ASPI | Afarand Scholarly Publishing Institute; Turkey
ISSN: 2345-2897; Health Education and Health Promotion. 2023;11(4):549-553. 10.58209/hehp.11.4.549

The Effectiveness of Metacognitive Knowledge and Skills Program on Visual and Auditory Dyslexia in Students with Learning Disabilities

ARTICLE INFO

Article Type
Original Research

Authors
Sharif F.[1] *MSc*
Johari Fard R.[1]* *PhD*
Borna M.R.[1] *PhD*

How to cite this article
Sharif F, Johari Fard R, Borna MR. The Effectiveness of Metacognitive Knowledge and Skills Program on Visual and Auditory Dyslexia in Students with Learning Disabilities. Health Education and Healt Promotion. 2023;11(4):549-553.

ABSTRACT

Aims Metacognitive processes are an aspect, through which students can significantly affect their learning process, allowing them to engage in multiple tasks simultaneously. This research was done to investigate the effectiveness of the metacognitive knowledge and skills program on visual and auditory dyslexia in students with learning disabilities.

Materials & Methods This study employed a semi-experimental design with a pre-test-post-test approach and a control group. The study population consisted of all second- and third-grade elementary school students with learning disabilities in Tehran who were supervised in educational centers. The research sample consisted of 30 students with dyslexia (15 participants in the experimental group and 15 in the control group). The Wechsler Intelligence Scale was used to measure dyslexia. Descriptive analysis was employed to calculate means and standard deviations, while inferential analysis using analysis of covariance was used to analyze the data at an inferential level. Data were analyzed by SPSS 23.

Findings The results showed the effectiveness of the Jager metacognitive knowledge and skills program in visual and auditory dyslexia in students with learning disabilities ($p<0.001$).

Conclusion It can be generally concluded that the Jager metacognitive knowledge and skills program can mitigate the challenges of visual and auditory dyslexia in students with learning disabilities. It is recommended that this program be implemented for students with learning disabilities.

Keywords Metacognition; Dyslexia; Learning Disabilities; Students

CITATION LINKS

[1] Learning disorder or learning disability: ... [2] Counseling needs of students with dyslexia and the effect of counseling on psychological ... [3] Defining and understanding dyslexia: past, ... [4] The role of visual attention in dyslexia: Behavioral and ... [5] The role of visual factors ... [6] A metacognitive intervention for teaching fractions to students with or at-risk for learning ... [7] Investigating the correlation between cognitive and metacognitive strategies and students' academic well-being mediated ... [8] Assessing metacognitive regulation during problem solving: A comparison ... [9] Fostering metacognition to support student ... [10] Metacognitive awareness and academic motivation and their impact on academic achievement of ... [11] Metacognition and reading: Comparing three forms of metacognition in normally developing readers ... [12] The development of metacognition in primary school ... [13] Effect of cognitive learning strategy on academic stress of the university students ... [14] The effectiveness of training of Jager's knowledge and meta-cognitive skill program on reading performance of students with ... [15] The developmental change of young pupils' metacognitive ability in mathematics in relation to their ... [16] The effect of metacognitive instruction on problem solving skills in Iranian students ... [17] Metacognitive strategies and development of critical thinking ... [18] What are the factors that enhance metacognitive skills in nursing students? ... [19] Strategies for improving learner metacognition in health ... [20] The effectiveness of training of jager's knowledge and metacognitive skill program on improving neuropsychological skills ... [21] The relationship between the use of metacognitive strategies and ... [22] Metacognitive training. Cognitive training: An overview of features and ... [23] Wechsler intelligence scale for ... [24] Effectiveness of Hesabyar cognitive rehabilitation on neuropsychological functions of children with ... [25] Role of components of metacognitive skills and mathematics attitude in predicting female students' ... [26] Developmental dyslexia: Predicting ...

[1]Department of Psychology, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran

Correspondence
Address: Department of Psychology, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran. Postal code: 68875 61349
Phone: +98 (61) 3334 8420
Fax: +98 (61) 33329200
rjoharfard@gmail.com

Article History
Received: August 20, 2023
Accepted: October 21, 2023
ePublished: October 29, 2023

Introduction

Learning disabilities are among neurodevelopmental disorders, including dyslexia or learning disorders characterized by reading difficulties [1]. Dyslexia refers to unexpected reading difficulties in individuals with cognitive abilities for better reading. It is mainly caused by challenges in processing phonemes, affecting an individual's speaking, reading, and spelling abilities [2]. Dyslexia is classified into different subtypes. The main subtypes include visual dyslexia and auditory dyslexia [3]. Visual dyslexia pertains to the condition where an individual can pronounce words, but he/she has difficulties in pronouncing words with different pronunciations from their written forms. In contrast, auditory dyslexia involves problems identifying vowel sounds within words and connecting letters to sounds [4, 5].

Structural ideas have influenced recent important innovations in reading and mathematics in elementary schools and have shed light on factors, like metacognition [6]. Metacognition refers to "thinking about thinking" and encompasses knowledge about the factors influencing task performance and awareness of strategies [7]. This includes metacognitive regulation processes, such as planning and monitoring task performance and evaluating the effectiveness of these strategies and monitoring processes [8]. Consequently, metacognitive processes are the aspect, through which students can significantly affect their learning process, allowing them to engage in multiple tasks simultaneously [9].

Metacognitive awareness is considered a crucial factor contributing to the success of students' learning [10]. One of the major challenges faced by dyslexic children is difficulty comprehending content due to their struggles in understanding words and sentences, necessitating the effective use of cognitive and self-regulatory (metacognitive) structures. Furthermore, research on reading and metacognition has shown that individuals with better reading abilities possess higher metacognitive knowledge than those with weaker reading skills [11]. Hence, various metacognitive programs and interventions have been designed for students, e.g., the Jager method [12].

Jager metacognition is the process, in which learners engage in thinking about their thinking and develop strategies for problem-solving. These processes encompass sub-constructs, such as planning, self-reflection, self-awareness, and cognitive strategies [13, 14]. Furthermore, cognitive and metacognitive strategies are goal-directed, consciously activated, and encourage students' efforts [15]. This educational program focuses on enhancing and correcting metacognitive knowledge and skills. It is believed that increasing metacognitive knowledge through simultaneous reading, providing self-feedback, and enhancing metacognitive skills, such as correcting predictions, attention control, identifying real problems, and defining them can improve learning difficulties and aid dyslexic children's progress [16]. These educational programs focus on supervisory and reflective skills for teaching metacognitive skills. The belief is that students will succeed when they have mastered extended cognitive and metacognitive strategies; otherwise, learning tasks will remain unresolved [17, 18].

Students are taught skills, such as thinking about the subject of study, revising their predictions, controlling their attention and focus, concentrating on the subject matter, identifying the actual problem, and defining and limiting it in metacognitive strategy instruction programs [19]. According to the literature, the Jager metacognitive approach effectively enhances neuropsychological performance among dyslexic students [20]. Sen [21] demonstrated that metacognitive strategy instruction improves and increases students' comprehension. Moreover, Schaeffner *et al.* [22] reported that employing such strategies for dyslexic children may improve their skills.

Considering the challenges of dyslexia, its slow progress among these students, and the resulting problems, it appears essential to adopt an instructional approach aligned with the fundamental needs of these children. Therefore, given the various significant challenges faced by dyslexic children, it is imperative to explore new methods to address dyslexia-related problems. Accordingly, the present study aimed to investigate the effectiveness of the Jager metacognitive knowledge and skills program on visual and auditory dyslexia in students with learning disabilities.

Materials and Methods

This study employed a semi-experimental design with a pre-test-post-test approach and a control group. Required data were collected through questionnaires. The study population consisted of all second- and third-grade elementary school students with learning disabilities in Tehran who were supervised in educational centers. A total of 30 students with dyslexia were selected by purposive sampling, of whom 15 cases were randomly assigned to the Jager method group and 15 to the control group. The sample size was selected using the G*Power software with a test power of 0.90, a significance level of 0.05, and an effect size of 0.76. The inclusion criteria were being second- and third-grade elementary students diagnosed with dyslexia, absence of intellectual and developmental disorders according to DSM-5, attending learning disability centers, not taking psychiatric medications, and parental consent to participate in the educational program. The exclusion criteria were simultaneous participation in other group educational programs or

receiving concurrent treatments, initiation of psychiatric medication during the study period, being absent more than one session in the experimental group, and the lack of participation and cooperation in the training exercises of the sessions.

Procedure

The study was implemented in the following steps. After selecting participants and randomly assigning them to the experimental and control groups, a pre-test was administered to both groups. Subsequently, the Jager method was conducted for the experimental group over eight 45-minute sessions, with one session per week. However, the control group did not receive this program. After completing the intervention sessions for both groups, an individual post-test was administered, and the pre-test and post-test results were compared between the groups.

Educational intervention

The educational intervention in this study consisted of the Jager method delivered to the experimental group of students over eight 45-minute sessions. The control group participants only received regular classroom instruction during the intervention period. This program was designed to teach metacognitive knowledge and skills to elementary school students and included two phases executed collaboratively by the researcher and teachers.

The educational program sessions are summarized as follows: In sessions one to five, questions were posed to assess the student's level of metacognitive knowledge.

The questions for these sessions were as follows: Session one: What is the best thing to do before reading a text? Session two: What is the best thing to do while reading a text? Session three: What is the best thing to do after reading a text to assess whether you understood the text well? Session four: What is the best thing to do when you do not understand a sentence? Session five: What is the best thing to do when you do not understand a part of the text? Instruction and practice were provided for metacognitive skills in sessions six to eight. In the sixth session, the necessary metacognitive skills before reading a text were taught and practiced. In the seventh session, metacognitive skills required while reading a text were taught and practiced. Finally, in the eighth session, metacognitive skills needed after reading a text were taught and practiced.

Research tools

The Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV): The fourth edition of the WISC, developed in 2003, assesses the intelligence of children aged 6 to 16 and comprises four indices: verbal comprehension, perceptual reasoning, working memory, and processing speed. The overall IQ has a validity of 0.97, the verbal comprehension index has a validity of 0.85, and the perceptual reasoning index has a validity of 0.70 [23]. The verbal comprehension and perceptual reasoning indices were used in this study to assess visual dyslexia and auditory dyslexia, respectively.

Data analysis

Descriptive analysis was employed to calculate means and standard deviations, while inferential analysis using analysis of covariance (ANCOVA) was used to analyze the data at an inferential level. The Kolmogorov-Smirnov test was used to check the normality of data distribution, and Levene's test was used to check the equality of variances. Data were analyzed using SPSS 23 software.

Findings

As shown in Table 1, the mean scores of visual dyslexia and auditory dyslexia in the experimental group were lower than those in the control group. In other words, the Jager method reduced visual dyslexia in the experimental group.

Table 1. Mean and standard deviation of research variables in experimental and control groups

Variables	Groups	Pre-test	Post-test
Visual dyslexia	Intervention	32.55±2.19	33.73±2.09
	Control	31.29±2.73	55.84±5.22
Auditory dyslexia	Intervention	37.45±1.67	37.80±1.91
	Control	36.87±2.17	58.79±2.15

The results of the Kolmogorov–Smirnov test indicated that the assumption of normality of data distribution in visual dyslexia and auditory dyslexia was maintained in the experimental and control groups in the pre-test and post-test phases ($p>0.05$). The results of Levene's test showed that the assumption of equality of variances in both variables was confirmed in both stages of the research ($p>0.05$). Data were analyzed using ANCOVA, and the results are reported in Table 2. The findings of the multivariate ANCOVA revealed significant differences between the experimental and control groups in terms of dependent variables ($p<0.001$). Therefore, it can be stated that there was a significant difference between the two groups in at least one of the dependent variables (visual dyslexia and auditory dyslexia).

Considering the results of Table 2, it can be concluded that the Jager program effectively reduced visual dyslexia ($F=33.18$, $p=0.027$) and auditory dyslexia ($F=56.16$, $p=0.001$) in students with learning disabilities.

Table 2. The results of analysis of covariance on visual dyslexia and auditory dyslexia in the experimental and control groups

Variables	Sum of squares	df	Mean Square	F	p-value	η^2	Power
Visual dyslexia	45.73	1	45.73	33.18	0.027	0.29	0.59
Auditory dyslexia	109.47	1	109.47	56.16	0.001	0.64	0.97

Discussion

This study aimed to investigate the effectiveness of the Jager method on visual and auditory dyslexia in

students with learning disabilities. The results demonstrated that the Jager method reduced visual dyslexia and auditory dyslexia in the post-test phase in the experimental group compared to the control group. In other words, the Jager metacognitive program effectively enhanced the knowledge and skills of students with learning disabilities. Consistent with the results of the present study, Narimani *et al.* [14] reported that the Jager method had a positive effect on improving the reading performance of students with dyslexia. Moreover, Moradi and Mirbod [20] reported that the Jager method was effective in improving the neuropsychological performance of dyslexic students.

The deficiency in metacognitive knowledge and skills is one of the challenges faced by students with learning disabilities in reading [24]. The Jager method is designed in a way that first teaches metacognitive knowledge to students, then imparts metacognitive skills for reading, and finally, guides them to practice reading [12]. From another perspective, in the Jager method, students with learning disabilities learn to think about the text and its purpose before reading it. Then, they learn to monitor their understanding while reading a text (simultaneously monitor reading comprehension), and finally, they learn to provide self-feedback after reading [20]. Moradi and Mirbod [20] reported that metacognitive approaches can improve neuropsychological skills by organizing the brain, and the improvement of these skills will lead to an increase in academic skills, including reading. From this standpoint, it can be concluded that the Jager method effectively improves the metacognitive knowledge and skills and enhances the reading performance of students with learning disabilities. Reading is a complex cognitive process involving various skills, including comprehension, cognition, knowledge, and metacognitive skills. These skills will be effective when there is a balance between them [14]. Narimani *et al.* [14] reported that the Jager method increases metacognitive and cognitive skills in students with learning disabilities. Dyslexia is a problem related to information processing, and since the Jager method improves cognitive and metacognitive skills, it plays an effective role in the learning process [20]. Therefore, the Jager method can play a key role in providing effective strategies to solve their problems.

Cognitive deficit is one of the most significant factors contributing to the likelihood of developing reading difficulties. The Jager method can be applied to various aspects of reading, including eye movements, language processing, working memory, retrieval skills, and automatization [25]. Evidence suggests that dyslexia may result from multiple risk factors, and children with a wide range of cognitive and sensory-motor deficits are more susceptible to reading problems [26]. The Jager method is implicated in language and cognitive skill aspects, including specialized engagement in reading. The literature indicates that the Jager method promotes progress in skill acquisition, including reading [14]. The Jager method is effective in all cognitive processes and continues to capture attention in mental activities. Precision or attention is a fundamental mental activity that enables an individual to maintain an accurate cognitive and behavioral readiness in the face of a stimulus or prolonged activity, acquire necessary information, and provide the required response [20].

Narimani *et al.* [14] reported that the Jager method is designed in such a way that first the student is taught metacognitive knowledge, then metacognitive skills are taught in reading the text, and then the student practices reading the text. Therefore, the Jager method provides suitable opportunities for active engagement with various sensory inputs from the environment. Purposeful motor behaviors contribute to improving performance and lead to the enhancement of cognitive skills, including attention. Implementing such interventions can prevent the emergence of psychological issues like depression and anxiety resulting from adverse conditions and effectively address these problems [14].

One of our limitations was conducting the research only on the second- and third-grade students; thus, caution should be taken in generalizing the results to other grades. Also, it was not possible to measure the effect of each subject of therapeutic-educational sessions separately.

Conclusion

The Jager method is applicable for enhancing the reading performance of children with learning disabilities. Many reading difficulties among dyslexic students stem from a lack of attention because the process of developing accuracy and attention in dyslexic children is slow and delayed. Consequently, inadequate attention can render an individual's learning vulnerable. Therefore, educators in schools using the Jager method must address the necessary prerequisites of accuracy and attention for reading. It is recommended that the Jager method be implemented for all school students. Considering the limited awareness of teachers regarding the Jager method, a training course should be organized as part of in-service programs for teachers. Additionally, parent-teacher meetings should harness the potential of families to further enhance the effectiveness of the Jager method in this regard. Students with dyslexia should be identified at the beginning of their school attendance, and the Jager method should be implemented to address this deficiency.

Acknowledgments: This article was extracted from a part of the PhD dissertation of Mrs. Sharif at the Islamic Azad University, Ahvaz Branch, Iran. The authors would like to

appreciate the collaboration of all students and their parents in the present study.

Ethical Permissions: The Ethics Review Board of Islamic Azad University, Ahvaz branch, approved the present study (code: IR.IAU.AHVAZ.REC.1400.158).

Conflicts of Interests: The authors declared no conflicts of interests.

Authors' Contribution: Sharif F (First Author), Introduction Writer/Methodologist/Original Researcher/Discussion Writer/Statistical Analyst (35%); Johari Fard R (Second Author), Methodologist/Assistant Researcher/Discussion Writer (35%); Borna MR (Third Author), Assistant Researcher/Discussion Writer/Statistical Analyst (30%)

Funding/Support: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References

1- Vidyadharan V, Tharayil HM. Learning disorder or learning disability: Time to rethink. Indian J Psychol Med. 2019;41(3):276-78

2- Ghiasi N, Sedrpoushan N, Abedi A, Soltani A. Counseling needs of students with dyslexia and the effect of counseling on psychological well-being of the students. Int J School Health. 2022;9(3):192-203.

3- Snowling MJ, Hulme C, Nation K. Defining and understanding dyslexia: past, present and future. Oxf Rev Educ. 2020;46(4):501-13.

4- Taran N, Farah R, DiFrancesco M, Altaye M, Vannest J, Holland S, et al. The role of visual attention in dyslexia: Behavioral and neurobiological evidence. Hum Brain Mapp. 2022;43(5):1720-37.

5- Kristjánsson Á, Sigurdardottir HM. The role of visual factors in dyslexia. J Cogn. 2023;6(1):31.

6- Hacker DJ, Kiuhara SA, Levin JR. A metacognitive intervention for teaching fractions to students with or at-risk for learning disabilities in mathematics. ZDM. 2019;51(4):601-12.

7- Mohammadi A, Parandin S, Akbari M, Yarahmadi Y. Investigating the correlation between cognitive and metacognitive strategies and students' academic well-being mediated by academic engagement. Int J School Health. 2022;9(4):225-31.

8- Zepeda CD, Nokes-Malach TJ. Assessing metacognitive regulation during problem solving: A comparison of three measures. J Intell. 2023;11(1):16.

9- Stanton JD, Sebesta AJ, Dunlosky J. Fostering metacognition to support student learning and performance. CBE Life Sci Educ. 2021;20(2):fe3.

10- Abdelrahman RM. Metacognitive awareness and academic motivation and their impact on academic achievement of Ajman University students. Heliyon. 2020;6(9):e04192.

11- Furnes B, Norman E. Metacognition and reading: Comparing three forms of metacognition in normally developing readers and readers with dyslexia. Dyslexia: IntJ Res Pract. 2015;21(3):273-84.

12- de Jager B, Jansen M, Reezigt G. The development of metacognition in primary school learning environments. School Effectiveness School Improv. 2005;16(2):179-96.

13- Uster-Guillén D, Díaz Vergara C, Guillén Aparicio P, Graciela Barzola Loayza M, Alva Borjas M. Effect of cognitive learning strategy on academic stress of the university students in COVID-19 context. Health Educ Health Promot. 2021;9(5):535-41.

14- Narimani M, Jalalinejad R, Sherbfzadeh A, Ajdari Z. The effectiveness of training of Jager's knowledge and meta-cognitive skill program on reading performance of students with reading learning disability. J Learning Disabilities.2015;4(2):100-20. [Persian]

15- Panaoura A, Philippou G. The developmental change of young pupils' metacognitive ability in mathematics in relation to their cognitive abilities. Cognitive Dev. 2007;22(2):149-64.

16- Safari Y, Meskini H. The effect of metacognitive instruction on problem solving skills in Iranian students of health sciences. Glob J Health Sci. 2015;8(1):150-6.

17- Rivas SF, Saiz C, Ossa C. Metacognitive strategies and development of critical thinking in higher education. Front Psychol. 2022;13:913219.

18- Asadzandi S, Mojtahedzadeh R, Mohammadi A. What are the factors that enhance metacognitive skills in nursing students? A systematic review. Iran J Nurs Midwifery Res. 2022;27(6):475-84.

19- Medina MS, Castleberry AN, Persky AM. Strategies for improving learner metacognition in health professional education. Am J Pharm Educ. 2017;81(4):78.

20- Moradi MR, Mirbod SM. The effectiveness of training of jager's knowledge and metacognitive skill program on improving neuropsychological skills in students with dyslexia. Neuropsychology. 2020;6(20):17-30. [Persian]

21- Şen HŞ. The relationship between the use of metacognitive strategies and reading comprehension. Procedia Soc Behav Sci. 2009;1(1):2301-5.

22- Schaeffner S, Chevalier N, Kubota M, Karbach J. Metacognitive training. Cognitive training: An overview of features and applications. 2nd ed. Basel: Springer Nature Switzerland; 2021. pp. 255-70.

23- Grizzle R. Wechsler intelligence scale for children. 4th ed. In: Goldstein S, Naglieri JA, editors. Encyclopedia of child behavior and development. Boston: Springer; 2011. p. 1553-5.

24- Ebrahimi M, Baezzat F, Nejati V. Effectiveness of Hesabyar cognitive rehabilitation on neuropsychological functions of children with special learning disabilities. Int J School Health. 2022;9(4):249-56. [Persian]

25- Hoveyda F, Adib Y. Role of components of metacognitive skills and mathematics attitude in predicting female students' homework management. J Modern Psychol Res. 2021;15(60):76-87. [Persian]

26- Thompson PA, Hulme C, Nash HM, Gooch D, Hayiou-Thomas E, Snowling MJ. Developmental dyslexia: Predicting individual risk. J Child Psychol Psychiatry. 2015;56(9):976-87.