluation approach. Accordingly, they each sub-dimension was evaluated to serve triple grading; 3 points: sufficient, 2 points: partially sufficient, and 1 point: not sufficient. In this context, it can obtain a maximum of 15 points and a minimum of 5 points from the full scale. The total points received are also categorized in three ways; 5-8.3 point range: not legible, 8.4-11.7 point range: moderately legible, and 11.8-15 point range: legible. A sample writing of a student with low vision is illustrated in Figure 1.

Spelling Error Evaluation Form was utilized to identify the spelling errors made by the fourth-grade students with low vision. The researcher prepared the form inspiring from several other studies on Turkish-speaking children (e.g., Babayigit, 2019; Erden et al., 2002; Erturk & Kucuktepe, 2019; Sugumlu, 2020; Uludag, 2002; Yildirim, 2018). During the determination of the items to be included in the form, the opinions of the visually impaired education specialist (3), the Turkish education expert (2), and the assessment and evaluation specialist (1) were obtained. They were asked to evaluate the items related to spelling errors as appropriate, be corrected, and not suitable to serve a triple assessment. In line with experts' recommendations, an evaluation form consisting of six sections and 21 items was developed. The form was

also evaluated with the help of two students who were not included in the study group. The form consists of the following sections with 21 items: letter (5), syllable (3), word (3), sentence (3), spelling (4), and punctuation (3). Calculation of spelling errors is evaluated based on the frequency of the errors made by the students. Table 2 shows some spelling errors from the writing of the students with low vision regarding the spelling error evaluation form items.

Data Collection

The data were collected in the 2020-2021 academic year after obtaining the ethical permission process. In addition, as the targeted study group consists of primary school (fourth-grade) students, the students' parents were informed and asked to voluntarily sign the Parent Consent Form for their children to participate in the study.

Figure 1

Sample Writing of a Student with Low Vision

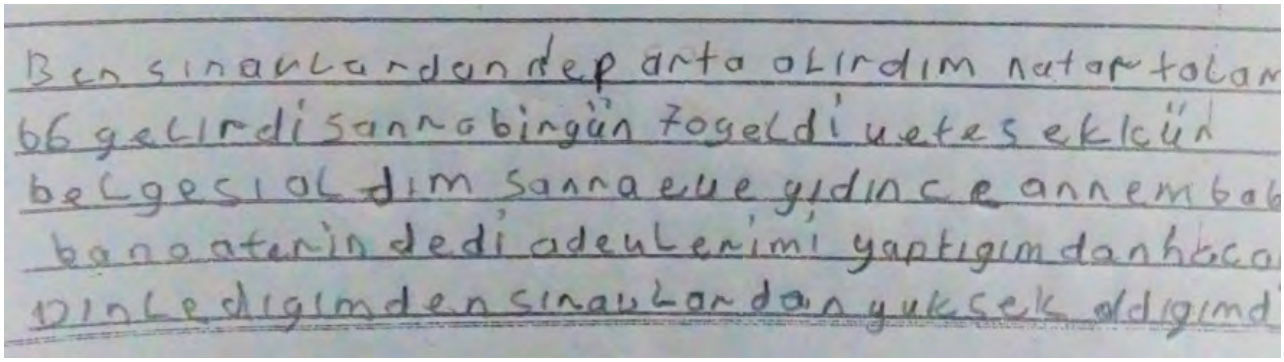


Table 2

Examples of Spelling Errors

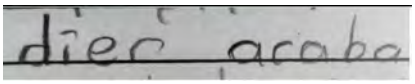
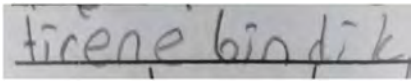
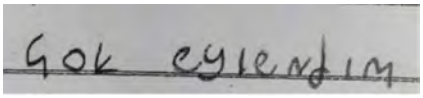
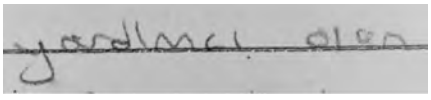
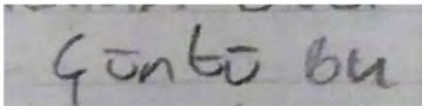
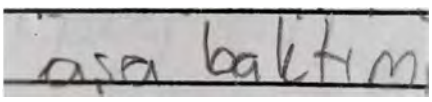
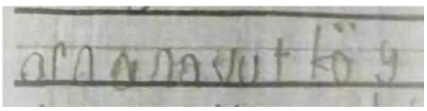
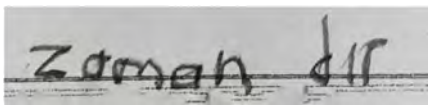
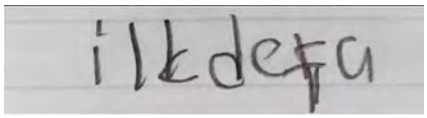
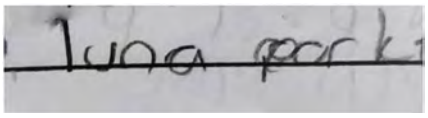
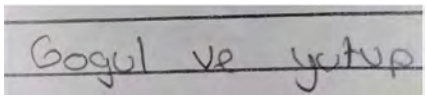
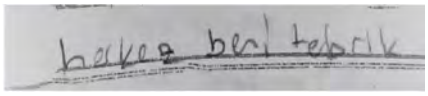
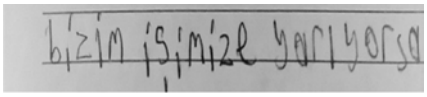
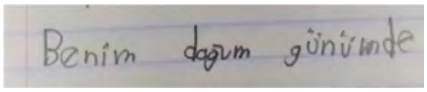
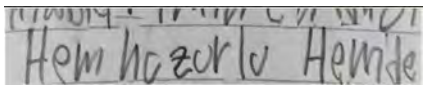
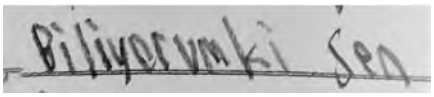
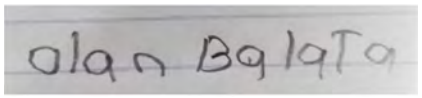
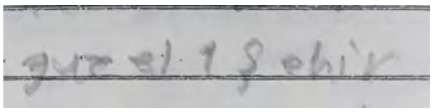
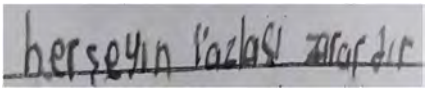
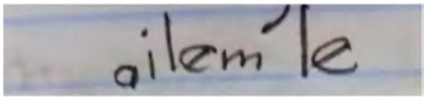
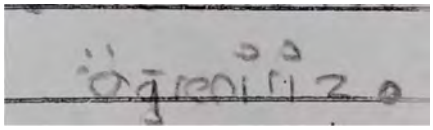
Sections	Items	What Students Wrote
Letter	Skipping Letters	
	Letter Addition	
	Letter Mixing/Changing	
	Writing the Letter Smaller/Bigger than the Relevant Range	
	Not Writing the Letter Properly	
Syllable	Skipping Syllable	
	Syllable Addition	
	Syllable Separation	

Table 2. continue
Examples of Spelling Errors

Sections	Items	What Students Wrote
Word	Combined Spelling of the Word	
	Dividing the Word	
	Misspelling	
Sentence	Leaving the Sentence Incomplete	
	Not Writing the Sentence in a Straight Line	
	Not Leaving Indents at the Beginning of a Sentence (Paragraph)	
Spelling	Misspelling suffix *(-de)*	
	Misspelling suffix *(-ki)*	
	Misspelling Uppercase/Lowercase Letters	
	Misspelling Numbers	
Punctuation	Not Using Punctuation in the Proper Place	
	Wrong Use of Punctuation	
	Not Writing Punctuation Properly	

The researcher personally visited to the schools with students with low vision and collected the data in the Turkish lessons in the students' curriculum. The student's classroom teachers and the researcher were together during the data collection process. Due to the COVID-19 pandemic in Turkey, the researcher paid attention to social distance rules during the explanation process. The classroom teachers also kept a certain distance from the students while distributing and collecting papers. At the begining of the lesson, teachers introduced the researcher to the students. The researcher brified the students about the study and explained the purpose and scope of the study with the information on what to do in this process and emphasized that participation is on a voluntary basis. He then asked students with low vision to do free writing. Graham et al. (2011) believed that allowing students to write in their preferred mode increases the validity of writing assessments. Accordingly, students wrote about the subject they wanted without any subject limitation. For the data collection process, a period of 40 minutes was allocated in the Turkish lesson. However, there was no limitation on time and word and page counts for the students. While the students with low vision used an average of 9.5 minutes to write, they wrote average 43 words during this period. The students' papers were collected by the teachers and delivered to the researcher. Afterward, the researcher ended the data collection process by thanking the students who participated in the study.

Data Analysis

The data analysis procedures of the study were performed using the SPSS 21.0 package program. Descriptive analyses such as frequency (*f*), percentage (%), arithmetic mean ($\bar{X}$), and standard deviation (*sd*) were used in the data analysis. Also, normality analyses were performed. In this context, the researcher analyzed the distribution of normality of the scores obtained from the legibility scale and the spelling error evaluation form from the fourth-grade students with low vision participating in the study. To check the distribution of normality, Kolmogorov-Smirnov and Shapiro-Wilk analyses were conducted, and thus, the Skewness and Kurtosis coefficient values were checked. The findings of the analyses showed that the *p* values were significant ($p < 0.05$), and the Skewness-Kurtosis coefficient values did not range within the desired threshold. The significance of these results indicates that the data do not show normal distribution (Hair et al., 1998). According to the findings, it would be safe to state that the data at hand do not show a normal distribution. Therefore, non-parametric analyses were performed in the survey. The Mann-Whitney *U* test was performed to analyze whether the data obtained from two unrelated samples created a significant difference concerning each other and whether the legibility and spelling error scores of fourth-grade students with low vision differ by *gender*, *type of school,* and *braille*. The correlation between legibility and spelling errors was analyzed using Spearman's rank correlation method.

Inter-Coder Reliability

The inter-coder reliability of the study was performed to determine legibility and spelling errors were calculated through a random sampling method for nine out of 32 students (30%). The coder's and researcher's evaluations for all writings were compared using the formula *"Agreement / [Agreement + Disagreement] X 100"* (House et al., 1981). According to the findings, the inter-coder reliability for legibility was found to be 95.6% and 92.1% for spelling errors.

Results

The findings on the legibility of the writings of fourth-grade students with low vision are shown in Table 3.

Table 3 shows that the writings of four students with low vision are legible. It is noteworthy to mention that these students are girls, participate in inclusive environments, and do not know how to read braille. The essays of 11 students with low vision are legible at a moderate level. Most of these students are boys, attend school for the visually impaired and know how to read braille. The essays of 17 students with low vision are not legible. The papers of more than half of the students with low vision are not legible, and the number of students is close to each other in terms of gender, school type, and braille.

Table 3

Findings Regarding the Legibility Level

Variables	Categories	Not Legible		Moderately Legible		Legible		Total	
		f	%	*f*	%	*f*	%	*f*	%
Gender	Male	10	55.5	8	44.5	-	-	18	56.3
	Female	7	50.0	3	21.5	4	28.5	14	43.7
School Type	Schools for the Visually Impaired	11	57.8	8	42.2	-	-	19	59.4
	Inclusive Environments	6	46.1	3	23.2	4	30.7	13	40.6
Braille	Yes	10	58.8	7	41.2	-	-	17	53.1
	No	7	46.8	4	26.6	4	26.6	15	46.9

The descriptive statistics findings of the scores of the fourth-grade students with low vision from the sub-dimensions and the total of the legibility scale are shown in Table 4.

Table 4
Descriptive Statistics on Scores Obtained from the Legibility Scale

Dimensions	*n*	*Min.*	*Max.*	*M*	*sd*
Slope	32	1.00	3.00	1.81	.78
Spacing	32	1.00	3.00	1.81	.69
Size	32	1.00	3.00	1.87	.55
Shape	32	1.00	2.00	1.68	.47
Line Straightness	32	1.00	2.00	1.37	.49
Total	32	5.00	13.00	8.56	2.43

Table 4 shows that students with low vision exhibited the highest performance in the size dimension (M = 1.87) and the most inadequate performance in the line straightness dimension (M = 1.47). The average score they obtained from the scale was M = 8.56.

The Mann-Whitney U test was performed to determine whether the scores of fourth-grade students with low vision from the sub-dimensions and total of the legibility scale differ by gender. The test results are summarized in Table 5.

Table 5
Mann Whitney U-Test Results of Legibility Scores by Gender

Dimensions	Gender	*N*	Mean Rank	Sum of Rank	*U*	*P*
Slope	Male	18	14.83	267.00	96.00	.222
	Female	14	18.64	261.00		
Spacing	Male	18	15.00	270.00	99.00	.261
	Female	14	18.43	258.00		
Size	Male	18	15.97	287.50	116.50	.658
	Female	14	17.18	240.50		
Shape	Male	18	16.17	291.00	120.00	.777
	Female	14	16.93	237.00		
Line Straightness	Male	18	16.72	301.00	122.00	.856
	Female	14	16.21	227.00		
Total	Male	18	15.25	274.50	103.50	.387
	Female	14	18.11	253.50		

The scores of fourth-grade students with low vision obtained from the sub-dimensions of slope (U = 96.00; p > 0.05), spacing (U = 99.00; p > 0.05), size (U = 116.50; p > 0.05), shape (U = 120.00; p > 0.05), line straightness (U = 122.00; p > 0.05), and total (U = 103.50; p > 0.05) do not make a significant difference by gender. No difference in the scores obtained by the boys and girls from the sub-dimensions and the total of the legibility scale was observed.

The Mann-Whitney U test was performed to determine whether the scores of fourth-grade students with low vision from the sub-dimensions and total of the legibility scale differ by the school type. The test results are shown in Table 6.

As Table 6 shows, the scores of fourth-grade students with low vision obtained from the sub-dimensions of slope (U = 109.00; p > 0.05), spacing (U = 96.50; p > 0.05), shape (U = 106.50; p > 0.05), line straightness (U = 89.50; p > 0.05) and total (U = 85.00; p > 0.05) do not significantly differ by the school type. According the table, only the scores obtained from the size (U = 74.50; p < 0.05) sub-dimension of the legibility scale made a significant difference by the school type. The mean rank in size sub-dimension scores revealed that the average of students with low vision in inclusive environments is higher than that of the students in schools for the visually impaired.

The Mann-Whitney U test was used to see whether the scores of fourth-grade students with low vision from the sub-dimensions and total of the legibility scale differ by braille. The test results are shown in Table 7.

As shown in Table 7, the scores that fourth-grade students with low vision obtained from the sub-dimensions of slope (U = 119.50; p > 0.05), spacing (U = 108.00; p > 0.05), shape (U = 100.50; p > 0.05), line straightness (U = 89.50; p > 0.05), and total (U = 91.00; p > 0.05) do not make a significant difference by the braille. The scores obtained from the size (U = 74.50; p < 0.05) sub-dimension of the legibility scale significantly differed by the braille. The findings of the mean rank in size sub-dimension revealed that the average scores of the students who do not know braille is higher than the students who know braille.

Descriptive statistics of the scores obtained by fourth-grade students with low vision from the sections (including the sub-items) and the sum of the Spelling Error Evaluation Form are presented in Table 8.

According to Table 8, fourth-grade students with low vision make the most letter errors (M = 105.93), followed by word (M = 8.78) and spelling errors (M = 7.06), at the section level. The least a made error is at the syllable level (M = 3.81). In the letter level spelling errors, writing the letter bigger/smaller than the relevant range (M = 51.68) has the highest average, and letter addition (M = .75) has the lowest average. The most common error made at the syllable level is a syllable separation (M = 1.68). At the word level, the combined spelling of the word (M = 7.40) was observed as the most common spelling error. At the sentence level, the most common spelling error not writing the sentence in a straight line (M = 4.93), while less common one leaving the sentence incomplete (M = .87). In the spelling errors, misspelling uppercase/lowercase letters (M = 5.84) have the most

Table 6

Mann Whitney U-Test Results of Legibility Scores by School Type

Dimensions	School Type	*N*	Mean Rank	Sum of Rank	*U*	*P*
Slope	Schools for the Visually Impaired	19	15.74	299.00	109.00	.551
	Inclusive Environments	13	17.62	229.00		
Spacing	Schools for the Visually Impaired	19	15.08	286.50	96.50	.256
	Inclusive Environments	13	18.58	241.50		
Size	Schools for the Visually Impaired	19	13.92	264.50	74.50	.021*
	Inclusive Environments	13	20.27	263.50		
Shape	Schools for the Visually Impaired	19	15.61	296.50	106.50	.417
	Inclusive Environments	13	17.81	231.50		
Line Straightness	Schools for the Visually Impaired	19	14.71	279.50	89.50	.120
	Inclusive Environments	13	19.12	248.50		
Total	Schools for the Visually Impaired	19	14.47	275.00	85.00	.135
	Inclusive Environments	13	19.46	253.00		

*p<0.05

Table 7

Mann Whitney U-Test Results of Legibility Scores According to the Braille

Dimensions	Braille	N	Mean Rank	Sum of Rank	*U*	*P*
Slope	Yes	17	16.03	272.50	119.50	.746
	No	15	17.03	255.50		
Spacing	Yes	17	15.35	261.00	108.00	.419
	No	15	17.80	267.00		
Size	Yes	17	13.38	227.50	74.50	.014*
	No	15	20.03	300.50		
Shape	Yes	17	14.91	253.50	100.50	.204
	No	15	18.30	274.50		
Line Straightness	Yes	17	14.26	242.50	89.50	.087
	No	15	19.03	285.50		
Total	Yes	17	14.35	244.00	91.00	.163
	No	15	18.93	284.00		

**p<0.05*

common error. In punctuation errors, the average of not using punctuation marks in the proper place (*M* = 3.93) is higher than other errors. In general, when looking at all spelling errors, the error writing the letter bigger/smaller than the relevant range (*M* = 51.68) has the highest average, and the misspelling suffixes (*-ki*) (*M* = .15) has the lowest average. In addition, the average of the total spelling errors of students with low vision is *M* = 138.06.

The Mann-Whitney *U* test was used to determine whether the scores obtained by fourth-grade students with low vision from the sections and complete in Spelling Error Evaluation Form create a gender difference. The findings of the test are shown in Table 9.

Table 9 shows that spelling errors of the fourth-grade students with low vision in letter ($U = 125.50$; $p > 0.05$), syllable ($U = 103.00$; $p > 0.05$), word ($U = 124.00$; $p > 0.05$), sentence ($U = 120.50$; $p > 0.05$), spelling ($U = 109.50$; $p > 0.05$), punctuation ($U = 82.50$; $p > 0.05$), and total ($U = 126.00$; $p > 0.05$) do not significantly differ by gender.

The Mann-Whitney *U* test was performed to determine whether the scores of fourth-grade students with low vision differ from the sections of the Spelling Error Assessment Form and their total differ by the school type. The results are shown in Table 10.

Table 10 shows that spelling errors of the fourth-grade students with low vision in letter ($U = 119.00$; $p > 0.05$), syllable ($U = 107.50$; $p > 0.05$), word ($U = 119.00$; $p > 0.05$), sentence ($U = 122.00$; $p > 0.05$), spelling ($U = 100.00$; $p > 0.05$), punctuation ($U = 103.50$; $p > 0.05$), and total ($U = 117.00$; $p > 0.05$) do not significantly differ by school type.

To determine whether the scores of fourth-grade students with low vision from the sections and the sum of the Spelling Error Evaluation Form differ by the braille, the Mann-Whitney *U* test performed. The results of the test are presented in Table 11.

Table 11 shows that spelling errors of the fourth-grade students with low vision in letter ($U = 116.00$; $p > 0.05$), syllable ($U = 104.50$; $p > 0.05$), word ($U = 126.00$; $p > 0.05$),

Table 8

Descriptive Statistics on Spelling Errors

Sections	İtems	*n*	Min.	Max.	$\bar{X}$	*sd*
Letter	Skipping Letters	32	0.00	19.00	1.68	3.51
	Letter Addition	32	0.00	9.00	.75	1.70
	Letter Mixing/Changing	32	0.00	23.00	4.65	6.55
	Writing the Letter Smallar/Bigger than the Relevant Range	32	3.00	174.00	51.68	40.18
	Not Writing the Letter Correctly	32	6.00	133.00	47.15	35.10
	Letter Subtotal	32	14.00	286.00	105.93	76.22
Syllable	Skipping Syllable	32	0.00	13.00	1.40	3.54
	Syllable Addition	32	0.00	10.00	.71	1.90
	Syllable Separation	32	0.00	10.00	1.68	2.33
	Syllable Subtotal	32	0.00	30.00	3.81	7.12
Word	Combined Spelling of the Word	32	0.00	69.00	7.40	16.39
	Dividing the Word	32	0.00	4.00	.43	.94
	Misspelling	32	0.00	5.00	.93	1.60
	Word Subtotal	32	0.00	77.00	8.78	18.08
Sentence	Leaving the Sentence Incomplete	32	0.00	6.00	.87	1.38
	Not Writing the Sentence in a Straight Line	32	0.00	18.00	4.93	4.33
	Not Leaving Indents at the Beginning of a Sentence (Paragraph)	32	0.00	5.00	1.21	1.00
	Sentence Subtotal	32	1.00	21.00	7.03	5.42
Spelling	Misspelling suffix (-de)	32	0.00	2.00	.53	.71
	Misspelling suffix (-ki)	32	0.00	1.00	.15	.36
	Misspelling Uppercase/Lowercase Letters	32	0.00	22.00	5.84	5.90
	Misspelling Numbers	32	0.00	6.00	.53	1.31
	Spelling Subtotal	32	0.00	23.00	7.06	6.09
Punctuation	Not Using Punctuation in the Proper Place	32	0.00	18.00	3.93	3.77
	Wrong Use of Punctuation	32	0.00	12.00	.75	2.18
	Not Writing Punctuation Properly	32	0.00	4.00	.75	1.04
	Punctuation Subtotal	32	0.00	18.00	5.43	4.15
Total Spelling Errors		32	16.00	441.00	138.06	104.80

Table 9

Mann Whitney U-Test Results of Spelling Mistakes According to Gender

Sectioons	Gender	*N*	Mean Rank	Sum of Rank	*U*	*P*
Letter	Male	18	16.47	296.50	125.50	.985
	Female	14	16.54	231.50		
Syllable	Male	18	17.78	320.00	103.00	.371
	Female	14	14.86	208.00		
Word	Male	18	16.61	299.00	124.00	.938
	Female	14	16.36	229.00		
Sentence	Male	18	16.19	291.50	120.50	.834
	Female	14	16.89	236.50		
Spelling	Male	18	17.42	313.50	109.50	.529
	Female	14	15.32	214.50		
Punctuation	Male	18	18.92	340.50	82.50	.097
	Female	14	13.39	187.50		
Total	Male	18	16.61	297.00	126.00	.909
	Female	14	16.49	231.00		

sentence (U = 114.50; p > 0.05), spelling (U = 116.50; p > 0.05), punctuation (U = 103.50; p > 0.05), and total (U = 116.00; p > 0.05) show do not significantly differ by braille.

The results of rank correlation coefficient are presented in Table 12. The results of the test show that there is a significant and negative relationship between the spelling error scores of fourth-grade students with low vision and their legibility scores (r = -.431, p < 0.05).

Discussion and Conclusion

This study investigates the writings of fourth-grade students with low vision in terms of legibility and spelling errors. According to study findings, the handwriting of more than half of the students was not legible. Handwritings of the vast majority of the remaining students were moderately legible, and only four students wrote legible writing. According to McCall (1999), there are wide variations in students' writing with low vision. Moreover, while some students

Table 10

Mann Whitney U-Test Results for Spelling Mistakes According to School Type

Sections	School Type	*n*	Mean Rank	Sum of Rank	*U*	*P*
Letter	Schools for the Visually Impaired	19	16.74	318.00	119.00	.863
	Inclusive Environments	13	16.15	210.00		
Syllable	Schools for the Visually Impaired	19	17.34	329.50	107.50	.529
	Inclusive Environments	13	15.27	198.50		
Word	Schools for the Visually Impaired	19	16.74	318.00	119.00	.860
	Inclusive Environments	13	16.15	210.00		
Sentence	Schools for the Visually Impaired	19	16.42	312.00	122.00	.954
	Inclusive Environments	13	16.62	216.00		
Spelling	Schools for the Visually Impaired	19	17.74	337.00	100.00	.365
	Inclusive Environments	13	14.69	191.00		
Punctuation	Schools for the Visually Impaired	19	17.55	333.50	103.50	.440
	Inclusive Environments	13	14.96	194.50		
Total	Schools for the Visually Impaired	19	16.84	320.00	117.00	.803
	Inclusive Environments	13	16.00	208.00		

Table 11

Mann Whitney U-Test Results of Spelling Mistakes According to Braille

Sections	Braille	*N*	Mean Rank	Sum of Rank	*U*	*P*
Letter	Yes	17	17.18	292.00	116.00	.664
	No	15	15.73	236.00		
Syllable	Yes	17	17.85	303.50	104.50	.373
	No	15	14.97	224.50		
Word	Yes	17	16.41	279.00	126.00	.954
	No	15	16.60	249.00		
Sentence	Yes	17	17.26	293.50	114.50	.621
	No	15	15.63	234.50		
Spelling	Yes	17	17.15	291.50	116.50	.677
	No	15	15.77	236.50		
Punctuation	Yes	17	15.09	256.50	103.50	.362
	No	15	18.10	271.50		
Total	Yes	17	17.18	292.00	116.00	.664
	No	15	15.73	236.00		

Table 12

Correlation Results between the Legibility Scores of Low Vision Students and Spelling Mistakes Scores

	1	2
Spelling Mistakes	-	-.431*
Legibility	-.431*	-

**p<0.05*

may write correctly and legibly, others may find it challenging to achieve their legibility and fluency goals. This is in line with the findings revealed by other studies. When the level of legibility was measured in terms of slope, spacing, size, shape, and line straightness dimensions. The findings of other studies examining these dimensions revealed that the font size of writing of students with low vision varies, and they cannot write in a straight line (Harris-Brown et al., 2015). Harley et al. (1997) claimed that students with low vision had difficulty in line straightness, and there were differences in size and slope in the letters they wrote. In this respect, the results of this study are in line with the findings of the provious studies.

As for the curriculum objectives (MONE, 2019), students with low vision are expected to achieve the same gains in writing as their peers with normal vision. However, based on the results of this study conducted with fourth-grade students, it would be safe to say that the legible writing skills that students with low vision are supposed to acquire have not been adequately improved.

Another finding of this study reveals that the common errors made by fourth-grade students with low vision are letter, word, and spelling errors. The students made the fewest errors at the syllable level. However, the most common error was writing the letter smaller/bigger than the relevant size. Other spelling errors encountered were not writing the letter correctly, mixing/changing letters, skipping syllables, the combined spelling of the word, not writing the sentence in a straight line, not leaving indents at the beginning of the sentences, misspelling uppercase/lowercase letters, and not using the punctuation marks in the proper place. Based on these findings, it would be safe to say that fourth-grade students with low vision made various spelling errors. Some previous studies also examined students' spelling errors with low vision. Harris-Brown et al. (2015) found that the font size written by students with low vision varies. They cannot write straight, and there are irregularities between their letters and words and spaces. In another study, Harley et al. (1997) reported that students with low vision made different spelling errors, such as unequal letter spacing, the combination of words, difficulty in line straightness, inconsistent letters, size and slope differences in letters, skipping words, and not adhering to margins. McCall (1999) stated that the writings of students with low vision may be extensive, irregular, and inconsistent in a letter structure. They may have difficulty leaving equal space between words and writing in a straight line, especially when the teacher shows the shapes of the letters. Cakmak et al. (2016) found that students with low vision had difficulty writing the desired words in the notebook and between the lines. Thus one can say that there is a similarity between the results obtained from this and that of the earlier studies. Students with low vision may experience difficulties in writing skills due to conditions such as motor skills, visual factors, and mechanical challenges (Arter et al., 1996; Kaiser et al., 2009; McCall, 1999). Therefore, they may show inadequacy in writing skills, which is an academic skill (Aki et al., 2008). Markowitz (2006) claimed that it may be challenging to use handwriting for students with low vision. Thus, these factors may have influenced students' writing skills with low vision. The performances of students with low vision in spelling mistakes can be associated with the aforementioned factors.

Furthermore, this study shows that fourth-grade students' legibility and spelling error scores with low vision did not significantly differ according to the gender variable. Harris-Brown et al. (2015) examined the legibility of the writing of students with low vision according to gender. Their study revealed no significant difference between the legibility of the essays of male and female students. Their findings are in line with the findings of this study. These findings reveal that the gender variable does not predict students' writing with low vision regarding legibility and spelling errors.

Apart from the gender variable, another variable examined in this study is school type. The results show that legibility and spelling error scores of the fourth-grade students with low vision did not significantly differ by the school type. In the size dimension, the scores of the students exhibit a difference by the school type. This difference was in favor of the students in the inclusive environments. In Turkey, students with low vision receive education either in schools for visually impaired or in inclusive settings. They follow the same program as students with normal vision do. That means MONE has adopted the normalization principle (Cakmak et al., 2017). Therefore, it would be safe to say that there is no difference between the achievements aimed to be acquired by students. This study revealed no significant difference in legibility and spelling error scores students with low vision who attended the school for the visually impaired and the students who receive their education in inclusive environments. Thus, it would be safe to say that the school type variable does not predict students' legibility and spelling errors.

Another issue examined in this study was braille writing. Students with low vision have two literacy tool options: printed (standard) materials and braille (Holbrook, 2009). Depending on their characteristics and needs, students with low vision can use one or both of these options. Although printed materials were taken as a criterion for fourth-grade students with low vision participating in the study, more than half of the participants also knew braille. The legibility (excluding size dimension) and spelling error scores fourth-grade students with low vision did not significantly differ

by the braille. This finding shows that the difference in size dimension difference is in favor of students who did not know braille. In a study by Savaiano & Hebert (2019), no difference between the mechanics of the writing written with paper-pencil and braille was reported. Another study reported that teachers working students with visual impairment differ in their beliefs about using paper-pencil and braille (Hebert & Savaiano, 2020). The findings of this study revealed that knowing or not knowing braille does not affect students with low vision to write legible and accurate handwriting.

Students with low vision made various spelling errors that were in line with the findings of previous studies. It was also was found that students with low vision who read and write in Turkish make different spelling errors, especially at the spelling level. These errors are mainly related to the spelling of suffixes or numbers. Similar findings were observed in studies conducted with students who read and write in Turkish (e.g., Babayigit, 2019; Sugumlu, 2020; Uludag, 2002). Therefore, the language can be considered an important variable. In this respect, it is thought that the findings obtained from the research provide important information from both international and national perspectives. Another result that should be emphasized in the study is that there is a significant and negative relationship between spelling mistakes and legibility scores. The tendency is that as the legibility level of the writings of fourth-grade students with low vision increases, their spelling errors decrease.

This study has expanded our knowledge about the challenges the students with low vision encounter in their school environment, but it has some limitations. The small sample size, lack of knowledge about the teachers' competence, and lack of addressing the SES-related factors are issues that were not addressed. More research is needed to address these issues and the skill-related issues such as dimensions of the students' writing speed, accuracy, and fluency dimensions of the students writing.

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