Online-Journals.org

iJIM International Journal of Interactive Mobile Technologies

iJIM | eISSN: 1865-7923 | Vol. 17 No. 22 (2023) | OPEN ACCESS

https://doi.org/10.3991/ijim.v17i22.43659

PAPER

The Effect of Using Mobile Applications in Treating Learning Difficulties Among Students in Jordan

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ABSTRACT

Dyscalculia and dyslexia are the most common learning difficulties in mathematics, and this constitutes a major educational challenge that must be addressed. This study aimed to explore the effectiveness of mobile applications (IPAD, Phonics Genius app, App Ginger Grammar Checker While Learning Ally Teen & Adult Phonics Library) in solving the problem of students suffering from dyscalculia and dyslexia in schools in Jordan. The study sample consisted of students from five schools during the academic year 2022/2023. The treatment group consists of 50 students. The control group consisted of 48 students. Based on the statistical analysis of data collected from the teacher's observation record, personal interviews of teachers, and tests conducted for students, we concluded that mobile applications contribute to solving the problem of students with dyscalculia and dyslexia.

KEYWORDS

learning difficulties, dyscalculia, dyslexic, mobile application

1 INTRODUCTION

[6] Many children suffer from difficulties in writing, which is one of the types of learning difficulties as well as from neurological problems. [9] Writing difficulty in children is a neurological problem characterized by the emergence of problems and difficulties in writing compared to the age group to which the person belongs, and difficulties in holding the pen in general. It is possible that this problem also exists in children and adults alike, and it appears in children when learning to write, and it can also appear in adults after suffering a head trauma. [7] Symptoms of writing difficulty in children vary greatly, but children who have difficulty writing or dysgraphia do not have difficulty in speaking. [4] Indeed, speaking is often easier than writing, and the symptoms of writing difficulty are as follows: the inability to write letters well, and the presence of errors in the formation and construction of sentences, or in grammatical rules. [4] Inability to adhere to writing in the same line, there are errors in the size of letters or the spaces remaining between letters,

Aqeel Alzoubi, K.A. (2023). The Effect of Using Mobile Applications in Treating Learning Difficulties Among Students in Jordan. *International Journal of Interactive Mobile Technologies (iJIM)*, 17(22), pp. 52–66. https://doi.org/10.3991/ijim.v17i22.43659

Article submitted 2023-08-02. Revision uploaded 2023-10-07. Final acceptance 2023-10-07.

writing speed is less than normal, words and letters are written upside down, inability to spell sentences correctly, inability to organize words to form sentences, – difficulty in transferring words and letters within the classroom. [21] Writing difficulties are diagnosed by psychologists and psychiatrists. We are looking for educational experts, special education experts, and communications experts. Correct diagnosis is a prerequisite for accessing treatment for writing difficulties in children (or treatment for dysgraphia). [3] Dysgraphia is diagnosed as follows: Take a medical history of this problem and ask if this problem exists in the family. Asking about the child's academic level and the extent of his progress in his studies. [7] Perform some tests to check for the presence of this problem, and to measure the extent of the condition. [6] Ensure that there are no other learning difficulties such as hyperactivity, attention deficiency, dyslexia, autism, and others, as their incidence increases in cases of ADHD and autism. [4] Strategies for treating children's writing difficulties include involving the family and schoolteachers in the child's treatment plan. It also involves using many skills to help the child deal with that problem. [19] Early diagnosis of the problem, to determine its progress and identify strengths and weaknesses in the case. Giving extra time to the child with this problem to write homework and assignments, or to solve tests. [21] Using all the child's senses in learning and helping to overcome the problem, using many activities that ensure the use of all senses in the treatment plan. [4] Continuous writing training. Reducing the written duties given to the child. This includes replacing written assignments with printed assignments, and reducing the written assignments provided to the child to help him gain self-confidence and overcome his fear of writing.

[14] Dysgraphia Dyslexia, in this type of problem is only in writing words automatically or spelling words without help, but the child can write normally if the texts are transferred from another place, and in this case, dysgraphia is accompanied by dyslexia. [17] The most important treatment strategy in this case is good intensive reading and writing training, training in the pronunciation of written words, as well as the use of educational games and applications that address dysgraphia and dyslexia. Dyscalculia is a developmental biological disorder that affects learning, mathematical and computational abilities in a profound way. [5] This disease is independent of the level of intelligence of the child and the educational curricula used. The difficulty centers on the ability to explain numerical symbols and arithmetic knowledge, such as addition, subtraction, multiplication, and division. A child who suffers from dyscalculia is one who confuses numbers and symbols and is unable to perform mental calculations and work with abstract concepts. These children have difficulty completing academic exercises or practical tasks, such as math problems or calculations. [2] The most effective treatment for dyscalculia, as it is for dyslexia, is early diagnosis. The sooner we spot the problem and provide children with tools to help them adapt to the learning process, the more likely they are to avoid learning delays, self-esteem problems or more serious disorders. There is a lot of research that has been done.

[2] This disease includes five types of dyscalculia. Children can write or read numbers, but they don't recognize them when others say them [14]. Cognitive practical dyscalculia: It relates to the difficulty of translating his knowledge of abstract mathematical meanings into real meanings. These people can understand mathematical meanings but have difficulties with numbers and measurements and using mathematical operations in practice. Lexical dyscalculia: is the difficulty in reading symbols, numbers, mathematical expressions, and equations [4–7]. A child with this type of dyscalculia can understand the meanings of mathematics when we talk about it but has difficulties reading and understanding it. Linear dyscalculia: Difficulty

reading mathematical symbols. Children with this type of dyscalculia can understand mathematical meanings, but they cannot read, write, or use mathematical symbols [2]. Cognitive intellectual dyscalculia: Difficulty performing mental operations without using numbers to obtain results and to understand meanings or ideas related to mathematics or arithmetic. A child with cognitive intellectual dyscalculia has difficulties remembering mathematical meanings after learning them [6–8]. Operational dyscalculia: It is related to the difficulty in performing arithmetic operations, whether verbal or written. A person with operational dyscalculia can understand numbers and the relationships between them but has difficulty using numbers and mathematical symbols in calculations. Dyscalculia is not easy to diagnose, most schools do not use any early detection device that allows for detecting disorder in the classroom and helping children with the necessary tools. Therefore, the burden often falls on the families themselves, who must be on the alert, detect the first symptoms of the disease, and turn to a specialist for diagnosis [2–3].

When the diagnosis is made, it is important to motivate children and show that they are capable of other things and that practice will lead them to success [11–16].

The importance of the study lies in providing learning opportunities for students with learning difficulties, which is guaranteed by justice in education and the rights of the child to education [11–17]. The marginalization and exclusion of children harms the effectiveness of the teaching and learning process, and the efforts of educational institutions in applying teaching methods and innovating means and applications are among the most important things that contribute directly to students' achievement and the development of their skills. Therefore, the importance of this study is summarized as follows: First, the theoretical importance: This study will provide a theoretical framework for mathematical concepts, and an attempt to improve the level of achievement of students with learning difficulties in mathematics [11–20]. In addition, this study will seek to present previous studies that showed some successful experiences in developing the abilities of students with learning difficulties [6–7]. Second: Practical importance: This study will provide a test for mathematical concepts, and the validity and reliability of the study tools will be verified. The researcher can employ these tools in other studies to measure the level of mathematical concepts acquisition among students [7] with learning disabilities. Activities include smart mathematical applications in the school curricula. Third: Students and teachers can benefit from the smart application provided by the researcher, and teachers and students need such applications to help them deliver learning to all students outside the classroom. Study limits: The generalization of the results of this study is determined by some limits, including the following: Human limits: This study was applied to (50) male and female students with learning disabilities who were transferred to the resource room after their diagnosis with the diagnostic test in mathematics skills issued by the Ministry of Education.

2 RELATED WORK

2.1 Mobile applications for the treatment of dyslexia and dyscalculia

[11] Dyslexia apps are available for Android and iOS that will help students with this condition, enabling them to read and write better [21]. Results may vary, but it's a step in the right direction [8]. Best Apps for Dyslexia: The first app, [20] TAP, a library of phonics for teens and adults, is a popular app for children with dyslexia. The second app, ABC Reading Magic, contains a series of apps, geared towards

children with learning disabilities such as ADHD. Attention and Dyslexia is a nifty little app that uses text-to-speech to read text out loud. As for the third application, Claro Speak, the student can import documents from several sources such as cloud storage and even messages. You can also copy and paste any text from other applications to listen to it [1]. Many students also use this app for dictation and spell check before writing [17]. As for the fourth app, Learning Ally, this app is a great source for audiobooks designed for children [6]. While most keyboard apps correct spelling and pre-predict the words you might type next, the fifth app, Ginger Grammar Checker, takes things one step further by correcting grammar rules. [10] The sixth application, Phonics Genius, groups users with similar words together in lists so that you can quickly refer to them in case of doubts or need to refresh their memory.

[16] There are quite a few apps on the market for children with dyslexia that target different areas such as teaching phonics, writing assistance, learning new words, their spelling and pronunciation, keyboard apps, and audiobooks [9]. In this study, smart mathematical applications were used: [18] they are composterized applications and programs provided by smart phones and (IPAD) devices that depend on facilitating the auditory and visual perception of the recipient by presenting the planned sports activities, and the student interacts with them in solving various mathematical problems at a specific time and provides the student with immediate feedback on his performance [11]. It was defined procedurally in this study by the mathematical application that the researcher used, which he called Easy math, to learn ascending and descending, number patterns, and some math problems on numbers, where students with difficulties in learning mathematics interact with games, sounds, pictures, puzzles, and math problems.

2.2 Previous studies

[14] aimed to find out the effect of using an educational program based on multiple intelligences in addressing the difficulties of learning mathematics among third-primary students. The study is a measure of multiple intelligences, and an educational program based on multiple intelligences and a post achievement test prepared by the study. [16] aimed at identifying the learning difficulties that students face when studying mathematics, identifying learning resources that can help a mathematics teacher overcome these difficulties, and designing a multimedia learning environment within learning resource centers to overcome learning difficulties in mathematics at the primary stage. The study found that there was a statistically significant difference at the level (0.05) between the mean scores of the control and experimental groups in the academic achievement related to the difficulties of mathematics due to the effectiveness of designing an educational environment (multimedia/traditional environment) for pupils with learning difficulties in mathematics in the primary stage in favor of the experimental group that used the multimedia learning environment. [8] aimed to identify the impact of a teaching program based on smart mathematical applications and its interaction with previous achievement in developing mathematical thinking among third-grade students in Jordan. The study followed the semi-experimental approach, and the study sample consisted of two groups: the experimental group, which was studied according to the teaching program based on smart mathematical applications, and the control group, which was studied according to the usual method. The sample of the study consisted of (60) male and female students distributed by (30) students for each group, and educational harvest schools were chosen in an intentional way. To achieve the objectives

of the study, a test in mathematical thinking was developed. The study reached several results, the most important of which is the presence of statistically significant differences between the average scores of the two groups in favor of the experimental group. The study [8] aimed to reveal the development of a mobile application design model for children with dyscalculia in Malaysia. The purpose of the study was to determine the appropriate components that should be available in the mobile application, and interviews were conducted with children's teachers, a doctor, and a specialist in educational psychology, and this led to the identification of seventeen components in mobile applications that fall under three factors: the educational factor, the personal factor, and the environmental factor. The results indicated that children with dyscalculia have problems in understanding numerical concepts, and therefore, they have a different style of learning, and it is important to determine the appropriate teaching strategies for children with dyscalculia. Teachers with arithmetic learning difficulties, the pediatrician, and the educational specialist agreed that the use of a multi-sensory approach (auditory, visual, tactile, and kinesthetic) is one of the important strategies in mobile applications. In a study [20] aimed at revealing the use of mobile phone technology to increase mathematics achievement and the involvement of students with special needs, the study compared the effectiveness of traditional teacher-led teaching and direct education with the learning provided via the mobile device. The 50-minute intervention was implemented over the course of two weeks to explore the intervention design, and to examine how students with disabilities use mobile technology in their learning. The sample consisted of 55 middle school students, and the students were registered in the resource room, and their ages ranged from 11 to 14 years, and they were randomly selected and divided into an experimental group and a control group. The construction of many scales assessed student learning, namely: a pre-test and a post-test to measure student performance on the targeted mathematical skills and concepts, independent practice activities to measure student learning at the end of the lesson, and a questionnaire of the teacher's perceptions about the mathematical knowledge that students possess. The results indicated that there were no significant differences between the results of the experimental group and the control group, and that the teacher did not notice an increase in students' achievement or their participation rates. Although the students were satisfied that they learned more and were more interactive than the students in the case of traditional education, and that the smart applications were attractive and easy to use. [17] A study aimed at revealing the impact of smart mathematical applications in improving the achievement of students with learning difficulties in mathematics, and (389) children in Britain were selected at the age (4–5) studying in kindergarten, and they were divided into an experimental group and a control group, and a study in the experimental group using smart mathematical applications for a period of (12) weeks, and children in the control group studied in the usual way. The results revealed the effect of using smart mathematical applications in improving the achievement of students with learning difficulties in mathematics, including mathematical generalizations, mathematical reasoning, and mathematical problem solving among children in the experimental group. The study [18] also aimed to know the effectiveness of an electronic application called (Calculi Kids) for students with dyscalculia, where a pre-test and a post-test were conducted to evaluate the effectiveness of the program, as the study sample consisted of 448 students with learning difficulties. In mathematics, the sample was distributed randomly, as the results revealed that the program was effective in supporting the learning of students with learning disabilities in mathematics and can be used in the classroom to improve the performance of students with dyscalculia in Malaysia. The study [14]

also aimed to reveal the effectiveness of a mobile application (Calcal) in learning mathematics for children between the ages of 7–12 years who suffer from dyscalculia. The application was built according to software engineering standards and allows the application to be used for a period of 60 minutes during four sessions. The sample consisted of eight individuals from the first to the sixth grade. The comparative statistical analysis between the pre and post test showed that the mobile application helped students with dyscalculia and improve the IQ. The study [16] aimed to investigate the impact of the educational application of smart devices in developing the academic achievement of students with dyscalculia, where the researchers used the semi-experimental approach, and the study sample consisted of 30 students with dyscalculia. The results showed that there were statistically significant differences between the mean scores of the achievement test consisting of twenty questions. The students were divided into two groups, the experimental group and the control group, and smart device applications were used in the experimental group and the traditional method was used in the control group. The results indicated that there was an improvement in the mathematical skills of the participants, and a significant increase in the speed of answering, and the reason for the improvement is due to the benefits of smart device applications used to enhance mathematical skills, and to practice exercises frequently, and thus smart applications helped students to realize their strengths and weaknesses.

3 METHODOLOGY

A semi-experimental approach was followed in this study, as five public schools affiliated to the Directorate of Education in Amman were selected, in which (50) male and female students with learning difficulties were taught. These schools were chosen intentionally due to the availability of students with learning difficulties, and the students in these schools were divided into an experimental group and a control group using a simple random method, and the willingness of the principals and teachers at these schools to cooperate with the researcher. The study standards were previously applied to the two groups of the study, and the teachers of the students in the experimental group were trained to use smart applications, then students with learning difficulties in the experimental group were taught using smart applications, while students with learning difficulties in the control group were taught according to regular education, which is usually based on explanation, discussion, and giving examples, and does not meet the needs, abilities, and capabilities of every student in the classroom.

3.1 The study sample

The sample of the study consisted of (100) male and female students with learning difficulties in (5) public schools from the basic girls' schools and mixed schools affiliated to the Amman Education Directorate. These schools are included in a previous experimental group consisting of (50) male and female students, including (20) male and (30) female students, and a control group consisting of (50) male and female students, including (20) male students and (30) female students. The students were distributed into the experimental group and the control group using the simple random method.

3.2 Description of the tests

These tests aim to measure the knowledge, skills, and mathematical concepts acquired by students with learning disabilities in mathematics. The mathematical concepts test consists of (13) questions. To build the mathematics test, the mathematical competency tests prepared by the Ministry of Education were referred to, and some of the studies that dealt with it were referred to, then the researcher did the following:

Firstly, analyzing the content of the mathematics book, the first unit for the fourth basic grade. Secondly, building a specification table that covers the weights of the study units mentioned in the mathematics book for the fourth basic grade.

Thirdly, setting questions about mathematical concepts, knowledge and skills contained in the mathematics books for the third grade, covering the relative weight of each unit and the level of knowledge in the table of specifications. The stability of the test using the test-retest method. Finally, the test application time is extracted. To verify the validity of the test for the fourth grade of basic mathematics, the test was presented in its initial form consisting of (13) questions to (10) arbitrators from faculty members with experience in the field of special education, measurement and evaluation at the University of Jordan, Al-Balqa Applied University, Amman Arab University and Princess College, Rahma University and educational experts at the Ministry of Education in Oman in the field of curricula and methods of teaching mathematics. They were asked to express their opinion on the test in terms of linguistic formulation, the validity of the test in measuring the achievement of fourth-grade students with learning difficulties, and the comprehensiveness of the test for mathematics skills contained in the two grade books. They were allowed the freedom to modify the wording of some questions or add questions or delete some questions. The stability of the achievement test for the fourth grade was verified by the test-retest method, as it was applied to an exploratory sample from outside the study sample consisting of (20) students from the fourth grade of students with learning difficulties who study in the learning resources at Hafsa School. The Pearson coefficient was calculated, and the correlation coefficient between the two applications was (0.93), which is a high correlation coefficient suitable for the purposes of this study. The difficulty coefficient for the test was extracted, and the difficulty coefficient for the test ranged between (0.36–76), and the discrimination coefficient was extracted for the test questions, and it ranged between (0.33–72). The time in which the first female student finished the test was measured (15 minutes). The time of the last student to complete the test was measured, and it reached (40 minutes), and thus the total time for the test was determined, which is (30 minutes).

3.3 Instrument and data collection

The researcher built this test in the form of a multiple choice, in which the theoretical literature and previous studies were reviewed, such as the study that was mentioned in previous studies that dealt with the definition of mathematical concepts, and then analyzed the first unit “Numbers” from the subject of mathematics for the fourth grade; to determine the mathematical concepts included in this unit, a table of specifications was built. Considering the table of specifications, a test for acquiring mathematical concepts of the type of objective tests (multiple choice)

will be prepared to achieve the greatest degree of stability of the correction, and the validity and reliability of the test will be extracted. The researcher used a smart application called Easy math for the first unit of the mathematics book for the first semester of the fourth grade, through cooperation with a programmer specializing in designing smart applications (Google Play) or Huawei (App Gallery). The application can also be downloaded to computers by downloading the Blue Stack program from Google and then installing the program on it. An explanation has been developed for each lesson of the unit (the sum of numbers), and an effective strategy at the beginning of each lesson that the student can use to make it easier for him to solve the exercises, in addition to a set of exercises and examples for each lesson with the availability of a video from YouTube that the student can go to directly to watch and listen to the lesson several times, through the button at the top of the page.

3.4 Data analysis

The statistical treatment included, first, the arithmetic means and standard deviations (Standard Deviation & Means) to calculate the arithmetic means of the experimental and control group on the mathematical concepts test. Secondly, the Pearson Coefficient to measure the stability of the study tools. The responses of the study sample were collected according to the study scale that includes mathematical concepts. The test of covariance results (ANCOVA) was used to test the differences between the control and experimental groups in the post test, considering the pre-test of the two groups, where the level of statistical significance was taken (0.05 = a). There were no statistically significant differences at the level of significance ($\alpha = 0.05$) between the control and experimental groups in the pre-measurement of the mathematical concepts test, as the value of "t" was (0.547), with a statistical significance (0.585), which is higher than the specified value (0.05), which refers to the equivalence between the two groups in the pre-measurement in mathematical concepts (see Table 1).

Table 1. The results of the (Paired Samples Test) test for the independent samples reveal the differences between the experimental and control groups on the pre-test

Study Sample	Arithmetic Mean	(SD)	T test	Significance Level
Treatment	0.652	0.477	0.547	0.585
Control	0.634	0.483		

One-way analysis of variance (ANCOVA) between the two study groups (control and experimental) in the post-test achievement showed that there were statistically significant differences at the significance level ($\alpha = 0.05$) in the mathematical concepts acquisition test on the post-test after adjusting the differences for the pre-test statistically as the value of (Q) from one-way analysis of variance for the group variable (14.771). This is statistically significant at the significance level (α) = 0.05), and this means that there is a statistically significant difference at the level of significance ($\alpha = 0.05$) in the mathematical concepts acquisition test, between the control group and the experimental group on the same test and in favor of the experimental group

who studied using smart applications, as noted from Table 5. Shown below is the adjusted arithmetic mean of the scores of the experimental group who studied using smart applications on dimensional mathematical concepts, and the achievement test was (0.832), which is higher than the adjusted arithmetic mean of the scores of the control group that was taught in the usual way, which amounted to (0.707). This indicates that the differences were in favor of the experimental group that studied mathematical concepts acquisition test, where the difference between the two averages was (0.125) see Table 2.

One-way analysis of variance (ANCOVA) between the two study groups (control and experimental) in the post-test achievement showed that there were statistically significant differences at the significance level ($\alpha = 0.05$) in the mathematical concepts acquisition test on the post-test after adjusting the differences for the pre-test statistically, as the value of (Q) from one-way analysis of variance for the group variable (14.771), which is statistically significant at the significance level (α). = 0.05), and this means that there is a statistically significant difference at the level of significance ($\alpha = 0.05$) in the mathematical concepts acquisition test, between the control group and the experimental group on the same test and in favor of the experimental group who studied using smart applications, as noted from Table 5. Shown below is the adjusted arithmetic mean of the scores of the experimental group who studied using smart applications on dimensional mathematical concepts, and the achievement test was (0.832), which is higher than the adjusted arithmetic mean of the scores of the control group that was taught in the usual way, which amounted to (0.707). This indicates that the differences were in favor of the experimental group that studied mathematical concepts acquisition test, where the difference between the two averages was (0.125) see Table 2.

Table 2. One-way analysis of variance (ANCOVA) between the two study groups (control and experimental) on the post achievement test

Source of Contrast	Sum of Squares	Degrees of Freedom	Mean of Squares	The Calculated f Value	Statistical Significance
concomitant (a priori) contrast	4.4	2	2.0	12.04	00.
method	113.9	1	113.6	662.85	00.
pre	1.68	1	1.68	9.773	0.002
the group	25	1	2.5	14.771	00.
The error	111.2	647	172		
total	500.0	650			
corrected total	115.3	649			

The modified arithmetic means and standard error on the post mathematical concepts acquisition test for the experimental and control groups show that the difference between the averages of the students of the two groups is in favor of the students of the experimental group that studied using smart applications. Thus, the results related to the hypothesis of the study showed that there were statistically significant differences between the experimental group and the control group due to teaching using smart applications see Table 3.

Table 3. Modified arithmetic means and standard error on the post mathematical concepts acquisition test for the experimental and control groups

Study Sample	Number	Arithmetic Mean	(SD)
Treatment	50	0.83	0.023
Control	50	0.7	0.023

4 RESULTS

4.1 Results and discussion the effect of mobile application in solving the problem of dyscalculia and the problem of dyslexic students

In the grades of the effect of mobile application in solving the problem of dyscalculia and the problem of students with dyslexia, measurement was done through a test developed by the researcher. The difference between the treatment and control group (effect size = 0.8, p = 0.016) is statistically significant and considered small with a moderate effect size, meaning that the difference between the treatment group and the control group is low. The effect of mobile applications in solving the problem of dyscalculia and the problem of dyslexic students *p < .05, see Table 4.

Table 4. The effect of mobile application in solving the problem of dyscalculia and the problem dyslexic students

Adjusted Means						
Outcome Measure	Treatment (SD)	Control (SD)	Difference (SE)	p-Value	Effect Size	Unweighted Student Sample Size
Post-test	19.97 (7.01)	19.08 (6.84)	0.85* (0.380)	0.016*	0.8	98
*p < .05						

The relationship between the improvement of the problem of dyscalculia and the post-test score was examined. Through regression analysis, the correlation between score was strong at r = 0.82, and this shows a significant amount of improvement in students who used mobile applications in the experimental group see Figure 1.

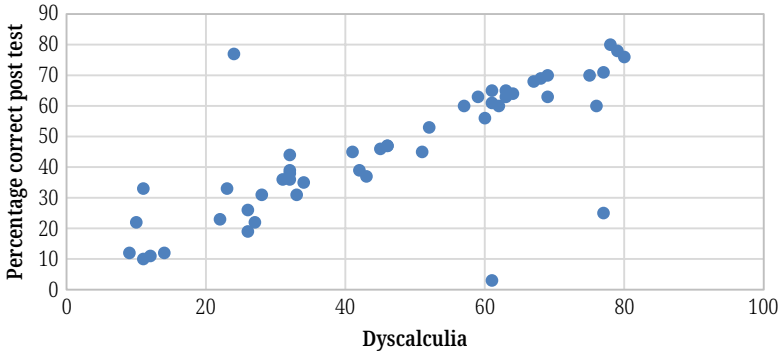

Fig. 1. Correlation, p < 0.01 between the improvement of the problem of dyscalculia and the score of the post-test scores r = 0.82 performance

The relationship between the improvement of the dyslexia problem and the post-test score was examined. The correlation between score was strong at r = 0.68 and this indicates a great deal of improvement in students who used mobile applications in the experimental group (see Figure 2).

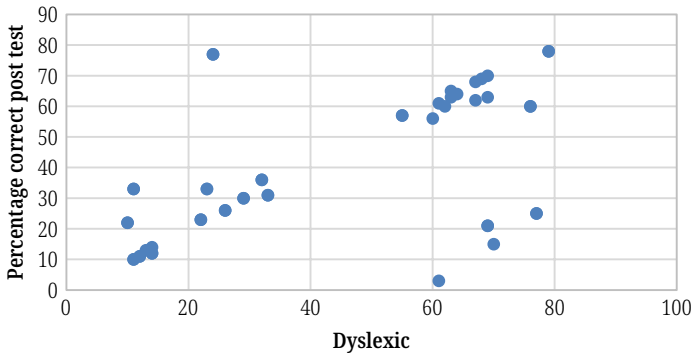

Fig. 2. Correlation, $p < 0.01$ between the improvement of the problem of dyslexic and the score of the post-test scores r = 0.68 performance

4.2 Results and discussion of teachers' perception of the effectiveness of mobile application in solving the problem of dyscalculia and the problem of dyslexic students

The teachers in the treatment group (n = 5) and the control group (n = 5) confirmed in the questionnaire at the end of the study the effectiveness of the mobile application in solving the problem of dyscalculia and the problem of dyslexia students, see Table 5.

Table 5. Teachers' perception of the effectiveness of mobile applications in solving the problem of dyscalculia and the problem of dyslexic students

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I want to continue using e-learning applications in my classroom.	0	0	0	0	5
E-learning apps were easy for me as a teacher.	0	0	0	1	4
I enjoyed using-learning apps in my classroom.	0	0	0	0	5
My students enjoyed using E-learning apps.	0	0	0	0	5
E-learning apps was very user-friendly for students.	0	0	1	1	3
E-learning apps adapted to my students' needs.	0	0	0	2	3
I understand how e-learning apps personalized learning for my students.	0	0	1	1	3

One of the teachers: "E-learning solved the problem of dyscalculia among students through a large number of mobile application activities, and students acquire numeracy skills quickly." One of the teachers explained: "Students use laptops. They are very interested. They share with each other their experiences during

mobile applications. This matter solved the problem of dyslexic students' reading." see Figure 3.

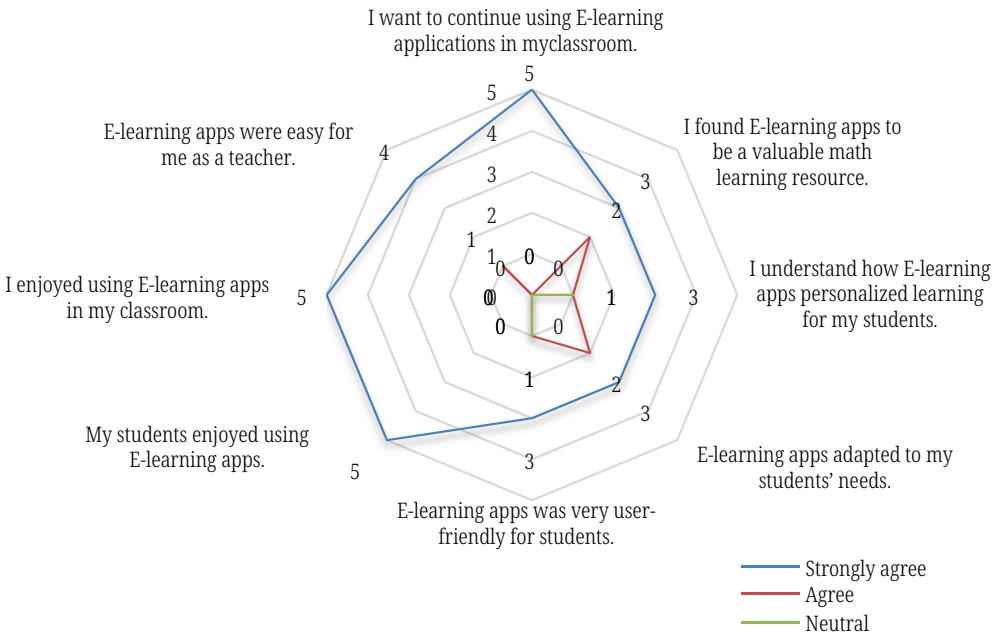

Fig. 3. Teachers' perception of the effectiveness of mobile applications in solving the problem of dyscalculia and the problem of dyslexic students

The study showed the need to pay attention to solving learning difficulties [9]. It stresses the importance of solving the problem of dyscalculia and the problem of dyslexic students [18–21]. The results indicate the value of mobile applications in solving the problem of dyscalculia. The results of this study are consistent with the study [14]. The effectiveness of mobile applications in solving learning difficulties and solving the problem of dyscalculia and the problem of students with dyslexia.

4.3 Limitations and future research

The shortcoming of this study is represented in the disparity in the use of programs and applications between schools according to the capabilities and educational environment between private and public schools through observation records and face-to-face interviews, and this leads to different evaluation results between schools, and this requires the need for increased attention to the infrastructure of schools and equipment. Another limitation in this study is the time it takes to work with students with learning difficulties and requires perseverance from teachers and that teachers receive more training in e-technologies and special education through training workshops.

5 CONCLUSIONS

The results indicated that there were statistically significant differences in the level of acquisition of mathematical concepts among the fourth grade students with learning disabilities in Jordan, due to the teaching method (using smart applications,

regular teaching) in favor of the experimental group that was taught by using smart applications, which indicates the effectiveness of smart applications in the level of acquisition of mathematical concepts among fourth-grade students with learning disabilities in Jordan. This result can be explained by the fact that the use of smart applications has clearly led to an increase in the comprehension of fourth-grade students with learning difficulties, dyslexia and dyscalculia. It is different in the classroom, it is characterized by challenge, interaction, and departure from the traditional atmosphere of the classroom, and this led to an increase in the level and effectiveness of the acquisition of mathematical concepts among fourth-grade students with learning difficulties, as the use of smart applications stimulated students' thinking by raising the level of happiness, interaction, integration and thus enthusiasm during the classroom. This result is consistent with many previous studies, including the study of Umm [9], which concluded that there is a significant effectiveness of an educational program based on multiple intelligences in addressing the difficulties of learning mathematics among third-primary students. It is consistent with the study [19] that found a significant effectiveness of a teaching program based on smart mathematical applications and its interaction with previous achievement in developing mathematical thinking among third-grade students in Jordan. Given the nature of the study individuals, it turns out that the result is consistent with the study of [2], which concluded that there is an effect of using smart mathematical applications in improving the achievement of students with learning difficulties in mathematics, and the study also revealed an improvement in the acquisition of mathematical concepts. This result can also be attributed to the fact that the use of smart applications as interactive and exciting tool leads to a deep understanding of mathematical concepts and their reinforcement in students' memory. In this regard, study [17] concluded that applied games improved mathematics learning, increased students' enthusiasm, and increased participation rates. In the classroom, the application helped increase knowledge of the studied concepts, which was confirmed by the study [9], which showed that students who were taught using smart applications were more interactive than students in the case of traditional education, and that smart applications were attractive and easy to use. The researcher also believes that the increase in the acquisition of mathematical concepts when using smart applications results from stimulating the brain by linking it to moving images, which works to enhance the capabilities of the brain and enhance the ability of students to think, reason and focus. In this, study [21] indicated that one of the important strategies in mobile applications uses a multi-sensory approach (auditory, visual, tactile, and kinesthetic).

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