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THE EFFECT OF USING THE MENTAL MAPS ON THE ACADEMIC ACHIEVEMENT IN MATHEMATICS AMONG THE EDUCABLE INTELLECTUALLY DISABLED STUDENTS IN RAFHA PROVINCE

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ABSTRACT

The study aims at investigating the effect of using the mental mapping on the educable intellectually disabled students' academic achievement in Rafha province in the Kingdom of Saudi Arabia. The researcher used the two-group experimental design with experimental and control groups. The study sample is restricted to the educable intellectually disabled students in the fifth grade in Rafha province in 2019. The sample consists of 18 students distributed into an experimental group with eight students and a control group with ten students. The researcher prepared the educational plans using mental maps for the two groups in addition to an academic achievement exam. The reliability was found by using the Kuder-Richardson Formula, and the Reliability Value was (0.90). By the end of the experiment, tests were conducted upon the two groups. After statistically processing the data using the t-test for two independent samples, the results showed the existence of statistically significant differences between the mean of the experimental group which studied using the mental mapping of concepts and the mean of the control group which studied using the ordinary learning methods in favor of the experimental group. Thus, the researcher highly recommends the using of the mental maps in teaching the educable intellectually disabled students.

Keywords: *Mental Maps, Academic Achievement Educable, Intellectually Disabled Students.*

INTRODUCTION

Intellectual disability is considered as one of the hardest and most serious problems that may face the family and the community. Having an intellectually disabled family member significantly impacts the lives of all the family members. Therefore; societies, organizations, and bodies take care of the special education categories in general and the intellectually disabled in specific to minimize the impacts of the intellectual disability on the family and the community through taking care of and paying attention to this category in addition to providing its members with education and rehabilitation.

Education is offered to the intellectually disabled students in the intellectual schools and colleges and special classes inside the regular schools. These classes are called the mainstream classes and provide the intellectually disabled students with many educational programs. These programs aim at providing different types of information, skills, and emotional aspects that meet the needs of the intellectually disabled individuals by using the teaching methods and strategies that suit the nature of their disability.

The educable intellectually disabled people are considered among the highest intellectually disabled groups in terms of their level of intelligence. Therefore, the Kingdom of Saudi Arabia pays special attention to this group by establishing mainstream classes in regular schools to teach them the academic aspects and different skills. Developing life skills is one of the goals of teaching intellectually disabled through the educational programs that can be provided to this category, since developing these skills develop their ability to deal with the various life situations. (Ayres et al., 2013) clarify that the life skills of people with intellectual disabilities are the skills needed to achieve a productive life. The lack of these skills prohibits the intellectually disabled person from acting independently in his community. Therefore, taking care of these skills is one of the important issues for intellectually disabled people.

Zaitoun (1996) shows that the prevailing teaching methods such as recitation, lecturing, presentation, and demonstration do not succeed alone in delivering the cognitive content and sometimes these methods become a source of difficulty that hinders the process of generating and acquiring the scientific concepts by learners.

The majority of the traditional courses and teaching methods are focusing on the left hemisphere of the brain that deals with logic, lists, numbers, sequences, words, and analysis. These tasks have to do with rational thinking which is what our students trained on in our schools and educational institutions. Using the right hemisphere of the brain, which concerns with colors, imagination, dimensions, area, volume, is less common. These concepts are usually related to creative thinking; so it is not strange when many of our students suffer from learning and memorizing difficulties that affect their exams and educational outcomes (Qilada, 2009).

Consequently, restricting the curriculum planning and teaching methods to support and activate the abilities of one of the brain's hemispheres weakens and disables the development of the skills of the other one. It also leads to tumulting the synchronization of the whole brain. Hence, it is so essential that the planner and the teacher take into consideration activating the left hemisphere of the brain since it is a crucial prerequisite for activating the abilities of the right hemisphere, which is responsible for creation and reconfiguration. They must also consider that any problem can be solved using both hemispheres of the brain.

The modern researches highlight the importance of striking a balance between the functions of the brain's two hemispheres when planning and teaching the curricula on the bases of total integration of the two hemispheres. Recently, some studies start investigating the overall learning process of the brain using primary techniques that activate the abilities of the right hemisphere and build a bridge between the two hemispheres. Some of the methods based on studying the human brain and its hemispheres' functions are related to teaching the metaphorical thinking, experience-based techniques (like the mental mapping), many discoveries, senses, divergent and creative thinking (like the mental mapping) and using emotions in education. These new fields enable planning and teaching the curriculum in a way that satisfies the brain's needs to use data and information in a perfect way (Qilada, 2009).

Buzan (2005) defined mental maps as an ideal intellectual tool to organize ideas. Mental maps also categorize and organize facts and ideas using colors and drawings. These maps depend on creating a central concept in the map's center, out of which several sub-concepts radiate. The map is identified either by words, symbols or images. This way, the map reflects the brain's mode of operation and invests its two hemispheres full capacities in addition to providing the student with interesting new ways to memorize and recall information in order to use them to



improve memory and enhance concentration and creativity by reviving imagination. Thus, the best methods are furnished to use the student's mental resources.

Mental mapping stood out from all other teaching methods as a useful tool that organizes, stimulates and urges the brain hemispheres. Luitan and his colleagues reviewed, in 1980, 135 cases that studied the impact of acquiring and keeping information with the help of organizational, motivational types of learning. The study results revealed that any organizational forms always has a positive impact that deepens the students' understanding of what they know.

The researchers clarify the role of these maps in strengthening the activities integration of the brain through lesson planning and teaching experiences. They also stress the importance of the interactive process between the two hemispheres and its impact on creativity development (Jensin, 2007).

Thus, the importance of the programs based on the mental maps for intellectually disabled people can be seen. These programs contribute to enhancing and help in developing the process of teaching those individuals, which is one of the primary learning goals.

Thus, the current study focuses on investigating the effect of using the mental mapping strategy on the academic achievement of the educable intellectually disabled student in the Kingdom of Saudi Arabia.

Problem Statement:

The problem currently being raised in education is the problem of the academic achievement of the intellectually disabled students. Those students generally suffer from this learning problem in different courses. Students with an intellectual disability suffer from deficiency and dispersion in attention and concentration, and some of them also suffer from hyperactivity. Therefore, the current study tries to help the students to overcome their problems in mathematics using an educational method that clarifies concepts, meanings, and examples in organized diagrams surrounded by frames and arrows. This method illustrates the content in a new attractive way that keeps the students' attention and enhances their academic achievement. Thus, the problem of the study is formulated as follows: Will the academic achievement of the fifth grade intellectually disabled students be affected by using the mental maps and is their academic deficiency going to be adjusted?

The Study Significant:

The present study derives significance from its compatibility with the objectives of the learning-teaching process that seeks to allow students to acquire the effective tools and strategies that enable them to develop the different levels of understanding. The study is also important because it draws the attention of the researchers and educational workers to an instructional method that may be effective in teaching mathematics, which may bridge the gap between the educational reality and what it is hoped to be.

The Study Objective:

The effect of using the mental maps on the academic achievement of the fifth grade educable intellectually disabled students in the Kingdom of Saudi Arabia.



The Study's Hypotheses:

- There is no statistically significant difference between the mean of the experimental group, which studied using the mental maps, and the mean of the control group which studied using the usual method, in terms of the academic achievement of the fifth grade educable intellectually disabled students in mathematics.
- There is no statistically significant difference between the means of the pre- and post-tests of the experimental group, which studied using the mental maps, in terms of academic achievement.
- There is no statistically significant difference between the means of the post and follow-up tests of the experimental group in terms of academic achievement.

The Study Limitations:

1. A sample from the fifth grade educable intellectually disabled students in Rafha province in the academic year 2018-2019.
2. The second semester of the academic year 2018-2019.
3. The topics of the fifth-grade mathematics textbook.

The Study Terminology:

- **Intellectual Disability:**

The definition of the American Association on Intellectual and Developmental Disabilities (AAIDD): It is a disability characterized by significant limitations in both mental functioning and in adaptive behavior, which covers many everyday social, intellectual and practical skills. This disability originates before the age of 18 (Legislative Goals, 2008).

The operational definition: A group of the fifth grade intellectually disabled students who suffer from some educational problems and need support, educational care and attention from their teachers in regards to explaining the scientific content in various ways and methods to help and empower them to reach the intended level.

- **Mental Maps:**

Mental Map is a graphical means of expressing an individual perspective that is made using images, drawings, colors, words, and simple sentences. It can also be defined as a successful method of study that links the information read from books and notes through drawings and words in the form of a map. It can also know that it is a great way to draw everything you want in one paper in an orderly manner where you replace words by drawing to indicate them so that you can put everything you want in one paper in a short and easy way to remember (Attia, 2008).

- **Academic Achievement:**

Alkubaisi and Rabie (2008) defined it as a tool used to determine the level of learner's acquisition of information and skills previously learned in a particular course (Alkubaisi and Rabie, 2008).



The operational definition of Achievement: It is the mark scored by the student in the exam prepared by the researcher. The exam indicates the extent of the students' understanding of the taught concepts and material limited to the mathematics textbook.

Theoretical Framework:

- **The Mental Maps:**

Many of those who are concerned about teaching methods and strategies are interested in Ausubel's theory. Mental mapping, or what is also known as the cognitive mapping or the graphs method, is one of the applications of this theory in the field of teaching methods (Attiah, 2008). He assumed that the learner's brain stores information in a hierarchical way arranged from the general to the specific and it could be easier to learn it effectively and easily recall it. Therefore, it is necessary to introduce information appropriately in the form of general summarization that includes intellectual pillars which confirm the new information and establish it in the learner's mental structure (Mar'y and Alhielah, 2002).

Mohammed (2007) confirmed the same idea stating that each has a cognitive structure. Whenever this individual goes through a new educational experience, the new piece of information is integrated into his cognitive structure, and so the individual's cognitive structure is reshaped with every new educational experience which in turn becomes an integral part of his overall cognitive structure (Mohammed, 2007)

Since meaningful learning is basically achieved by connecting the newly learned material with what exists in the learner's cognitive construction, it is necessary to connect what the learner already knows and what he learns. The meaningful learning could not be achieved unless the cognitive material's construction is organized, clear, reliable, and connected to the new material, because this is what enhances the learner's ability to memorize the material and recall it (Abujado, 2009).

The previously mentioned is achieved by mental mapping. It is defined as a tool to organize the ideas and meanings included in the subject or unit and illustrate the relationships between these concepts to help the students in organizing their knowledge to deepen their understanding of the studying unit or course (Attiah: 2008). Thus, using mental maps is necessary in the following cases:

- When the teacher likes to evaluate the student's previous knowledge on the subject he intends to teach.
- When the teacher likes to evaluate the level of the student's identification of the new concepts.
- When the teacher likes to plan the learning process, so he can be aware of the concepts included in the subject and how to present them.
- When the teacher likes to connect the previous information with the new information.
- When curriculum planning is needed.
- When we like to organize the learner's cognitive constructions and enable them to understand the material.
- When deepening the learner's comprehension and learning is needed.
- A useful tool to strengthen academic achievement.



- An effective learning tool to teach the educable intellectually disabled students.
- Could be used with students from the kindergarten to the university (Attallah, 2002, 390)
- **The Components of a Mental Map :**
- The scientific concept: the mental construction that results from the common features of the phenomenon or the individual's intellectual perspective of objects. The concepts written inside an oval, circle or square.
- Linking words: Words used to connect two concepts or more, such as: classified as, composed of, consists of, from, has, etc.. These words are written on the branches that connect concepts.
- Downward-branching: It is a link between two concepts or more in a hierarchical structure and takes the form of a downward-branch.
- The examples: The events or the specific actions that represent the concepts and they are usually proper names (Khataiba, 2005).

- **Pedagogical benefits of mental mapping:**

Hilal (2007) stated that mentalmapping helps learner and teacher to achieve the following:

1. Organizing the cognitive skills structure of the learner and the teacher.
2. Establishing, reviewing and recalling data and information, due to the image drawn in the learner's mind.
3. Recurrent revision of the subject, since it widens the understanding and enables the addition of new data and information to what already exists.
4. Swift revision of the topics by the learners when they do not find enough time for a thorough revision.
5. Employing modern technology in learning and teaching such as computers, projectors, slide projectors, recorders, etc.
6. Reducing the number of words used in the lesson, which helps in increasing the level of concentrating and facilitating the learner's understanding.



Alharoon (2007) added some of the mental maps' features, such as:

1. Giving confidence when presenting information in a short time.
2. Simplifying the composite data.
3. Improving the ability to recall information.
4. Achieving individual and group creativity.
5. Organizing the ideas in clear and effective communication.
6. Activating thinking abilities.

- **Achievement:**

Academic achievement is the occurrence of the intended educational process provided that it is a result of a specialized training and teaching program. Achievement is closely related to teaching. However, the teaching concept is more comprehensive since it indicates the performance changes during the training and practicing. It is also represented in the

acquisition of skills and information and the changes in attitudes and values which includes the desired and undesired results. Achievement is more connected to the educational desired outcomes or educational objectives.

The researcher is going to survey some of the academic achievement definitions, some of the concepts and subjects related to academic achievement and the factors that affect it.

The definition of academic achievement:

The definition of AbdulaliAljusmani (1994): Academic achievement is the occurrence of the intended educational process provided that it is a result of special training and a teaching program.

The definition of FarouqAbdusalam (1992) cited in RuqaiiaAlsaid (1999): Academic achievement means the level reached by a student in the courses he studies, which is evidenced by the marks obtained in the exams.

In light of these two definitions, the researcher studies the effect of using the mental maps on the level of the academic achievement of the educable intellectually disabled students which helps in rehabilitating them.

Academic Achievement and Intelligence:

MajidaAlsaidObied “2000” confirmed that there is a close connection between academic achievement and intelligence. Students with high intelligence usually achieve high marks, and they are characterized by their hard-working. Meanwhile, students with low levels of intelligence lack such hard-working and are characterized by negligence in-class work. The intelligent students may fail due to their overconfidence in their intelligence, and so they will not prepare appropriately. Many studies confirmed the existence of a relationship between academic achievement and intelligence. These studies show the importance of intelligence and its impact on academic achievement and that academic achievement and intelligence are closely connected. This connection varies according to the educational stage. It is stronger in the early education stages than in higher ones.

The Factors Affecting the Academic Achievement:

The educational process has three pillars; student, teacher, and curriculum. Since the student is the cornerstone, it is essential to identify the factors that affect academic achievement by knowing the factors and variables related to the student, which are:

1. Social factors.
2. Emotional factors.
3. Mental factors, which are related to mental, cognitive organization such as intelligence and mental abilities.
4. Personal factors: Many studies tackle the relationship between personal characteristics and academic achievement. The studies confirmed having a positive correlation between academic achievement on the one hand and the emotional stability, mood, and self-confidence on the other.
5. Motivation: This factor is significant to the extent that no job or task can be fulfilled as desired without having motivation as its vital driver to reach the goal and achieve the task correctly.



The importance of achievement:

The school's elementary stage is one of the most important and dangerous educational stages since it largely contributes to the construction of the students' personalities and provides them with the basic needs to continue the following educational stages. The classrooms in this stage have a prominent feature that nobody can ignore, which is the phenomenon of the individual difference between learners. This feature is considered one of the most important challenges facing learners during this stage.

The main point in this phenomenon is the fact that individual differences take place in any educational stage especially in the elementary stage. Not considering this phenomenon leads to variation in the students' achievement. Therefore, students' academic achievement varies from high, medium to low achievement (Bultieh and Mitwaly, 1999).

Intellectual Disability:

Intellectual Disability has different definitions that reflect the evolution of the concept that occurred as a reaction to the development in the society in general and in the intellectually disabled society in specific. Reviewing these definitions, one finds that they vary according to the way of considering an intellectual disability. Some view it as a social problem; others consider it a medical problem, while some consider it an educational issue.

The American Psychological Association (A. P. A. 1994) provides the following definition in its Diagnostic and Statistical Manual of Mental Disorders (DSMIV): a below-average functional intellectual performance with IQ of 70 or less in an individual intelligence test. For children, it is a clinical report of below-average functional performance.

Due to the nature of this study which interests in the educational aspect, the researchers define the intellectually disabled child as "the child who cannot normally achieve the same level as his ordinary peers in the same class and whose IQ ranged between 50-70 point and is considered a member of the educable intellectually disabled category".



Teaching Intellectually Disabled People the Academic Skills

Reading, spelling, arithmetic, science, and health are the academic skills learned by intellectually disabled students in special education classrooms. Surely, they are unequal to ordinary students in terms of their ability to learn academic skills. Some differences show less understanding of comprehension. These difficulties in learning the skills can be attributed to the lack of general intelligence, emotional immaturity, the absence of self-confidence and the adaptation difficulty among the intellectually disabled students. In addition to that, those students suffer from general poor health conditions, visual and hearing impairment and language impediments, which necessitate drawing up plans and developing unique methods to teach them academic skills. The following are some of these teaching methods.

Teaching the intellectually disabled to read: The most important bases for teaching the intellectually disabled to read are:

1. The individual attention to the intellectually disabled person.
2. Making the intellectually disabled person feels that he is a successful person and the attention is paid to him.
3. Choosing reading material that fits the affinity of the intellectually disabled person.

4. The reading sessions must be short. Each session must be between 20-40 minutes. The number and frequency of classes must be increased.

Taking into consideration the mental age of the intellectually disabled student: The special education teacher must prevent the intellectually disabled student from the frustration felt while reading. Many skills must be provided to the intellectually disabled student which enable him to learn reading and increase his experience and diction, such as:

1. Trips and tours.
2. Knowing the environment and its symbols.
3. Showing a group of books and pictures that go with their affinity.
4. Telling tales and stories by the special education teacher.
5. Preparing some skits and allowing the intellectually disabled students to perform them.
6. Making clay models of objects from the surrounding environment.
7. Throwing special parties in the classroom like birthday parties.
8. Carrying out group activities such as school gardening.
9. Performing some rhythmic and group gymnastics.

Teaching the intellectually disabled to write

The special education teacher must know when the intellectually disabled student is ready to write. The teacher must also pay attention to the motor coordination and the training of the hand's muscles before start learning the writing skills. The methods of teaching writing are many, which include:

1. Stiros Wilhite cited in Faisal Makki "1988" indicated that the best way to teach intellectually disabled people how to write is the interrelated or sequenced writing method since the total recognition of the word becomes more natural when the letters are connected which helps to develop the sensorimotor cognition.
2. Employing the intensive training on Writing.
3. Clarifying the correct writing methods that include an appropriate way of laying the paper and seating the student. It is noticed that the majority of the intellectually disabled students use their left hands to write so they must be seated appropriately while writing.
4. The written word must have a meaning for the intellectually disabled student. Writing must be related to reading, arithmetic, and other activities to give a deep meaning to the writing skill.

Teaching arithmetic to the intellectually disabled students

The intellectually disabled students are known for their deficiency in mathematical thinking due to their poor general intelligence and their impaired memory with numbers in addition to the emotional reasons that accompany the arithmetic operations such as; fear, anxiety, lack of self-confidence, lack of concentration, misbehaving and lack of experience. The special education teacher must consider the following when teaching arithmetic to the intellectually disabled students:

1. Arranging the students in small groups.
2. Using concrete materials in teaching arithmetic.

3. Applying mathematics on practical situations related to purchasing, farming, gardening, handcraft, and sport.

Teaching science and health to the intellectually disabled students

MajidaAlsiedObied (2000) indicated that the science course for the intellectually disabled students must include teaching them taking care of pets and birds, school gardening, knowing the seasons and weather changes, identifying the types of harmful insects and knowing the five senses and their organs. In health course the curriculum must include, knowing the infectious disease, learning some healthy habits, knowing the manners and places of urinating and training students on personal hygiene, dressing and first aid skills.

Previous Literature

The study of Goodnough& Woods (2002) aimed at determining the students' and teachers' perceptions of the mental maps and their attitude towards them. The researchers trained 16 students from the fifth and sixth grades in one of the American schools for ten months. The students were trained on designing mental maps in a science course for four days a week in which each session lasted for 90 minutes. The results showed that the students consider mental mapping an effective funny and suspenseful teaching method that enhances learning the scientific concepts. Most of the students prefer the mental maps that they designed by themselves. The teachers support using the mental maps' technique in teaching since it elevates the learning motivation and adds suspense to the teaching process.

AalRahma (2004) conducted a study to find out the effect of the integration of the mental mapping and the learning cycle on the real-time and postponed academic achievement in the "Motion, Force and Pressure" unit in the science course for the female students in the first preparatory grade in the Kingdom of Bahrain. The study sample consisted of four groups, the first group (of 26 students), was studied using the traditional method; the second group (of 28 students) was studied using the learning cycle method; the third group (of 23 students) was studied using the mental map method; the fourth group (of 33 students) used the process of merging the mental map and the learning cycle methods. The students sat for an exam before carrying on the programs, after that and two weeks after the end of the programs. The bilateral discrepancies showed the existence of statistically significant differences in the average of the students' achievement in favor of the integrated method group.

The study of Akinoglu&Yasar (2007) aimed at identifying the effect of notetaking using the mental maps on learning the concepts during the science class. It also aimed at determining the academic achievement and the attitude of the elementary stage students towards science. The researchers used qualitative research and experimental method. Eighty-one students were randomly selected from the sixth grade in a public school in Istanbul, Turkey. The students of the control group were taught using the traditional method while the students of the experimental group were taught using the mental maps method. The results of the field experiment showed positive statistically significant differences in learning scientific concepts due to using mental maps. The researchers recommended employing this method for teaching science.

The study of Almane'i (2008) aimed at investigating the effect of using the mental mapping strategy on reading comprehension in the English language among the Saudi first-year university female students. An experimental study, with post and pre-tests, was conducted



upon a sample of 122 students studying in the English Language Department. The analysis of the results showed that the performance of the experimental group increased significantly in the post-test in comparison with their performance in the pre-test. The researcher concluded that the strategy is positive and effective since it increased the students' reading comprehension level.

Alqubilat and Alobiedi's study (2009) aimed at knowing the impact of three mental mapping strategies on academic achievement, conceptual comprehension, and problem-solving in mathematics among (124) students from the tenth grade in Dhiban, Jordan. The experimental group was exposed to the mental mapping strategy according to teacher-students construction, students' construction and a teacher's construction while, the control group was taught using the ordinary method. All the groups sat for an exam that tests the conceptual comprehension and problem-solving before and after conducting the program. The results revealed that the students of the experimental group, who studied using the mental mapping strategy, excelled in the achievement of the students of the control group.

Waqquad (2009) conducted a study to determine the efficiency of using the mental mapping strategy on academic achievement in some of the biology topics. The researcher used the experimental method on a sample from the first secondary female students. She also used an achievement test, designed by the researcher, in addition to a teacher guidebook to teach the chosen topics. The researcher found out that there are statistically significant differences between the pre- and post-tests among the control and experimental groups.

THE STUDY PROCEDURES

The procedural steps:

To conduct the practical part of the current study, the researcher followed the following steps:

1. Having access to the files of all the children registered in the fifth grade in Rafha's intellectual schools.
2. Identifying and homogenizing the study's sample.
3. Preparing the mental mapping program of the mathematics course for the fifth-grade educable students with intellectual disabilities in the Kingdom of Saudi Arabia.
4. Applying the achievement test on the intellectually disabled students in both groups (the experimental and the control).
5. Exposing the students in the experimental group to the independent variable (the program) and leaving the students in the control group without being exposed to this program.
6. Conducting a post-test on the students of the experimental and control groups at the end of the program. Accordingly, the experimental design of the current study could be represented as the following:

The experimental group: pre-test- implementing the program- post-test.

The control group: pre-test - post-test.

7. Conducting the follow-up test one month after implementing the program.
8. Using the appropriate statistical methods and concluding the study's results.
9. Interpreting the study's results considering the theoretical framework and the previous studies.



10. Drawing educational recommendations related to the study's topic.

Study tools:

The researcher used the following tools in the current study:

1. Child's primary data collecting form (designed by the researcher).
2. Mental mapping program specially designed for the mathematics course of the fifth-grade educable students with intellectual disabilities in the Kingdom of Saudi Arabia (designed by the researcher).
3. Observation form of children with intellectual disability (designed by the researcher).
4. Mathematics academic achievement test (designed by the researcher).

The Study Design

The researcher used the experimental design of two equal groups. One group studied using the Mental Mapping method while the other used the traditional method (Dawod and Abdulrahman: 1990) as shown in table (1).

Table 1: Experimental design.

Post-test	Independent variable	Pre-test	Group
Achievement exam	Mental Mapping	Achievement Exam	Experimental
	Traditional method		Control



Study sample and population:

The study population means all the visible items studied by the researcher (Milhim: 2002), which includes the special education fifth-grade students in Rafha province (2018-2019).

The study sample consisted of 18 students divided into an experimental group of 8 students and a control group of 10 students from the fifth-grade special education classes in Haroun Alrashied elementary school 2018-2019.

Equality between the study groups:

The researcher did his best to create a state of equality between the control and experimental groups in terms of the various variables that may affect the dependent variable (Table 2), which are:

1. The chronological age in months.
2. The final mark of mathematics in the fifth grade in 2017-2018.
3. Fifth grade general average in the academic year 2017-2018.
4. Fathers' educational attainment.
5. Mother's educational attainment.

Table 2: The calculated T-value of the equivalence variables of the study sample's members

Variables	Group	Number	Mean	Standard Deviation	The Calculated t-Value	The Tabulated
Chronological Age in Months	Experimental	8	121.875	7.33755	1.9820	2.120

	Control	10	127.6	4.9035	
Mathematics Subject's Mark	Experimental	8	7.875	1.7268	0.2210
	Control	10	7.7	1.6227	
General Average	Experimental	8	7.4687	1.0559	0.7657
	Control	10	7.85	1.0446	
Fathers' Educational Attainment	Experimental	8	8.6250	4.4057	1.2844
	Control	10	6.2	3.6147	
Mother's Educational Attainment	Experimental	8	7.125	1.5526	0.4970
	Control	10	6.4	3.8643	

The results show that there is no statistically significant difference between the two groups at the level of 0.05, and a degree of freedom of 16 since the calculated t-value is less than the tabulated value (2.120) which indicates that the two groups are equivalent in terms of the variables mentioned in the above table.

Preparing the educational plans

The material was limited to the topics of the mathematics textbook of the fifth elementary grade which are comparing numbers, ordering numbers, adding two-digit numbers, subtracting two-digit numbers, forms, and plane figures. In light of these topics, the researcher specified the behavioral objectives and depended on Bloom's taxonomy in this cognitive domain within its three levels (knowledge, comprehension, and application). The sum of the behavioral goals is 32. Accordingly, twelve education plans were prepared for the two groups; the experimental group that studied using the mental mapping method and control group that studied using the traditional method. These plans were submitted to a group of experts specialized in special education and psychology and according to their guidance and remarks the plans were modified.

Preparing the study tool

Preparing the achievement exam

The achievement exam was developed in light of the six topics of the fifth grade's textbook and following the steps of making a specifications table (Alqemish et al, 2001). The items of the achievement exam are (20), which measure the three levels of Bloom's taxonomy (knowledge, comprehension, and application). The first (10) items are three-option multiple-choice questions and the remaining items are "True or False" items that need to be chosen by putting

a cross or a tick mark next to the sentence. These items were reviewed by a group of experts, specialized in special education and psychology, and in the light of their views and remarks, the items were modified. Table (3) illustrates the achievement exam's specifications table.

Conducting a pilot study

The achievement exam was conducted upon a pilot sample of 10 students from the fifth-grade special education classes in Haroun Alrashied elementary school on 6/1/2019. The researcher graded the students' answers and distributed them into two groups; upper and lower, to calculate the difficulty coefficient and the discrimination power. The difficulty coefficient was between 0.30-0.70, which is considered a good result as stated by Althahiret al. (2002) since the difficulty coefficient is between 0.20-0.80. Meanwhile, the discrimination power ranged between 0.40-0.80.

Table 3: Achievement exam's specifications.

Content	The Number of Sessions	Concentration Ratio	Knowledge	Comprehension	Application	Sum 100%
			37.5%	25%	37.5%	
Comparing Numbers	2	11%	1	1	1	3 items
Ordering Numbers	2	11%	1	1	1	3 items
Adding Two-Digits Numbers	3	18%	1	1	1	3 items
Subtracting Two-Digits Numbers	3	18%	1	1	1	3 items
Shapes	4	24%	2	1	2	5 items
Plane figures	3	18%	1	1	1	3 items
Sum	17 sessions	100%	7 items	6 items	7 items	20 items



Reliability

The researcher found the tool's reliability using the Kuder-Richardson formula (20) since it is used for the objective achievement testing in which the student's answer is either right or wrong (Milhim, 2009), and the achievement exam's reliability is 0.90.

The study tool grading criterion

The items of the achievement exam were graded by giving one mark for each right answer and a zero for the wrong answer, the unanswered questions, or the item with two answers.

Carrying out the experiment

The experiment was initiated on Sunday 6/1/2019, after meeting the research's requirements that include the two groups' (experimental and control groups) equivalence, preparing the education plans and the achievement exam. The experiment was finished on Tuesday 30/4/2019.

Conducting the tool's post-test

The post-test was conducted on the students of the experimental and control groups on 2/5/2019 under the researcher's supervision.

- Statistical Instruments:

1. Two independent sample t-test.
2. Pearson correlation coefficient.
3. Kuder-Richardson Formula.
4. Spearman-Brown formula.
5. Wilcoxon test.

RESULTS AND DISCUSSION

After grading the study tool, the data were statistically processed to verify the study's hypotheses, as follows;

First hypothesis

There is no statistically significant difference between the mean of the experimental group's grades, which studied using the mental mapping method, and the mean of the control group's grades, which studied using the ordinary method, in terms of the academic achievement in the mathematics course among the special education fifth-grade students.

The results showed that the grades' mean of the students in the experimental group, who studied using the mental mapping method is 15.5000, and the grades' mean of the students in the control group, who studied using the ordinary method is 13.0000. A statistically significant difference is found at the level of 0.05 and a degree of freedom of 16 since the calculated t-value is bigger than the tabulated value which is 2.120 (Table 4).

Table 4: The results of the t-test for the experimental and control groups regarding the achievement.

Group	Number	Mean	Standard Deviation	T-value	
				Calculated	Tabulated
Experimental	8	15.5000	1.19523	3.043	2.120
Control	10	13.0000	2.05480		

This indicates that the students of the experimental group, who studied using the mental mapping method, excelled the students of the control group, who studied using the ordinary method. Thus, the first hypothesis is rejected since the mental mapping is an effective method in organizing, arranging, and summarizing the scientific material for the students.

Second hypothesis

There is no statistically significant difference between the average achievement grades in mathematics in the pre- and post-tests of the experimental group's students, who studied using the mental mapping.

The results showed that the mean of differences between the pre- and post-tests of the experimental group is 8.6520 while the standard deviation is 6.32314. The calculated t-value is 3.8580 which is bigger than the tabulated value (2.365) at a significant level of 0.05 and a degree of freedom of 7 (Table 5).

Table 5: The t-value of the experimental students' pre- and post-achievement test.

Group	Number	Mean			Standard Deviation	T-Value	
		Pre-	Post	Difference		Calculated	Tabulated
Experimental	8	62.750	54.1250	8.6250	6.32314	3.8580	2.365

This indicates the existence of a difference between pre- and post-tests in favor of the post-test. Thus, the second hypothesis is rejected since the mental mapping can modify the academic achievement of the students of the experimental group in terms of organizing and summarizing the scientific material and introducing it simply and attractively which enables the students to focus on the material using this different way.

Third hypothesis

There is no statistically significant difference between the experimental group's average grades of the post and follow-up tests. To test the validity of this hypothesis, the difference between the grades means of the students of the experimental group in the post and the follow-up tests were calculated using the Wilcoxon test (Table 6).



Table 6: Illustrates the significant difference between the experimental group's average grades in the post and follow-up achievement tests

Direction	N	Mean Rank	T-Value	Z-Value	Significance Level
Negative ranks	6	6.5	16	1.173	Insignificant
Positive ranks	4	4			
Equal	0	-			

Table (6) clarifies that there are no statistically significant differences between the post-tests' means of the students of the experimental groups in the post and follow-up tests in terms of achievement, since the (Z) value is insignificant, which indicates the effectiveness of the mental mapping in organizing, arranging, and summarizing the scientific material for the students.

CONCLUSION

In light of the study results, the researcher concludes the effectiveness of the mental mapping in improving the achievement of the students of the special education fifth elementary grade in mathematics.

Recommendations

In light of the current study, the researcher recommends the followings:

1. Mental maps in teaching special education students mathematics by their teachers.
2. The necessity of training the special education teacher on using the mental maps since it enhanced the academic achievement of the educable intellectually disabled students.
3. The necessity of providing the teachers with a guidebook that explains the nature of the mental maps, how to use them, and how to train the students through these maps. Conducting training sessions for the science teachers on applying the mental maps strategy in teaching their courses.
4. The need for furnishing the curriculum with diagrams that clarify the relations between the concepts to enable the student to acquire these concepts and distinguishing between them.
5. Eliminating the traditional way in teaching concepts, which focuses on the mere acquiring of data and knowledge and creates a kind of dependence on the teacher that makes such knowledge less significant and less valuable for the student and focusing instead on the teaching strategies which are based on participating, interacting, and positiveness such as the mental maps.

Proposed Researches

The researcher suggests conducting the following researches:

1. Conducting a similar study in other subjects and on different academic stages.
2. Studying the effect of the mental maps on other variables such as, science operations' acquisition, creative thinking development, and adjusting the teachers' misunderstanding.
3. Conducting comparative studies between the mental mapping strategy and other modern teaching strategies such as learning cycle, cooperative learning, investigative learning, problem-solving, and fast learning.

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