



The Effect of Visual and Auditory Accuracy Training Strategies on Improving the Reading Performance of Second-Year Elementary Students with Dyslexia in Sabzevar

Hassan Bagheri nia, Ph.D.

Gholamreza Zareian, Ph.D.

Seyed Ahmad Mohammadi Hoseini, Ph.D.

Department of Educational Sciences, Hakim Sabzevari University, Sabzevar, Iran.

Zahra Ejadi, Ph.D.

Department of Educational Science, Esfaryen Branch, Islamic Azad University, Esfaryen, Iran

Abstract

In the present study, the effect of visual and auditory accuracy training strategies on improving reading performance in second-grade dyslexic students was investigated. The statistical population of this study was estimated to be 900 second grade elementary school students with dyslexia in Sabzevar in 2017. According to the study population, a sample of 30 dyslexic children who referred to the Learning Disorders Center was selected by multistage cluster random sampling and randomly divided into three groups of ten -two experimental and one control groups-. The research method was quasi-experimental with a pretest-posttest design. The instruments used in the study were the Wechsler Intelligence Scale for children (WISC-R), the reading performance test and a teacher checklist. The experimental groups participated in 12 sessions of audio-visual accuracy training while the control group received their instruction by the conventional teaching method during the same period. The duration of each session was 45 minutes. The obtained data were analyzed by covariance analysis method, and the results indicated that there is a significant difference between the adjusted mean of participants' reading error scores in the visual acuity group and the control group ($p < 0.0001$). It was also found that visual and auditory accuracy training is practical in the reading progression of dyslexic students. Reinforcement of Visual and Auditory Accuracy Training Strategies as a prerequisite for the neuropsychological neuropathy leads to improved reading performance in students with learning disabilities.

Keywords: audio and visual accuracy, training strategies, dyslexia, reading progress

Receive Date: 15 August 2021

Revise Date: 18 November 2021

Accept Date: 17 December 2021

Publish Date: 01 January 2022



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Corresponding Author: Hassan Bagheri nia

Email: hbagherinia@gmail.com

Online ISSN: 2645-5455

Print ISSN: 2645-5447

How to Site: Bagheri nia, H., Zareian, G., Mohammadi Hoseini, S., Ejadi, Z. (2022). The Effect of Visual and Auditory Accuracy Training Strategies on Improving the Reading Performance of Second-Year Elementary Students with Dyslexia in Sabzevar. *Iranian Journal of Learning & Memory*, 4(16), 55-62. <https://dorl.net/dor/20.1001.1.26455455.2022.4.16.5.5>

Introduction

Children with special needs require special attention and specific facilities in comparison to other children.

Therefore, their well-being and growth are dependent on how well they benefit from assistance (Fadzil et al., 2022). Special needs can also be a legal designation, particularly in the adoption and foster care community,

wherein the child and guardian receive support to help them both lead productive lives (Tomić, 2022).

A learning disability is a neurological condition which affects the brain's ability to send, receive, and process information (Kalyanpur, 2022). A child with a learning disability may have difficulties in reading, writing, speaking, listening, understanding mathematical concepts, and with general comprehension (Modak & Gharpure, 2022). Learning disability is one of the issues that has been of interest to researchers in recent decades. Students with learning disabilities are unable to learn in specific areas despite having an excellent educational environment and natural intelligence and lacking brain and biological deficits and psychosocial problems. Until the mid-1960s, learning disabilities not considered specific disabilities (Törmänen, Takala & Sajaniemi, 2008).

At least 5 percent of school-age children are affected by learning disorders, and in the United States, about half of all public-school children receive exceptional educational services (Kamhi, 2014). The Disability Education Act of 1975 required the United States to provide free and appropriate educational services to all children. (Russo, 2019). Learning disorders are associated with the risk of a variety of concurrent disorders, including attention-deficit hyperactivity disorder, communication disorders, conduct, and depression (Morsanyi, van Bers, McCormack, & McGourty, 2018).

According to the US federal government, learning disability is defined as "a disorder of one or more of the underlying psychological processes involved in the process of understanding or using oral or written language. This disorder can impair a person's ability to listen, think, speak, read, write, spell, or do mathematical calculations (Lachmann & Leeuwen, 2008). This term includes conditions such as caring disabilities, brain damage, minor impairments in brain function, dyslexia and Aphasia (Chupan Zideh, Abedi, & Pirooz Zijerdi, 2015). This term does not apply to children whose learning difficulties arise from motor, visual or hearing impairments, mental retardation, emotional disturbances, environmental, cultural or economic poverty (Chen & Li, 2008).

Reading is the most basic learning tool for students, and dyslexia accounts for the most significant percentage of students with learning disabilities, which defined as failure in language skills such as reading, writing, and spelling (Bonacina et al., 2015). Carefulness and attention are also one of the essential factors in learning where these students are severely impaired. Dyslexia defined as a disorder in children who, despite having adequate training with their level of

intelligence, are not successful in language skills such as reading, writing, and spelling (Ellis, 2016).

One of the significant problems of students that disrupts the educational process and reduces their efficiency in academic performance is the lack of attention (May & Elder, 2018). Attention defined as taking the mind purposefully and focusing on a particular subject, thought, or object among several items at a time (González et al., 2015). Attention is needed in all mental processes. In a cognitive activity, we first focus on the stimulus and then perceive it. Therefore, attention is critical in cognitive, behavioral and subjective performance because even a small amount of attention affects learning performance (Zoubrinetzky et al., 2016).

Attention acts as the mind's keeper, which does so by regulating and prioritizing the stimuli processed by the central nervous system. Components of attention include arousal and care regulation, selective attention, sustained attention, attention span, or divided attention, inhibition, and behavior control (Ruffino et al., 2014). However, it is difficult to identify and measure the components of attention because attention is usually assessed by different activities, and other parts of the brain influence the processing of attention (Alves et al., 2016). However, many studies have found that the leading cause of learning deficits are attention deficiencies in the flow of information.

Dyslexia, more than other learning disorders in different domains impede academic achievement (Visser et al., 2020). Moreover, according to the findings of the above research, attention deficit disorder is one of the main issues in students with reading deficiency (Kofler al., 2019). Therefore, it is essential to find a solution to reduce or eliminate this problem and this study aims to help achieve this purpose.

Attention is an integral part of all mental processes. As mental activities require precision, problems in attention and lack of mindfulness lead to impairments in perception, recall, authentic learning, and conceptualization that consequently lead to the poor performance of students at school. Thus, pecial activities can provide treatment for these children. One of the measures used is to employ a precision training method for these individuals to increase their precision and attention. In general, this study sought to examine whether training of auditory and visual accuracy strategies influences reading improvement in elementary school students with reading disorder.

Colé et al. (1999) examined the effects of auditory and visual accuracy training on the ability to distinguish voice recognition letters and reading words in children at risk of developing dyslexia. The experimental group performed better in voice recognition letters, recalling

sounds and letters, and recognizing words in the posttest phase. Results show the effect of visual and auditory training on the recognition of sounds and letters and the reading performance of third-grade students. Also, the results of Howes et al.'s (2003) study showed that children with reading impairment perform significantly lower on visual and auditory perception than healthy children.

Moreover, based on a study conducted by Ali et al. (2021), defects in visual and auditory perception causes difficulty in dyslexic attention. This impairment of attention may impair the development of phonetics and the recognition of sounds and letters that are essential for reading learning and may make reading difficult. Therefore, based on the results of numerous studies on the effect of perception, primarily visual and auditory perception on reading performance, and considering the effectiveness of visual perception and auditory perception training on reading performance, the main issue of the present study was to compare the effectiveness of visual and auditory perception training on the ability of reading dyslexic children (Hsu et al., 2013).

Method

Design

The method of this research was experimental using pre-test and post-test design with three groups: two experimental groups with visual and auditory accuracy training and one control group.

Participants

According to the study population, that was estimated to be about 900 students, a 30-person sample of dyslexic children who referred to the Learning Disorders Center was selected by multistage cluster random sampling and randomly divided into three groups of ten. In addition to the control variables, the inclusion criteria for the sample selection included dyslexia and average intelligence, and being healthy is auditory and visual senses and no other disorder like stuttering.

Table 1.

The Instructional Protocol in 12 Sessions

Session	Objective	Activity	Session	Objective	Activity
1	Reading assessment	Administering NEMA	7	Practical accuracy	Targeting
2	Listening accuracy	Listening to recorded sounds	8	Eye and hand coordination	Playing with patterns

Instruments

Three instruments used in this study: the Wechsler Intelligence Scale for children (Razavieh & Shahim, 1990), the Reading and Dyslexia Test (Karami Nouri & Moradi, 2008), and a researcher-made reading problems checklist.

The Wechsler Intelligence Test for Children: The Wechsler Intelligence Test for Children was originally developed by David Wechsler (1949) and later validated for Iranian learners by Razavieh & Shahim (1990). This scale includes verbal, practical and general intelligence dimensions with 12 subcomponents and has been translated and adapted to measure the intelligence of children aged 6-16. The overall reliability of the test was 0.95 for each age group.

Reading and dyslexia test (NAMA): This test was designed and validated by Karami Nouri and Moradi (2008) and was performed and standardized on 1614 students (770 boys and 844 girls). According to the cut-off point of the test (157), a student who scores 157 or less than 157 (114 errors or more), will be recognized as a dyslexic student. The internal consistency of reading and dyslexia test was reported to be 0.81 (Karami Nouri & Moradi, 2008).

Reading Problems Checklist: This checklist was developed by the researcher based on dyslexic students' problems reported by Azizifar et al. (2019) with 14 items on problems in speech sound processing, word recognition, attention, motor coordination, and reading fluency including speed, accuracy, and appropriacy. The overall index of inter-rater agreement was 90% and the disagreements were resolved through discussion.

Procedure

The research method was quasi-experimental with a pretest-posttest design — the experimental groups were trained in 12 sessions of 45 minutes of visual and auditory accuracy. A summary of the instructional protocol is presented in Table 1.

Session	Objective	Activity	Session	Objective	Activity
3	Auditory memory	Repetition of words, numbers, and sentences	9	Touching accuracy	Identifying things by touching them
4	Visual accuracy	Identifying differences, defects, and additions	10	Review	Listening accuracy and auditory memory
5	Visual memory	Concentration and following lines	11	Review	Visual accuracy and memory
6	Descriptive memory	Remembering parts of pictures	12	Evaluation	Reading test

Data were analyzed using descriptive statistics such as mean and standard deviation, and inferential statistics used for analysis of covariance. In this analysis, the effect of pre-test control variables on the post-test scores was removed and the least significant difference was used to compare the groups.

Table 2.

Descriptive Statistics for Reading Error Scores in Pre-and Post-Tests in all Groups

Group situation	Number	Pre-test		Post-test	
		mean	Standard deviation	mean	Standard deviation
Visual accuracy experimental group	10	66.80	14.05	36.70	12.78
Auditory accuracy experimental group	10	66.10	14.80	42.50	13.92
Control group	10	66.40	15.25	58.80	17.24

As seen in Table 2, in the pre-test stage, the average reading error score in the visual acuity training group was 66.80, and the mean in the second experimental group, auditory accuracy group training group, was 66.10 and in the control group 66.40. Whereas after training, in the posttest, the average score of reading error was 36.70 in the visual accuracy training group, 42.50 in the auditory accuracy training group, and 58.80 in the control group.

Inferential Results

In analysis of covariance (ANOVA) there are some assumptions such as independent observations, normality, homogeneity of variances, and linearity that were examined and confirmed. The inferential results as seen in tables 3-5, by omitting the effect of all control variables, indicate that there is a significant difference between the adjusted mean of participants' reading error scores in the visual acuity group and the control group ($p < 0.0001$). The difference in the post-test means that the variance or individual differences between the post-

Findings

Descriptive Results

The descriptive results of the study as presented in Table 2 show the differences in the means of reading errors for all the three groups.

test reading scores are related to the effect of visual accuracy training methods. The statistical power of one and a statistical level of zero indicate that the sample size is sufficient

Table 3.

Levene's Test of Equality of Error Variances

Dependent Variable: posts			
F	df1	df2	Sig.
4.932	2	42	.012

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.

a. Design: Intercept + perSS + group

As it can be seen in Table 3, the results of the Levene's test, the significance level is 0.012 and the calculated f is 4.932. It shows that the assumption of equality of variance in the dependent variable is confirmed because the value of significance is smaller than the error level.

Table 4.
Tests of Between-Subjects Effects

Dependent Variable: posts								
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Squared	Eta	
Corrected Model	2581.524 ^a	3	860.508	47.441	.000	.776		
Intercept	603.906	1	603.906	33.294	.000	.448		
Pre-test	2472.324	1	2472.324	136.303	.000	.769		
Group	245.046	2	122.523	6.755	.003	.248		
Error	743.676	41	18.138					
Total	454526.000	45						
Corrected Total	3325.200	44						

a. R Squared = .776 (Adjusted R Squared = .760)

As the results of Table 4 show, the significance level of the pre-test and the control group is less than 0.05. Also, the calculated f is more than the allowable value of

1.96, so according to the results obtained in the table above, it can be inferred that there are significant differences in the means of pre-test and control group.

Table 5
Multivariate Tests^a

Effect		Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^d
Intercept	Pillai's Trace	.387	12.306 ^b	2.000	39.000	.000	.387	24.611	.993
	Wilks' Lambda	.613	12.306 ^b	2.000	39.000	.000	.387	24.611	.993
	Hotelling's Trace	.631	12.306 ^b	2.000	39.000	.000	.387	24.611	.993
	Roy's Largest Root	.631	12.306 ^b	2.000	39.000	.000	.387	24.611	.993

As the results of Table 5 show, the significance value is equal to zero and is less than 0.05. Therefore, it can be

concluded that the reading performance of students with dyslexia depends on educational strategies.

Table 6
Paired comparisons of the three groups of visual accuracy, auditory accuracy, and control in the post-test phase

Group		Averages difference	Standard deviation	Sig
Visual accuracy experimental group	Visual accuracy	-3.87	2.30	0.11
	Auditory accuracy	-21.83	2.30	0.0001
Auditory accuracy experimental group	Visual accuracy	3.87	2.30	0.11
	Auditory accuracy	-17.95	2.30	0.0001
Control group	Visual accuracy	21.83	2.30	0.0001
	Auditory accuracy	17.95	2.30	0.0001

As can be seen, the difference between the mean scores of post-test error reading in the visual acuity group and the auditory accuracy group in the post-test was not significant ($p < 0.1$). In other words, there was no significant difference between the mean reading error scores of the visual acuity group and the auditory

accuracy group in the post-test phase and the hypothesis was confirmed. Given that the sample size was equal, Tukey post hoc test was used.

Considering the non-significant difference between the mean error scores in the post-test phase, it can be concluded that both educational interventions (visual

accuracy training and auditory accuracy training) significantly and almost equally increased the reading ability of students with the reading disorder.

However, the difference between the mean error scores in the posttest reading of the two experimental groups and the control group in the posttest was significant ($p < 0.0001$). Moreover, training for both experimental groups has been practical.

Discussion

In this study, the effect of visual and auditory accuracy training strategies on improving reading performance in second-grade dyslexic students was investigated. The results of the analysis of covariance showed that there was a significant difference between the mean scores of error in the pre-test and post-test, in the reading test of the experimental groups, in the visual and auditory accuracy Compared to the control group. The results showed no difference between the two experimental groups and both treatments were useful in reading dyslexic children. Given the high effect of this effect, it can be concluded that the present study educational intervention significantly increased the reading ability of students with reading disorders.

The findings in a study conducted by Howes et al. (2003) showed that children with reading impairment perform significantly lower on visual and auditory accuracy than healthy children. Also, according to Facoetti et al. (2003), defects in visual and auditory accuracy cause problems in the attention of children with dyslexia. Moreover, this impairment of attention may have negative effects on the development of phonetic knowledge that is essential for the recognition of the sounds and letters as the early stages of reading.

The results of various studies show that although dyslexic children have average intelligence, they have lower reading performance than their typical peers. In a study by Soltani et al. (2021), the effect of executive functions and attention on reading and mathematics impairment were investigated. Their findings showed that after the end of the training period, the performance of children improved. Recent studies of attention processes on the performance of children with learning disabilities all suggest that children with learning disabilities have poor performance on selective attention, attention retention, etc.

the reviewed studies revealed that there is a mental defect in dyslexic children and that it is the inability to focus attention on the subject at stake. Also, children with particular learning disabilities have delayed their growth process in acquiring precision and natural attention. These children perform the worst performance in assignments where distracting factors are present, and

most teachers rate them as people who are significantly less attentive than their typical peers.

Moreover, in a study, Törmänen et al. (2008) investigated the effect of visual-auditory adaptation training on the rehabilitation of dyslexic reading skills. During their training, they worked on matching audible sounds to visual signs, processing and identifying sounds, letters, and visual cues. Specifically, there were improvements in word reading and speed reading because of improvements in the processing and recognition of sounds and letters and visual cues and the adaptation of visual and auditory symptoms. Such problems with reading dyslexia may be rooted in perceptual problems and the perception of visual and auditory signs and symptoms for encoding. Based on the present study findings, it can be said that many reading problems of dyslexic students are due to lack of attention as the process of developing attention in dyslexic children is slow and delayed, so teachers in special schools must meet the prerequisites by paying more attention to reading. As a corollary of such an emphasis, attention training can be used to improve reading performance in children with dyslexia. Moreover, in explaining this finding, it can be said that the implementation of such interventions can prevent the occurrence of psychological problems such as depression and anxiety caused by the conditions and play an effective role against problems. Reinforcement of attention as a prerequisite for the neuropsychological neuropathy leads to improved reading performance in students with learning disabilities.

Conclusion

If educational and therapeutic measures are not taken to remedy this disorder, in many cases, these students will have difficulty with adulthood. Therefore, timely measures to solve such problems are primarily the responsibility of the education system. On the other hand, learning problems considered a factor in the anxiety of teachers and parents. The consequences of learning disabilities are now more evident than at any other time in history. Therefore, it seems necessary to use therapeutic methods for these children. Moreover, while the results of this study confirm the effectiveness of precision training interventions on reading performance, precision rehabilitation can be considered as a necessary measure to reduce learning problems, especially dyslexia.

These results explained by the fact that learners' attention to the subject is one of the main factors in teaching and learning, and if their attention is not sufficient, one's learning is impaired. Therefore, primary school teachers should pay attention to teaching reading

to children, especially children with dyslexia. Attention training and its variants are either a game or a rhythmic game as a behavioral intervention. Intervention indicates improvement effects in a child with dyslexia. Also, dyslexic children may have difficulty with neuropsychological skills that include attention and memory. Dyslexic child attention can increase by playful and lively physical activity. As a result, this method can improve reading performance in children with learning disabilities. Therefore, teachers and educators should pay particular attention to attention training.

One of the limitations of this research is that the participants of this study were dyslexic students. Therefore, caution should be exercised in extending the results to other learning disabilities, including Dysgraphia and dyscalculia. Moreover, This study was limited to second graders and the results cannot be generalized to other age groups. And finally, the educational facilities for teaching auditory and visual accuracy were limited to devices used by teachers in classes without any homework or out of class activities.

It is suggested that in the first step, screening and early identification of students at risk be included in the primary priorities of education, and in the second step, in-service training courses for teachers, strengthening skills of accuracy and visual and auditory attention be taught. It is also suggested that in future research, the effect of this educational method on other areas of learning such as written expression, comprehension and mathematical problems of students with learning disabilities in different age and gender groups be examined.

Conflicts of Interest

No conflicts of interest declared.

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