

Impact of Educational Application of Smart Devices on Developing the Academic Achievement for Students with Dyscalculia

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Abstract: The aim of this study is to examine the impact of educational application of smart devices on developing the academic achievement for Students with Dyscalculia, the researchers used the experimental approach (the Quasi-experimental Design),The study was conducted on 30 students with Dyscalculia from East Gaza-Palestine. Results showed significant differences at significant level ($\alpha \leq 0.05$) among the average scores of the student's achievement test of the experimental group in the pre- and post- application. The findings of the study indicate that the mathematical skills of the participants have developed and there has been significant increase in their speed of answering and that the educational application of Smart Devices has a significant impact with $\eta^2=0.961$

Key Word: (smart devices ,Academic Achievement,Dyscalculia)

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I. Introduction

Technology is a light which brightens the way of learning and solve a lot of problems.Successive technological developments in this era have had many positive effects on various aspects of life in general, and the educational system in particular; and as a result of the many of these developments, a set of challenges has appeared in front of workers in the field of education, namely, trying to benefit from all that is new in Technology to improve learning outcomes. Important standard for the development of mathematics education in the twenty-first century, which is the use of technology in mathematics teaching. This standard indicates that technology's applications are effective for developing the capacity to think and solve problems.

In light of the huge technological revolution, we need a revolution in education in order to get along with the new developments. We need a change not only in the degree of the attractiveness of education, but also in what lies behind it, i.e. the essence of the educational system with its various components, in order to keep pace with the era of the information revolution. Therefore, it has become necessary to use e-learning, computers and networks for the transmission of information, to move from the case of rigid education to flexible education (Salem and Saraya, 2003).

Marta & Antoni (2016) believes that the applications of mobile phones and smart devices have become overwhelmingly popular all over the world and for all users of all groups, including students at all levels of education.

Al-Harbi (2016) defines smart devices as: "modern telephony devices that have a bundle of programs and applications of audio-visual and written communication, and that includes the capabilities of computers and the use of the Internet", while Al-Alawiya (2015) defines smart devices as: " One of the advanced equipment with an operating system, provides a set of services: communication, transfer of phrases and news, exchange of programs and texts files that include pictures.Al Balasi (2014) defines it as" smart phones contains advanced properties compared to other traditional phones, by the presence of a set of free and paidapplications and programs that are used in the process of teaching and learning. "

Daily,teachers note that there are some students in classes who differ from their peers, as they have some movement and educational difficulties.There are simple educational difficulties that the student can overcome with a little help and understanding by the teacher or by making arrangements or procedures in the classroom, but others appear to have severe difficulties, so theyneedmore attention and advice from the teacher,or referral to a specialist.

The field of learning difficulties is one of the fields of special education that have occupied the attention of researchers, as a result of the growing interest of parents and educators in the problem of learners with learning difficulties, and who suffer from behavioral and educational problems, although they do not suffer from any apparent disability (mental, auditory or visual). They seem normal in terms of their mental abilities, and their intelligence is around the average or above, except that they suffer from various difficulties, including

developmental skills (attention disorders, perception, and memory) or academic skills (difficulties reading, writing, and arithmetic) (Zahlouk, 2005)

Among the most important types of learning difficulties for students is Dyscalculia which is a specific learning disability in mathematics. School students with dyscalculia may have difficulty to understand number-related concepts or using symbols or functions needed for achievement in mathematics

Dyscalculia can cause different types of mathematics difficulties. So symptoms may vary from student to another. Observing student and taking notes to share with teachers is a good way to find the best strategies and supports for our school students. Dyscalculia often looks different at different ages. It tends to become more apparent as students get older. But symptoms can appear as early as preschool to high school. (Rajkumar & Hema, 2018)

For (Badian, 1999), Dyscalculia's mathematics learning difficulties are categorized into:

1- Developmental Dyscalculia: arises as a result of some deficiency or disorder

Cognitive processes such as attention, perception, memory, spatial visualization, information processing.

2- Difficulties in learning acquired mathematics (acquired dyslexia): arise as a result of damage to one or both halves of the brain.

Kosc presented six sub-patterns of math learning difficulties that are prevalent in children and adults:

1- Verbal Developmental Dyscalculia in learning mathematics:

The ability to call terms, relations, and symbols is disturbed.

2- Lexical Developmental Dyscalculia

The ability to read mathematical signs is disturbed

3- Graphical Developmental Dyscalculia, in which the child finds it difficult to write numbers and symbols.

4- Operational Developmental Dyscalculia, in which the child finds it difficult to perform mathematical operations such as: addition, subtraction, multiplication, and division.

5 - Difficulties learning to arrange mathematical, orderly development, Practognosic Developmental Dyscalculia, where children who suffer from this disorder find it very difficult to place things according to a specific arrangement based on their size or amount, and therefore it is difficult for them to determine whether one of the groups contains a number of elements greater than or less or equal to the number of items in the other group.

6- Ideognosic Developmental Dyscalculia, which means the inability to understand mathematical ideas and relationships with mental calculation. Although these children are able to read and write numbers, they are unable to understand what they write or read.

Smart Devices have become powerful technological tools for educational purpose, so they have become among the methods used to treat learning difficulties in mathematics Dyscalculia. This study showed the impact of educational application of smart devices on developing the academic achievement for Students.

1.2. Study Problem

The study aims to investigate the Impact of Educational Application of Smart Devices on Developing the Academic Achievement for Students with Dyscalculia in Gaza. The problem was formulated in the following main question:

What is the Impact of educational application of smart devices on developing the academic achievement for students with Dyscalculia in Gaza?

It has the following sub-questions:

1. What are the mathematics learning difficulties facing students with Dyscalculia while studying mathematics?
2. Are there statistically significant differences at the level of ($\alpha \leq 0.05$) between the mean scores on the Pre-post applications in developing the academic achievement for students with Dyscalculia?

1.3. Study Hypothesis

1. There are no statistically significant differences at the level of ($\alpha \leq 0.05$) between the mean scores on the Pre-post applications in developing the academic achievement for students with Dyscalculia.

1.4. Research Objectives

The study aims to achieve a number of objectives including:

- Determining the learning difficulties that students with Dyscalculia face when learning mathematics.
- Identifying smart applications that can help mathematics' teacher in treating learning difficulties in mathematics (Dyscalculia).
- Examining the impact of educational application of smart devices on developing the academic achievement for Students with Dyscalculia.

1.5. The limitations of the study

The study was conducted in the first semester of the academic year 2019/2020 in AL- ZAHRAA secondary school in east area of Gaza on 30 students with Dyscalculia.

1.6. Study Importance

The importance of this study is that:

1. This study can benefit the teachers concerned with treating learning difficulties in mathematics, and help to deepens the understanding of Dyscalculia.
- 2- The study provides some smart applications which help students with Dyscalculia.

1.7. Study Terms

The researchers define the study terms operationally as:

- **smart devices:**

A smart device, is an electronic gadget that is able to connect, share and interact with its user, became a powerful tool for educational purpose.

- **Academic Achievement**

represents performance outcomes that indicate the extent to which a student has accomplished specific goals.

- **Dyscalculia**

A specific learning disability of mathematics pertaining to fluent numerical computations, numbers and arithmetic skills.

II .Methodology

2.1 Research design:

The study used the Quasi-experimental design (Pre-Post group design) to examine the impact of educational application of smart devices on developing the academic achievement by applying the achievement test, analyzing the data and detecting the impact.

2.2 Data Collection Instruments:

After reviewing the previous studies, the researchers constructed an achievement test consisting of 20 questions. Students were tested in two sessions, the first before using the applications of smart devices and the second session was after using the applications of smart devices.

2.3 Procedures of the study:

Students studied in the usual way for two weeks, then the achievement test was applied. The test session lasted approximately 1 hour and the tasks were: vector magnitude, operations on vectors, and graphing vectors. Students were trained and taught by using smart devices applications, such as Vector Grapher app. And Crocodile Mathematics for two weeks, then the achievement test was repeated.

2.4 Data analysis:

Data collected in the study were analyzed by using SPSS Statistics version 22 program, paired samples test was conducted to determine if the difference between the pre-test and post-test of scores was significant, the value of η^2 was computed to determine the effect size of the educational application of smart devices on developing the academic achievement for students with Dyscalculia.

III. Findings

Answer of first question 1. What are the mathematics learning difficulties facing students with Dyscalculia while studying mathematics?

This study focus on the main difficulties which face students with Dyscalculia, which are:

- 1- Written developmental mathematics skills: include representation and mathematical expression with symbols and graphing.
- 2- Procedural developmental mathematics skills: represented in performing mathematical operations, setting arithmetic operations terms in the sub-stages of the solution.

Results of question 2 : Are there statistically significant differences at the level of ($\alpha \leq 0.05$) between the mean scores on the Pre-post applications in developing the academic achievement for students with Dyscalculia?

The researchers formulate the hypothesis:

There are no statistically significant differences at the level of ($\alpha \leq 0.05$) between the mean scores on the Pre-post applications in developing the academic achievement for students with Dyscalculia.

Table1: (Paired Samples T-Test)

Mathematical Skills	df	App.	Means	Standard deviation	t-test	sig
Written developmental mathematics skills.	29	Pre-	9.233	1.478	15.382	0.000
		Post-	13.633	2.042		
Procedural developmental math skills.	29	Pre-	9.266	1.484	22.938	0.000
		Post-	14.533	1.431		
Total	29	Pre-	2.129	18.500	26.862	0.000
		Post-	2.560	28.166		

As indicated in table 1, there is a significant difference at level ($\alpha = 0.05$) between students' pre-test results and post-test results in all dimensions of mathematical skills test :Written developmental mathematics skills and Procedural developmental mathematical skills. These results reflect the positive impact of the educational application of the smart devices. To determine the effect size, the value of η^2 was computed as shown in table 2. The values of η^2 for all the Mathematical Skills were all > 0.14 which means that the educational application of the smart devices has a big effect size in developing the academic achievement for students with Dyscalculia.

Table2: (Effect Size η^2)

Mathematical Skills	t-test value	t ²	df	η^2
Written developmental mathematics skills.	15.382	236.609	29	0.890
Procedural developmental math skills.	22.938	526.151	29	0.947
Total	26.862	721.593	29	0.961

IV. Discussion

This study was conducted to investigate the impact of Educational application of smart devices on developing the academic achievement for students with Dyscalculia. Through the results of the student's scores, it was found that there was a positive impact on developing the academic achievement comparing pre and post results. The reason of this improvement refers to the benefits of smart devices applications used in enhancing written and procedural mathematical skills, practicing repeatedly and student's performance. Also, these applications encourage individual learning because of its interactive features which help students with mathematics difficulties to learn mathematics even being out schools.

The study shows that the most developed skills were the procedural developmental mathematics skills because they have the highest mean scores. This result refers to the features of the used applications, since they focus on mathematical operations, setting arithmetic operations terms in the sub-stages of the solution. The study reveals that the smart devices applications help students become aware of their strengths and weaknesses, understanding how students learn best is a big step in achieving academic success and confidence.

The results of this study are consistent with other studies that searched in employing assistive technology to help students with dyscalculia to overcome academic achievement problems, such as (Rajkumar & Hema, 2018) that shows the importance of assistive technology for students with dyscalculia, (Pirani, 2013) indicated the role of accommodation required by students with dyscalculia and focus on technological techniques.

V. Recommendation

- 1- Correctly identifying students' mathematics learning difficulties.
- 2- Providing teachers with a list of smart devices applications which help in treating Dyscalculia.
- 3- Holding specialized courses for the teachers about dealing with Dyscalculia among students.
- 4- Studying the impact of technological techniques on learning difficulties in general.

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