

## The Effectiveness of Perceptual Enrichment on Self-Efficacy in Third Grade Primary School Students: A Randomized Clinical Trial

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### Original Article

#### Abstract

**Introduction:** The ability to read is one of the most critical skills in today's modern world. Since many people have reading problems, the early and correct diagnosis and effective treatment seem necessary. The present study aims to determine the effectiveness of perceptual enrichment on the self-efficacy in the third grade children suffering from dyslexia in Hamadan, Iran.

**Materials and Methods:** 50 children participated in this randomized controlled clinical trial, all of whom were suffering from dyslexia and studying at the third grade of primary school in the city of Hamadan in the school year 2019-2020. The subjects were selected using the purposive method and randomly divided into the two experimental and control groups. The intervention consisted of 21 sessions. The control group, with the agreement of the child and the parents, did not have any parallel treatment process during the study. In the experimental and control groups, the Motivational Strategies for Learning Questionnaire (MSLQ) was used. Multivariate analysis of variance (MANOVA) was used to analyze the data.

**Results:** The results showed that the native pattern of perceptual enrichment had a significant effect on improving self-efficacy in children with dyslexia ( $P > 0.01$ ).

**Conclusion:** The study findings suggested that the native pattern of perceptual enrichment is effective in improving self-efficacy in the children with dyslexia.

**Keywords:** Perceptual enrichment; Dyslexia; School children; Self-efficacy

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#### Introduction

In the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), the learning disability is renamed to specific learning disability and dyslexia is included in the Specific Learning Disorders (SLD) set, which is recognized with symptoms such as incorrect or slow and with difficulty reading of words, difficulty understanding the meaning of what is being read, and difficulty spelling words (1). However, students with mental disabilities, untreated vision or hearing problems, or other mental and neurological disorders, and students who have experienced poor psychosocial conditions and those with poor educational and reading performance are not included in the

definition of dyslexia (2). Based on the latest reports, the prevalence of this disorder in Iran is estimated to be equal to 10% in primary school students, and is twice in boys compared to girls (3). Various hypotheses have been put forward in the etiology of this disorder, which in general can be a combination of environmental and genetic impacts (4). Among the main causes of dyslexia are perceptual disorders (impairment in auditory, visual, sensory, and motor perceptions and visual and auditory processing), inability to understand words, inability to pay attention to important aspects of words, sentences, or paragraphs, and inability to understand speech units represented by letters (5).

Reading is a kind of psycho-linguistic process

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based on the reader's visual, auditory, and touch perceptions and awareness, as well as phonological and semantic rules and the result of perceptual processing in his/her brain. Therefore, perceptual skills play an important role in reading (6). Perceptual disorders mean the inability to identify, distinguish, interpret, and explain feelings that should be distinguished from sensory disorders (5).

The ability to read a text is an essential skill for educational success. However, many students lack the basic skills in reading and recognizing the main idea and message of the text (3). The prevalence of reading ability problems in all students is estimated to be 6.8% and in boys three times higher than girls, and the different levels of comprehension (reading literacy) in students with dyslexia are lower than the average performance of other students (7). This problem adversely affects students' ability to read, comprehend, and recall information presented in the text, followed by many learning activities in school (3). The main reason for the difficulty of perception in individuals with dyslexia is their weakness in short-term memory and also, lack of attention to sensory stimuli (5). When a sensory stimulus is ignored, that stimulus does not enter the short-term memory, or if it enters the short-term memory, it takes so long to process that is erased from the short-term memory and this slowing or deletion of the information prevents the child from perceiving this information and stimulus (6). A child who cannot read has very little chance of succeeding in school. The child's failure to learn to read in the early years of school effectively deters him or her from other curricula (3).

Reading and comprehension skills in the first grade of primary school are incomplete due to the excitement of entering school, unequal level of education, and also teaching aids, and these skills are gradually completed by the third grade of elementary school, so that dyslexia can be recognized in third grade students with higher reliability (7). On the other hand, children who have difficulty learning to read often have a negative view of their competence, lower self-esteem, self-valuation, self-efficacy, and academic vitality, and show higher procrastination, anxiety, and stress (8).

Sometimes, due to environmental pressures and the inattention of others to the special abilities of this group of children, psychological and behavioral problems are added to the previous problems (3). In fact, reading in the early years is the most important factor for internal evaluation, self-efficacy, and academic achievement of children (8). For this reason, various researchers at the elementary level

have paid special attention to this issue (5-9).

Children with reading difficulties also have difficulty with classroom activities (1) and often have doubts about their academic self-efficacy (7). This skepticism is the result of their frequent failures in classroom activities, which spread their disinterest in all matters related to school and education to the point that many of them drop out of school halfway through and prefer hard, exhausting, and even false jobs to continuing their education (8).

In order to treat psychiatric disorders related to reading disorder, different approaches have been proposed, including the multi-sensory approach such as the Hegge-Kirk-Kirk method (5), Everton-Gillingham approach (6), Corrective Reading program (8), Computer training (4), Cena Training tool (6), Fernald method (5), and Perceptual approach (8,10).

The perceptual enrichment package (10) includes the senses of sight, hearing, and touch, as well as sensory-motor exercises, i.e. proprioception and kinetic sense (9). The criterion of movement and work in compiling this package is the sensory integrity pyramid. In other words, the integrated sensory pyramid is the basis of the perceptual enrichment program (10) and includes stage A (attention training only), stage B (attention and memory training), and stage C (higher levels of attention, memory, and sensory multiplication training). In compiling the package, it has been tried to observe the pyramidal feature in the whole package and the exercises are moving from simple and low-challenge (in stage A) to hard and challenging (stage C) (8,10).

Reinforcement skills include Sensory cleansing (the ability to recognize difference between sensory stimuli), Sensory memory (the ability to memorize sensory stimuli), Sensory sequence memory (the ability to memorize sensory information consecutively and in order), Spatial directions (ability to recognize directions relative to self, environment, or other object), stimulus stability (identification of a sensory stimulus in different states and conditions), and recognizing the shape of the background (only related to the sense of sight). These exercises promote eye-hand coordination, body awareness, motor programming, balance, input control, and body posture regulation (10), in addition to enhancing the skills of the senses of sight, hearing, touch, taste, and movement (9,10). Recent research on perceptual stimuli (10-14) and their satisfactory results in children and adolescents with dyslexia (14, 13, 11, 10, 6) are reasons to use cognitive enhancement packages. For example, their significant effect on the development of movements, perception, and senses in

infants and children (11,12) and adolescents (10,13,14) has been confirmed. Cognitive-behavioral perceptual enrichment significantly reduces the social fear of children aged 5 to 11 years (10). In a study, the effect of perceptual enrichment on reading performance improvement in male students with dyslexia in the second and third grades of elementary school in Hamadan, Iran was investigated. With the implementation of the treatment program, the reading performance, comprehension of the text, recognition of syllabic words, and recognition of sounds were effectively improved in the students. However, the ability to produce the words that belonged to a category, the ability to produce the words with a single letter sign, and the performance of reading non-words and quasi-words did not show a significant change (9). Given the results of a study, students with dyscalculia and dyslexia have poor performance in visual-spatial perception and working memory (WM) compared to normal students (13). Accordingly, enhancing visual-spatial perception, which is addressed in the Cognitive Enrichment Package, is recommended for these children.

In a similar study in which perceptual enrichment was prescribed for the sole purpose of modifying reading performance (8), the assignments in the intervention group were specifically designed to strengthen the reading domain. In another study, early motor development (Fine and Gross) was considered (12).

Since the prevalence of dyslexia in boys is three times higher than in girls (3) and in educational planning in Iran, students' reading and comprehension skills are completed in the third grade of elementary school in all schools (7), the implementation of treatments designed to improve dyslexia in students are prioritized in the third grade of elementary school. Limitation of research background on the use of perceptual enrichment with the aim of improving self-efficacy in children with dyslexia led the present study to investigate the effectiveness of perceptual enrichment on self-efficacy of these children in the third grade of primary school in Hamadan. The main hypothesis of the study was the significant effect of the perceptual enrichment treatment on improving the self-efficacy of male students with dyslexia in the third grade of elementary school. The present study focused on cognitive abilities and skills in general, and since perceptual enrichment, in addition to cognitive skills, leads to an increase in capacities and abilities in the neurological, sensory, and motor fields, it was assumed that using this package will enhance a wider range of skills and senses. Additionally, the exercises

designed in the study were not subject to and limited to specific assignments in a specific field of study (for example, reading), and accordingly, the student seemed more likely to experience success in educational and non-educational life. On the other hand, it was expected that this method would enhance the ability to distinguish sensory, reading, (reading words, word chains, rhymes, naming pictures, text comprehension, word comprehension, sounds,...), internal evaluation, and self-efficacy with exercises related to the senses of sight, hearing, movement (i.e., proprioception and kinetic sense), touch, and taste, spatial relationships and sensory memory.

### Materials and Methods

This study was a randomized controlled clinical trial in which the perceptual enrichment training package was considered as an independent variable and the self-efficacy of children with dyslexia as a dependent variable. The intervention of the perceptual enrichment training package for the experimental group was performed as a group.

The study population included all male students with reading disorders in the third grade of elementary school who referred to the learning disabilities centers in Hamadan in 2019. Due to the limitation of the statistical population, the samples were selected using the convenience sampling method. Information about the type of treatment, how the students attended the sessions, and the number and timing of the sessions was provided to the students and their parents. Confidentiality was explained as the main principle in the treatment and finally, the clients who expressed their consent to participate in the groups were selected. The code of ethics in the research was received from the Vice Chancellor for Research, Isfahan (Khorasgan) Branch, Islamic Azad University. Finally, considering that the available statistical population (total clients) was 50 students with dyslexia, given the total population and using the Morgan table (15), the sample size was estimated to be 44 people (22 in each group). However, due to the possibility of drop of some members of the sample and the decline in the final number, 25 people were considered for each group. First, the list of people who had referred to the learning disability centers in Hamadan in 2019 was inquired and by random method, numbers 1 to 25 in the list were placed in the first group (experimental) and from 25 to 50 in the second group (control).

The study inclusion criteria were diagnosis of dyslexia based on DSM-5 by clinical psychologists (2), education in the third grade elementary school, boy gender, no other disorder or physical illness that

exacerbated dyslexia (according to the clinical child psychologists and child psychiatrists), not taking drugs such as Ritalin and risperidone (taking these drugs to increase concentration and reading skills), not being in any parallel treatment process, and consent of parents and students to participate in the study. Absence of more than two sessions, not doing the homework, and not completing the questionnaires in the pre-test and post-test stages were also considered as the exclusion criteria.

Given the satisfactory results of previous research on perceptual skills (5,6,9,10,12-14) and the limited number of studies conducted on the perceptual enrichment package which did not fully examine all aspects of perceptual skills covered by this package (8,10,12), the perceptual enrichment package training method was employed in the experimental group.

21 60-minute sessions were held in groups and once a week as the treatment sessions. With the agreement of the child and the parents, the control group did not have a parallel treatment process during the study, but it was decided that after the completion of the study, they would also receive the perceptual enrichment package. The data collection and analysis were performed by a PhD in Educational Psychology, a PhD in Psychology, and a PhD in Psychology/Children with Special Needs.

A summary of the treatment plan content is provided in table 1. Accordingly, the acceptance coefficient related to the approval of the games among child psychologists and child psychiatrists (with at least a PhD degree and in the academic rank of professor or associate professor who were teaching and working with children) was evaluated at the time of package design and calculated as a percentage.

The Motivational Strategies for Learning Questionnaire (MSLQ) questionnaire was utilized to assess internal evaluation and self-efficacy. This questionnaire is used to measure the constructs of two scales of motivational beliefs (25 items) and self-regulated learning strategies (22 items), which has a total of 47 items and was developed by Pintrich in 1990 at the American Center for National Studies (16). The motivational beliefs scale consists of two sub-tests of self-efficacy and internal evaluation in which the answers are scored on a five-point Likert scale from Strongly Agree (Score 5) to Strongly Disagree (Score 1), and finally, the scores of the items are added together. The maximum and the minimum scores are 219 and 63, respectively; The higher the score, the higher the internal evaluation and self-efficacy (16,17). The results of calculating the correlation between the factors of the questionnaire in the study of Pintrich et al. showed correlation coefficients of 0.74 and 0.83 for motivational beliefs and self-regulated learning strategies, respectively. The construct validity of this

instrument was investigated and confirmed by Pintrich et al. in a study on 380 students in 14 courses and five fields of study in order to test the application of the theoretical model (17). In the present study, the self-regulated learning strategies scale was used to measure the variable of self-regulated learning strategies and three subscales of "task value, self-efficacy, and internal and external goal orientation" were used to measure motivational beliefs (17). Mousavinejad examined the content validity of this questionnaire and using factor analysis, extracted three factors of low-level cognitive strategies, high-level cognitive strategies, and metacognitive self-regulation, in addition to reporting their reliability using the Cronbach's alpha coefficient as 0.98, 0.79, and 0.84, respectively (10). In the present study, the Cronbach's alpha coefficient was used to evaluate the reliability of the pre-test stage ( $n = 36$ ), which was obtained as 0.85, 0.86, 0.77, 0.84, and 0.78 respectively for the subscales of self-efficacy, internal evaluation, test anxiety, cognitive strategies, and meta-cognitive strategies.

After determining the descriptive statistics, the Shapiro-Wilk test was used to check the normality of data distribution and multivariate analysis of variance (MANOVA) test was used to test the hypothesis. Finally, the data were analyzed in SPSS software (version 22, IBM Corporation, Armonk, NY, USA).

## Results

The aim of this study was to investigate the effectiveness of the perceptual enrichment model on self-efficacy of children with dyslexia studying in the third grade of elementary school in Hamadan. The study had no sample loss and therefore, no intention-to-treat (ITT) analysis was performed. Based on the results of the Shapiro-Wilk test, all data followed a normal distribution. Demographic characteristics of the study samples by group are presented in table 2.

In both groups, a higher percentage of mothers and fathers were over 30 years old and had a higher level of education than a diploma. It should be noted that before performing the MANOVA test, the hypotheses related to this test were tested. One of the hypotheses was the homogeneity of variances. The Levene's test results for self-efficacy and internal evaluation were  $F_{(2, 25)} = 2.12, P = 0.002$  and  $F_{(2, 25)} = 2.27, P = 0.003$ , respectively, confirming the hypothesis of homogeneity of variances. Another hypothesis was that the data followed a normal distribution, which was confirmed by the Shapiro-Wilk test. The results of the mean scores of internal evaluation and self-efficacy of the experimental and control groups along with the results of analysis of covariance (ANCOVA) are shown in table 3.

**Table 1.** Summary of treatment plan content

Description of Stage A activity		Acceptance coefficient (%)
Magnifier	Detecting the hidden object in a sandbag	
Finding sound with the eyes closed	Identifying and naming objects based on smell and taste with the eyes open	98
Ball and spoon		
Difference between two images	Recognizing numbers and signs on the skin	
Word lost in poetry	Identifying and naming objects based on smell and taste with the eyes open	92
Hanging the balloon		
Catching the ball with both hands	Detecting the hidden object in a sandbag	
	Describing and naming objects based on smell and taste with the eyes open	95
Identifying differences	Recognizing the sponge letter/treasure map	
Question from the story read	Arrangement of flavored/fragrant materials based on the required pattern	95
Threading the beads		
Missing shape	Fastening the screw with the eyes closed	
Question from the story read	Treasure map with smell/taste stimulus	90
Fastening the screw/catching the ball with the bucket		
Frastic (the name of a game, a kind of dotted line game)	Recognizing numbers and signs engraved on the skin	
Deleted name	Treasure map with smell/taste stimulus	94
Closing the nut		
Missing shape	Threading the beads with the eyes closed	
Catch the ball with both hands/hanging balloon	Arrangement of substances by smell based on the requested list	98
Repeating the word list		
<b>Stage B Activity description</b>		
Missing shape + arrangement of numbers from 1 to 50	Doing puzzle with the eyes closed	
Answering the questions from the story read	Arranging objects in the list with the eyes closed	88
Guiding the ball with a straw/catching objects with a hook		
Memorizing Tizbin (sharpness) game + answering questions from the image	Identifying objects inside the sandbag/Fastening the nut with the eyes closed	
Repeating word list + identifying the deleted word	Arranging items based on taste and smell in the requested list	91
Separating objects with tweezers		
Memorizing Frastic	Separating objects with the eyes closed	
Answering questions from the story + repeating the list of words	Treasure map based on smell and taste	93
Guide the ball by blowing from a straw/Fishing		
Arrangement of number cards from 1 to 50 + rearrangement of image cards	Doing wooden puzzles with eyes closed + writing on sand	
Hearing the story from two ears and answering its questions	Identifying the amount of different water-soluble compounds	90
Separating objects with tweezers + balance board		
Playing Frastic by heart + copying the pattern with the keyboard by heart	Identifying and describing objects touched through a set of objects + finding the right nut and bolt by touch	
Recalling the sound of xylophone (an instrument from the percussion family with small and colored models made for children's play)	Identification of the missing fragrant substance	91
Guiding the golf ball through obstacles		
Missing shape	Arranging colored cubes	
Hearing and remembering the word list from headphones	blindfolded/Identifying similar shapes blindfolded	89
Walking on the curb with a glass of water in the hand	Identification of requested materials based on smell	
Kidoku (a kind of game similar to Sudoku where color is used instead of numbers)	Fishing from the balance board	
Reverse answers to questions	Separating objects by touch	90
Identifying the deleted word		
The child repeats the words spoken by the therapist while holding the ball with both hands. In this case, music will be played for him.	The child listens to the story and answers questions with a glass of water in his hand while standing on the balance board or crossing the table.	98

**Table 1.** Summary of treatment plan content (continue)

Description of Stage C activity		Acceptance coefficient (%)
The child repeats the words spoken by the therapist while holding the ball with both hands. In this case, music will be played for him.	The child listens to the story and answers questions with a glass of water in his hand while standing on the balance board or crossing the table.	98
The child focuses the laser light on one of the desired images on the wall while listening to music and holding a spoon containing the ball in his mouth.	The child first looks at the set of the pictures, then while answering the questions or reading a poem from memory, tries to arrange all the pictures according to the pattern, first from the pattern and then from the memory.	95
The child repeats the words read by the therapist while separating the objects with tweezers (the interval between the therapist's expression and the child's repetition gradually increases to the point of disability).	As the child lies on his or her stomach on a large ball (the therapist grabs the back of his or her legs) and tries to maintain balance, he or she picks up number or picture cards based on the pattern while looking at it or from memory.	95
While the child is preventing the balloon (s) from hitting the ground, must read the poem from memory.	The child sees the picture, then has to answer questions while holding a glass of water while walking across the curbs or fishing.	98
The child repeats the poem or words read by the therapist as he or she passes the ball through the obstacles with a golf bat.	The child should say the names of the taste and smell stimuli while standing with his eyes closed on the balance board.	98
The child, while blindly uttering the therapist's words, must at the same time look for the desired smell stimulus among the smell stimuli.	The child separates the bead determined from the whole beads and threads them according to the pattern, and at the same time reads a poem from memory.	97
The child should take the requested objects out of the bag in his/her hand while holding the spoon containing the ball in his/her mouth and give it to the therapist.	After hearing the list of words, the child tries to hook the requested words and (as much as possible) give them to the therapist according to the arrangement.	98

Based on the data presented in table 3 and the ANCOVA test results, with the pre-test control, the perceptual enrichment treatment led to the improvement of the adjusted mean of internal evaluation scores ( $F_{(2, 25)} = 148.01, P = 0.001$ ) and self-efficacy ( $F_{(2, 25)} = 61.14, P = 0.001$ ) in the experimental group compared to the control group. Therefore, the perceptual enrichment treatment was effective on the internal evaluation and self-efficacy of students with dyslexia and increased these two variables. The effect size on the intergroup factor of the training package was reported to be greater than 0.5 in all cases, indicating a large (or strong) effect size. In other words, the effect of the training package (independent variable) on self-efficacy and internal evaluation (dependent variable) was high. Moreover, the test power was 1, indicating a very high test power.

### Discussion

The aim of this study was to investigate the effectiveness of perceptual enrichment on internal evaluation and self-efficacy of students with dyslexia. The results indicated that using this method to control dyslexia-related psychological disorders can be effective in increasing the internal evaluation and self-efficacy of the students with dyslexia compared to the control group who did not receive the treatment.

The findings were consistent with previous studies conducted in Iran (8) and other countries (11) in the field of dyslexia. Siminghalam et al. conducted a study and concluded that the development of perceptual-motor skills was effective in students with learning disabilities in elementary school (14), which was consistent with the findings of the present study.

**Table 2.** Demographic characteristics of the studied samples for each variable

Group	Parent age group (year)		Mother's literacy level		Father's literacy level			
	Mother		Father		Less than diploma	Higher than diploma	Less than diploma	Higher than diploma
	30<	30>	30<	30>				
Experiment	6 (24)	19 (76)	4 (16)	21 (84)	3 (12)	22 (88)	1 (3)	24 (97)
Control	9 (36)	16 (64)	6 (28)	18 (72)	7 (28)	18 (72)	3 (12)	22 (88)
Total	15 (30)	35 (70)	11 (22)	39 (78)	10 (20)	40 (80)	4 (8)	46 (92)

Data are reported by n (%).

**Table 3.** Descriptive information of experimental and control groups on internal evaluation and self-efficacy variables along with the analysis of covariance (ANCOVA) test results

Variable	Group	N	Pre-test (Mean $\pm$ standard deviation)	Post-test (Mean $\pm$ standard deviation)	Eta coefficient (effect size)	P	Test power
Internal evaluation score	Experiment	25	32.08 $\pm$ 3.50	43.04 $\pm$ 2.80	0.829	< 0.001	1
	Control	25	31.92 $\pm$ 1.70	31.48 $\pm$ 1.60	0.765	< 0.001	1
Self-efficacy score	Experiment	25	29.08 $\pm$ 3.20	40.60 $\pm$ 3.70	0.935	< 0.001	1
	Control	25	28.50 $\pm$ 1.60	28.84 $\pm$ 3.20	0.845	< 0.001	1

The results of the study by Farsi et al. suggested that perceptual-motor enrichment had a significant effect on the development of children's coarse movements (12). In the present study, enrichment of motor skills and increasing children's coarse motor abilities were also used. Improving coarse motor skills by increasing the child's ability to perform tasks increases self-efficacy and internal evaluation. Additionally, synchronization of motor and visual perception leads to improved ability (6). Therefore, the findings of the present study were consistent with the results of Farsi et al. (12).

Nasri and Karimi Lichahi conducted a study and found that multisensory and perceptual-motor education had a significant effect on improving the reading skills of students with dyslexia and the multisensory perceptual reinforcement method was more effective than the motor-perceptual method on improving reading skills of elementary students (18). Perhaps using the perceptual enrichment, visual perception exercises (difference between two pictures, doing puzzles, pattern continuation, arrangement of geometric shapes, etc.), auditory perception (finding the sound source, answering questions about the story, spelling words, answering questions conversely, etc.), sensory perception (doing puzzles with eyes closed, shape recognition with eyes closed, making play dough based on pattern, identification based on smell, taste, etc.), and motor perception (balance board, domino arrangement, walking on the curb, grabbing objects with a hook, throwing loops, cutting pattern paper, etc.), increase the ability to encode, process information, and organize and record information in memory, in addition to facilitating the construction and comprehension of long words and sentences. Therefore, reading skills become stronger, which itself provides victory and a sense of success in the person and leads to the formation of functions such as better and more fluent reading (10). Perceptual enrichment in other cognitive and even functional areas also creates a successful experience and increases the self-efficacy and internal evaluation of the student (8-10).

Auditory perception is the highest level of auditory processing, and most children with reading difficulties are poor at auditory processing (19). On the other hand, perceptual enrichment has an effective role in enhancing auditory processing and differentiation and auditory memory and integration between the senses (20). Auditory processing and reading disorders are related in many studies (19,20). People with dyslexia have difficulty in most of their courses. Although most of the time they have natural intelligence (13), this group cannot have a normal and desirable educational achievement and thus, they either continue to study very hard or drop out of school, which imposes social, economic, cultural, and emotional-psychological consequences on the individual and society (7).

There is ample evidence of the significant role of perceptual disorders in learning failure, especially dyslexia, especially in the early years of school, which significantly reduces internal evaluation and self-efficacy in children (7,10,21). Based on research, it can be said that direct training of perception leads to the improvement of dyslexia, which in itself is a strong reinforcer of the child's internal evaluation (19). In general, the reason for the effectiveness of perceptual enrichment is exercises that enhance visual perception, visual discrimination, auditory discrimination, and sensory-motor perception, which by integrating the senses, leads to the improved child learning (8,10). Research confirms that stimulation of the senses and enrichment of the environment can lead to the increased perceptual and cognitive abilities (6,8-10,18).

Cognitive and perceptual skills predict reading, spelling, phonological awareness, naming speed, mathematics ability, and fluency (23). The results of studies have shown that the self-efficacy of children with dyslexia is lower than that of normal children (10,13) and increasing auditory perception (19), motor perception (14), and visual perception (6), play an effective role in improving dyslexia in these children and leads to successful experiences, especially in the school environment (6,8,10,13,18). The present study focused on one or at most two

dimensions of perceptual skills, but in the perceptual enrichment package, all perceptual aspects were considered.

In perceptual enrichment, exercises to enhance and correct sensory perception, auditory perception, visual perception, and motor and balance perception all lead to improved learning and, consequently, internal evaluation and self-efficacy in children with dyslexia. High or desirable level of self-efficacy gives people, especially students, the belief that they are effective in performing tasks and special situations, and internal evaluation makes the tasks important and purposeful, and the desirable levels of these two factors in all people lead to successful performance in education, work, and personal life (4,10,18).

### Limitations

Among the limitations of the present study were the convenience sampling, the limitation of the sample to the third grade elementary school students, the lack of long follow-up due to the limited study time, and also the financial limitations of the project.

### Recommendations

It is suggested that in order to investigate the long-term effects, the results obtained in the present study be used for appropriate longitudinal studies. It will also be valuable to conduct similar studies at other levels of education, especially in primary schools and for female students.

### Conclusion

Based on the findings of the present study, the perceptual enrichment treatment had a significant effect on internal evaluation and self-efficacy of students with dyslexia and its application can be effective. Therefore, the combination or use of perceptual enrichment therapy in the treatment programs of third grade elementary school male students with dyslexia is recommended.

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### Authors' Contribution

Hamid Reza Salehi: study design and ideation, attracting financial resources for the study, study support, executive, and scientific services, providing study equipment and samples, data collection, analysis and interpretation of results, specialized statistical services, manuscript preparation, specialized manuscript evaluation in terms of scientific concepts, approval of the final manuscript to be sent to the journal office, responsibility for maintaining the integrity of the study process from the beginning to publication, and responding to the referees' comments; Hamid Taher Neshat-Doost: study design and ideation, study support, executive, and scientific services, analysis and interpretation of results, specialized statistical services, manuscript preparation, specialized manuscript evaluation in terms of scientific concepts, approval of the final manuscript to be sent to the journal office, responsibility for maintaining the integrity of the study process from the beginning to publication, and responding to the referees' comments; Salar Faramarzi: study design and ideation, study support, executive, and scientific services, analysis and interpretation of results, manuscript preparation, specialized manuscript evaluation in terms of scientific concepts, approval of the final manuscript to be sent to the journal office, responsibility for maintaining the integrity of the study process from the beginning to publication, and responding to the referees' comments.

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### Conflict of Interest

The authors do not have a conflict of interest. Hamid Reza Salehi paid for the basic study related to this article and has been studying as a PhD student at the Isfahan (Khorasgan) Branch, Islamic Azad University since 2019. Dr. Hamid Taher Neshat-Doost has been a professor at the University of Isfahan since 1991 and Dr. Salar Faramarzi has been an associate professor at the University of Isfahan since 2006.

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