

The Effectiveness of Phonological Awareness Training in Treating Deficiencies in Auditory Processing Among Children with Learning Disabilities

This study aimed at identifying the effectiveness of using a phonological awareness-based instructional program in developing the phonetic sequential-memorization skill among students with learning disabilities in the Aseer region. The study sample consisted of forty students from the third, fourth, fifth, sixth, and seventh grades, selected from schools in the Directorate of Education in the Aseer region. The sample was diagnosed by the special education teacher as having learning disabilities. The study used the quasi-experimental methodology and divided the sample into an experimental group and a control group. After applying the instructional program, the results showed that the experimental group outperformed the control group in acquiring the phonetic sequential-memorization skill. The results showed no statistically significant differences in the phonetic sequential-memorization skill due to the difference of grade. It is concluded that the instructional program has a continuing effect in developing the phonetic sequential-memorization skill among students with learning disabilities in the Aseer region.

Keywords: *phonological awareness, phonetic memorization, sequential memorization, students with LD.*

Introduction

The sequential phonetic memory is closely related to the success of the reading process because the ability to analyze, sequence, and remember auditory stimuli is essential for the reading skill. Students with reading disabilities fail to distinguish the phonemic structure of spoken language (Al-Khasawneh, 2016), whether at the word level or the sentence level. To address these difficulties, special phonological training programs should be developed because such category perceive things differently. Therefore, the existence of programs to develop the phonetic sequential-memory for students with learning disabilities has become an important element for the development of their learning process. These programs call for the use of methods appropriate with the abilities of students with LDs. Developing these capabilities may positively affect the development of aspects of personality, whether psychological or social, and it is expected to raise their ability in academic achievement due to its importance from various aspects, whether personal or academic.

Therefore, this study was designed to investigate the effectiveness of a training program based on phonological awareness skills in developing the skill of phonetic sequential-memory skills among students with LDs in the Aseer region. Students who suffer from deficiencies in decoding the written letter are making a lot of their mental effort in order to decode the letter. This leads to

1 the loss of the element of comprehension and thus the absence of
2 understanding and building the rest of the other higher capacities of analysis,
3 conclusion, criticism, and other higher mental skills.

4 5 **Problem Statement**

6
7 Reading is one of the most important language skills for people with
8 learning disabilities, as it is the basis for developing other language skills and
9 expanding knowledge. The ability to auditory recall is the most important
10 component of language knowledge. Students with learning disabilities face
11 major problems with auditory recollection. This study is significant
12 theoretically in opening the way for researchers to pay attention to
13 phonological processes for people with learning disabilities because the skill of
14 phonological awareness is one of the basics on which the skill of reading is
15 built. This skill contributes to creating awareness about the sounds, syllables,
16 and words of the language, which is reflected positively on the speed of
17 reading and then comprehension.

18 19 **Research Objectives**

- 20
21 - Identifying the level of phonological awareness of students with
22 learning disabilities in the Aseer region.
23 - Identifying the level of auditory recollection of students with learning
24 disabilities in the Aseer region.
25 - Developing a training program based on the theory of phonological
26 awareness in order to develop the skill of phonetic sequential-memory
27 among students with learning disabilities in the Aseer region.

28 29 **Research Questions**

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31 The present study seeks to give answers to the following research
32 questions

- 33
34 1. Are there any statistically significant differences between the mean
35 scores of the experimental group and the control group in the level of
36 phonetic sequential memory due to the instructional program?
37 2. Are there any statistically significant differences between the mean
38 scores of the experimental group and the control group in the level of
39 phonetic sequential memory due to the school grade?
40 3. Are there any statistically significant differences between the mean
41 scores of the experimental group and the control group in the level of
42 phonetic sequential memory due to the follow-up test?

43
44 In order to answer these questions, the following hypotheses were developed:
45

- 1 1. There are no statistically significant differences at the level of ($\alpha \leq$
2 0.05) between the mean scores of the experimental and control group in
3 the level of phonetic sequential memory in the post-test due to the
4 instructional program.
- 5 2. There are no statistically significant differences at the level of ($\alpha \leq$
6 0.05) between the mean scores of the experimental and control group in
7 the level of phonetic sequential memory in the post-test due to the grade
8 variable.
- 9 3. There are no statistically significant differences at the level of ($\alpha \leq$
10 0.05) between the mean scores of the experimental and control group in
11 the level of phonetic sequential memory in the post-test due to follow
12 up test.

14 **Significance of the study**

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16 The theoretical significance of the study lies in revealing the importance of
17 the skill of phonetic sequential memory in diagnosing and detecting those with
18 learning disabilities. As for the practical importance of the study, it is
19 highlighted through its ability to come up with an instrument to measure the
20 phonetic sequential memory. The instrument has acceptable validity and
21 reliability indications that educational institutions, special education centers,
22 teachers, and educational counselors can benefit from in diagnosing learning
23 disabilities. The significance of this study is also in providing teachers of
24 learning disabilities with a practical training program that helps them in
25 training people with learning disabilities on phonological awareness skills
26 because learning difficulties rooms lack such training programs.

28 **Delimitations of the Study**

- 30 - Psychometric properties of the tools used in diagnosing those with
31 learning disabilities from the study sample.
- 32 - The study sample was limited to students with LDs who are aged (8-12)
33 years, and those enrolled in the learning difficulties rooms in schools in
34 the Directorate of Education in Aseer region for the academic year
35 2017/2018.
- 36 - The results of this study are determined by the ability of teachers of
37 learning difficulties rooms to implement the instructional program, and
38 the ability to measure their response on the instrument that has been
39 prepared for this purpose.

41 **Definition of Operational Terms**

42
43 **Phonological awareness:** Stanovich (1982) is considered the first to
44 define the phonological awareness skill. He argued that it is the conscious
45 interaction with the phonemic level in speech, or it is the mental ability to
46 change (manipulate) in the phonemic level of words. In other words,

1 phonological awareness means having the ability to know the places of
2 articulation of linguistic sounds, how to produce these sounds, and how these
3 sounds are formed together to form words, sentences, and expressions. It also
4 the ability to perceive the similarity and difference between these sounds,
5 whether these sounds come in singular or in different linguistic words and
6 expressions. As for the current study, it defines phonological awareness as the
7 set of practical activities that the instructional program contains.

8 **Phonetic sequential memorization:** It means the ability of the individual
9 to organize his learned experiences, store them and then retrieve them, and
10 identify them in order to benefit from these experiences in his different life
11 situations (Lerner, Beverly, 2013). In this study, it is defined as the score that
12 students with learning disabilities obtain on the test prepared by researchers.

13 **Students with LDs:** This category of students are defined as those who
14 have disturbances in one or more of the basic psychological processes that
15 include the understanding and use of written or spoken language, which appear
16 in disorders of hearing, thinking, speech, reading, spelling, and math, and are
17 due to a functional injury in the brain, and have no relation to any disability,
18 whether it is mental, auditory, visual, or other (Al-Rousan, Al-Khatib, and Al-
19 Natour, 2004). In this study, students with LDs are defined as the students who
20 were detected using the tests approved by the Directorate of Education in the
21 Aseer region and who are enrolled in its schools.

22 23 24 **Literature Review**

25
26 The category of students with learning disabilities attracts researchers to
27 investigate and study, and perhaps the reason for this is the large number of
28 students who suffer from different disabilities. Lerner (2012) points out that
29 this category is one of the most common categories of special education. It
30 constitutes (52%) of the community of people with special needs, and at the
31 same time, its prevalence among school students ranges from 1% - 8% (Al-
32 Waqfi, 2012).

33 Students with LDs are a heterogeneous category, which requires finding
34 appropriate strategies and methods for the difficulties they face and in
35 accordance with the theoretical background of each disability. Therefore,
36 different points of view emerged in defining the concept of learning
37 disabilities, such as the medical theory that considers learning disabilities to
38 have a neurological basis, or the educational theory that believes in modifying
39 behavior, and the linguistic theory that defines it as based on a defect in the
40 basic linguistic processes in acquiring the reading system (Smith, 2012). The
41 phonological awareness skill is defined as the child's ability to identify,
42 distinguish, and change the sounds in her mother tongue, regardless of the size
43 and meaning of the word. Stanovich (1982) defined this skill first as the
44 conscious interaction with the phonemic level in speech, or the mental ability
45 to change (or manipulate) in the phonemic level of words.

1 One of the most common causes of reading difficulties is the difficulty in
2 processing the linguistic sounds in a language, or what is known as impaired
3 phonological awareness (Lerner, 2012). Phonological awareness is the ability
4 to process phonemes, and it has a strong relationship with reading ability. It
5 means the ability to manipulate individual sounds in words, and it consists of
6 basic vocal skills, such as the ability to judge whether two words have the same
7 weight or not (Smith, 2012). Growth in mental abilities enables students with
8 LDs to link between sound and meaning. This symbolic function of language
9 builds for the student the basis for recognizing the phonological awareness of
10 the language and facilitates knowledge of words. This in turn enables the
11 student to divert his/her attention from the meaning of spoken speech to
12 thinking and speaking about the language in use.

13 Different studies attempted to investigate and explore the impact of
14 increasing the phonological awareness in improving different learning
15 disabilities. Salem (2020) investigated the impact of developing phonological
16 awareness on the improvement of different learning disabilities. The study was
17 applied on a sample of 36 third grade students with reading difficulties and was
18 chosen using a Phonological Disturbance note. The Descriptive method and
19 Experimental method were used in this study. The results showed that the
20 training module was effective in developing the loud reading skills (treatment
21 of Phonological disorders) in primary school students with reading disabilities
22 (overall). The program was effective in developing the loud reading skills
23 (treatment of Phonological disorders) in primary school students with reading
24 disabilities.

25 26 **Previous Studies**

27
28 A number of studies have been conducted to investigate the investigated
29 the effectiveness of a proposed program based on phonology awareness in the
30 development of some verbal reading skills among students, and these studies
31 have come up with different results. Salem (2020) explored the effectiveness of
32 Training on Phonological awareness skills in the treatment of loud reading
33 disabilities (Phonological Disorders) of primary school students with learning
34 disabilities. The study was applied to a sample consisted of (36) students with
35 learning disabilities in the third grade of the primary, who were selected by the
36 Phonological Disturbance note card. The results revealed that the training
37 module, which was developed by the researcher, was effective in developing
38 the loud reading skills

39 Qasim, E. Q.Hana, A. D., and Hassan, I. H. (2019) investigated the
40 effectiveness of a proposed program based on phonology awareness in the
41 development of some verbal reading skills among students in the preparatory
42 stage. The experimental method was followed using the pre and post
43 measurement of the one group design .This study concluded that the
44 effectiveness of the Suggested program based on phonology awareness in the
45 development of some of the reading skills of the study (identification -
46 pronunciation - comprehension) in the students of the preparatory stage.

1 Al-Brairi (2019) explored the development of some listening skills,
2 phonics awareness for non-Arabic speaking students. The study aimed at
3 determining the extent of effectiveness of the suggested program to the
4 development of some listening skills, phonics awareness for non-Arabic
5 speaking. The participants were foreigners at Al-Azhar University who were
6 randomly selected. The study followed the experimental method. The results
7 revealed positive results after applying the instructional program in developing
8 phonological awareness of non-Arabic speaking students.

9 Rababah (2017) investigated the effect of using written expression
10 activities and reading stories on developing phonological awareness and
11 awareness of printed material among kindergarten children in Jordan. The
12 study included (50) students from one of the governmental kindergartens in the
13 city of Irbid, who were divided into two groups: control and experimental.
14 Students received 24 classes, in which the stories were read in groups with a
15 focus on the rules of printed materials, and they were involved in written
16 expression activities once every weekend for 14 weeks. The results of the study
17 indicated that the experimental group outperformed the control group in the
18 level of phonological awareness.

19 Al-Shorbaji et al (2017) conducted a study aimed at identifying the impact
20 of a program based on phonemic and artistic awareness of the reading
21 performance of the Arabic language for first-grade primary students. The
22 researchers designed a reading test on phonemic and phonological awareness in
23 the Arabic language, in addition to a training program on phonemic and
24 phonological awareness for Arabic language teachers. The study sample
25 included (205) male and female students from four schools, divided into two
26 groups: experimental and control. The results showed that there were
27 statistically significant differences in the average results of the tests between
28 the experimental and control groups in favor of the experimental group. The
29 results also showed the presence of statistically significant differences in the
30 average results of the experimental group in the third test that seeks to
31 investigate the effect of the experiment on students. On the other hand, the
32 results showed no statistically significant differences in the mean scores
33 between males and females.

34 Al-Farsi and Imam (2017) also conducted a study aimed at identifying the
35 effectiveness of a training program based on the introduction of phonological
36 awareness in improving the decoding skill of third-grade basic students with
37 reading disabilities. The sample included (40) students enrolled in the third-
38 grade in the Sultanate of Oman. The study tools included the phonemic
39 awareness test, the decoding skill test, in addition to a training program based
40 on the introduction to phonological awareness. The results of the study
41 indicated that there were statistically significant differences between the
42 experimental group and the control group in all dimensions of the phonological
43 awareness test and the decoding skill test, except after reading the words of the
44 text, and in favor of the experimental group.

45 Most of these studies emphasized the importance of developing auditory
46 memory skills due to their close association with the ability to learn academic

1 skills. Most studies have confirmed the deficiency in the skill of phonological
2 awareness among students with learning disabilities (Rababah, 2017; Al-
3 Shorbaji et al, 2017; Al-Farsi, 2017). The current study differs from previous
4 studies in the nature of the instructional program that was prepared based on
5 the cognitive theory to develop phonological awareness skills among students
6 with LDs. This study also focuses on exploring the effectiveness of the
7 program on developing the phonetic sequential-memorization.

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10 **Methodology**

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12 This study followed the semi-experimental approach to determine the
13 effect of the instructional program based on phonological awareness skills in
14 developing the phonetic sequential memory skill among students with LDs.
15 The study divided the sample into two groups, an experimental and a control
16 group, and applied a pre-test and post-test to measure the level of phonological
17 awareness and then applied a follow-up test.

18

19 **Population and Sample**

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21 The study population consisted of all 326 students with learning
22 disabilities studying in schools of the Directorate of Education in the Aseer
23 region, whose age is from (8-12) years, and in the third, fourth, fifth, and sixth
24 elementary grades. These students are divided into thirty-three rooms from the
25 learning difficulties classrooms in Aseer region schools. A sample of 40
26 students was selected randomly from four schools out of thirty-three schools.
27 The sample was divided into two groups, an experimental and control group.

28

29 **Research Instrument**

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31 The phonetic sequential-memory test

32 This test consists of a series of numbers ordered by length, beginning with
33 two numbers and ending with eight numbers, distributed on seven levels. The
34 examiner reads the numerical series to the student orally at the rate of one
35 second for each number, and the student is asked to repeat the series numbers
36 immediately after hearing them. The purpose of the test was to measure the
37 student's ability to remember a series of numbers of different lengths in the
38 same order.

39

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41 **Validity and Reliability of the Instrument**

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43 The content validity was achieved by presenting the test to (15) specialized
44 judges. The researchers relied on the consensus of 80% of the judges as a
45 criterion for accepting the paragraph; the observations of more than 20% were

1 a sufficient criterion for amending, deleting, or adding some paragraphs.
 2 Accordingly, the comments of all expert judges were collected, as no
 3 paragraph was deleted, and their observations were limited to modify the
 4 drafting of the application instructions.

5 The discrimination validity of the test was extracted by applying the test an
 6 exploratory group of (30) male and female students (15 students with LDs and
 7 15 regular students). They were randomly selected from outside the study
 8 sample from students of the Aseer Region Education Directorate. To verify the
 9 validity, the mean scores and standard deviation of each group were calculated
 10 on the total scores of the test, and the (t) test was used to find out the
 11 significance of the differences. Table 1 presents the results.

12
 13 *Table 1.* The mean means and standard deviations of the exploratory sample to
 14 verify the discriminatory validity of the phonetic sequential memory test

Test	Student category		Mean score	Standard deviation	T value	Sig.
	Students with LDs	Regular students				
phonetic sequential memory	22.70	3.813	32.52	2.923	10.323	0.000

15
 16 The researchers used the test-retest method in extracting the reliability by
 17 applying the test to a pilot sample of forty students, who were selected from
 18 two schools from the Directorate of Education in Aseer region, who were
 19 chosen in a simple random way from outside the study sample, but from the
 20 same age group. The test was applied again after fifteen days. The Pearson
 21 correlation coefficient was extracted between the first and the second tests, and
 22 the value of the correlation coefficient was (0.84), which is a good indicator of
 23 stability. Isawi (1985) argued that if the correlation coefficient between the first
 24 and second applications is 0.7 or more, it is a good indicator of the stability of
 25 the scale. This means that the current scale has a high degree of stability over
 26 time, and that this value is statistically significant at the level of significance
 27 ($\alpha \leq 0.05$).

28 29 **The Instructional Program**

30
 31 This program aims to develop the skill of phonetic sequential-memory
 32 among students with learning disabilities who are enrolled in the learning
 33 difficulties classrooms in the Aseer region. The program consists of a set of
 34 exercises and activities that the researchers have developed to allow students to
 35 acquire skills that fall within the dimensions of the Phonological awareness.

36 The need to design this instructional program was to develop the skill of
 37 phonetic sequential memory among students with LDs at the basic stage. This
 38 problem was confirmed by previous studies in the field of reading that

1 phonological awareness helps in preventing reading difficulties. This program
2 came to meet the students' needs by training them in some methods that
3 develop their sequential memory by providing audio content appropriate for the
4 target age group. the program will help students to effectively receive the
5 communication material and recall it, especially in the communication
6 processes that take place during classroom education.

7 8 Designing the instructional program

9 The instructional program was designed according to the following
10 principles:

- 11
12 1. Identifying the theoretical foundations that dealt with the importance of
13 developing phonological awareness skills for students with learning
14 disabilities, and the effect of applying the phonological awareness
15 program on developing the skill of phonetic sequential-memory.
- 16 2. Taking into account the nature of the age stage for primary school
17 children, as this stage is essential in their lives and is one of the main
18 pillars in building their future personality.
- 19 3. Taking into account that all members of the sample have learning
20 difficulties in reading.

21 22 Content of the instructional program

23 The current program is concerned with treating deficiencies in the skill of
24 phonetic sequential-memory. Therefore, this program is not based on pre-
25 defined academic content. The training materials are based on the skills of
26 phonological awareness, noting that the program included sixteen training
27 sessions, which were given collectively to the children of the experimental
28 group in four sessions per week, and the duration of the session was one class.
29 The assessment was conducted individually by using the phonetic sequential-
30 memory test.

31 32 Content validity of the program

33 The program was presented to a group of judges, with the aim of
34 identifying the relevance of the objectives, the relevance of the content of the
35 program, the appropriateness of educational methods, and the appropriateness
36 of the language formulation for the target age group of students with LDs. The
37 linguistic wording of some paragraphs has been slightly modified in light of the
38 judges' remarks. The percentage of agreement between the judges reached
39 96%, and this is considered acceptable for the purposes of this study.

40 41 **Data Analysis**

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43 The returned test was recorded and tabulated with the assistance of
44 Statistical Package for Social Sciences (SPSS) for windows 17.0 to identify the
45 correlated relationships of variables concerning phonological awareness skills
46 in developing the phonetic sequential memory skill among students with

1 learning disabilities. Different statistical methods were used to achieve the
 2 main objectives of the present investigation. These methods include descriptive
 3 statistics, independent sample T-Test, and analysis of variance (ANOVA).
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6 Findings and Discussion

8 First: the results of the first question, “Are there any statistically
 9 significant differences between the mean scores of the experimental group and
 10 the control group in the level of phonetic sequential memory due to the
 11 instructional program?”

12 To answer this question, the mean scores and standard deviations were
 13 calculated for each of the experimental and control groups for students with
 14 learning disabilities on the pre and post-tests as shown in Table (2).
 15

16 *Table 2.* The mean scores and standard deviations of the students' grades on pre
 17 and post sequential memory test according to the group variable

Group	No.	Pre-test		Post-test	
		Mean score	St. dev	Mean score	St. dev
Experimental	20	22.70	3.813	57.20	5.238
Control	20	23.90	4.038	41.65	5.480

18
 19 It is noted from Table 2 that the mean scores of the experimental group on
 20 the pretest was (22.70), while it was (57.20) in the post-test. The mean scores
 21 of the control group on the pretest was (23.90), while it was (41.65) in the post-
 22 test. To find out the significance of these differences between the mean scores
 23 and determine their direction, ANCOVA analysis was used, and Table (3)
 24 presents the results.
 25

26 *Table 3.* ANCOVA results for group effect on students with learning
 27 disabilities in the phonetic sequential-memory test

Source of variance	Sum of squares	Freedom value	Squares average	F-value	Sig.
Pre-test	19.355	1	19.355	0.668	0.419
Group	2294.296	1	2294.296	79.158	0.000
Error	1072.395	37	28.984		
Total	101223.000	40			

28
 29 Table (3) indicates that the differences between the mean scores of the
 30 experimental and control groups are statistically significant, as the F value was
 31 (79.158), which is statistically significant at the level of (0.000). Therefore, the
 32 first null hypothesis is rejected, and the alternative hypothesis is accepted.
 33 There are statistically significant differences at the level of ($\alpha \leq 0.05$) between
 34 the mean scores achieved on the phonetic sequential memory post-test among

1 the members of the experimental group (who were subjected to training in the
 2 phonological awareness development program) and the mean scores of the
 3 control group (who were not subjected to training program). This result agrees
 4 with previous studies (Rababah, 2017; Al-Farsi, 2017). These results are also
 5 attributed to the many advantages that the program has. The program included
 6 a variety of training activities, such as those that focus on auditory recollection
 7 skills. This was done using various teaching methods. The phonological
 8 awareness program was incorporated so that it begins with ease and then
 9 moves gradually to challenging the capabilities of students with LDs. This
 10 enabled students to go through successful experiences in the learning
 11 difficulties classroom. It enhanced his self-confidence, which was missing in
 12 the classroom. The appropriate reinforcement techniques contributed to the
 13 effectiveness of the program. Students with LDs would receive a piece of
 14 candy if they could participate and perform their work without errors, then the
 15 best child in the group would get a poster that would be attached to his dress
 16 and seen by his classmates and his teacher, then he showed it to his parents at
 17 home. Moreover, the educational environment provided by the researchers
 18 during the training sessions, which focused on reinforcement and led to
 19 increasing students' interest in the program and their effective participation in
 20 it.

21 **Second:** results related to the second question, “Are there any statistically
 22 significant differences between the mean scores of the experimental group and
 23 the control group in the level of phonetic sequential memory due to the school
 24 grade?”

25 To answer this question, means and standard deviations were calculated
 26 for each of the two groups on the pre and post-tests. Table 4 presents the
 27 results.

28

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Table 4. The mean scores and standard deviations for the pre and post-tests

Group	Test		Grade				
			Third	Fourth	Fifth	Sixth	Seventh
Experimental	Pre-test	Mean score	21.25	24.00	25.50	19.75	23.00
		Standard deviation	3.304	4.397	2.380	4.349	3.162
	Post-test	Mean score	60.00	56.25	61.25	54.25	54.25
		Standard deviation	2.160	8.016	4.646	3.403	3.862
Control	Pre-test	Mean score	26.75	20.00	22.50	25.75	24.50
		Standard deviation	4.031	2.944	4.435	3.775	2.380
	Post-test	Mean score	40.25	45.00	42.75	39.75	40.50
		Standard deviation	4.992	6.377	8.098	5.500	1.732

30

Table 4 shows the mean scores and deviations of the pre and post-test scores for the two experimental and control groups according to the academic grade. To identify the existence of any statistical differences, ANCOVA analysis was conducted to reveal the effect of the grade of the student. Table 5 shows the results.

Table 5. ANCOVA analysis of the effect of the grade on the students with LDs in the phonetic sequential-memory test

Source of variance	Sum of squares	Freedom value	Squares average	F-value	Sig.
Pre-test	12.901	1	12.901	0.450	0.508
Grade	152.872	4	38.218	1.333	0.281
Group	2266.341	1	2266.341	79.057	0.000
group× grade	87.393	4	21.848	0.762	0.558
Error	831.349	29	28.667		
Total	101223.000	40			

Table 5 shows that the value of the significance level of the grade variable was (0.281), and the value of the significance level of the grades' interaction with the group variable was (0.558), both of which are greater than (0.05). This means that there are no significant differences in the skill of phonetic sequential-memory among students with LDs in the experimental and control groups due to the grade variable. This study did not agree or disagree with previous studies because previous studies did not take this variable into their study, and this is what distinguished this study from previous studies.

Third: results related to the third question, “Are there any statistically significant differences between the mean scores of the experimental group and the control group in the level of phonetic sequential memory due to the follow-up test?”

To answer this question, the mean scores and standard deviations were calculated for each of the experimental and control groups of students with LDs for the pre-tests and follow-up tests as shown in Table 6.

Table 6. The mean scores and standard deviations of students with LDs on the phonetic sequential-memory pre and post-tests according to the group variable

Group	No.	Pre-test		Post-test	
		Mean score	St. dev	Mean score	St. dev
Experimental	20	22.70	3.813	56.55	5.176
Control	20	23.90	4.038	42.15	4.545

It is noted from Table 6 that the mean scores of the experimental group on the pretest was (22.70) while on the follow-up test was (56.55). The mean scores of the control group on the pretest was (23.90) while on the follow-up

1 test was (42.15). To find out the significance of these differences between the
 2 mean scores and determine their direction, the ANCOVA analysis was used,
 3 and Table 7 illustrates the results.

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5 *Table 7.* ANCOVA analysis of group effect on students with LDs in the
 6 phonetic sequential-memory test

Source of variance	Sum of squares	Freedom value	Squares average	F-value	Sig.
Pre-test	15.596	1	15.596	0.651	0.425
Group	2079.270	1	2079.270	86.841	0.000
Error	885.904	37	23.943		
Total	100392.000	40			

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8 Table 7 shows that the differences between the mean scores of the
 9 experimental and control groups are statistically significant, as the value of F
 10 was (86.841), which is statistically significant at the level of significance
 11 (0.000). Therefore, the first null hypothesis is rejected, and the alternative
 12 hypothesis is accepted; there are statistically significant differences at the level
 13 of significance (α 0.05 متوسط) between the mean scores of the experimental
 14 group (who were subjected to training on the phonological awareness program)
 15 and the mean scores of the control group (who were not subjected to training
 16 program). This result can be explained by the strength of the training program,
 17 which left a clear impact on students with LDs. This indicates the continuing
 18 impact of the phonological awareness development program on developing the
 19 skill of sequential memory.

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23 **Conclusion and Recommendations**

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Based on these results, the study recommends the following:

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1. Developing more instructional programs to develop the developmental skills of students with learning disabilities, with a focus on the academic difficulties of the same group.
2. Conducting research studies that investigate the relationship between phonetic sequential memory skills and academic achievement, and the

- 1 effect of improvement in this skill in reading, writing, and spelling
 2 among students with learning disabilities.
 3 3. Conducting studies examining the relationship between deficiencies in
 4 auditory follow-up skills, social isolation, and lack of self-esteem
 5 among students with learning disabilities.
 6
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