Journal Website

Article history:
Received 15 August 2024
Revised 05 October 2024
Accepted 28 October 2024
Published online 12 November 2024

International Journal of Education and Cognitive Sciences

Volume 5, Issue 5, pp 158-169

E-ISSN: 3041-8828

The Effectiveness of Cognitive-Emotional-Social Working Memory Training on Improving Verbal Creativity and Academic Self-Efficacy of Elementary School Students

Mohammad Ali Chari[1], Samaneh Salimi[2]*, Allahnazar Alisofi[3]

1.PhD Student, Department of Educational Psychology, Zahedan Branch, Islamic Azad University, Zahedan, Iran.
2. Assistant Professor, Department of Educational Management, Zahedan Branch, Islamic Azad University, Zahedan, Iran (Corresponding author).
3. Assistant Professor, Department of Psychology and Counselling, Farhangian University, Tehran, Iran.

*** Corresponding author email address**: sa.salimi@iauzah.ac.ir

A r t i c l e I n f o

Article type:
Original Research

How to cite this article:
Chari M, Salimi S, Alisofi A. (2024). The Effectiveness of Cognitive-Emotional-Social Working Memory Training on Improving Verbal Creativity and Academic Self-Efficacy of Elementary School Students. *International Journal of Education and Cognitive Sciences, 5*(5), 158-169.
https://doi.org/10.61838/kman.ijecs.5.5.17

A B S T R A C T

Purpose: The aim of the present study was to investigate the effectiveness of cognitive-emotional-social working memory training on improving verbal creativity and academic self-efficacy among elementary school students.

Methods and Materials: The research method was quasi-experimental, utilizing a pretest-posttest design with a control group. The statistical population included all fifth-grade students in the city of Zabol during the 2022-2023 academic year. The study sample consisted of 40 students with poor working memory performance, selected through multistage cluster random sampling, and randomly assigned to experimental and control groups (20 students in each group). To collect data, the Torrance Test of Verbal Creativity (1979) and the Academic Self-Efficacy Scale by Jing and Morgan (1999) were used. In the pretest phase, both groups were assessed using these instruments. The experimental group received working memory training over three months, consisting of 20 sessions, each lasting 90 minutes, while the control group did not receive any intervention. Data were analyzed using analysis of covariance.

Findings: The results showed that cognitive-emotional-social working memory training significantly improved verbal creativity and academic self-efficacy among students.

Conclusion: Based on the findings of this study, it appears that cognitive-emotional-social working memory training, due to its multi-faceted, diverse, numerous, and ability-appropriate tasks, is effective in enhancing verbal creativity and academic self-efficacy in students with poor working memory performance.

Keywords: *Cognitive-Emotional-Social Intervention, Working Memory, Verbal Creativity, Academic Self-Efficacy*

1. Introduction

Working memory is one of the essential components of human cognitive functions (Bulut et al., 2024; Sosa et al., 2018) and refers to the ability to retain and process information while engaging in mental activities (Ahmed et al., 2022). Working memory helps students hold necessary information in their minds and use it simultaneously to solve problems, comprehend content, and complete tasks (Hassani et al., 2020). This skill is crucial for academic success and learning because many educational activities, such as reading, solving mathematical problems, and participating in classroom discussions, require the optimal use of working memory (Asadi Rajani, 2023; Babaei et al., 2024; Baniasadi, 2024; Li et al., 2024).

During the early years of schooling, students' working memory is still developing and gradually strengthens through daily learning and experiences (Moshtaghy Sharifzadeh et al., 2021). Working memory abilities impact not only academic performance but also play a key role in the development of students' social and emotional skills (Vaccaro & Fleming, 2018). For example, students with stronger working memory can retain more information in social situations, respond more appropriately, and interact more effectively with peers and teachers (Friedman & Robbins, 2022). Conversely, students with weaker working memory may struggle with simultaneously processing multiple pieces of information (Mohammadi et al., 2020), leading to difficulties in understanding academic content and managing school tasks (Dehghani & Moradi, 2018). This highlights the importance of developing and enhancing working memory, particularly during childhood and adolescence.

Consequently, intervention-based training programs aimed at strengthening working memory can significantly assist students in improving academic performance, increasing self-efficacy, and managing emotions (Bayat Shahbazi et al., 2022). Focusing on working memory enhancement and providing suitable educational strategies enables students to approach learning and academic growth with greater confidence and ability (Sarshar et al., 2024). Cognitive-emotional-social working memory training is among the modern approaches to strengthening working memory, helping students improve their cognitive and emotional-social abilities for better mental and academic performance (Sarshar et al., 2024). This type of training is designed based on the concept that working memory relies not only on cognitive abilities, such as focus and information processing, but also significantly on emotional and social factors (Melby-Lervag & Hulme, 2013).

Working memory requires high levels of concentration and the ability to rapidly process information to perform multiple activities simultaneously (Ghahreman et al., 2020). Cognitive interventions, through focus and mental processing exercises, help students strengthen their working memory and process academic information more accurately (Sala & Gobet, 2017). Many students experience declines in working memory performance due to negative emotions or anxiety. These interventions, employing emotion management and self-regulation techniques, aid students in maintaining composure and focusing better on tasks under stressful and challenging conditions (Sardari, 2021). Emotional control enhances working memory performance and boosts students' confidence (Rahimipour et al., 2017). In fact, these interventions can be effective tools for improving learning abilities, academic performance, and personal development, providing a foundation for students' comprehensive growth and flourishing (Khaloei et al., 2022).

The link between working memory and creativity has been demonstrated in numerous studies. Lu et al. (2024) found that individuals with higher working memory capacity exhibit greater creativity and are better at nurturing it.

Verbal creativity is a crucial aspect of creativity in students, referring to the ability to generate and express new and innovative ideas, thoughts, and concepts (Beaty et al., 2014). It involves creating, combining, and reconstructing linguistic concepts and using language in novel and engaging ways to communicate, express emotions, and solve problems (Benedek & Fink, 2019). This ability helps students respond creatively in various situations and find diverse solutions to linguistic and non-linguistic challenges (Yeh et al., 2015).

When students use their working memory more efficiently, they can retain and integrate more information in their minds (Nazer et al., 2018). This ability aids them in developing new ideas and creative solutions to language-related problems, allowing them to express their thoughts in different ways (Arjmandniya et al., 2021). Cognitive-emotional-social working memory training is specifically designed to enhance students' cognitive and emotional-social abilities, playing a significant role in improving their verbal creativity (Amiri et al., 2018). By using exercises and activities that develop working memory, creativity, and emotional-social self-regulation skills, this type of training helps students effectively apply their linguistic and creative

E-ISSN: 3041-8828

capabilities to address problems and use language innovatively (Akbari et al., 2015).

One key factor in exhibiting verbal creativity is self-confidence. Cognitive-emotional interventions designed to strengthen working memory and improve self-efficacy enable students to believe in their ability to process and express thoughts, confidently showcasing their verbal creativity (Gerver et al., 2023). This self-confidence in expressing creative ideas allows them to perform better in challenging academic situations (Gu et al., 2022). On the other hand, academic self-efficacy is a crucial and influential factor in students' academic and psychological success (Igomigo et al., 2023). It enables them to engage in learning with greater motivation and confidence, facing academic challenges with strength and perseverance (Du Rocher, 2020). Therefore, focusing on academic self-efficacy and creating conditions that enhance this belief can aid in students' academic growth and pave the way for greater academic and personal achievements (Asdolahzadeh et al., 2021; Haseli Songhori & Salamti, 2024).

Cognitive-emotional-social working memory training is purposefully designed to help students gain greater belief and confidence in their academic abilities, enhancing their self-efficacy (Taghvai Yazdi & Astana, 2018). By focusing on strengthening working memory, managing emotions, and developing social skills, this training provides an appropriate context for increasing students' academic self-efficacy (Hassani et al., 2020). This approach employs a combination of cognitive, emotional, and social exercises, allowing students to operate with more confidence in academic settings and feel more motivated to successfully complete academic tasks.

Given the critical role of cognitive, emotional, and social factors in learning and academic achievement, one of the major challenges in education systems is enhancing students' cognitive and emotional abilities, especially at the elementary level. At this stage, students need strong cognitive skills, such as working memory, verbal creativity, and academic self-efficacy, to successfully engage in learning and solve educational problems. However, due to natural developmental limitations, many students face challenges in maintaining focus, processing information, and believing in their abilities, which may reduce their motivation and academic engagement.

Working memory, as a key cognitive component, plays a crucial role in processing information and completing academic tasks. Weakness in working memory can reduce the ability to learn and understand complex concepts. Additionally, academic self-efficacy, referring to students' belief in their abilities to complete tasks and confront academic challenges, is essential for their level of effort and persistence. A lack of self-belief and low self-efficacy can reduce motivation and lead to academic decline. Verbal creativity, as the ability to produce and express new ideas, helps students approach problems diversely and benefit from new opportunities for learning.

Research indicates that intervention programs focusing on strengthening working memory, verbal creativity, and academic self-efficacy can bring significant improvements in these areas. However, there is still insufficient and convincing evidence on the effectiveness of these interventions in improving elementary students' academic performance and cognitive development. Therefore, the main question is whether intervention training focused on enhancing working memory and developing cognitive, emotional, and social skills can effectively improve verbal creativity and increase academic self-efficacy in elementary school students.

The present study aims to address this question and assess the effectiveness of these educational interventions on elementary students. It is hoped that the findings of this research will assist teachers and educational policymakers in designing educational programs based on psychological and cognitive principles to improve educational quality and learning in schools by strengthening working memory and verbal creativity.

2. Methods and Materials

2.1. Study Design and Participants

a) Research Design and Participants: This study utilized a quasi-experimental design with a pretest-posttest control group. The statistical population consisted of all fifth-grade elementary students in the city of Zabol during the 2022-2023 academic year. A multistage cluster random sampling method was used to select the participants. Specifically, from among educational levels, elementary education was selected; from the elementary grades, the fifth grade was chosen; and from the elementary schools, one school was randomly selected. After obtaining the necessary permissions from the Zabol Department of Education and coordinating with the schools, all fifth-grade students were screened. With parental written consent, teachers were asked to identify students with weaker academic performance, who were then assessed using a working memory test to identify those with poor working memory performance. Once

E-ISSN: 3041-8828

students with weak working memory were identified and parental consent was obtained for participation in the research program, 30 students were randomly selected based on similar quasi-experimental studies and recommended sample sizes from statistical books. They were randomly assigned into two groups of 15 (15 in the experimental group and 15 in the control group). The inclusion criteria were: enrollment in the fifth grade, an age range of 10-12 years, attendance in public schools, confirmed diagnosis of poor working memory performance, and student and parental cooperation and consent to participate in the study. The exclusion criteria included withdrawal by the student or parent and absence from more than two intervention sessions.

The experimental group received cognitive-emotional-social working memory intervention for approximately three months, 3 to 4 times a week, in 20 sessions lasting 90 minutes each. The control group received no intervention during the study. To prevent fatigue and maintain focus, the content of each session was delivered using four methods: lectures, paper-pencil tasks, targeted games, and computer exercises. Weekly sessions were held to answer parents' questions after the first week of training. Ethical principles were followed, obtaining student and parental consent and keeping participants informed throughout the intervention. Both groups were assured of data confidentiality, used in group reports for research purposes. The control group was assured they would receive the intervention post-study. After the intervention, a posttest was conducted for both groups, and data were analyzed using analysis of covariance.

2.2. Measures

2.2.1. Working Memory

The Wechsler Digit Span Test assesses working memory by measuring rote memory, attention, and changes in thought patterns. The forward digit span measures rote memory, while the backward digit span evaluates focus, patience, and flexibility (Khodadadi, Mashhadi, & Amini, 2006). The computerized version, consisting of four stages, was used in this study. In the first stage, participants had to memorize numbers they heard and then select them in the same order on the screen. The second stage presented numbers audibly in reverse order. In the third stage, numbers appeared on the screen, which participants had to select in the same order. The fourth stage presented numbers visually in reverse order. Scores in the computerized version were based on the number of correct responses. The content validity of the test has been established internationally and reported as satisfactory. The reliability was reported as 0.87, and the test-retest reliability was 0.82. The test's validity was confirmed by calculating its correlation with other memory tests (Bayat Shahbazi et al., 2022; Mohammadi et al., 2020; Moshtaghy Sharifzadeh et al., 2021). In the present study, test-retest reliability was assessed by examining the correlation between the pretest and posttest scores of the control group, yielding correlation coefficients of 0.91 for auditory memory and 0.89 for visual memory.

2.2.2. Verbal Creativity

Among creativity assessment tools, the Torrance Test has the highest applicability and has been extensively used in educational and psychological research. It has been used in over 2,000 studies, with results published in reputable American scientific journals. The complete Torrance test comprises 12 tasks classified into verbal, figural, and auditory components, yielding four scores for fluency, originality, flexibility, and elaboration. According to the manual, reliability coefficients range from 0.80 to 0.90. Predictive validity, calculated over 20 years, was 0.63. The verbal section contains 60 questions, each with three options: option A scores zero, option B scores one, and option C scores two, with total scores ranging from 0 to 120. Higher scores indicate greater creativity. The test duration is 45 minutes and can be administered individually or in groups, covering a sample age range from kindergarten to university level (Hassani et al., 2020).

2.2.3. Academic Self-Efficacy

Jing and Morgan's Academic Self-Efficacy Questionnaire (1999): This 30-item questionnaire measures student academic self-efficacy across three subscales: ability (items 1-10), context (items 11-20), and effort (items 21-30). It uses a Likert scale (1 = strongly disagree, 2 = disagree, 3 = somewhat agree, 4 = agree, 5 = strongly agree). Scoring involves direct items (e.g., items 1-3, 6-10, 11-14, 17-18, 21, 24-30) and reverse-scored items (e.g., items 4-5, 15-16, 19-20, 22-23). Scores between 30 and 52 indicate low self-efficacy, 52 to 75 indicate moderate self-efficacy, and scores above 75 indicate high self-efficacy. The questionnaire's reliability was reported as 0.82 using Cronbach's alpha. Subscale reliabilities were 0.78 for ability, 0.66 for context, and 0.66 for effort (Taghvai Yazdi & Astana, 2018). In this study, the reliability was 0.91 using Cronbach's alpha, and

E-ISSN: 3041-8828

item-total correlations confirmed the questionnaire's validity.

2.3. Intervention

2.3.1. Cognitive-Emotional-Social Working Memory Training

The cognitive-emotional-social working memory training program comprises 20 structured sessions designed to improve students' working memory, emotional regulation, and executive functioning. Each session incorporates a mix of cognitive strategies, emotional exercises, and social activities to ensure holistic development. Sessions are supplemented with digital tools for memory enhancement and are geared toward engaging students actively while reducing monotony. Below is a detailed description of each session (Hassani et al., 2020; Sarshar et al., 2024).

Session 1: The session begins with an introduction to effective study techniques, emphasizing their importance and outlining the training program. Activities include techniques to reduce pause time, increase the field of vision using cards, and practice reading speed adjustment. Engaging games like "Sit/Stand" and "Freeze/Move" are played forward and backward. Exercises target working memory and executive functions, such as spatial perception, numeric memory, visual processing, and coding differences. A 15-20 minute emotional memory practice using memory-enhancing software concludes the session.

Session 2: Students learn to identify and label emotions encountered in daily life through interactive assignments. Using colorful pins and a foam board, students create geometric designs, followed by a reaction-based sign game. Working memory and executive function exercises, including visual stability, visual completion, and processing sequences, are performed. The session ends with 10-15 minutes of emotional memory enhancement using software.

Session 3: Techniques for reading, thinking, recalling, and expanding information are introduced, with students practicing aloud and silently. Following a series of forward and reverse commands, they create geometric patterns using matchsticks or colored squares. Exercises focus on improving spatial perception, attention, and flexibility, ending with 10-15 minutes of software-based memory training.

Session 4: Target-based ball games are played using balls of varying sizes and distances. Stringing colorful shapes according to patterns follows, along with exercises for visual stability and memory. The session concludes with 10-15 minutes of emotional memory practice using software, aimed at enhancing spatial awareness, attention, and executive functions.

Session 5: This session focuses on note-taking and summarizing key information. Students classify geometric shapes by size and color and engage in working memory and executive function exercises. The session finishes with 10-15 minutes of software-based emotional memory practice, promoting attention and cognitive strategies.

Session 6: Students identify emotions related to specific desires and practice memory retention through activities like copying text without dots. Exercises include shape identification and memory-based tasks, followed by 10-15 minutes of emotional memory enhancement software.

Session 7: Concept mapping and problem-solving strategies are taught, and students play games like bingo and solve age-appropriate Sudoku puzzles. Exercises target memory and executive functioning, ending with a 10-15 minute software-based memory practice session.

Session 8: Students work on recognizing beliefs associated with emotions and practice writing sentences without a specific letter. They complete puzzles by matching cut-out images to originals. The session ends with memory and executive function exercises, plus software practice.

Session 9: Characteristics of successful learners are discussed, followed by obstacle-based activities like ball movement and races. Memory recall tasks are integrated, concluding with a 10-15 minute emotional memory enhancement session.

Session 10: Techniques for reducing vulnerability to negative emotions are introduced, with students engaging in calming exercises. Games include noticing changes in a sequence of objects. Exercises and software-based memory practice end the session.

Session 11: Collaborative study methods and reciprocal questioning are taught. Activities include storytelling with restricted vocabulary and word-card games. The session concludes with working memory and executive function exercises, plus software practice.

Session 12: Techniques for separating emotions like sadness, fear, and anger from problems are presented. Students complete shape-matching and design activities, ending with memory-enhancing exercises using software.

Session 13: Problem-solving techniques are taught, and students balance on one leg while moving between numbered squares. The session includes visual perception tasks, finishing with a 10-15 minute software-based memory session.

E-ISSN: 3041-8828

Session 14: Positive affirmation techniques (Part 1) are covered. Students perform balance and agility activities and create directional maps. The session concludes with exercises and software practice.

Session 15: Exam preparation and question-answering techniques are taught. Students practice holding a flag steady and walking with balance challenges. A timed puzzle activity ends the session.

Session 16: Positive affirmations (Part 2) are discussed. Students estimate time intervals and recall a narrated story. Exercises and a 10-15 minute software-based session complete the activities.

Session 17: Relational strategies, like visualization and mnemonic devices, are introduced. Students play games involving counting beads and practice memory exercises. The session ends with 10-15 minutes of memory software training.

Session 18: The "if-then" technique is taught to encourage strategic thinking. Students engage in shape-matching activities and memory exercises, finishing with software practice.

Session 19: The PQRST study method is taught. Students learn to respond to target stimuli and ignore non-targets through a bottle-color game, ending with a 10-15 minute software-based memory session.

Session 20: Emotional regulation techniques are practiced, focusing on discussing feelings of anger, sadness, and acceptance. Students complete geometric threading activities. The session concludes with exercises and emotional memory software practice.

2.4. Data Analysis

Data were analyzed using analysis of covariance through SPSS-26.

3. Findings and Results

Table 1 presents the mean, standard deviation, and normality of students' scores in the experimental and control groups for the variables of verbal creativity and academic self-efficacy in the pretest and posttest phases.

As shown in Table 1, the mean scores of verbal creativity and academic self-efficacy, as well as their dimensions, in the experimental group increased in the posttest compared to the control group, indicating an improvement in verbal creativity and academic self-efficacy. To test the normality assumption, the Shapiro-Wilk test was used, confirming normality for both variables of verbal creativity and academic self-efficacy in both pretest and posttest stages across the two groups ($P > 0.05$). Therefore, given the acceptance of the normality assumption, using parametric tests is justified.

To examine the impact of the cognitive-emotional-social working memory training package on verbal creativity and academic self-efficacy, univariate analysis of covariance (ANCOVA) was used. Before conducting the ANCOVA, Levene's test was performed to check the homogeneity of variances for the dependent variables. The results showed that the variances for verbal creativity ($F = 1.370$, $P > 0.249$) and academic self-efficacy ($F = 2.547$, $P > 0.119$) were equal across the groups.

Table 1

Descriptive Statistics and Normality Test for Pretest and Posttest Scores in Experimental and Control Groups

Variable	Dimension	Test	Group	Mean	Standard Deviation	Shapiro-Wilk	Significance Level
Verbal Creativity	Fluency	Pretest	Experimental	56.10	8.39	0.981	0.718
			Control	50.05	10.74	0.981	0.743
		Posttest	Experimental	60.05	7.21	0.974	0.481
			Control	53.55	8.42	0.984	0.839
	Originality	Pretest	Experimental	39.80	8.87	0.982	0.771
			Control	56.10	6.91	0.739	0.951
		Posttest	Experimental	63.50	8.40	0.963	0.204
			Control	50.95	9.32	0.904	0.201
	Flexibility	Pretest	Experimental	41.00	10.70	0.961	0.177
			Control	52.55	6.88	0.992	0.993
		Posttest	Experimental	63.15	5.16	0.971	0.375
			Control	40.15	6.88	0.967	0.294
	Elaboration	Pretest	Experimental	56.40	13.81	0.944	0.095
			Control	41.00	5.58	0.952	0.089
		Posttest	Experimental	62.50	3.48	0.966	0.261
			Control	48.15	16.20	0.964	0.223
Academic Self-Efficacy	Ability	Pretest	Experimental	33.45	9.34	0.933	0.121

E-ISSN: 3041-8828

			Control	34.30	6.46	0.956	0.123
		Posttest	Experimental	42.77	6.13	0.949	0.346
			Control	38.70	14.07	0.955	0.448
	Context	Pretest	Experimental	29.20	8.79	0.934	0.293
			Control	31.15	6.14	0.917	0.088
		Posttest	Experimental	42.55	4.99	0.945	0.301
			Control	31.15	6.07	0.971	0.316
	Effort	Pretest	Experimental	32.45	8.56	0.973	0.498
			Control	31.65	6.14	0.972	0.768
		Posttest	Experimental	42.40	4.78	0.981	0.861
			Control	33.40	7.76	0.918	0.815

Based on the findings in Table 2, the F-statistic for verbal creativity in the posttest stage (F = 41.94) is significant at the 0.001 level, indicating a significant difference in verbal creativity between the experimental and control groups. The effect size of 0.722 indicates a large effect. The pretest F-statistic (F = 42.78) is also significant at the 0.001 level, demonstrating that the pretest had a significant effect on posttest scores. Additionally, the F-statistic for academic self-efficacy in the posttest stage (F = 26.51) is significant at the 0.001 level, with an effect size of 0.669, indicating a substantial difference between groups. The pretest F-statistic for academic self-efficacy (F = 15.03) is also significant at the 0.001 level. These results suggest that the cognitive-emotional-social working memory training package effectively improved both verbal creativity and academic self-efficacy in students.

Table 2

Results of Univariate Analysis of Variance for Differences Between Experimental and Control Groups in Verbal Creativity and Academic Self-Efficacy

Variable	Source	Sum of Squares	Degrees of Freedom	Mean Squares	F-Statistic	P-Value	Effect Size
Verbal Creativity	Pretest	6.146	1	6.146	42.78	<0.001	0.718
	Group Membership	31431.725	1	31431.725	41.94	<0.001	0.722
	Error	12318.254	37	332.926			
Academic Self-Efficacy	Pretest	481.933	1	481.933	15.03	<0.001	0.418
	Group Membership	5683.856	1	5683.856	26.51	<0.001	0.669
	Error	7930.367	37	214.334			

To examine the effects of the cognitive-emotional-social working memory training on the components of verbal creativity (fluency, originality, flexibility, elaboration) and academic self-efficacy (ability, context, effort), multivariate analysis of covariance (MANCOVA) was used. Levene's test results showed homogeneous variances for fluency (F = 2.124, P > 0.727), originality (F = 1.065, P > 0.800), flexibility (F = 2.140, P > 0.711), and elaboration (F = 3.875, P > 0.065). Similarly, variances for ability (F = 1.901, P > 0.349), context (F = 2.466, P > 0.125), and effort (F = 1.545, P > 0.221) were equal across groups. Box's test also confirmed the equality of covariance matrices for verbal creativity (F = 1.261, Box M = 14.26, P > 0.246) and academic self-efficacy components (F = 1.870, Box M = 10.54, P > 0.189). MANCOVA results indicated significant differences between groups for verbal creativity (F = 11.64, P < 0.001, Wilks' Lambda = 0.400) and academic self-efficacy components (F = 16.04, P < 0.001, Wilks' Lambda = 0.407). Univariate results for specific components are presented in the following.

Table 3

Univariate Analysis of Variance Results for Differences in Verbal Creativity Components

Dimension	Group	Mean	Standard Error	F-Statistic	P-Value	Effect Size
Fluency	Experimental	57.78	4.57	29.19	<0.001	0.665
	Control	51.81				
Originality	Experimental	59.10	3.82	27.58	<0.001	0.451
	Control	53.34				
Flexibility	Experimental	60.62	2.70	36.15	<0.001	0.515

E-ISSN: 3041-8828

	Control	52.67				
Elaboration	Experimental	62.07	2.76	19.25	<0.001	0.362
	Control	56.57				

The F-statistics for fluency (F = 29.19), originality (F = 27.58), flexibility (F = 36.15), and elaboration (F = 19.25) were all significant at the 0.001 level, indicating substantial differences between groups in verbal creativity components. The experimental group's mean scores in fluency (60.05), originality (63.50), flexibility (63.15), and elaboration (62.50) were higher than those of the control group (53.55, 50.95, 40.15, and 48.15, respectively). The effect sizes, ranging from 0.362 to 0.665, indicate above-average impacts, with the training program accounting for 66%, 45%, 51%, and 36% of the improvement in each component, respectively. Thus, the cognitive-emotional-social working memory training effectively enhanced verbal creativity in fifth-grade students.

Table 4

Univariate Analysis of Variance Results for Differences in Academic Self-Efficacy Components

Dimension	Group	Mean	Standard Error	F-Statistic	P-Value	Effect Size
Ability	Experimental	42.89	2.38	21.67	<0.001	0.246
	Control	38.50				
Context	Experimental	42.63	2.17	28.17	<0.001	0.579
	Control	37.06				
Effort	Experimental	42.19	2.45	17.36	<0.001	0.332
	Control	38.60				

The F-statistics for ability (F = 21.67), context (F = 28.17), and effort (F = 17.36) were significant at the 0.001 level, indicating significant differences between groups. The experimental group had higher mean scores in ability (42.89), context (42.63), and effort (42.19) compared to the control group (38.50, 37.06, and 38.60, respectively). Effect sizes ranged from 0.246 to 0.579, with the training program accounting for 25%, 58%, and 33% of the improvements in these components. Therefore, the cognitive-emotional-social working memory training was effective in enhancing academic self-efficacy in fifth-grade students.

4. Discussion and Conclusion

This study aimed to examine the effectiveness of cognitive-emotional-social working memory intervention training on improving verbal creativity and academic self-efficacy in elementary students in Zabol. The initial findings revealed a significant difference between the two groups of students with poor working memory performance, indicating that 20 sessions of cognitive-emotional-social working memory intervention training increased verbal creativity and its components in students in the posttest. These results align with findings from previous studies (Arjmandniya et al., 2021; Gerver et al., 2023; Gu et al., 2022; Hassani et al., 2020; Lu et al., 2022), which have also highlighted the effectiveness of cognitive-emotional-social working memory training programs in improving various forms of creativity and skills.

In explaining these results, it can be stated that cognitive-emotional-social working memory training plays a crucial role in developing cognitive skills and creativity, particularly verbal creativity, which includes key components such as fluency, originality, flexibility, and elaboration. Each of these components can improve through the enhancement of working memory and the application of cognitive, emotional, and social interventions. These trainings can increase verbal fluency by strengthening working memory. As working memory is critical for storing and accessing information, students can more easily retrieve words and ideas. Furthermore, reducing anxiety and enhancing emotional regulation through these interventions helps students express their ideas more fluidly and confidently, without the fear of making mistakes. Thus, cognitive-emotional interventions lead to greater idea generation and fewer mental blocks in verbal fluency. Verbal creativity, characterized by generating novel and unconventional ideas, reflects originality. Cognitive-emotional interventions, by promoting deep mental processing and creating a calm and cohesive mental space, help students come up with more creative ideas. Cognitive exercises, especially those that emphasize multidimensional analysis and diverse perspectives, foster innovative thinking. Additionally, managing emotions and fostering self-efficacy give students

E-ISSN: 3041-8828

the confidence to express their unique ideas and display their verbal creativity.

Flexibility in verbal creativity refers to the ability to change perspectives and generate various ideas. Strong working memory enables students to hold and process information simultaneously, allowing them to produce diverse responses and quickly shift between different ideas. Cognitive and social interventions enhance mental flexibility by improving processing abilities and encouraging the use of different viewpoints. Emotional regulation and anxiety management further enable students to approach new perspectives with openness and adaptability (Arjmandniya et al., 2021; Gerver et al., 2023).

On the other hand, students with strong working memory can add more details to their ideas and expand on them. Cognitive and emotional interventions strengthen working memory and reduce mental barriers, helping students enrich their ideas with more information. Social interventions that encourage group interactions and classroom discussions provide opportunities for students to express and elaborate on their ideas, benefiting from peer feedback to refine their explanations and details (Hassani et al., 2020).

Overall, the effectiveness of cognitive-emotional-social working memory training in enhancing verbal creativity is evident. These trainings help students improve their fluency, originality, flexibility, and elaboration by strengthening working memory and enhancing emotional regulation. These skills are crucial not only for academic and verbal performance but also for developing communication skills and social interactions. Therefore, using cognitive-emotional-social interventions can be a significant step in fostering verbal creativity in students, preparing them for future challenges and success across various fields.

Another finding of this study revealed a significant difference between the two groups of students with poor working memory performance, indicating that 20 sessions of cognitive-emotional-social working memory intervention training increased academic self-efficacy and its components in the posttest. These results are consistent with prior findings (Du Rocher, 2020; Hassani et al., 2020; Igomigo et al., 2023; Taghvai Yazdi & Astana, 2018), which have also highlighted the effectiveness of cognitive-emotional-social working memory training programs in enhancing self-efficacy, academic achievement, and task performance.

In explaining these results, it can be stated that cognitive-emotional-social working memory training has a significant impact on increasing students' academic self-efficacy. Academic self-efficacy, defined as a student's belief in their ability to successfully complete academic tasks, includes three key components: ability, context, and effort. Cognitive, emotional, and social interventions, by enhancing working memory and developing various skills, can improve each of these components. The ability component in academic self-efficacy refers to students' beliefs in their inherent and acquired capabilities. Working memory, as a core element of cognitive functioning, helps students retain and process information more effectively. Cognitive-emotional-social interventions, through cognitive exercises and memory enhancement, enable students to develop greater confidence in their abilities. Improved information processing and retention increase students' faith in their cognitive capabilities, enhancing their ability to learn and perform tasks successfully. Additionally, these interventions help manage emotions, anxiety, and stress, enabling students to trust their abilities and experience higher academic self-efficacy (Igomigo et al., 2023).

The context component pertains to the surrounding environment, including educational and social settings. Social aspects of cognitive-emotional-social training encourage students to engage in group activities and interactions. These group experiences can create a more positive perception of the educational environment, increasing students' sense of belonging and mastery over their academic surroundings. Positive experiences in learning environments help students feel more connected and prepared to face academic challenges. Strengthening social connections enables students to perform better in group projects and benefit from the support of peers and teachers (Hassani et al., 2020).

Effort refers to students' persistence in their academic pursuits. Cognitive-emotional interventions teach self-regulation skills, preparing students psychologically to maintain continuous effort in their studies. Enhanced working memory and better emotion and stress management make students more willing to tackle challenges and persist in their efforts. These interventions also teach students to continue striving even when faced with academic difficulties, staying committed to their learning. This persistence and continuous effort, facilitated by emotional management and reduced anxiety, contribute to stronger academic self-efficacy (Hassani et al., 2020; Igomigo et al., 2023).

In conclusion, cognitive-emotional-social working memory intervention training effectively improves academic self-efficacy in the areas of ability, context, and effort.

E-ISSN: 3041-8828

Through these interventions, students gain greater confidence in their abilities, develop a better perception of their educational environment, and are more motivated to work diligently. Strengthening working memory, alongside emotional and social self-regulation, provides a foundation for students to approach academic tasks with confidence and succeed in their academic goals.

This study aimed to leverage scientific principles to enhance working memory and related components by addressing emotional, cognitive, and social dimensions. The findings of this study can be beneficial for teachers, educators, psychologists, and specialists in the field of learning disorders.

It is recommended that cognitive games and exercises that emphasize concentration, problem-solving, and working memory be incorporated into teaching practices, as they can help students improve their information processing and retention. Activities like puzzles, quick reaction exercises, and short-term memory training can enhance working memory and increase verbal creativity. Additionally, incorporating activities focused on emotional regulation, anxiety reduction, and emotional management alongside academic content can boost students' academic self-efficacy. For instance, practicing deep breathing and relaxation techniques before tests or giving positive feedback after solving difficult problems can help students feel more self-efficacious.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

We hereby thank all individuals for participating and cooperating us in this study.

Declaration of Interest

The authors report no conflict of interest.

Funding

According to the authors, this article has no financial support.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. Each participant received an informed consent form to understand the study's objectives.

References

Ahmed, S. F., Ellis, A., Ward, K. P., Chaku, N., & Davis-Kean, P. E. (2022). Working memory development from early childhood to adolescence using two nationally representative samples. *Developmental Psychology*, *58*(10), 1962. https://doi.org/10.1037/dev0001396

Akbari, E., Hasani, J., & Moradi, A. (2015). Investigating the effect of inducing emotional experiences on the executive functions of attention and working memory by looking at the spectrum of depression. *Neuropsychology*, *1*(1), 7-25. https://clpsy.journals.pnu.ac.ir/article_2417_245.html

Amiri, F., Sepahvandi, A., & Veyskarami, H. (2018). Investigating the effectiveness of teaching cognitive regulation of emotion on emotional intensity and mental vitality of gifted students of the first year of high school. *Cognitive Analytical Psychology*, *5*(33), 47-57. http://ensani.ir/fa/article/512137/%D8%A7%D8%AB%D8%B1%D8%A8%D8%AE%D8%B4%DB%8C-%D8%A2%D9%85%D9%88%D8%B2%D8%B4-%D8%AA%D9%86%D8%B8%DB%8C%D9%85-%D8%B4%D9%86%D8%A7%D8%AE%D8%AA%DB%8C-%D9%87%DB%8C%D8%AC%D8%A7%D9%86-%D8%A8%D8%B1-%D8%AE%D9%84%D8%A7%D9%82%DB%8C%D8%AA-%D9%87%DB%8C%D8%AC%D8%A7%D9%86%DB%8C-%D9%88-%D9%86%D8%B4%D8%A7%D8%B7-%D8%B0%D9%87%D9%86%DB%8C-%D8%AF%D8%A7%D9%86%D8%B4-%D8%A2%D9%85%D9%88%D8%B2%D8%A7%D9%86-%D8%AA%DB%8C%D8%B2%D9%87%D9%88%D8%B4-%D8%AF%D9%88%D8%B1%D9%87-%D8%A7%D9%88%D9%84-%D9%85%D8%AA%D9%88%D8%B3%D8%B7%D9%87

Arjmandniya, A., Ghasemzadeh, S., Shafiei, E., & Mesbahipour, N. (2021). Investigating the effect of verbal active memory intervention on emotional active memory performance of students with reading disorders. *Teaching and Learning Studies*, *13*(1), 163-180. https://jsli.shirazu.ac.ir/article_6318.html

Asadi Rajani, M. (2023). Investigating the Performance of Selective Attention and Working Memory in Adolescents Recovered from Acute Covid-19 with Normal Adolescents. *International Journal of Education and Cognitive Sciences*, *3*(4), 44-51. https://doi.org/10.22034/injoeas.2023.357896.1036

Asdolahzadeh, P., Sadeghi, J., & Abbasi Asfajir, A. A. (2021). Modeling the Structural Equations of Mode Metacognition

E-ISSN: 3041-8828

with a Tendency to Cyberspace Mediated by Self-efficacy in Gifted Students [Research Article]. *Iranian Journal of Educational Sociology*, *4*(2), 14-23. https://doi.org/10.52547/ijes.4.2.14

Babaei, F., Abdollahi, M., Amini Gilvani, M., & Masoomifard, M. (2024). The Mediating Role of Theory of Mind in the Relationship Between Executive Functions and Marital Burnout Using Structural Equation Modeling and Artificial Neural Networks (SEM-ANN). *International Journal of Education and Cognitive Sciences*, *5*(4), 62-73. https://doi.org/10.61838/kman.ijecs.5.4.7

Baniasadi, T. (2024). Comparison of Executive Function and Working Memory among Children with High and Low Levels of Physical Activity. *International Journal of Education and Cognitive Sciences*, *5*(3), 9-15. https://doi.org/10.61838/kman.ijeas.5.3.2

Bayat Shahbazi, F., Arjmandnia, A., & Nemati, R. (2022). Effectiveness of working memory on visual-spatial working memory performance of pre-school children with learning problem at risk. *Shenakht Journal of Psychology and Psychiatry*, *8*(6), 69-82. https://doi.org/10.32598/shenakht.8.6.69

Beaty, R. E., Silvia, P. J., Nusbaum, E. C., Jauk, E., & Benedek, M. (2014). The roles of associative and executive processes in creative cognition. *Memory & Cognition*, *42*(7), 1186-1197. https://doi.org/10.3758/s13421-014-0428-8

Benedek, M., & Fink, A. (2019). Toward a neurocognitive framework of creative cognition: The role of memory, attention, and cognitive control. *Current Opinion in Behavioral Sciences*, *27*, 116-122. https://doi.org/10.1016/j.cobeha.2018.11.002

Bulut, S., Bukhori, B., & Parsakia, K. (2024). Enhancing Selective Attention in Children with Learning Disorders: Efficacy of Executive Functions Training. *KMAN Counseling & Psychology Nexus*, *1*(2), 86-93. https://doi.org/10.61838/kman.psychnexus.1.2.14

Dehghani, Y., & Moradi, N. (2018). Active memory training on inhibition and reading performance of students with specific learning disabilities (dyslexia). *Scientific-Research Quarterly of Neuropsychology*, *4*(15), 123-142. https://clpsy.journals.pnu.ac.ir/article_5571.html?lang=en

Du Rocher, A. R. (2020). Active learning strategies and academic self-efficacy relate to both attentional control and attitudes towards plagiarism. *Active Learning in Higher Education*, *21*(3), 203-216. https://doi.org/10.1177/1469787418765515

Friedman, N. P., & Robbins, T. W. (2022). The role of prefrontal cortex in cognitive control and executive function. *Neuropsychopharmacology*, *47*(1), 72-89. https://doi.org/10.1038/s41386-021-01132-0

Gerver, C. R., Griffin, J. W., Dennis, N. A., & Beaty, R. E. (2023). Memory and creativity: A meta-analytic examination of the relationship between memory systems and creative cognition. *Psychonomic Bulletin & Review*, *30*(6), 2116-2154. https://doi.org/10.3758/s13423-023-02303-4

Ghahreman, M., Habibi Kliber, R., & Farid, A. (2020). The effectiveness of emotional working memory training on reducing behavioral problems and behavioral inhibition in students. *Education and Evaluation (Educational Sciences)*, *13*(49), 169-184. https://www.sid.ir/paper/413376/fa

Gu, X., Tan, Y., Wu, X., Cai, Z., Lai, Q., Cheng, M., & Zhao, Q. (2022). Active versus passive strategy in online creativity training: How to best promote creativity of students with different cognitive styles? *Thinking Skills and Creativity*, *44*, 101021. https://doi.org/10.1016/j.tsc.2022.101021

Haseli Songhori, M., & Salamti, K. (2024). The Linkage Between University Students' Academic Engagement and Academic Support: The Mediating Role of Psychological Capital [Research Article]. *Iranian Journal of Educational Sociology*, *7*(2), 72-84. https://doi.org/10.61838/kman.ijes.7.2.10

Hassani, M., Nadi, M., & Sajjadian, I. (2020). The effect of the cognitive-emotional-social working memory training package on the improvement of metacognition and emotional creativity in students. *Quarterly Journal of Child Mental Health*, *7*(3), 108-127. https://doi.org/10.52547/jcmh.7.3.10

Igomigo, R., Obosi, A., & Oyelade, O. (2023). Influence of self-efficacy, academic motivation, academic stress and anxiety on memory recall among PG students. https://doi.org/10.21203/rs.3.rs-3715535/v1

Khaloei, H., Salari Chine, P., Khosravi, S., & Manzari Tavakoli, V. (2022). Investigating the effectiveness of motor rehabilitation training on working memory and attention and concentration of students with reading learning disorders. *Bimonthly Research Journal of Rehabilitation Medicine*, *11*(2), 238-249. https://doi.org/10.32598/SJRM.11.2.7

Li, S., Wang, Z., Wang, J., & He, J. (2024). Metacognition predicts critical thinking ability beyond working memory: Evidence from middle school and university students. *Thinking Skills and Creativity*, 101572. https://doi.org/10.1016/j.tsc.2024.101572

Lu, R., Zhang, Y., Bao, N., Su, M., Zhang, X., & Shi, J. (2022). Visuospatial, rather than verbal working memory capacity plays a key role in verbal and figural creativity. *Thinking & Reasoning*, *28*(1), 29-60. https://doi.org/10.1080/13546783.2021.1911848

Melby-Lervag, M., & Hulme, C. (2013). Is working memory training effective? A meta-analytic review. *Developmental Psychology*, *49*(2), 270. https://doi.org/10.1037/a0028228

Mohammadi, H., Hatami, J., Karami Nori, R., Mansouri, J., Mafakheri, D., & Khademi, H. (2020). Comparison of working memory performance in monolingual and bilingual students with special learning disabilities. *Applied Psychological Research*, *11*(4), 165-179. https://japr.ut.ac.ir/article_79957.html

Moshtaghy Sharifzadeh, M., Mansouri, A., & Bagherzadeh Golmakani, Z. (2021). The Mediating Role of Processing Speed in the Relationship between Working Memory and Phonological Awareness with Reading in Students with Reading Disorder. *RBS*, *18*(4), 568-576. https://doi.org/10.52547/rbs.18.4.568

Nazer, M., Mirzaei, H., & Mokhtaree, M. (2018). Effectiveness of neurofeedback training on verbal memory, visual memory and self-efficacy in students. *Electronic Physician*, *10*(9), 7259. https://doi.org/10.19082/7259

Rahimipour, T., Ghazanfari, F., & Kadampour, E. (2017). The effectiveness of teaching active memory strategies on the motivation to progress and reading performance of dyslexic elementary school students. *Knowledge and research in applied psychology*, *19*(4), 136-124. https://www.sid.ir/paper/163978/en

Sala, G., & Gobet, F. (2017). Working memory training in typically developing children: A meta-analysis of the available evidence. *Developmental Psychology*, *53*(4), 671. https://doi.org/10.1037/dev0000265

Sardari, B. (2021). Effectiveness of teaching working memory strategies on cognitive flexibility and emotional self-regulation in primary school students. *Thinking and the Child*, *12*(1), 103-124. https://journals.ihcs.ac.ir/article_6267.html

Sarshar, M., Emadian, S. O., & Hassanzadeh, R. (2024). Effectiveness of Cognitive-Emotional-Social Training of Working Memory on Attention Bias, Executive Functions, and Academic Performance of Students with ADHD. *Executive Functions, and Academic Performance of Students*

E-ISSN: 3041-8828

with ADHD. https://doi.org/10.2139/ssrn.4935159 10.61838/kman.jarac.6.4.1

Sosa, P. M., Gonçalves, R., Carpes, F. P., & Mello-Carpes, P. B. (2018). Active memory reactivation previous to the introduction of a new related content improves students' learning. *Advances in Physiology Education*, *42*(1), 75-78. https://doi.org/10.1152/advan.00077.2017

Taghvai Yazdi, M., & Astana, R. (2018). Investigating the effect of teaching metacognitive strategies on the academic self-efficacy of the first year students of the second year of Noorabad secondary school. The Third National Conference of Cognitive Educational Psychology,

Vaccaro, A. G., & Fleming, S. M. (2018). Thinking about thinking: A coordinate-based meta-analysis of neuroimaging studies of metacognitive judgements. *Brain and Neuroscience Advances*, *2*, 23-39. https://doi.org/10.1177/2398212818810591

Yeh, Y. C., Lai, G. J., Lin, C. F., Lin, C. W., & Sun, H. C. (2015). How stress influences creativity in game-based situations: Analysis of stress hormones, negative emotions, and working memory. *Computers & Education*, *81*, 143-153. https://doi.org/10.1016/j.compedu.2014.09.011

E-ISSN: 3041-8828