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Research Paper

The Effectiveness of Mindfulness Training on Working Memory Capacity of Children with Dyslexia: A Case Study

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Abstract

Aim: This study aimed to determine the effectiveness of mindfulness training on working memory capacity of children with dyslexia in a case study with A-B design. The study sample comprised three fourth-grade girls with dyslexia who were randomly selected from the children referred to Shiraz counseling centers in the academic year 2020-2021. The research tools were Wechsler Intelligence Scale for Children (1986), and Pickering and Gathercole's (2001) Working Memory Test. Mindfulness program was instructed in ten 90-minutes sessions. Paired t-test was used to analyze the data. The results indicated that mindfulness training program had a significant effect on improving the working memory capacity of children with dyslexia in three components: Central Executive, Phonological Loop and Visual Spatial Sketchpad. According to the findings, it is suggested that teachers and therapists use mindfulness techniques as an independent method or complementary to other treatment methods to strengthen the working memory capacity of children with dyslexia.

Keywords*: Mindfulness, Working Memory, Children, Dyslexia*

Introduction

The most common and important learning disability is dyslexia (Maughan et al., 2009). A child with dyslexia distorts words and uses them interchangeably and only understands some of what is read (Hallahan et al., 2020).

The theory of deficiency in working memory is among theories proposed in the field of developmental etiology of dyslexia, which has received a lot of attention and acceptance today. (Nevo and Breznitz, 2011).

Working memory is an essential component for normal reading. People who have more working memory capacity are able to keep more parts of the processing levels in mind while reading and thus perform better in terms of semantic integration in the text. The results of various studies have shown that dyslexic students have poor working memory (Moura et al, 2015; Papalia, 2013; Pennington, 2009; Swanson et al, 2009.

Research findings have shown that many factors related to students' memory are effective in their academic progress, a most important of which is mindfulness skills.

Kabat-Zinn (2003) has defined mindfulness as paying attention in a specific and purposeful way in the present time without judgment or prejudice. Mindfulness implicitly refers to awareness, attention and remembering. In fact, conscious attention to the present moment and therefore, selective attention is promoted in mindfulness training, thereby strengthening working memory (Awh et al., 2000).

A review of the research background indicates that attention deficit and working memory deficit are the core of learning disabilities in general and dyslexia in particular. A review of the literature did not yield any research that investigated the effectiveness of mindfulness training on the working memory of children with learning disabilities.

Methodology

This research was a case study with an A-B design. The study sample comprised three fourth-grade girls with dyslexia who were randomly selected from the children referred to counseling centers in Shiraz in the academic year 2020-2021. These three children were homogenous in terms of intelligence level, age and educational level.

The participants received Hooker and Foder's (2008) mindfulness training program for children. This program is a combination of relaxation techniques, body monitoring, breathing training and behavioral-cognitive techniques and includes three parts "environmental awareness, body awareness and mindfulness meditation". This program included ten 90-

minute sessions once a week. The participants took the posttest after completing the training course.

To collect research data, the revised Wechsler Intelligence Scale for Children (WISC) (1974) was used. WISC consists of 12 subtests of six verbal scales and six non-verbal scales. Furthermore, the Persian version of Pickering and Gathercole's Set of Working Memory Tests for Children (2001) translated by Arjmandnia (2018) was used. This tool was designed to measure the working memory of people aged 5 to 15 years based on the three-component model of Baddeley and Hitch. These three components include the central executive, the phonological loop and the visuospatial sketchpad. Finally, the data were analyzed using descriptive statistics (mean and standard deviation) and inferential statistics (paired t-test) in SPSS software version 22.

Results

The results of inferential statistics are presented in the following tables:

Table 1. The results of paired t-test to compare pretest and posttest of working memory

Variable	Stage	Mean	t	P-value
Central Executive	Pretest	25	-5.23	0.03
	Posttest	43		
Phonological Loop	Pretest	54	-9.28	0.01
	Posttest	75		
Visuospatial Sketchpad	Pretest	34	-5	0.03
	Posttest	40		

According to paired t-test results (Table 1), the increase in scores in all three components of working memory in the posttest phase are statistically significant ($P<0.05$). This means that mindfulness skill training has been effective in strengthening the working memory capacity of children with dyslexia.

Table 2. The results of clinical significance of mindfulness training on working memory capacity

Variable	Central Executive			Phonological Loop			Visuospatial Sketchpad		
	Yekta	Hasti	Sheida	Yekta	Hasti	Sheida	Yekta	Hasti	Sheida
Reliable Change Index (RCI)	12	14	27.5	36	2	52	16	16	8
Improvement Percentage	17	19	2	30	36	56	25	22	11
Total Improvement Percentage		12.6			40.6			19.3	
Standardized Mean Difference (SMD)		22.22			3.67			4.25	

RCI was used to measure clinical significance, and was greater than 1.96 in all components of working memory in the participants, therefore, with a confidence interval of 95%, the resulting change in posttest scores is due to the effect of mindfulness training.

Furthermore, phonological loop improved in all three participants, and visuospatial sketchpad improved more than 25% in one of them (Yekta), which indicate successful treatment.

According to the results, standardized mean difference in all three components was more than 0.8, which indicates the extremely significant effect of mindfulness training on strengthening the capacity of three components of working memory.

Discussion and conclusion

Children with dyslexia have little concentration and may even experience a range of negative emotions such as anxiety, fear and disappointment. Since mindfulness training improves attention, concentration and hence their performance in an ongoing task .Therefore, it can strengthen the working memory capacity, which requires high attention and concentration.

It is recommended that elementary school teachers and therapists use mindfulness techniques along with other methods to improve the capacity of working memory in children with dyslexia.

One of the limitations of the present study was the use of A-B design. The researchers had to use this design because this research was conducted during the COVID-19 pandemic, and we measured only twice: at the baseline phase and after the intervention, but we did not have any follow-ups. Therefore, it is suggested that several follow-up phases be planned after the posttest in future studies in order to check the improvement rate more precisely and to ensure the reliability of changes.

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