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Comparing the Effectiveness of Fernald's And Rossner's Multisensory Teaching Methods in Reducing the Spelling Disorder of Elementary Students

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Abstract

Background: Writing disorders have an adverse effect on students' academic achievement in school. These children need to learn new concepts or skills that they have not learned in the usual way through new methods such as multisensory teaching. Therefore, the aim of the present study was to compare the effectiveness of Fernald's and Rossner's multisensory teaching methods on reducing the spelling disorder of elementary school students in Tehran.

Methods: Using a multi-stage cluster sampling method, 120 research samples were selected from third and fourth grade elementary school students in districts 6 and 11 of Tehran in the academic year of 2018-2019 and randomly divided into two experimental groups (15 students each) and one control group (15 students). Research instruments included Fallah Chai Spelling Test (1974), the Wechsler Intelligence Test for Children, and Fernald's and Rossner's Multisensory Teaching Protocols.

Results: Fernald's multisensory teaching method was found to be more effective than Rossner in reducing the post-test spelling disorders of the students. Furthermore, the students in Rossner's multisensory teaching group showed more reduction in spelling disorders in the post-test than those in the control group. Overall, the effectiveness of Fernald's sensory method was greater than that of Rossner's sensory training method.

Conclusion: The results showed that Fernald's and Rossner's multisensory teaching methods are both effective on students with spelling disorders. However, Fernand's sensory method is more effective than Rossner's in reducing spelling disorders.

Key Words: Fernald, Multisensory Teaching Method, Rosner, Spelling Disorder, Students.

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1- INTRODUCTION

Based on the definition of DSM-5 (1), learning disorder refers to specific learning disorders including reading disorder, writing disorder, and math disorder, each of which was previously considered an independent and separate disorder while now they are all considered as specifiers in learning disability. These types of learning disorders have a lot in common with other childhood mental problems. Writing disorder in this division includes problems in writing words correctly, correct grammar and punctuation, as well as the clarity and organization of the essay (2).

Actually, the act of writing deals with some very specific skills, including the ability to keep the subject in the form of words, graphically drawing the shape of letters and words, using writing tools correctly, and having an efficient visual and motor memory (3). Compared to other learning disabilities, little is known about writing disability, especially when it occurs in the absence of reading disability (4). Research findings show that the inability to learn spelling is highly prevalent among students. According to statistics, 27% of all learning disabilities are spelling learning disabilities. Considering that the writing disorder has an adverse effect on the student's academic success in school, many of these children need to use new methods to learn concepts or skills that they did not learn in the usual ways. Research studies have supported the effectiveness of the multi-sensory educational method for some children with learning disabilities (5, 6, 7). It emphasizes the use of movement and tactile stimuli along with visual and auditory effects.

The use of multi-sensory methods stimulates the child's nerves, and this method is considered one of the most efficient ways to solve the problems of students with writing disorders. On the other hand, the use of the multi-sensory method, due to the fact that it considers listening attention, seeing, correct pronunciation, reading, tracing with the finger and the details of the word, simultaneously enhances the learning' phonological awareness of the word; Also, if this method is used effectively, it will cause children's writing problems to be fundamentally solved, and their spelling weaknesses will not return, and in this way, effective and sustainable learning will occur (8). Therefore, educators and specialists have suggested the use of stimulating different senses in order to restore and strengthen the learning of children with dyslexia and dyslexia (9). From this point of view, methods such as Fernald's method, Rosner's method, and Sina's method are among the multisensory methods that are widely used in the field of special learning difficulties (10).

Fernald's multi-sensory approach emphasizes visual, auditory, kinetic and tactile approaches in teaching writing, spelling, and reading. The word that the child wants to learn is written on the paper in capital letters and the students trace it with their fingers. This process continues until the student can write the word without looking at the word and from memory. Finally, the student finds the ability to generalize words and can create new words (11). Also, in Rosner's multisensory method, which is generally the ability to understand the differences and similarities in a set of shapes, it is a visual perception skill. The ability to recognize and classify auditory stimuli and trace their meaningful patterns and distinguish between sounds in spoken language depends on strengthening auditory perception. Many tasks performed by hand (e.g., writing and typing) require movements. Also, many game and sports activities require high gross motor skills. It is for these reasons that lower-level tasks in this hierarchy are

very important in educational programs for children with learning difficulties (12).

Dolatabadi and Hosni's research (13) showed that the effect of Rosner's multisensory method on three subscales of word reading and word chain and category signs was confirmed with 99% confidence. Salari and Abbasi (14) investigated the effect of education based on Fernald's multi-sensory method on the number of spelling errors of students with learning disabilities. They showed that Fernald's method reduces students' spelling errors. Therefore, it can be concluded that Fernald's multisensory method can be a suitable method for improving the spelling of students with dictation disorder. The results of Pakofte et al. 's study (15) showed that Fernald's method is effective in improving spelling learning disability among primary school students. Newman et al. (16) found that by having multisensory training techniques, maximum senses - seeing, speaking, hearing, enhancing memory and recall are involved and it, simultaneously, brings with it a wide range of improvements in cognitive abilities. It appears in the academic performance of students. Bardford (17), in a recent research, claimed that multisensory education is the most efficient method to solve the problems of students with special learning disorders stating that it significantly improves the learning of reading and writing (handwriting and dictation) of primary school students. Therefore, the present study sought to answer the question of whether Fernald and Rosner's multisensory training methods are effective in improving the level of spelling disorders of elementary school students in Tehran and what is the difference between these two methods?

2- MATERIALS AND METHODS

2-1. Study design and population

The current research was practical and semi-experimental with a pre-test and post-test design along with a control group. The statistical population of the research included all the students in the third and fourth grades of primary schools in the 6th and 11th districts of Tehran (3123 students) in the academic year of 2018-2019.

2-2. Sampling and procedure

To determine the inability to learn spelling in the first stage of the project, a sample of 30 elementary schools (15 boys' schools and 15 girls' schools) was considered using a multi-stage cluster sampling method from regions 6 and 11, and two classes from the third and fourth grades were taken from each school. A total of 60 classes were selected. In the second stage of the sampling plan, the students with spelling learning disabilities were identified using the dictation test, the Wechsler IQ test and examining the academic record.

Among the students who had been diagnosed with problems, 600 students were given a pre-dictation test as a prototype. Among those whose dictation test score was one standard deviation higher than the average (45 points), 150 students were selected as the initial sample; and out of these 150 students, 45 cases were randomly selected as the research sample through screening and replacement. They were divided into two experimental groups and a control group (15 each). The 15 controls were randomly selected from the normal students of the same 60 classes. In this way, the total sample of 45 people included 15 people with spelling disorders in the experimental group of Fernald's multisensory training method (8 girls and 7 boys), 15 people with spelling disorders in the experimental group of Rosner's multisensory training method (7 girls and 8 boys), and 15 normal students in the control group (8 girls and 7 boys). The participants'

hearing and vision health was determined based on the measurement plan in the student file.

Before implementing the independent variable, a pre-test (spelling test) was taken from both groups. Then, the experimental groups were respectively subject to fourteen 45-minute sessions of Fernald's multisensory training and 9 sessions of Rosner's multisensory training. There was no intervention in the control group. At the end, the post-test of the spelling test was performed and the results were compared. Fernald's and Rossner's Multisensory Teaching Protocols are described in **Tables 1** and **2** below.

Table-1: Summary of Fernald's multisensory method of teaching

Meeting	Purpose and process of meetings
First	Familiarization with the students and talking about their family status, number of brothers and sisters, how the class is doing, encouraging and persuading the student to learn, asking the student to cooperate with the researcher. Then form A of the test (pre-test) was read to the student and they were asked to write the read words.
Second	A common text was selected from the text comprehension subtest of the test, and the students were told to read the text one by one, and we chose all the words in which they had reading difficulties, so that we could practice these words in the next sessions. To create motivation, we practiced some words that the student could read in the sand tray. At the end of the session, the researcher listed the number of words to be taught.
Third	First, the first word was written on a piece of paper and given to the student, and then it was read aloud by the researcher. And the student looked at the word and listened; then s/he moved his finger on the word while listening and seeing. In the next step, we asked the student to write the word in the air and to further strengthen the sense of touch and Write s/he wrote it in the sand tray.
Fourth	Another set of words was given to the students for 45 minutes, which was the time of the training session, to practice like in the third session. In this session, apart from the sand tray, sandpaper was also used. That is, the student glues the letters of the desired word together to make that word; Then they put their hands on the word and read it out loud.
Fifth	In these sessions, like the third and fourth sessions, we taught the remaining words that we had determined in advance.
Sixth	Like the third and fourth sessions, we taught the remaining words that we had determined in advance.
Seventh	In this session, the goal is to prepare the student to create and write a story with the learned words. We read the story from which we had chosen the words; And then we showed the educational words to the child and encouraged him/her to make a story with these words. At the end of the meeting, we gave a cardboard CD as a reward for encouraging them.
Eighth	The students were asked to read the first text of the second grade of the comprehension subtest of our test, and we chose all the words that they had difficulty reading in order to teach the words in the next sessions.
Ninth to Twelfth	In this stage, the goal was to prepare the students to create a story and write a story with the learned words. After the story was written, it was typed for

	the student and s/he was asked to read the typed version. After finishing the story, the subject must write the new words one by one on cards and put them in his personal file.
Thirteen and Fourteen	In the last sessions, the goal is to read the text aloud, the researcher selects a text from the student's book and reads each sentence aloud to the student, and, the students listen carefully while looking at the sentences and tracing the read words with their hands. Each student is asked to read the text aloud and trace the words with his fingers. After the training, Form B of the test (post-test) is read out to the students and they are asked to write the words.

Table-2: Summary of Rosner's multisensory teaching method

Meeting	Purpose and process of meetings
First	1. Strengthening visual memory through different objects; 2. Strengthening perception and visual clarity by using images that have minor differences despite their appearance; 3. Teaching spelling by multi-sensory method
Second	1. Strengthening visual memory by presenting composite images that include several components; 2. Strengthening perception and visual clarity through the practice of recognizing image differences. 3. Teaching spelling in a multi-sensory way
Third	1. Strengthening visual memory by naming the missing object 2. Strengthening visual perception and clarity by finding some shapes in images 3. Teaching spelling by multi-sensory method
Fourth	1. Strengthening visual memory by imitating the instructor's body movements 2. Strengthening visual perception and clarity through frosty cards 3. Teaching spelling by multi-sensory method
Fifth	1. Strengthening visual memory and visual sequence through cards that contain different images. 2. Strengthening perception and visual clarity through the use of images in which some specific images are hidden and the student must find the hidden images. 3. Teaching spelling in a multi-sensory way
Sixth	1. Strengthening visual memory and visual sequence through cards on which geometric shapes are drawn. 2. Strengthening perception and visual clarity by finding one shape among other shapes 3. Teaching spelling by multi-sensory method
Seventh	1. Strengthening visual memory and visual sequence through cards on which geometric shapes are drawn. 2. Strengthening perception and visual clarity through matching based on shape, color and size 3. Teaching spelling by multi-sensory method
Eighth	1. Strengthening perception and visual distinction through the use of perceptual-visual progress tests 2. Strengthening perception and visual distinction using Kohs cubes 3. Teaching spelling by multi-sensory method
Ninth	Reviewing some of the previous techniques and evaluating the improvement in perceptual abilities and visual memory and evaluating academic progress in spelling.

Fallah Chai spelling test was implemented for data collection. This test is used to diagnose and measure the level of writing ability of subjects with writing disorders. The validity of the writing disorder test in Fallah Chai's research was found to be 86%. In terms of degree of difficulty, it is arranged according to the age and grade of elementary students. The test was designed by Falah Chai for the third and fourth elementary grades, and the number of words for the fourth grade is 80 and for the third grade is 70, and it is prepared from the text of the students' Persian books. There are three levels in this test. A) Writing 90%-100% of the words correctly, b) writing 75-89% of the words correctly, c) the number of mistakes in writing is more than 25% of the words in the spelling test. If in level (C), the student is considered to act below his age and, if confirmed in the subsequent tests, he is diagnosed with a learning disability for spelling. In fact, weakness in spelling is diagnosed when the student (examiner) misspells more than 25% of the words. The internal and retest coefficients of the third grade spelling test were 0.74 and 0.84, respectively, and in the fourth grade spelling test, they were 0.73 and 0.91, respectively (18).

2-6. Inclusion and exclusion criteria

The criteria for entering the students into the research were having a writing disorder based on Falah Chai's spelling test, being elementary school students between the ages of 7-11 years, having a normal IQ, and having healthy hearing and vision based on the assessment plan that is available in the students' files. The criteria for leaving were the absence of more than 2 sessions in the educational course and/or distorted and incomplete questionnaires.

2-7. Data Analysis

In this research, in order to analyze the data, descriptive and inferential statistics such as Lownes test and covariance analysis were performed, using spss-21.

ANQUA test presumptions for spelling disorder variable include: 1- Existence of linear relationship (straight line) between the dependent variable (in pre-test and post-test) which is done by examining the chart; 2- normal distribution of the univariate data; 3- homogeneity of the slope of the regression line. To compare the difference between the averages of two groups of Fernald's multi-sensory training method and the control group, the Lametrics post hoc test was used for the spelling disorder variable.

3- RESULTS

As can be seen in **Table 3**, out of 15 people in Fernald's multi-sensory training group, 8 of their mothers (53.33%) are 20-30 years old, and only 2 of the mothers (13.33%) are over 40 years old. Out of the 15 people in Rosner's multisensory training group, 9 of their mothers (60%) are 20-30 years old, which is the largest number of people in the group, 3 mothers (20%) are more than 31 years in age, and 3 mothers (20%) are between 31 and 40. Out of the 15 people in the control group, most of the mothers (n: 6, 40%) are in the age group of 20-30, and those in the age group of 31-40 are the least (n: 4, 27.26%).

According to **Table 4**, it is clear that there is a difference between the average of the control group and the average of the experimental group in the dependent variable of spelling disorder.

The results of **Tables 5** and **6** show that there is a significant difference in the amount of spelling disorder between the experimental group that was influenced by Fernald's multisensory training method and the control group in the post-test. According to the comparison of the mean difference (-6.364) of Fernald's multisensory training group and the control group in the amount of spelling

disorder, the effectiveness of Fernald's method in reducing spelling disorder is confirmed, when compared to people who did not undergo the method. Therefore, with a probability of 0.99, it can be said that the hypothesis of the research regarding the effectiveness of Fernald's multisensory training method on reducing spelling disorders is confirmed.

Table-3: Frequency distribution in the three groups according to mothers' age

Mothers' age	level	Abundance	Abundance percentage	Cumulative frequency percentage
in Fernald's multisensory training group	20-30 years	8	53.33	53.33
	31-40 years	5	33.33	86.67
	more than 40 years	2	13.33	100
In Rosner's multisensory training method	20-30 years	9	60	60
	31-40 years	3	20	80
	more than 40 years	3	20	100
In the control group	20-30 years	6	40	40
	31-40 years	4	26.67	66.67
	more than 40 years	5	33.33	100

Table-4: Statistical characteristics of spelling disorder variable (n=45)

Group		Spelling disorder	
		Average	The standard deviation
Fernald multisensory training method	pre-exam	49	1.512
	post-test	41.47	1.807
Rosner's multisensory method	pre-exam	49.27	2.120
	post-test	44.13	1.187
control group	pre-exam	48.47	1.407
	post-test	47.67	1.291

Table-5: the dependent variable of spelling disorder in adjusted average conditions (n=45)

Groups	Spelling disorder	
	Average	The standard deviation
Fernald multisensory training method	41.439	0.354
Rosner's multisensory method	44.024	0.357
control group	47.024	0.358

Table-6: Univariate covariance analysis of Fernald's multisensory method and the control group on spelling disorder

Diffraction source	SS	df	MS	F	P	Difference of means
spelling disorder	298.594	1	298.594	158.679	0.0005	-6.364
error	80.859	41	1.972	-	-	-

The results of **Table 7** showed that there is a significant difference between the experimental and control groups in the post-test of spelling disorder. According to the comparison of the averages of the two groups (-3.780), Rosner's multisensory training, as compared to the control group, is more effective in reducing the amount of spelling disorder in the post-test.Thus, according to the obtained results, with a probability of 0.99, it can be said that the hypothesis of the research regarding the effectiveness of Rosner's multisensory training method on reducing spelling disorders is confirmed.

Table-7: Univariate covariance analysis of Rosner's multisensory training method and the control group on the spelling disorder

Diffraction source	SS	df	MS	F	P	Difference of means
spelling disorder	103.120	1	103.120	54.800	0.0005	-3.780
error	77.152	41	1.882	-	-	-

Table-8: Univariate covariance analysis of Fernald and Rosner training methods and the control group on spelling disorder

Diffraction source	SS	df	MS	F	P	Effect size η^2
spelling disorder	300.931	2	150.465	79.960	0.0005	0.796
error	77.152	42	1.882	-	-	-

The results presented in **Table 8** show that there is a difference between the experimental groups influenced by Fernald and Rosner's multisensory training method and the control group that did not receive any training. There is a significant difference in the amount of variance of the spelling disorder variable.

$F_{(2, 42)}=79.960$, $P<0.01$, Partial $\eta^2=0.796$

Table-9: Univariate covariance analysis of the spelling disorder in Fernald and Rosner's multisensory training methods

Diffraction source	SS	df	MS	F	P	difference in averages
spelling disorder	49.880	1	49.880	26.507	0.0005	-2.584
error	77.152	41	1.882			

As presented in **Table 9**, there is a significant difference in the amount of spelling disorder in the post-test between Fernald's and Rosner's experimental groups.

$F_{(1, 41)}=26.507$, $P> 0.01$

Based on the comparison between the two group averages (-2.584) in the amount of spelling disorder, it is revealed that Fernald's multisensory training was more effective than Rosner's method in reducing

the variable of spelling disorder in the post-test.

4- DISCUSSION

The findings showed that there is a significant difference in the amount of spelling disorder between the experimental group that was influenced by Fernald's multisensory training method and the control group in the post-test. This finding was consistent with the results of Bradford (17), Ashbaugh (19), Haqtalab et al. (10), Staki et al. (18), and Pakofte et al. (15). In fact, the result of the present research confirms the effectiveness of using more than one sense during education in increasing the level of learning. Learning to spell is difficult. Because spelling is a complex linguistic and cognitive process and parrot-like memory is also important in spelling. In the present study, by using Fernald's method and enhancing various aspects of learning, including memory at the level of vision and hearing, improvement in students' spelling scores was achieved. Multi-sensory method helps the person with a learning disability to be more successful in learning through using different senses and strengthening them. In Fernald's multi-sensory approach, an attempt is made to present new words for hybridization with the extensive use of visual, auditory, tactile and kinetic methods. In this way, the child sees the word (vision), reads it (language-hearing) and writes it (touch-movement). In this method, the child is provided with the condition to first see the words in a large and legible font. Then that word is read to him and he is allowed to see the shape of the word; after hearing the pronunciation of the word, he repeats it, and finally, he draws his finger on the writing of that word, draws it on the sand, or writes with chalk on the blackboard. As revealed in the results, inputting data and concepts from different sensory channels helps to cognitively stabilize that word, and creates harmony. Also, the findings of this research are in line with the results of studies (16, 20) which emphasized that Fernald's multi-sensory training method has a positive and significant effect in improving the dictation problems of students with dictation disorder. Since Fernald's method is a whole-word methodology of language experience, the student feels, sees, pronounces and hears the word at the same time. For this reason, it is considered a suitable method to restore and strengthen learning. According to the mentioned studies, we can see that Fernald's multisensory teaching method helps students with learning disabilities a lot so that they can achieve more progress in learning by involving their various senses and developing them, and since in the multisensory method of sense Visual, auditory, kinetic and tactile senses are used simultaneously and continuously, the speed of children's progress in the ability to imitate increases.

Also, the findings of the research indicated that Rosner's multisensory training method has an effect on reducing spelling disorders. These findings were consistent with the findings of Dolatabadi and Hosni (13). As the results of this research showed, Rosner's multi-sensory teaching method was effective in improving students' dictation performance; and several factors can be mentioned for the proper efficiency of this method. One of the reasons for its success is that this new educational method is different from the usual and older methods in that it provides real and objective experiences, learner attraction, and speed in receiving information. Also, the availability of this training, coordination with the student's needs and matching the student's ability level are other reasons for its effectiveness. Masterson and Apel (21) mention learning in a meaningful way as one of the success factors of this method. As stated by Ainsworth and Mayer, learning in this way can be called

meaningful learning, because with this method, the learners are able to get a coherent mental image of these multiple sources of information (i.e. sound, image, etc.); and they are so able to give meaning to the presented materials and to provide the reasons for the consolidation of learning. According to Rosner's multisensory learning perspective, the learner first receives verbal information from a text, then receives visual information from a form, and finally receives auditory information, and thus a text (verbal mental representation), sound or image (visual and auditory representations) build a foundation to be integrated by the child (22). With the addition of attractive and age-appropriate songs and sounds, the child's mind can be more involved in the process of learning. Therefore, it can be generally concluded that teaching how to use a word processor together with self-questioning strategies has been effective in improving the writing performance of children with writing disorders.

Furthermore, the research findings showed that there is a significant difference in the amount of spelling disorder in the posttest between the experimental group that was influenced by Fernald's multisensory training method and Rosner's multisensory training method group. In previous studies, we found no research comparing the effects of these two methods on the improvement of students' writing disorder. However, Ziniwand has compared the multisensory methods of Orton and Fernald on the improvement of students' reading disorders, and based on the results obtained, it has been determined that teaching in the multisensory method of Fernald is more effective than teaching in the multisensory method of Orton in the reading disorder of students. Also, Molodi et al. (23) compared the effectiveness of Fernald's multisensory training and computer-based training on reducing spelling problems and showed that Fernald's multisensory training is more effective and beneficial in reducing students' spelling problems. In another study, Kakavand et al. (24) aimed to compare the effect of Fernald's and Orton's multisensory methods on improving reading disorders, and concluded that Fernald's training method is more beneficial than Orton's method in the reading performance of dyslexic students.

5- STUDY LIMITATIONS

Lack of attention to disorders such as hyperactivity and attention deficit, language delay, anxiety and family issues was among the limitations of the present study. Although such disorders are associated with spelling problems, they could not be considered due to time constraints and the epidemic Corona. Another limitation was the lack of follow-up of the consequences of the application of Fernald’s and Rosner's multisensory education methods in improving the dictation problems of students with special spelling disorder. Considering the fact that an available sampling method was applied in the study, the limited samples can be also considered among the limitations.

6- CONCLUSION

Fernald's method is a whole-word method of language experience. In this method, the student feels, sees, pronounces and hears the word at the same time. For this reason, it is considered a suitable method to restore and strengthen learning. In line with the results of previous studies, we found that Fernald's multisensory teaching method helps students with learning disabilities a lot so that they can make more progress in learning by involving their various senses and strengthening them, and since in the multisensory method Visual, auditory, kinetic and tactile senses are used simultaneously and continuously, the

speed of children's progress in the ability to imitate increases. It is, then, suggested that considering the effectiveness of both educational methods, we can use them as effective methods in solving spelling problems for the scientific community in the field of special learning disorders in educational and rehabilitation centers.

7- ETHICAL CONSIDERATIONS

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