

The Impact of Direct Teaching Strategy in the Development of Math Skills among a Sample of Students with Learning Disabilities

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Abstract

The present study aimed to investigate the effect of the direct teaching strategy on the development of mathematics skills in a sample of students with learning disabilities. To achieve the objectives of the study, the researcher applied the direct teaching strategy to develop mathematics skills (introduction, presentation, guided practice, independent practice). The researcher prepared a scale for the achievement of mathematics for students of learning difficulties in the fifth grade. The study sample consisted of (20) students who were chosen purposefully from students with difficulties in mathematics enrolled in the resource rooms. The sample was divided into two equal groups: The first experimental and the second control, the results showed a statistically significant difference at the level of statistical significance ($\alpha = 0.05$) between the arithmetical averages of students' performance on the achievement test in mathematics due to the difference in the study group, and for the benefit of the experimental group who studied using the direct teaching strategy. The results showed that there were statistically significant differences at the level of statistical significance ($\alpha = 0.05$) between the mathematical averages of the post-performance of the students on the scale in the dimension (mathematical concepts, computational skills, problem solving skills) attributed to the difference in the study group, and for the benefit of the experimental group, the study recommends the use of special education teachers for the strategy of direct teaching in the teaching of mathematics and conduct a study to investigate the effectiveness of teaching strategies in teaching the skills of mathematics to the students with learning difficulties at different age levels.

Keywords: Direct Teaching Strategy, Math Skills, Students with Learning Disabilities

Introduction

Mathematics is one of the most important subjects taught in the primary stage. Mathematics has a great role in life and its relation to different knowledge systems and because of its contributions to the renaissance of nations and their advancement, therefore, studies were concerned with the mathematics curricula of the primary stage and its content and the difficulties that hinder the learning of mathematics at that stage, studies have shown that the difficulties faced by students in the learning of mathematics lead to their failure to understand some concepts, facts and mathematical principles, and thus their inability to solve the problems which are considered a major goal of the objectives of the teaching of mathematics in the primary stage in general and for students with learning difficulties in particular.

The term learning disabilities is relatively new. This category has been identified as a special education category recently. Special education literature describes learning difficulties as invisible hidden disability, the members of this category are in the regular classroom showing a drop in academic achievement from their ordinary classmates with normal intelligence above average, but they show difficulty in some processes related to learning: such as understanding, thinking, cognition, attention, reading, writing, spelling, pronunciation, math or skills related to each of the previous processes and excluded from learning disabilities those who are mental handicaps, emotional disorders, people suffering from hearing and sight disabilities and multiple disabilities, as their disability may be a direct cause of their difficulties, which entails a great interest in identifying and diagnosing those difficulties, and preparing their own educational programs for the close link between academic skills and daily life.

Our incomplete knowledge of the suffering of the child or of the individual, the circumstances surrounding him, the reasons for that, and the best way to deal with him in his particular circumstances will not have the clear and tangible effect in overcoming and dealing with this suffering, and in dealing with him, ensuring an acceptable level of success, we should not act in this case of understanding the things and stand on their reality only, and we must understand with all seriousness and interest, and work to help this category to overcome these problems (Adas, 2000). In the 1960s, the term learning disabilities and specialized associations were introduced to highlight the problem and improve the services provided to students that they encountered in learning such as the Association of Children with Learning Difficulties, at the end of the 1960s, learning disabilities became a formal handicap like any other disability, especially with the issuance of the Specific Learning Disabilities law (1969), No. 91/23, as for the 1970's, it marked the emergence of General Act, known as the Education for All Handicapped Act (PL94-142: EHA) which is considered by educators to be one of the

most important laws that generally guaranteed the rights of people with special needs to education and other supporting services, and defined the roles of specialists and the rights of their families. The field of learning difficulties has a large share as other areas of disability as stipulated in this law; the scope of this law has changed and is now known as the Individuals with Disabilities Education Act (IEDEA) in the United States of America. Since its inception in 1975, this law has given associations and groups in support of the field of learning difficulties a legal basis to benefit from their guidance and demands to provide free education suitable for students with learning difficulties (Sartawi et al., 2002).

Some scientists interested in the field of learning difficulties see a bright future for this field of education if the efforts of specialists in all fields contribute to finding a more accurate and comprehensive knowledge about the person and his characteristics and the impact of various environmental factors. Learning theories provided much in the field of learning disabilities, whether cognitive learning theories, which focused on capacity training or developmental psychology theories that focused on the natural sequence of child development and the sequential growth of cognitive or behavioral abilities that focused on explicit learning and direct teaching with regard to the teaching of this category of students, this study will emphasize the process of direct education, which focuses on the teaching of academic skills and the teacher is clear and specific to the goals and needs of the student in advance.

Students with learning disabilities face various problems including dyslexia, Dysgraphia and Dyscalculia difficulties, as well as difficulties in the social skills imposed by the nature of disability on the one hand, and the usual teaching methods used in regular classes that are not appropriate to their circumstances and their special needs on the other hand, these difficulties hinder the educational process of these students, which may generate their frustration and thus create a negative image of the self and low academic achievement (Obeidat, 2003).

The development of strategies requires students to understand thoroughly and comprehensively all aspects of their abilities by revealing their strengths to use them and their needs to overcome them and learn how to learn, each student has his or her own way of learning, knowing the way in which the student learns not only determines his knowledge but also gives us important information on how to learn, which allows us to choose the best ways and materials to teach the student in addition to saving the time and effort spent by the teacher in the experimentation of learning methods proceeding from the right and wrong attempt that we get through diagnostics as well as the effort of an integrated team of the family to the guide to the sources teacher, so that the educational plan is comprehensive and strong able to help the student to overcome the problem of learning (Hafez, 1998). Therefore, specialists in the field of private education in general and workers in the field of learning difficulties in particular worked to find strategies and programs aimed at addressing those learning difficulties.

The problem of the study and its question

The problem of the study lies in the following main question:

- What is the impact of the direct teaching strategy in the development of math skills for fifth grade students with learning disabilities in Al-Kharj governorate?

The following two sub-questions arise:

- Are there statistically significant differences at the level of ($\alpha = 0.05$) between the performance of the experimental and the control group on the achievement scale in mathematics due to the teaching strategy?
- Are there statistically significant differences at the level of significance ($\alpha = 0.05$) between the performance of the experimental and the control groups on the achievement scale in mathematics due to gender?

The importance of the study

Mathematical skills are basic and necessary skills in the lives of ordinary students or students with learning disabilities, as it helps the student improve school performance and daily life, which is reflected in the achievement of the student's goals and aspirations. However, students with learning difficulties show a marked weakness in these skills, especially in mathematics skills; therefore, they need a teaching strategy that develops these skills and thus show the importance of study as follows:

1. Introducing mathematics programs for students with learning disabilities.
2. Introducing methods of teaching mathematics to students with learning disabilities, especially individual educational plans.
3. Providing tools for measuring and diagnosing learning difficulties in mathematics among special education specialists and resource room teachers, which have signs of reliability and validity and acceptable standards for the Saudi environment.

4. Applying the appropriate strategy by the teacher of the learning resource rooms with the students with difficulties in learning mathematics in light of his abilities, capabilities and preparations and the nature of the educational task.

Justifications for the study

The justifications for the study can be summarized as follows:

- The lack of studies that dealt with teaching strategies in the difficulties of learning mathematics compared to the strategies of the difficulties of learning to read and write.
- Needs of learning resource room teachers for learning disability diagnosis tools and measures to measure the effectiveness of individual educational programs in the field of difficulties in mathematics.
- Needs of teachers of learning resource rooms for individual educational programs in the field of difficulties in mathematics.
- Needs of resource room teachers for scales to measure the effectiveness of individual learning programs in the field of difficulties in mathematics.
- To enrich the field of scientific research in the field of learning difficulties.

Procedural Definitions

Direct teaching strategy: is a teaching strategy consisting of the main steps (presentation, display, practice, independent practice) with the aim of developing (mathematical concepts, computations and problem solving), which is based on measuring the student's current level of performance with a test developed for this purpose, its signs of validity and reliability were verified, and preparing and implementing individual educational plans.

Students with Learning Disabilities: A group of students who are located in the learning resource rooms and who have been diagnosed according to the official tests in the Kingdom of Saudi Arabia.

Mathematics skills: These are the skills that a student has in the field of mathematics, which enables him to perform computations (addition, subtraction, division, multiplication), solving verbal problems and applying them in daily life, included in the program, where the fifth grade program included (30) items, including: (18) items for the dimension of mathematical concepts and (8) items for the dimension of calculations and (4) items for the problem solving dimension.

Study determinants

The results of the study are determined by the availability of conditions regarding the size of the sample, its characteristics and method of selection from the study population and those enrolled in the learning difficulties rooms in the public schools affiliated to the Ministry of Education selected from schools affiliated to the Directorate of Education in Al-Kharj Governorate.

In order to identify the effectiveness of a computer-based teaching program to solve the difficulty in solving the basic processes of multiplied from (6×1) to (9×9) for fifth graders who have learning difficulties in mathematics, al-Dhafiri (2001) conducted a study its sample consisted of 8 students from the fifth grade, The results showed that there were statistically significant differences between the scores of the students on the pretest and their grades on the post-test in favor of the post-test due to the application of the program.

Sawalha (2004) conducted a study to investigate the impact of using the direct teaching strategy in teaching mathematics skills to students of resource rooms with learning difficulties in mathematics, the sample of the study consisted of (60) students randomly selected from the study community, the results showed statistically significant differences in achievement, attitudes, and academic self-concept between the experimental group and the control group in favor of the experimental group.

A study by Abu Zeitoun (2005) aimed at designing a training program in the learning skills of students of learning difficulties, measuring its impact on improving their academic skills, academic achievement, and academic self-concept. The study sample consisted of (68) students who had learning difficulties in reading and mathematics or both of them from third and fourth grades. In order to develop a computerized program in teaching arithmetic operations of students with learning disabilities in the resource rooms at the basic stage in the Sultanate of Oman, Masquerade (2006) conducted a study consisting of (44) male and female students. The results indicated significant differences in achievement in favor of the experimental group, and there were no significant differences in achievement due to gender.

In a study by Mccoy (1994) aimed at identifying gender differences in the ability to solve verbal mathematical problems. The sample consisted of (90) students from the second and third primary grades (46 females, 44 males). The results indicated that there were no gender differences in the ability to solve verbal

mathematical problems correctly, she also noted that there were no gender differences in the use of organized and sequential steps in resolving verbal mathematical issues, in contrast, Skaalivk and Rankin (1994) aimed to identify the differences between males and females in mathematics achievement, verbal expression of mathematical concepts, and self-concept and motivation in mathematics. The study sample consisted of (356) students from the sixth grade of primary schools in Norway. The results of the study indicated that there are no differences between males and females in achievement in mathematics, whether in grade 6 or grade 9. The results also indicated that the self-concept in mathematics among males is higher than that of females, while females are higher than males in the verbal expression of mathematical concepts.

In a study aimed at evaluating the effectiveness of teaching that focuses on teaching students with learning disabilities, Garderen (2007) investigated how to solve multiple-step or two-step verbal mathematics problems in mathematics, three students of learning difficulties participated in the study from eighth grade. The results indicated that students' performance in solving verbal problems improved, Students also created and used graphs to solve different types of verbal issues. In general, students were very satisfied with teaching and wanted to continue using graphs and a strategy to solve verbal math problems in other classrooms.

Lynn et al. (2008) conducted a study aimed at assessing the effectiveness of an individual learning program to solve verbal math problems for third grade students with learning difficulties in mathematics and reading. The study sample consisted of (35) male and female students. The results indicated the effectiveness of using the individual educational plan in improving performance in solving verbal math problems.

Population of the Study and its Sample

The study population included all students enrolled in the learning resources rooms of the government schools affiliated to the Directorate of Education for Al-Kharj Governorate. The total number of students enrolled is (228) students from the fifth grade, the number of learning resource rooms in Al-Kharj schools is (18) rooms for the academic year 2015/2016. A sample of (20) students was selected purposefully from students with difficulties in mathematics enrolled in the resource rooms, and who got the lowest performance on the achievement scale in mathematics prepared by the researcher. The sample was divided into two equal groups: the first experimental and the second control, by (10) students for each group according to gender.

Study Tools

Two study tools were developed:

First: the strategy of direct teaching to teach math skills: a strategy of teaching a method of learning centered on the teacher, which combines between the teacher's explaining information or show how to perform skills for a number of students, and students conduct educational activities (questions, application exercises) to develop the mathematical skills of the students of learning difficulties based on the diagnosis of the difficulties of mathematics measured by the mathematical achievement scale which was prepared by the researcher, where the current level of performance of the student was measured, the strengths and weaknesses of the student's current ability were determined by applying the achievement scale to diagnose the mathematics difficulties prepared by the researcher for this purpose, and then prepare the Individualized Educational Program (IEP) for each student alone, from which the Individualized Instructional Plan (IIP) was derived for each student, finally, the final performance of the educational goals was assessed using the evaluation method based on comparing student's performance before and after the educational process. The overall objectives of the strategy are as follows:

1. Developing the student's ability to acquire mathematical concepts.
2. Developing the student's ability to acquire mathematical calculation skills (collection, subtraction, multiplication, division).
3. Developing the student's ability to acquire verbal problem solving skills.

The strategy consists of the following steps (introducing, presentation, practice, independent practice) to develop the following skills: mathematical concepts, computational skills, problem solving, each step involves a set of educational tasks derived from the fifth grade curriculum. The tasks are formulated in the form of behavioral goals, taking into account the comprehensive formulation of all parts of the content, and determining the level of performance required for the task, with a focus on describing the output of learning in the students in the light of ability to observe and measure students' performance for tasks and exercises. The educational tasks were prepared by the researcher after reviewing the theoretical literature on the subject; these tasks were distributed after being formulated in the form of educational objectives on the steps of the strategy. The program was then presented to a group of specialists in mathematics, educational curricula and special education at the University of Prince Sattam bin Abdul Aziz and King Saud University, and teachers of special education in the Ministry of Education of the province of Al-Kharj, And those who have experience in dealing with students with learning disabilities, both in regular schools or in special education centers, in order to review it, verify the

validity and suitability of its items and its training, and the adequacy of the proposed standards and implementation procedures, in addition to its linguistic review.

Second: Mathematical Achievement Scale: The researcher has prepared a scale to measure the achievement of mathematics for students of learning difficulties in the fifth grade in order to identify the strengths and weaknesses of a sample of students with learning difficulties, the objectives of the scale and its use are summarized as follows:

- Identifying the students with learning difficulties in mathematics.
- Determine the strengths and weaknesses of students with learning difficulties in mathematics.
- Preparing educational programs and plans for students by making the points in which the student showed weakness as objectives within these plans and programs.

Study variables

Independent variables: the strategy of direct teaching to develop the skills of mathematics based on the results of diagnosing the difficulties of mathematics using the scale developed by the researcher and has two levels (training, no training)

The modified variable: it is gender and has two levels (male, female)

The dependent variable: the post-performance on the achievement scale in mathematics prepared by the researcher.

Results of the Study

To ascertain the equivalence of the study groups prior to the application of the study, the researcher applied the pretest to the sample of the study. It was divided into two parts: the first is related to the performance of the students on the pretest as a whole and the second is related to the performance of the students on the post-test.

The first hypothesis: Are there statistically significant differences between the performance of the experimental group and the control on the scale due to the direct teaching strategy

1) Part 1: Regarding students' performance on the pretest as a whole:

The mathematical averages and standard deviations of student performance were calculated on the pre-test as a whole and according to the variable of the teaching strategy. The table shows this.

Table (1): means and standard deviations of students' performance on the pre-test according to the male variable and the variable of the direct teaching strategy

Strategy	N	Mean	Standard deviation
Direct teaching strategy	5	6.8000	2.68328

* The maximum score (20)

The table shows that there is a virtual difference where the mean is (6.8) and the standard deviation is (2.68).

Table (2): means and standard deviations of students' performance on the pretest according to the female variable and according to the direct teaching strategy variable

Strategy	N	Mean	Standard deviation
Direct teaching strategy	5	4.80	1.92354

* The maximum score (20)

The table shows the existence of a virtual difference where the mean is (4.8) and the standard deviation is (1.92).

1) Part 2: Regarding the performance of students on the post-test as a whole:

Means and standard deviations of student performance were calculated on the post-test as a whole and according to the teaching strategy variable and the table shows that.

Table (3): Means and standard deviations of the students' performance on the post-test as a whole and according to the male variable and the variable of the direct teaching strategy

Strategy	N	Mean	Standard deviation
Direct teaching strategy	5	6.00	2.73861

* The maximum score (20)

The table shows the existence of a virtual difference where the mean was (6) and the standard deviation was (2.73).

Table (4): Means and standard deviations of students' performance on the post-test as a whole and according to the female variable and according to the variable of the teaching strategy

Strategy	N	Mean	Standard deviation
Direct teaching strategy	5	4.8	1.48

* The maximum score (20)

The table shows the existence of a virtual difference where the mean is (4.8) and the standard deviation is (1.48).

Table (5): Mean and Standard Deviation of the Control and Experimental Groups for Pre-Test

Test	Group	N	Mean	Standard deviation	T value	Sig
Pretest	Experimental	10	15.10	4.65	11.995	0.00
	Control	10	5.8	2.44		

* Not statistically significant at significance level ($\alpha=0.05$)

Table (5) shows statistically significant differences between the mean scores of the experimental and control groups on the pretest, this indicates the equivalence of the two groups before starting the study. After testing conducting the experiment on the experimental group, the researcher used a t-test to answer the study question as shown in Table (6).

Table (6): Test results for the performance of the experimental and control groups on the post-test

Group	N	Mean	Standard deviation	Calculated T	Sig
Experimental	10	10.20	1.98	9.374	0.240
Control	10	5.4	2.17		

*Statistical significance level ($\alpha = 0.05$) degrees of freedom = 5

Table (6) shows that there are statistically significant differences ($\alpha = 0.05$) between the average scores of students in the two groups on the post-achievement test, which is in favor of the group that used the direct teaching strategy. The calculated T value was (9.37) with a statistical significance reached ($\alpha = 0.024$) in the sense that there is a statistically significant difference between the performance of the experimental group and the control on the scale due to the direct teaching strategy in the experimental and control groups in favor of the experimental group where the means was (10.20).

The second hypothesis: Are there statistically significant differences between the performance of the experimental group and the control on the scale attributed to gender? To test this hypothesis, the researcher used ONE-WAY ANOVA test of variance as shown in the following table (7)

Table (7): Results of ONE-WAY ANOVA test of variance for the performance of the experimental and control groups on the pretest

Gender	N	Mean	Standard deviation	F value	Sig
Male	10	6	2.73	0.742	0.41
Female	10	4.8	1.48		

Table (7) shows that there are no statistically significant differences between the average scores of students on the pretest due to gender variable, where the level of significance is (0.41).

Table 8: Results of ONE WAY ANOVA test of variance test for the performance of the experimental and control groups on the post-test

Gender	N	Mean	Standard deviation	F value	Sig
Male	10	17	4.74	1.819	0.21
Female	10	13.2	4.14		

Table (8) shows that there are no statistically significant differences between the averages of the students' scores on the post-test due to the gender variable, where the level of significance is (0.21)

The two previous tables show that there are no statistically significant differences between the performance of the experimental group and the control on the scale due to gender.

Discussion of the results of the study

This study dealt with the strategy of direct teaching in the development of math skills for students with learning difficulties for the fifth grade.

To achieve this, the performance of the students of the experimental group who were subject to the direct teaching strategy was compared to the performance of the control group that continued in its normal program on the achievement scale in mathematics before and after the implementation of the strategy. The results confirmed that there were statistically significant differences ($\alpha = 0.05$) between the two groups on the scale are attributed to the teaching strategy.

Discussion of the results related to the first question: Are there statistically significant differences at the level of significance ($\alpha = 0.05$) between the performance of the experimental and control groups on the achievement scale in mathematics due to the direct teaching strategy?

The results of this study showed that the experimental group - the group that was trained according to the direct teaching strategy - in all its steps in the development of (mathematical concepts, computational skills, problem solving) on the control group, there was a statistically significant difference at the level of statistical significance ($\alpha = 0.05$) between the two means of the performance of students on the post achievement test in mathematics as a whole as a whole is attributed to the difference in the study group and in favor of the members of the experimental group who studied using the direct teaching strategy.

The results showed that there was a statistically significant difference at the level of statistical significance ($\alpha = 0.05$) between the two averages of the mathematical calculations of the performance of students on the dimension (mathematical concepts) attributed to the difference of the study group and for the members of the experimental group who studied using the direct teaching strategy. The results also showed a statistically significant difference at the level of statistical significance ($\alpha = 0.05$) between the two arithmetical averages of students' performance on the (computational skills) dimension attributed to the difference in the study group, for the benefit of the experimental group members who were taught using the Direct Teaching strategy.

Finally, a statistically significant difference ($\alpha = 0.05$) was found between the two computational averages of student performance on problem solving skills due to differences in the study group and in favor of the members of the experimental group; this result can be explained by the fact that the educational content of the strategy has led to the superiority of the members of the experimental group, in establishing the steps the following was put into account:

- Individual learning according to the actual needs of each student.
- Instability learning time for all students
- Diversifying the method of handling the contents of the course, such as: the method of mathematical games, a meaningful activity of the student or a group of students to accomplish a specific mathematical task in light of the rules of the game with the availability of motivation to continue the student activity, this method is characterized by:
 - Increased motivation of students to learn
 - Increased understanding, application and retention of mathematical skills.
 - Use aids to help establish concepts and methods of solution.
 - Focus on enabling the student to take a lesson before moving on to the next lesson.
 - Identify teaching aids to include colorful interesting materials.

Students may be taught in an unusual way in the class, which is why the experimental group has excelled in all the program skills. The researcher has noticed the interaction of the students in dealing with the skills of the program. In addition, the method of implementation of the program and the accompanying activities

provided interaction between the teacher and the student, where this interaction works to develop the thinking of the individual, all led to the superiority of the experimental group on the control group.

The previous finding is consistent with the findings of the Abu Zeitoun study (2005), from the experimental group's superiority over the scholastic skills scale, the academic self-concept scale, and the achievement tests scale in Arabic and mathematics. The results of this study are also consistent with the results of Lynn et al. (2008), which demonstrated the effectiveness of using individual programs to improve performance in solving verbal math problems. The impact of the direct teaching strategy may be due to its following characteristics:

- The strategy has changed the role of the teacher and the student in the fact that decentralization of the teacher makes the students more responsible for the learning process, more motivated by what they achieve, and desire to learn, which in turn enhances problem solving skills and learning enjoyment.
- The application of the strategy required a collaborative environment that focused on student activity, allowing him to explore himself, interact and express his views freely, through the learners' practice of the activity, this leading to shifting the goal from acquiring new knowledge to acquiring how to apply this knowledge to learning mental processes and skills, then to acquire positive values and trends, especially during teamwork.

Discussion of the results relating the second question: Are there statistically significant differences at the level of significance ($\alpha = 0.05$) between the performance of the experimental group and the control on the achievement scale in mathematics due to gender?

The results revealed that there were no statistically significant differences at the level of statistical significance ($\alpha = 0.05$) between the modified calculation averages of students' performance on the achievement test in mathematics as a whole as a whole due to gender differences. The study also showed that there is no statistically significant difference ($\alpha = 0.05$) between the two computational averages of students' post performance on the dimensions of the scale, the skill (Mathematical concepts, computational skills, problem solving) according to the gender variable (males and females).

The researcher explains the current result of the study sample (male and female) with the same educational experience regardless of gender. The study sample (males and females) also took the same period of time during the application of the study, in particular that the researcher supervised the application of the study. Add to the similar educational, cultural and economic conditions for both sexes, especially since the study sample members are from the same geographical area. The program also enabled the learner to interact, manipulate and assimilate the information contained in the program, making it more suitable for use, and the similar incentives and material and moral reinforcements received by male and female students.

This finding is consistent with the findings of a study by Masquerade (2006), which indicates that there are no significant differences in achievement due to gender.

This result is also consistent with Farhan's (2002) study, which indicates that there is no gender impact on students' performance in solving verbal mathematical problems. In light of the results of the present study, Recommendations of the study by preparing special education teachers and training them in the methods of teaching mathematics in general, and solving mathematical problems in particular, and conducting a study to determine the effectiveness of instructional strategies in teaching mathematics skills for students with learning disabilities at various age levels, and conducting further studies on the difficulties of mathematics in students with learning disabilities.

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