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The effect of employing Digital Mental Representations on developing comprehensive thinking and communication skills for success among preparatory school Female students in mathematics

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Abstract

The effect of Digital Mental Representations on the development of comprehensive thinking among fourth grade middle school
A cohort of math students participated in a research study. The investigation divided them into two groups: an experimental group and a control group. The total count of students was 64, with 33 in the experimental group and 31 in the control group. The experimental group utilized an innovative electronic mind mapping technique to learn mathematical concepts, such as induction and deduction. Meanwhile, the control group followed the conventional teaching method. Throughout the study, the experimental group was instructed via electronic mind mapping, and the control group received instruction in a typical classroom setting. Before and after the study, both groups were given a pre and posttest with a highly reliable coefficient of 0.87. The test results were utilized to assess the levels of achievement.
showed that there were statistically significant differences between the two groups in favor of the experimental group due to the use of electronic mental maps.

Keywords- Digital Mental Representations. Thinking. Comprehensive thinking.

أثر توظيف التصورات الذهنية الرقمية في تنمية التفكير الشامل والمهارات التواصلية على النجاح لدى طالبات المرحلة الإعدادية في الرياضيات

الملخص

معرفة اثر توظيف الخرائط الذهنية الالكترونية في تنمية التفكير الشامل ومهارات التواصلية على النجاح لدى طلبة الصف الرابع الاعدادي في الرياضيات. استخدمت هذه الدراسة تصميم بحث شبه تجريبي مع مجموعات ضابطة وتجريبية. تكونت عينة الدراسة من (64) طالباً ، منهم (31) في المجموعة الضابطة و (33) في المجموعة التجريبية. درست المجموعة التجريبية مهارات الرياضيات (الاستقراء- الاستنتاج) باستخدام استراتيجية الخرائط الذهنية الإلكترونية ، بينما درست المجموعة الضابطة نفس المهارات بالطريقة التقليدية. تم تدريس المجموعة التجريبية باستخدام الخرائط الذهنية الإلكترونية ، بينما تم إعطاء المجموعة الضابطة تعليمات الفصل التقليدية. تم إجراء اختبار تحصيلي بمعامل ثبات (0.85) لكلا المجموعتين كاختبار قبلي وبعدي. أظهرت النتائج وجود فروق ذات دلالة إحصائية بين المجموعتين لصالح المجموعة التجريبية تعزى لاستخدام الخرائط الذهنية الإلكترونية

الكلمات المفتاحية :- تصورات الذهنية- التفكير الشامل –المهارات التواصلية – الرياضيات .

THE PROBLEM OF RESEARCH AND IMPORTANT

Girls in the fourth grade who are in the preparatory stage of their academic careers find mathematics to be an engaging and challenging subject; but, for others, the subject's rules and nature are a barrier to success. Mathematics is the bedrock of 21st-century scientific advancement, however most students study only to pass examinations rather than to understand the subject on a deeper level. Many also experience hate, dread, anxiety, and loneliness towards the subject. Across grade levels, female students may be subject to these assumptions and biases, which might hinder their mathematical performance. However, when it comes to teaching mathematics, the instructor sticks to tried-and-true approaches. Researchers used electronic mental maps, a type of modern thinking-based teaching strategy, to help fourth grade math students learn to think comprehensively by creating patterns to build links using various thinking processes (sequence-arrangement and different mental operations). Given the above, the following primary inquiry surrounds the issue of the present investigation: How can students in the fourth math preparation stage use electronic mental maps to improve their capacity for holistic thought?

The importance of the current research is reflected in the following points:

- The use of digital mind maps to foster students' capacity for holistic reasoning in mathematics education is the subject of this pioneering research..

- This study helps students in the fourth year of middle school to understand the laws of mathematics, its nature, and basic mathematical skills, which helps to raise their level in mathematics.

- The current study may contribute to pushing students towards a better level and developing thinking, as the use of electronic mental maps increases students' effectiveness, by shifting them from learning based on memorization to learning based on conclusion, investigation, and thinking - induction.

The current research presents a theoretical framework related to electronic mental maps and the procedural steps for designing lessons through them, their importance and the pillars on which they are based, and the development of comprehensive thinking in mathematics, its skills and how to develop it.

- The current research is important for mathematics teachers: it restricts them in developing the teaching of mathematics in the preparatory stage and in other educational stages through the application of teaching procedures.

The current research presents teaching methods based on employing technological innovations aimed at developing comprehensive thinking among female students, and enabling them to train female teachers on these trends.

- Useful for researchers in educational psychology, curricula, and methods of teaching mathematics: research opens room for further studies; Develop comprehensive thinking of mathematics by using modern teaching strategies and models that keep pace with global changes

Terminology

Digital Mental Representations

It is a technology that aims to transform information from its complex image into a set of shapes and images using one of its design programs after assimilating the information and achieving learning pleasure when studying it.(18)

The procedural definition is a computer program used by fourth-grade students in the experimental group to help them analyze and organize ideas to understand mathematics using tables, numbers and colors. gradient curves. Using this technique, students can provide scales and colors to match the main and sub-ideas. These were mind maps**.**

Thinking

The deliberate investigation of experience for a purpose, and that purpose may be understanding, decision-making, planning, problem-solving, judgment, or action.(6)

The procedural definition is Thinking is those acquired abilities or intellectual tactics that enable one to perform the various cognitive operations in the list of identifiable thinking skills.

Comprehensive thinking

"a sequence of symbolic processes". It makes use of symbols, concepts, images, and concepts. Images are either sensory or verbal. The symbols represent or stand for objects or events in the environment. Therefore, thinking involves representative processes. (1)

Research Goals

1-Measuring the effect of using Digital Mental Representations

on developing comprehensive thinking skills among 4th preparatory Female students in mathematics.

2- There are statistically significant differences between the scores of the experimental group and the control group in the post-measurement in favor of the experimental group

3-Designing Digital Mental Representations that develop comprehensive thinking skills for among 4th preparatory Female students in mathematics.

Search Limits

- Human Limitation: High School with Al-Sawary for girls / Rusafa 2.
- Time limit: three chapters of the book of mathematics scheduled for the fourth grade preparatory, for the year (2022/2023).
- The spatial limit: the province of Baghdad

Theoretical framework

Digital Mental Representations

- Life in the information age is characterized by many rapid and successive changes in knowledge. There is also a huge explosion of information, and electronic mind maps are among the modern technological techniques that help in thinking and facing current challenges and developments in the amount of knowledge, because they help to organize and arrange them in a simple way, especially in mathematics that must be understood. (18)

• It's the best tool for organizing thoughts, the simplest way to input data into the brain and then retrieve it later, and a creative and efficient way to take notes. Numerous characteristics unify all mind maps, such as their use of colors, unifying natural structure, and beginning with a center from which lines branch out, emulating the shape of a neuron. Moreover, all mental maps incorporate words, symbols, and lines in addition to imaginary diagrams, transforming notes and summaries into a coherent, vivid, and memorable diagram that functions appropriately and similarly to how the brain functions. (4)

The importance of using electronic mind maps in the educational process:

1. Mind maps contribute to the development of students' creative thinking.

2. It works to arrange and organize ideas, or I see the relationships that link different topics or ideas in the scientific topic.

3. Contribute to the development of students' skills in the technical field.

4. Make education fun and exciting by using new and innovative tools that make learning easier than traditional.

5 - The educational process indicates that it takes into account the individual differences of the learners and motivates them to be creative. (2)

Electronic mind maps help develop comprehensive thinking through the use of different thinking skills.

Comprehensive thinking

"Visual diagrams associated with basic thinking skills that enable the learner to reformulate the cognitive content in his own way" (3) describes electronic mind maps. Teachers and students of all subject areas and skill levels may benefit from using mind maps, which are visual thinking tools, to organize and conceptualize complex concepts and information. (5)

Where thinking constitutes an active and accurate evaluation of all assumed knowledge about a fact or phenomenon with logical and empirical coherence. This is because developing thinking is about focusing on research, evaluating the data obtained, and thus explaining judgment with a critical and contextual basis . (16) logic and rationality that seeks to solve problems. Thus, the development of mental activity is the product of personal effort from the interrelated capacities of memory, attention, comprehension, and learning. (20)

Thus, it is important for the management of learning to focus on developing comprehensive thinking and enabling the development of students' research files and increasing their relevance in confronting facts and phenomena. The development of comprehensive thinking involves the use of various mental processes to perform analysis and evaluation, such as classification, selection, value judgments, and application, as well as interpretation, inference, and interpretation.(9)

Mathematics

Knowing all the relationships between the many facts and words that make up mathematics is crucial for delving into this fascinating field.

In school, kids frequently have lower preferences for the topic of mathematics. A number of characteristics, such as attitude, motivation, and the way that students are taught, are linked to their poor performance in mathematics. Math performance issues in high school are typically attributed to teachers. As to Aguaga (quoted in 22), the old method of mathematics teaching persists, which has been deemed insufficient and a significant contributor to pupils' subpar performance in the subject. Thus, the purpose of this study was to examine how fourth-grade pupils at

Al-Sawary School for Girls / Al-Rusafa performed mathematically after beginning to learn mind maps.

Improving pupils' material acquisition is a goal of successful teaching methods used throughout education. Hence, throughout the last few decades, pedagogical frameworks grounded on the constructivist tenets of education have evolved. (13). These methods encourage student agency in knowledge creation while also accommodating the limitations of working memory in an effort to improve academic achievement. It is obvious that familiarity with visualization tactics is necessary when knowledge is seen as a connection between ideas and suggestions. According to, there is a plethora of options for content visualization.Visual metaphors, semantic networks, idea maps, mind maps, and conceptual diagrams all fall within this category.(19)

In the late 1960s, Tony Buzan developed mind maps as a tool for both students and instructors to take notes creatively using visuals and simple language. Many find that mind maps are more efficient in terms of both creation time and memorability and revision ease due to their visual character. It is simple to make connections and references to various parts of a mind map since it is not linear (15). Another reason mind maps are so useful for studying is that they make it simple to review previously covered material with just a quick look. If you are familiar with the structure and form of mind maps, you will find that they aid with memorization. They need far more mental effort than conventional methods of instruction when it comes to processing and integrating new knowledge. (14)

1- It helps when defining key terms and the relationships among them, creating a meaningful structure, and making the necessary connections and relationships understandable.

2- It allows the implementation of new information in the context of broader groups of words and pictures that integrate the two hemispheres of the brain into the learning process and make learning mathematics more effective.

3- It helps to develop cognitive skills and the ability to analyze, classify and group terms.

4- It enables and stimulates close, divergent, critical, strategic and complex mathematical thinking. The shape, colors and structure of the map will enable the information to be remembered better.

5- Develop a comprehensive and complex understanding of mathematical terms and properties

6- They support the development of metacognitive skills - learning how to learn and think about knowledge.

7- Functions of mind maps:

- Self-diagnosis (for the student) - The mental map allows the student to clearly know his perceptual and cognitive arrangement of the subject under discussion.

- It also provides the possibility of observing one's own learning actions - It develops the metacognitive abilities of the student.

- Diagnostic (for the teacher) - The mind map is a tool for identifying attitudes to make decisions about the nature of educational intervention.(17)

It is also a diagnostic tool to determine the level of understanding of the student who accepts new concepts and activates the mind, as well as providing suspense for the scientific subject and the study in general, and achieving pleasure and helping to remember important ideas and retrieve information easily and simplify it appropriately, it is used for quick review of topics by learners when they do so . to do that. You do not find enough time to review its details, and you also work to develop the learners' skills in artistic creativity to clarify the data and information that make up the subject, increase the learner's self-confidence, make him feel that he is capable of production and creativity, and build a mind map that leads to transforming abstract concepts into diagrams. . that can be dealt with with understanding.

Mind maps will enable students to orient themselves in the grid of mathematical terms

Therefore, electronic mind maps need special planning and design for each lesson.

Digital Mental Representations exercises that are interactive

1- After downloading and installing the application on the computer, launch it.
2- From the application or program's templates, select the suitable mind map template.
3- Put an image that captures the map's theme next to the text that describes it to create the main notion.
4- 4-Count the number of map branches that comprise the primary idea's content, then begin constructing it by clicking the symbol on either side of the concept and dragging in the desired direction.
5- Text has been added to the main branches, and more content (photos, sketches, videos, text files, and shapes) can be added at will.

6- Sub-branches were developed from the main branches, and text files, images, videos, and other types of information were added. Smaller terminal ends, if any existed, were likewise made and expanded upon until the minimum degree of branching was attained.

7- The ability to move the written text in a color that matches the sounds it pronounces, as well as the possibility to include an audio clip that will enable the text to be read aloud while being shown.

8- The ability for each map element to have its color and shape altered to suit the designer's preferences.

9- Choosing a color that complements the map's theme allows you to alter the mental map's background.

10- The ability to synchronize the size, placement, and color of the map's parts as well as the ability to create visual links between two or more of them to make their relationship more apparent.

11- The ability to modify the process and timing of displaying information on a mind map prior to exporting it.

12- Emailing the mind map in any format that the program supports, such as a picture, video, flash file, PDF, WEB file, or another type.

12- Emailing the mental diagram For the following reasons(11)

The researcher employed the (I Mind Map10) program to create interactive electronic mind maps for her study: it is the only one that mind map creator Buzan has approved of. Its design is incredibly adaptable. For the pupils, it provides a joyful, exciting, and suspenseful environment. - Fonts, colors, backgrounds, and artwork are allotted by the program. - The ability to add symbols, drawings, or actual images that are saved on a computer or the Internet, as well as the flexibility to alter the produced maps whenever you choose.

i. The ability to use presentations to show prepared maps. - Sending it as a PDF file or an image with ease.

II. RESEARCH METHODOLOGY AND PROCEDURES

Comprehensive reasoning test

Comprehensive thinking skills appropriate for their development among the fourth grade preparatory female students were determined in the light of the content of the mathematics curriculum "Chapters One and Two". These skills were five basic skills that included sub-questions, taking into account the skills in the test prepared for the study. The comprehensive thinking test, in its final form, consisted of (thirty-two) questions in the light of the objectives of the fourth grade preparatory curriculum. The researcher prepared the test questions according to the following:

First: Design Experiments

There were experimental and control groups in this quasi-experimental design study. There was a pre- and posttest design. Electronic mental mapping technology was used to study the experimental group and to enhance fourth preparation students' cognitive abilities. female math students, and there was no treatment given to the control group. They received instruction in the same subject matter as the experimental group, but in a conventional manner..

Second: Determining the Scientific Subject:

The scientific subject (Chapters One and Two) was identified by the researcher from the Fourth Preparatory Mathematics Book for the year (2022-2023).

Third: the formulation of behavioral goals:

the test to assess the comprehensive thinking skills of fourth year middle school students.

Fourth: Determine the list of comprehensive thinking skills measured by the comprehensive test

that were tested in the first test and the second test material that was tested in the first test, deduction - investigation and deduction - solving equations)

fifth: Research Community and Sample

The current research community represents4th preparatory Female students school girls of the General Directorate of Education of Baghdad Governorate / Second Rusafa for the academic year 2023-2024.

The researcher intentionally chose the research sample from Al-Sawary Secondary School for Girls to be the field of the current research.

She chose two sections using the simple random drawing method (Section C) to represent the experimental group studying mathematics according to the electronic mind map strategy. (Section D) to represent the control group that studies mathematics according to the usual teaching method.

The number of students in the research sample was (64) students, (33) for the experimental group, and (31) for the control group.

Sixth: Test instructions

Putting instructions to the test: After you have developed an idea ready for testing.

1- Data for female students, which are the name, section and name of the school

2- Instructions for measuring by number

3 - Instructions for answering the questions in the various different stores located in the appropriate place.

The test was in its final form of thirty-two questions, and it was tested with (1) mark, while the correct answer was (0).

Seventh :An exploratory application for the comprehensive reasoning test

Verifying the stability of the comprehensive thinking test in mathematics, the subject of the study, based on an exploratory sample from a sample outside the study sample consisting of (39) female students. Test of school students ( ) with the aim of calculating the validity and reliability of the school test for girls of the General Directorate of Education of Baghdad / Al-Rusafa Governorate in comprehensive thinking skills in mathematics.

To calculate the validity and reliability of the test and the test time to test their ability to measure the performance of the students of the General Directorate of Education Baghdad / Rusafa in comprehensive thinking skills in mathematics

Eighth: correcting the test

The validity of the study tools

- After completing the preparation of the mathematics test for the development of comprehensive thinking (deduction - induction - conclusion - investigation)) they were presented to a group of arbitrators from Iraqi universities and to a group of educational supervisors who have master's and doctoral degrees in mathematics and its curricula

To express opinions, and then judge the validity of the study tool.

- Internal consistency validity

Exam test and grade

1)) Trade table of the correlation between a question of the comprehensive thinking test and the total score of the test

It is clear from Table (1) that most of the correlation values are higher than (05.0) at (38) degrees of freedom, and therefore it is characterized by a high degree of consistency

Correlation coefficient between comprehensive thinking test questions in mathematics and the total score of the test table (1)

significance level	semantic value	correlation coefficient	N	significance level	semantic value	correlation coefficient	N
(0.01)	0.002	0.544**	21	(0.05)	0.038	0.353*	1
(0.05)	0.004	0.423*	22	(0.01)	0.00	0.523**	2
(0.05)	0.0432	0.328*	23	(0.01)	0.07	0423*	3
(0.01)	0.021	0.526**	24	(0.05)	0. 034	0.317*	4
(0.01)	0.004	0.423*	25	Unknown	0.28	0.170	5
(0.01)	0.001	0.544**	26	(0.05)	0.034	0.384*	6
(0.01)	0.003	0.533**	27	Unknown	0.398	0.221	7
(0.01	0.002	0.543**	28	(0.05)	0.02	0.352*	8
Unknown	.0 172	0.223	29	(0.05)	0.003	0.411 *	9
(0.01	0.00	0.551**	30	(0.05	0.02	0.432**	10
(0.01)	0.005	0.444**	31	(0.05)	0.005	0.441**	11
(0.05)	0. 0327	0.327*	32	(0.05)	0.03	0.349*	12
(0.01)	0.001	0.427**	33	(0.05)	0.04	0.342*	13
(0.05)	0.028	0.322*	34	(0.05)	0.037	0.314*	14
(0.05)	0.025	0.341*	35	(0.05)	0.003	0.463**	15
(0.05)	0.02	0.323**	36	(0.05)	0.032	0.315*	16
(0.01)	0.007	0.423**	37	Unknown	0.225	0.199	17
(0.05)	0.045	0.322*	38	Unknown	0.75	0.123	18
Unknown	0.432	0.129	39	(0.05)	0.0432	0.328*	19
Unknown	0.818	0.131	40	Unknown	0.818	0.131	20

The tabular value of (t) at (38) degrees of freedom and at the level of significance 0.05 = 0.3

Table (1) shows that most of the correlation values are higher than (0.05) at (38) degrees of freedom. Therefore, the test is characterized by a high degree of consistency.

Test Reliable

split-half Method

The test questions were divided into two parts: questions with odd numbers and questions with even numbers, where the Pearson correlation coefficient was calculated between the first half of the test and the second half of the test, and it

was (0.74), and then the value was corrected by applying the Spearman-Baron half-partition equation, and it was (0.85).).

Richard Coder method

We conclude that the value of the stability coefficient by the half-part method = 0.85 and by the Coder Richard method = 0.84

Discrimination treatment

Shows the discrimination treatment for each question of the visual reasoning test and the total score

Table(2) for each question.

discrimination	N	**discrimination**	N
0. 36	21	0. 36	1
0.36	22	0. 36	2
0.27	23	0.45	3
0.27	24	0.45	4
036	25	0.18	5
0.45	26	0.27	6
0.54	27	0.18	7
0.54	28	0.45	8
0.18	29	0.45	9
0. 36	30	0.27	10
0.37	31	0. 36	11
0. 36	32	0. 36	12
0. 36	33	0. 54	13
0.37	34	0.51	14
0. 36	35	0.62	15
0.54	36	0.36	16
0.54	37	0.18	17
0.50	38	0.09	18
0.09	39	0.62	19
0.18	40	0.09	20

As it became clear from the previous table that most of the good muscle is deleted and replaced.

(0.27), which is eight, so the questions that are less than the discrimination coefficient were deleted

(5-7-17-18-20-29-39-40)

Ninth : study tools

Acova Test-

For deviations t-test –

I Mind Map software

Comprehensive reasoning test, mathematics

Tenth :Adjust variables before starting the experiment:

The researcher modified some of the study variables

1. Adjusting the gender variable: as all the sample members are female students.

2. Adjusting the age variable: The researcher monitored the ages of the students of the two groups (experimental and control) in order to adjust the age variable and make sure of that.

There were no differences in the mean ages of the groups

eleventh : Study procedures

. 1- Preparing a mathematics test to develop comprehensive thinking in its initial form and presenting it to a group of specialists and experts in it to make appropriate adjustments and determine its validity and stability in order to reach its final form and the extent of its conformity with the two tables. of specifications.

2- Preparing a teacher's guide for using electronic mental maps.

3- Ensure the readiness of tools, materials and equipment in the selected schools before starting the implementation of the study.

4- Applying the survey on time.

5- Pre-application of the () mathematics test in comprehensive thinking skills on the study groups on today's date

Mathematics in comprehensive thinking skills in study groups per day (T 5- pre-assessment test)

Date

6- The study began on the day of the offering and the study continued. Each group was taught four weekly lessons.

7- Subsequent application of the mathematics test in comprehensive thinking skills to the study groups in days.

8-To test validity of the test (SPSSSS), debug the test and perform the appropriate statistical manipulations using the program

Hypotheses and answers to the study questions.

9- Presentation, discussion and interpretation of the results in the light of the study hypotheses and previous studies.

10- Draw the results of the study and present the appropriate recommendations and suggestions in the light of the findings of the study.

Accordingly, the total score of the test is equal to (32) degrees, and a set of controls were taken into account when preparing and applying the test:

1- The test contains all comprehensive thinking skills in the light of the first and second chapters "Mathematics".

2- Ensure the correctness of the figures and the clarity of the issues.

3-. Choice of shapes, clear drawings, and special instructions (1st and 2nd semester, Mathematics).

4- Taking into account individual differences among students.

The probability of a correct answer to an alternative.

6- The exploratory application of the comprehensive thinking test.

Twelfth : the groups' equivalence in the comprehensive thinking test

The arithmetic means and standard deviations were calculated for the experimental and control groups in the pre-application of the mathematics test as shown in the following table (3)

type of group	variable	N	average	standard deviation
experimental group	Electronic mind maps	33	11.39	3.50
control	traditional	31	11.32	3.22

THE RESEARCH FOUND THE FOLLOWING INFORMATION Group equivalency

The pre-test means, standard deviations, and (t) for the control and experimental groups are displayed in Table 4. The achievement pre-test scores did not significantly differ between the control and experimental groups, according to the t-test results (t=0.504, P=>0.05). These findings suggest that the two groups—Control and Mind Map—were comparable**.**

Table 4:- t-values, standard deviations, and means for the pre-tests administered to the Digital Mental Representations and control groups

Achievement	Means	N	Means	S.D	df	t	p	
Test	control	34	11.96	6.07	63	0.504	0.61	
	Experimental	32	12.64	4.74				

Both the experimental and control groups' post-test means and standard deviations are shown in Table 4. The results show that there is a difference between the two groups in terms of student accomplishment.

Table 5: The post-test means and standard deviations for each group (control and Digital Mental Representations)

Achievement	Groups	N	Means	S.D
Test	control	34	15.93	5.35
	Experimental	32	20.76	4.85

The findings of the analysis of covariance (ANOVA) are shown in Table 5, which shows that the control and experimental groups are statistically different. The F-ratio was 21.381 at the p-value of.000. This shows that the mind map approach has a substantial effect on fourth graders' understanding of mathematical ideas.

Source	S.S	df	M.S	F	Sig	Eta^2		
Achievement	730.181	1	730.181	49.869	0.00	0.44		
Group	313.059	1	313.059	21.381	0.00	0.25		
Error	907.808	62	14.642					
Corrected total	2016.154	64						

Table 5 shows the ANOVA results indicating that there was a statistically meaningful distinction between the experimental and control groups. At p =.000, the F-ratio was 21.381. This indicates that the mental map approach significantly influenced the fourth-grade female preparatory students' math performance.

Interpretation of the results

The study was conducted to find out the effect of Digital Mental Representations on developing comprehensive thinking skills for the fourth grade of mathematics. The results showed that there were statistically significant differences between the groups in the achievement test scores in favor of the experimental group. Mind mapping has a positive impact on understanding mathematical concepts and laws. The use of Digital Mental Representations It is necessary for students to create

their own mind maps in order to learn and teach. Through this approach, students can put a variety of talents to use.. Moreover, Students benefit from the use of Digital Mental Representations technology in the classroom since it facilitates their thinking, relational, analytical and focus skills. And the creativity that made the students think, focus and be creative in the solution, which made them feel happy during the solution.

Using electronic Using mind maps to improve thinking is a novel approach. Since thinking involves the coordination of cognitive relationships, By using computerized Digital Mental Representations, pupils are able to establish connections with their cognitive networks., which strengthen cognitive connections and facilitate learning (12); This method is important in forming organized mental images for the learner and facilitating the process of retrieval and activation in the brain, as it is a tool that helps in thinking, remembering and learning. Allow him to understand the academic topics at hand.

By using the Digital Mental Representations that were created by the fourth graders in this study, which were based on the idea of connecting sub-ideas and providing examples of their main assets in a logical and understandable order, the students were able to gain comprehension through textual analysis. The usage of computerized mind maps helped fourth graders better communicate shapes and images, but the freedom to be creative with color was a byproduct of the imaginative computer environment. On top of that, it helped pupils visualize abstract ideas by coordinating the right and left hemispheres of their brains, which are responsible for processing visual information (such as colors and numbers) and language (21) There was consensus that the electronic mind map mimics brain function; so, it rearranged data in a manner that facilitates comprehension and memorization rather than the conventional linear approach. This contributed to the development of thought. It made use of both areas of the brain and activated them simultaneously.

The study employed Digital Mental Representations to teach fourth grade pupils mathematics in a novel and innovative way that may spare them from the monotony and tedium that come with teaching the subject in a traditional manner. Students were encouraged to compete in utilizing their computer talents to prepare for the electronic mind map, which allowed them to develop numerous map ideas and mathematical principles. Working on it in a computer lab made it easy.

The experimental group of children outperformed the control group in the academic achievement test, according to the results. These results support the notion that children who learn mathematics through conventional means frequently struggle to comprehend specific ideas and how they relate to one another..

CONCLUSION

The research found that the experimental group had significantly higher mean scores on the post achievement test scale compared to the control group. The impact of mind maps was substantial. When comparing the two groups' average results on the post-test for mathematical achievement, the experimental group comes out on top, according to statistical analysis.**RECOMMENDATIONS**

1. Offering pre-service training sessions to student teachers on electronic mind mapping technologies can help both teachers and students.
2. Carrying out additional research and methodological investigations with the goal of extending the influence of electronic mind maps on mathematical thinking abilities, among other subjects.
3. Using modern methods to develop thinking in the field of teaching mathematics.

PROPOSALS

1. Conducting a study similar to the current study in the other stages of the study.

2. Conducting a study on the effect of using electronic mind maps on developing comprehensive thinking skills in various subjects

3. Conducting a similar study on males to find out the effect of employing electronic mind maps on developing comprehensive thinking skills for the fourth grade of mathematics

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