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Training programme impact in improving the working memory of students with learning disabilities in reading arabic

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ABSTRACT

The study aimed to investigate the effect of a training program on improving working memory for students with learning difficulties in reading Arabic. The study sample consisted of (10) students with learning disabilities from Basic Education students from the fifth and sixth grades, and those between the ages (10-11) years as a pilot group and (10) students from the same stage and of the same age as a control group. The researcher used a working memory battery, Raven Test, and a training program he prepared to achieve the study goal. The results showed that there are statistically significant differences in the fields of working memory scale between the members of the experimental and control groups in the dimensional measurement, and in favor of the experimental group to which the training program was applied, by applying the measure of working memory in its three fields. The results also showed that there are statistically significant differences between the pre and post measurements of the areas of the working memory scale in favor of the post application, and for the benefit of the experimental group,This confirms the effectiveness of the training program used. Some recommendations were suggested.

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1. INTRODUCTION

The learning ability is closely related to the memory, and relevant experiences should be kept, collected and used in the learning process. Thus, memory disabilities may cause different symptoms according to the type and level of the memory deficiency, on the one hand, and the learning task, on the other. The working memory is one of the critical and necessary cognitive abilities to keep attention, follow instructions – especially those of multiple steps – remember information at once and employ logical thinking. In other words, it helps in controlling attention, resisting distraction and enhancing the student's ability of reading comprehension, solving complicated problems and answering tests [1].

The working memory represents the most effective processing knowledge component in activating information in the human memory in order to carry out several information tasks, especially that of achievement, through relevant knowledge systems. Baddeley [2] refers to the working memory's functional role in the knowledge tasks related to learning, logical thinking and understanding.

The memory functioning is linked to the temporal storage and processing of information at the same time, while the several working memory components are connected with different functions. Therefore, the working memory components are responsible for perception, attention and information keeping and

restoration. They also help visual-spacial functions, like maintaining direction in space and tracing changes in the vision scope over time [3].

Studies indicate that the working memory stores information for a short time until the brain carries out the next step, which is processing. As the working memory implements the two processes simultaneously, issues arise in relation to capacity, scope, information processing and problem solving [4, 5]. In addition, as a result of imbalances in the working memory functions, indications of learning disabilities come to the fore, reducing the learner's ability to make use of previous experiences [6, 7].

According to conclusions made by research over the past 25 years, there is a connection between the working memory imbalances and the basic problems with children and adults suffering from learning disabilities. It has been found that imbalances in the working memory's secondary components within the cognitive function patterns constitute a distinctive feature of learning disabilities [1].

It has also been shown that most of the students facing such problems have learning disabilities, as they cannot carry out more than one process at the same time [8]. Furthermore, students with learning disabilities lack the strategies which enable them to properly recall, restore and store information [9].

The working memory problems represent an obstacle for students with learning disabilities in achievement especially reading, which requires a number of skills. Many researchers argue that learning disabilities in reading, which is the most common type of learning disabilities, are the main reason for academic failure [6].

Swanson [10] points out that there is a link between the working memory inefficiency and the short-term memory for those with dyslexia. The performance differences were statistically significant in favour of other peers. Moreover, studies indicate that the working memory is connected with learning disabilities, as schools find many of the students with learning disabilities in reading and maths suffer from notable weakness in the working memory [11].

Studies [10, 12] also argue that children with learning disabilities suffer from working memory deficiency in understanding language, composing sentences, paragraphs or stories and problem solving. Scholars agree that the objective of teaching reading is reading comprehension [13, 14], and such children need special training programmes.

Previous studies show the efficiency of training programmes in boosting the students' working memory performance of different age groups of regular and special education students. Thus, the present study is aimed to investigate the impact of a special training programme in improving the working memory performance of students with learning disabilities. Their abilities are explored with reference to the implantation of the strategies they have been trained on to keep the impact of the programme until setting the delayed test.

Problem and Questions of the Study, Students with learning disabilities suffer from several problems in learning associated with the working memory abilities, like following instructions and memorizing texts [15]. Upon the author's experience and supervision on students of field training courses and field visits to follow up on trainees who teach students with learning disabilities in the basic stage, relevant problems have been found in the short-term memory and working memory. They have also concluded that the development exercises done by students in the learning disabilities programmes and learning sources rooms do not cover the memory deficiency.

As a result, the present study attempts to examine the impact of a training programme in improving the working memory performance of students with learning disabilities in the fifth grade. Focus is laid on the three following questions: Question One: Are there statistically significant differences between the averages of the experimental group scores and those of the control group at the level of the working memory's post measurement in favour of the former attributed to the training programme? Question Two: Are there statistically significant differences between the averages of the experimental group scores and those of the control group at the level of the working memory in favour of the post measurement attributed to the training programme? Question Three: Are there statistically significant differences between the averages of the experimental group scores at the level of the working memory post and delayed measurements in favour of the latter attributed to the training programme?

Concepts of the Study: (i) Training Programme is procedurally defined as the set of training procedures and methods derived from Baddeley's multicomponent model, aimed at creating ways to improve the working memory level for students with learning disabilities, which would help them concentrate on their required tasks and raise their academic achievement. (ii) Working Memory is procedurally defined in the present study as the process of storing verbal and visual information for a short period of no more than 2 minutes, in addition to its processing and appropriate re-storage in the long-term memory. The working memory requires attention. (iii) Learning disabilities in reading is procedurally defined in the present study as the difficulty in deciphering Arabic words when trying to read or write them, as well as the difficulty in comprehending an Arabic reading passage.

Justifications of the Study: (i) Scarcity of studies on the Arab environment with regard to the design of student training programmes for learning disabilities in reading and other subjects. (ii) Use of the training programme prepared in the study to improve the working memory level in the students with learning disabilities for relevant staff and psychiatrists. (iii) Employment of this training programme's methods and techniques in training other categories with the same problems.

Scope of the Study: (i) Human limitations: a sample of students with learning disabilities from the basic stage aged 10-11. (ii) Temporal limitations: 2nd semester of the academic year 2018/2019. Objective limitations: the employed tools, namely: training programme, Raven's coloured progressive matrices test.

2. RESEARCH METHOD

Methodology of the Study: The study adopts the quasi-experimental method. In addition, to check indicators of statistical significance between the two groups, the Mann-Whitney Test is employed as the sample is small and to avoid the assumption of moderate natural distribution. The training programme was carried out for 4 months, 2 for application and 2 for follow-up.Sample of the Study: The study consisted of 10 students of learning disabilities in reading from the fifth grade and another 10 from the control group at the same school in Amman.

Experimental vs Control Groups Equivalence To measure the statistical equivalence between the experimental and control groups, the researcher applied the Raven Intelligence Test adapted to the Jordanian environment, aimed at preventing the internal intelligence factors from influencing the results of the study. The Working Memory Test was also applied so that the working memory's high level of either sample would not affect the results of the training programme. Due to the small size of groups and non-moderate natural distribution, the nonparametric Mann-Whitney Test is employed, as is shown in Table 1 and Table 2.

Table 1. Mann-Whitney Test for statistical equivalent between the two groups using Ravan test

Domains	group	number	rank means	Sum of ranks	Z	Sig
Raven Test	Experimental	10	6.28	31.47	0.83	0.398
	Control	10	4.67	23.45		

Table 2. Mann-Whitney Test for statistical equivalent between the two groups related to working memory

Domains	group	number	rank means	Sum of ranks	Z	Sig
Central port	Experimental	10	6.18	31.00	0.734	0.464
	Control	10	4.77	24.50		
Verbal	Experimental	10	5.28	26.50	0.212	0.833
component	Control	10	5.67	27.50		
Visual	Experimental	10	4.01	20.00	1.576	0.117
component	Control	10	4.17	34.00		
Total	Experimental	10	5.38	28.00	0.103	0.899
	Control	10	5.66	27.00		

According to Table 1, there is statistical equivalence between the experimental and control groups under the Raven Intelligence Test. According to Table 2, there is statistical equivalence between the experimental and control groups under the Working Memory Test.

Tools of the Study:

a. Working Memory Test Battery: The researcher used the Working Memory Test Battery for children, created by Alloway and Arabicized by Suleiman (2010). It consists of 12 tasks to measure the short-term and working memories. For the purposes of the study, 5 tasks were chosen to measure the working memory's 3 components. In this battery, the programme automatically provides alarms, corrects scores and prepares them in an Excel report to show the examined student's scores in all the tasks. The employed tasks to test the working memory's 3 components are: counting, audio recalling to measure the verbal component; recalling the different shape to measure the central port; the special scope; and the clown to measure the visual-spacial component. The psychometric features of the tool were taken from Al-Fawri [16] due to the close age level in the samples. The working memory tasks were verified through contributions of Suleiman [17] and Al-Ansari & Suleiman [18] by criterion validity. Six tasks were applied to test the short-term memory in the battery itself. The correlation coefficients of the working memory's verbal and visual-spacial tasks ranged 0.76-0.85, indicating a high level of validity.The coefficient construction of the battery was verified by the theory composition validity or concept validity test, using Amos version 20 and estimating the parameters by maximum likelihood.

The tool stability was verified according to Al-Fawri (2015) on the 4th grade students by re-application and internal consistency of the working memory test battery tasks for children. The stability coefficient was 0.96 [19].

b. Raven Test: This is a prominent international (non-verbal) test for general and culture-free mental abilities [20], and the measure consists of 36 matrices. The test stability was validated through Kathem et al [20] in three ways. The planned indicators were high and acceptable, as the stability coefficient was 0.56 by re-applying the test. By halftone segmentation, the stability coefficient was 0.705-0.858 with a median of 0.88, which is acceptable.

c. Training Programme: The researcher reviewed literature on learning disabilities, working memory and some therapeutic and training courses dedicated to this category in relation to the working memory and therapeutic, cognitive strategies of learning disabilities aimed at improving memory. Then, a training programme based on Baddeley's multicomponent model was constructed.

The programme sessions were composed with reference to the working memory's three components, in addition to the properties and relevant strategies to improve each component. The following strategies were employed: hearing, story synthesis, problem solving, mental perception, classification, coding and passage segmentation. It consisted of four stages: preparation, moving, construction and conclusion. Each session started with welcoming students and discussing the homework assignment and the strategy to be used. Then, the students were trained to employ the strategies. Finally, the group members' emotions and impressions of each session were documented. To verify the validity of the programme, it was reviewed by 10 specialists in special education and learning disabilities. To make the necessary modifications, 80% of agreement between the referees' feedback was achieved.

Procedures of the Study:

- Exploring the theoretical framework on the working memory in different sources
- Exploring the training programmes set to improve the working memory
- Reviewing the programme (by the referees)
- Choosing the sample of the study
- Starting the application of the Raven and Working Memory tests
- Carrying out the training programme.

Employed Statistical Methods:Nonparametric Mann-Whitney and Wilcoxon tests for the first and for the second and third hypotheses, respectively

3. RESULTS AND ANALYSIS

Results related to Question One: Are there statistically significant differences between the averages of the experimental group scores and those of the control group at the level of the working memory's post measurement in favour of the former attributed to the training programme? To verify the significance of such differences, the nonparametric Mann-Whitney Test was used, with the results shown in Table 3.

Table 3. Mann-Whitney Test for comparing means of both groups on working memory scale (post test)

Domains	group	number	mean	SD	Z	Sig
Central port	Experimental	10	25.30	3.276	2.617	0.009
	Control	10	11.75	4.435		
Verbal	Experimental	10	48.55	5.558	2.615	0.009
component	Control	10	23.75	2.674		
Visual	Experimental	10	42.50	4.819	2.618	0.009
component	Control	10	21.75	6.115		
Total	Experimental	10	118.50	11.857	2.618	0.009
	Control	10	62.50	12.813		

Table 3. The Mann-Whitney nonparametric Test results to measure the significance of differences between the average scores of the experimental group and those of the control group in the level of the working memory's post measurement. Table 3 indicates that there are statistically significant differences related to the working memory's measurement fields between the two groups at post measurement in favour of the experimental group. It is argued that such positive results in improving the working memory of the experimental group are mainly attributed to the effective strategies employed in improving the working memory. The strategies appropriate for students with learning disabilities were selected from several studies and proved successful. Hearing, for instance, keeps the information available in the student's mind. Story synthesis helps maintain the information to be remembered once the story is mentioned. Coding alleviates the memory burden. Passage segmentation trains the student to split the text units to smaller parts.

The programme content and purposive diverse activities were designed to largely suit the characteristics of the sample[21, 22].

Results related to Question Two: Are there statistically significant differences between the averages of the experimental group scores and those of the control group at the level of the working memory in favour of post measurement attributed to the training programme? Due to the small size of the sample, the nonparametric Wilcoxon Test was employed to verify the significance of the differences, as is shown in Table 4.

Table 4. Wilcoxon Test Pre- Post for Domains of working memory scale for both groups.

Domains	measurement	number	mean	SD	Z	Sig
Central port	Experimental	10	13.50	4.147	2.124	0.043
	Control	10	25.70	3.862		
Verbal	Experimental	10	23.20	4.503	2.024	0.043
component	Control	10	51.40	5.942		
Visual	Experimental	10	16.90	2.831	2.024	0.043
component	control	10	44.80	4.817		

Table 4. Results of the Wilcoxon Test for prior and post measurement of the working memory's fields related to the experimental group members. Table 4 indicates that there are statistically significant differences between the working memories's prior and post measurement fields in favour of the latter and the experimental group, which confirms the effectiveness of the programme. The result is attributed to the fact that the experimental group members made notable achievement in learning reading in Arabic. When the programme was served, it mainly focused on improving the students' working memory abilities through the programme's advanced activities, methods and strategies as well as up-to-date technologies [23].

Results related to Question Three: Are there statistically significant differences between the averages of the experimental group scores at the level of the working memory's post measurement in favour of the delayed measurement attributed to the training programme? To verify the significance of the differences, as is shown in Table 5, the Wilcoxon Test was employed.

Table 5. Wilcoxon Test Pre- Post for Domains of working memory scale for experimental group

Domains	measurement	number	mean	SD	Z	Sig
Central port	Post	10	25.30	3.861	1.831	0.066
	Pre	10	23.20	2.913		
Verbal	Post	10	50.50	5.459	0.261	0.876
component	Pre	10	50.00	0.000		
Visual	Post	10	43.20	4.817	0.678	0.429
component	Pre	10	24.45	4.456		
Total	Post	10	118.00	11.842	0.132	0.885
	pre	10	117.5	5.816		

Table 5. Results of the Wilcoxon Test's prior and post measurement and follow-up of the working memory's measurement fields of the experimental group members. Table 5 indicates that there are no statistically significant differences between the prior, post and delayed measurements of the working memory's measurement fields. The persistence of the programme impact is attributed to the fact that its method helped improve the experimental group members' working memory by taking into consideration these students' actual needs. Rather than depending on theorizing and lecturing, the presentation of the training was diversified in terms of activities, tools, techniques and strategies[24, 25].

4. CONCLUSION

Out of this, the foregoing, the researcher concludes that the training program that was applied to the experimental group has achieved a positive impact on working memory in children with reading difficulties. The researcher believes that the effect of the training program is due to its dependence on cognitive strategies that have proven effective in multiple studies, and in different age stages, which contributed to improving the working memory of the fifth basic class students in the experimental group. Also, the training program relied on activating the audiovisual senses of the experimental group, which contributed greatly to improving and expanding their working memory, even after a period of time from the application of this program that did not exceed three months.

5. RECOMMENDATIONS

Setting a training programme for the first three basic grade teachers on how to use memorization strategies and their role in improving the working memory. Dveloping an electronic programme which is attractive and interesting, in a bid to use it in improving the children's working memory. Conducting an empirical study on the progress of the reading comprehension of Arabic for students with learning disabilities by improving their working memory.

REFERENCES

[1] Abu aldayar Mossad, *Working memory & learning disabilities*, Egypt, 2012.
[2] Baddeley. A., "The Fractionation of Working Memory," *Proc. Nat. AC. Ed.*, vol. 93, pp. 13468-134320, 1996.
[3] Lava Hoffman and Ronald B Gillam, "Verbal and Spatial Information Processing Constraints in Children with Specific Language Impairment," *Journal of Speech, Language & Hearing Research.* Rockville, vol. 47, pp. 1, pp. 114, 2004.
[4] Ann, R., *Working memory and reading disabilities: The use of the syracuse*, United States: UMI Company, 1998.
[5] Ebrahem Safinaz, "Differences in verbal and nonverbal memory among students with learning disabilities and attention disorders and ordinary students from the primary school in Medina," *Journal of Faculty of Education Zagazig*, vol. 64, pp. 109-156, 2009.
[6] Swanson, H. L. and Saez. L., "Memory disabilities in children & adults with learning disabilities," in H. L. Swanson, S. Graham. and K.R, Harris (Eds). *Handbook of Learning Disabilities*, pp. 182-198. New York: Guildford Press, 2003.
[7] Samir Alhsani, "The impact of a training program on working memory skills in developing the level of reading comprehension among students with reading problems," *Journal of Faculty of Education Zagazig*,,vol 71, pp. 191-256, 2011.
[8] Ibrahim Sleiman, *Learning disabilities psychology*, Alexandria. Dar Alwafaa Press, 2010.
[9] Gray. S., "Evaluation of A Working Memory Training Program in Adolescents with Severe Attention Deficit Hyperactivity Disorder and Learning Disabilities," Doctoral dissertation, University of Toronto. Canada, 2011.
[10] Swanson. H. L., "Reading Comprehension and Working Memory in Learning Disabilities Readers: Is the Phonological Loop More Important than the Executive System is?" Journal of Experimental Child Psychology, vol. 72, no. 1, pp. 1-31, 1999.
[11] Hind Alnabi., "Effectiveness of a training program to develop working memory in improving the solving of mathematical problems among fourth grade students with learning disabilities in the schools of the first cycle of basic education," Unpublished master thesis, Sultan Qaboos university. Sultanate of Oman, 2016.
[12] Gutierrez – Clellen, V.F., Calderon, J.and Ellis Weimar, S., "Verbal Working Memory in Bilingual Children," *Journal of Speech-Language –Hearing Research*, 47. 863-876, 2004.
[13] Henry. L. A., "The Episodic Buffer in Children with Intellectual Disabilities: An Exploratory Study," *Research in Developmental Disabilities*, vol. 31, pp. 1609-1614, 2010.
[14] Siegel and Rayan, "The development of working memory in normally achieving & subtypes of learning disabled children," *Child Development*, vol. 60, pp. 973-980, 1999.
[15] Conway. A. R. A., Kane, M.J. and Engle. R.W., "Working Memory Capacity & its Relation to General Intelligence," *Trends in cognitive sciences*, vol. 7, pp. 547-552, 2003.
[16] Alloway, J. M and R., *Understanding working memory*, 2nd Ed., Los Angeles, 2015.
[17] Fatimah Alfori, "Effectiveness of a training program using memory strategies to improve the working memory of a sample of students of the first cycle of basic education in the fourth grade in Muscat Governorate," Unpublished master thesis, Sultan Qaboos University, Sultanate of Oman, 2015.
[18] Abed rabu Suleiman, "The role of working verbal and visual memory in the achievement of students in basic education," *Journal of Social Sciences* – Kuwait, vol. 38, no. 4, pp. 43-71, 2010.
[19] Badr AL Ansar, "Structural modeling of memory components of Kuwaiti children aged 4-12 years," *Journal of Educational and Psychological Science*s. Bahrain, vol. 14, no. 4, pp.103-138, 2013.
[20] Kazem Ali, Adapt the Raven test for consecutive color matrices for Omani children, 2008.
[21] Conlin, J.A., Gathercole, S.E., Lexicality and Interference in Working Memory in Children and in Adults. Journal of Memory and Language, vol. 55, no. 3, pp. 363-380, 2006.
[22] Dahlin, k., "Effects of working memory training on reading in children with special needs," *Read Write*, vol. 24, pp, 479-491, 2011.
[23] Jerman, O., Reynolds, C., and Swanson, H., "Does Growth in Working Memory Span or Executive Processes Predict Growth in Reading and Math in children with Reading Disabilities?" *Learning Disabilities Quarterly*, vol. 53, no., pp.144- 157, 2012.
[24] Nevo, E. and Breznitz, Z., "The development of working memory from kindergarten to first grade in children with different decoding skills," *Journal Experimental Child psychology*, vol.114, pp.217-228, 2013.
[25] Swanson, H., Zheng, X., and Jerman, O., "Working Memory, Short-Term Memory and Reading Disabilities," Journal of Learning Disabilities, vol. 42, no. 3 pp.260-287, 2009.