European Journal of Humanities and Educational Advancements (EJHEA)
Available Online at: https://www.scholarzest.com
Vol. 4 No.10, October 2023
ISSN: 2660-5589

THE EFFECTIVENESS OF USING THE RECIPROCAL TEACHING STRATEGY IN MATHEMATICAL THINKING FOR SECOND-YEAR INTERMEDIATE STUDENTS IN MATHEMATICS

Assistant Lecturer. Luma Ali Ahmeed Al-Agaili
The General Directorate of Education in Maysan Governorate – Iraq
Email: asala6397@gmail.com

Article history:

Received: August 24th 2023
Accepted: September 28th 2023
Published: October 28th 2023

Abstract:

The study aimed to measure the effectiveness of using the reciprocal teaching strategy in mathematical thinking for second-year intermediate students in mathematics, the researcher followed the quasi-experimental method with the post-test.

The study sample consisted of (42) students who were divided into two groups (Experimental and it' number (21) students taught using the reciprocal teaching strategy, and control and its number (21) students.

Students were taught in the usual way, and the two groups were equivalent on the extraneous variables.

The researcher prepared two tests of mathematical thinking, consisting of (38) items, and validity, reliability, and statistical analysis of the items were conducted.

One of the results of the research was the superiority of the experimental group that used the reciprocal teaching strategy .On the control group in mathematical thinking.

Keywords: strategy, reciprocal teaching, mathematical thinking

THE INTRODUCTION:

The current era is characterized by amazing and rapidly growing scientific development, and the individual will not be able to live

In this era, what is not possible is the necessities of practical scientific life, so educational institutions seek to prepare and train a generation of creative technological teachers, who practice modern educational roles in which the student becomes the focus of the educational process.

Therefore, the greatest burden falls in bringing about learning, and thus the role of the teacher becomes a facilitator, guide, guide, preparer of educational materials, prepare the interactive educational learning environment, and define

To the level of his students, and in preparation for diagnostic and achievement tests, and in light of this, the educational process becomes based on democracy and flexibility(Ghaith, 2003 , p.3) therefore, the search began for special teaching strategies that make the student an active element in the "small village" in which we have come to live, or to develop well-known strategies to be more effective, and to assign them to work or An activity that they carry out together in cooperation, in a comfortable atmosphere free of stress and anxiety, in which their motivation increases to the maximum possible extent (Bani Arshid, 5, 2005). Mathematics, as a basic subject in the various stages of education, and due to its abstract nature and its dealing with symbols, represents a fertile field for achieving these goals, and given the Solving mathematical problems, as an essential component of the content of mathematics curricula in the middle school, is based on a main idea that involves the student thinking about the information he has,it is not hidden from any mathematics teacher that many students have weakness in their acquisition of the subject and their inability to comprehend many of its topics, in addition to their inability to master the basics of that subject and their weak ability to think and analyze. This is supported by many studies, including one (Al-Qaisi, 2001: p. 2). And a study by (Al-Naimi, 2002: p. 3) and (Al-Kubaisi, 2007: p. 28), Mathematics is a cumulative subject and subsequent learning depends on previous learning,if the student has not mastered the previous learning

He will face difficulties in understanding the new topics that are built upon him (Abu Saleh 1996, 4-14) .Educational research and studies have addressed the reciprocal teaching method in its effectiveness in providing students with thinking skills,the effectiveness of the studies that were mentioned in the section of previous studies has confirmed its effectiveness, and it can be defined as a strategy for teaching students that enables them to read with meaning, and to

Teach them to monitor their own absorption and understanding. This teaching includes the teacher and his groups

Student cooperative, where they exchange roles in leading discussion and dialogue regarding a specific topic (Hashey, & Connors, 2003, p. 224-233).

The results of educational research and psychological theories indicated the importance of the reciprocal teaching strategy

According to the following basic aspects:

1- Education is based on a reciprocal teaching strategy, through which students with learning difficulties are taught how to learn well.

2- It is considered supportive education for students, through which they are provided with what supports their learning in an interactive learning environment, sophisticated social negotiation, and scientific and logical discussion all revolving around the content to be learned.

3- As students progress through their studies in different grades, the prescribed curricula become more dependent on the assimilative skills available to each of them.

4- Difficulties in comprehension, if not treated, negatively affect the progress of the learning process among students in

Almost all areas of learning.

5- If skills, any skills, are not taught in the classroom and through the curriculum or the teacher, then there is a great possibility that they will not be acquired by some students themselves. Therefore, it is necessary for the teacher to become familiar with the so-called reciprocal teaching strategy, where the process of discussion and dialogue between the teacher and the student groups is based on the use of four pivotal steps whose goal is to continue and increase the students' active engagement in learning the content to be understood, which are:

- Summarizing the content so that the most important information and data are summarized and identified from parts to the whole.
- Generating, formulating and raising questions about the content and reinforcing the key ideas that were previously summarized.
- Clarifying and discussing difficult or new examples, terms, and concepts.
- Predict the content of the upcoming content and develop hypotheses about it, in order to activate the cognitive element and prepare the ground for new learning

The researcher believes, based on his knowledge of the literature on the subject, that the reciprocal teaching strategy is most common.

They employed it in teaching the subjects of reading texts, and it proved its worth in understanding and increasing achievement in subjects, most of which are humanities. The researcher did not find a study that specialized in mathematics, for example, and it is possible to apply the strategy of reciprocal teaching to mathematics and measure it on mathematical thinking.

THE STUDY PROBLEM

Based on the above, the researcher can define the research problem in the following main question (Is there effectiveness in using the reciprocal teaching strategy in mathematical thinking for second-year intermediate students in mathematics)?

Research hypothesis

There are no statistically significant differences at the level of (0.05) between the average scores of the mathematical thinking test in the posttest between the experimental group taught using the reciprocal teaching strategy and the control group taught using the usual method.

Objectives of the study

The current study aims to:

Measuring the effectiveness of the reciprocal teaching strategy in mathematical thinking among second-year intermediate students in mathematics.

the importance of studying

1- Experimenting with the use of modern teaching strategies in the educational process to develop thinking methods and raise the level of mental ability in response to and keeping pace with contemporary educational trends.

2- Informing mathematics teachers about modern teaching strategies, how to apply them, and the role of both the teacher and the student in them to develop their teaching methods.

3- The need to pay attention and direct the training directorates in the governorate to establish and discuss such teaching strategies when holding development courses for mathematics teachers in the middle school.

4- The researcher will transform the mathematical topics in the mathematics book, which are characterized by dryness and the student's inability to comprehend them on his own, into texts that the student can read on his own and discuss with a group of students in his class under the guidance of the teacher. This may ease the teacher's burden and the material will be organized in order to facilitate the use of the reciprocal teaching strategy and benefit from it. Developing students' reading comprehension.

5- The study may benefit the authors and developers of mathematics curricula on how to transform mathematical texts into texts that are easy to read and understand by the student.

6-The study may benefit mathematics teachers, both male and female, about the importance of mathematical thinking and learning about its skills, especially in the middle stage, because of the importance of this stage in the development of students' mental abilities.

SEARCH LIMITS

The current study was limited to the following:

1- Second year middle school students in the city of Amara/Maysan Governorate/Iraq for the academic year 2021-2022, its second semester.

2- Mathematical topics from the mathematics textbook for the second intermediate grade (Al-Sharqawi et al., 2009, 16th edition), which includes the fourth and fifth chapters, which include the topics (algebraic expressions - mathematical sentences).

In keeping with the limits of the study, and to answer its questions, the researcher followed the following steps:

1- A theoretical study based on reviewing the literature on the subject and previous studies on the concept of reciprocal teaching strategy in particular.

2-Reviewing many studies and research specialized in mathematics and mathematical thinking.

3- Identifying the reality of teaching mathematics in the Iraqi country at the intermediate level.

4-Learning about the foundations and principles of the reciprocal teaching strategy and how to convert the mathematics course into reading texts that are easy to comprehend by students.

5- Preparing the scientific material by analyzing its content and using it to extract:

- Behavioral objectives for the study unit and according to Bloom's cognitive levels for the first three levels (knowledge, understanding, and application).
- Preparing study plans for the educational unit for the experimental and control research groups.
- Organizing and formulating the unit using the reciprocal teaching strategy for the experimental group.
- Identifying the scientific activities that students can carry out while studying the proposed unit.
- Presenting the proposed unit, including its objectives and content, to a group of arbitrators from the specializations of teaching methods, psychology, and some mathematics supervisors who have experience in the field of scientific and environmental teaching, and making the necessary amendments in light of their suggestions.

6- Preparing study tools:

- Achievement test to measure Bloom's three levels to verify the research hypothesis.
- Mathematical thinking test to verify the research hypothesis.

7- Choosing the study sample, which is an intentional school from the schools in the city of Amara in Maysan Governorate, due to the availability of 3 classes to choose two random groups, one experimental and the other control.

8- Carrying out procedures to equalize the two groups.

9- Teaching the experimental group using the reciprocal teaching strategy and the control group in the usual way.

10- Choosing an experimental design for a study - applying the post-test for mathematical thinking.

11-Present and interpret the results and present conclusions, recommendations and proposals.

Define terms

Define both: Strategy

First: 1- (Zaytoun 2003) is: the planned teaching and learning method that the teacher follows inside or outside the classroom to teach the content of a specific academic subject in order to achieve predetermined goals. This method includes two groups of stages, which are the steps - the sequential and inter-coordinated procedures entrusted to the teacher. Students do this while teaching that content. (Zaytoun, A5, 2003)

2- (Al-Kubaisi, 2008) is: the teacher's movements within the classroom, and the actions he performs, which occur regularly and sequentially. In order for the teacher's movements to be effective, he is required to have teaching skills: vitality and activity, movement within the classroom, changing pitches of voice while speaking, And signals, and the transition between sensory focus centers (Al-Kubaisi, 2008, 118).

Everyone knew him:

(Reciprocal Teaching) Second: Reciprocal Teaching

1- (Zaytoun, 2003) that it is: an educational activity that takes the form of a dialogue between teachers and students, or between students with each other, so that they exchange roles according to the sub-strategies that include (prediction - questioning - clarification - understanding by monitoring it and controlling its processes). (Zaytoun, B, 2003, 223)

2- (Ahmed, 2006): An educational activity that aims to train the student in intellectual dialogue about scientific text using four cognitive and metacognitive activities: (summarizing, generating questions, clarification, and prediction) (Ahmed, 125, 2006).

Third: Mathematical thinking

1- (Dienes 1972) The ability to see, understand and assimilate the relationships that are connected between ideas, concepts, rules and laws and emphasizes mental activity (Dienes, 1972, 26)

2- (Abu Mallouh, 2002) It is: about a mental activity that leads to the formation of a mental image or an abstract idea for a group of elements or experiences that have distinct verbal characteristics and characteristics. It can be referred to by a symbol, a single word, or a group of words, and it can be determined procedurally through abstraction and comprehensiveness. Idiom or symbolism.(Abu Mallouh, 8, 2002).

Operational definitions of search terms

- Strategy: A set of actions and a planned sequence carried out by the mathematics teacher that lead to reaching specific intended results from the second-grade mathematics book.
- Reciprocal teaching: A teaching method in which cooperation occurs between the teacher and student groups through the implementation of cognitive activities in mathematics for the second intermediate grade, which are: (summarizing, generating questions, clarifying, predicting).
- Mathematical Thinking: The ability of a second-year intermediate student to use some mathematical information to relate the situations presented to him and draw a conclusion related to the premises. This is measured by the score he obtains in the test prepared by the researcher.

Theoretical framework and previous studies:

(Reciprocal Teaching strategy): First: Reciprocal teaching strategy

The way to improve students' level in the learning process is to develop their ability to derive appropriate strategies for learning, and how to activate previous knowledge,and employ it in current learning situations,focus attention on salient points and elements in the content,and practicing methods of critical evaluation of ideas and meanings,monitoring the mental, cognitive and linguistic activities used to verify the extent to which understanding has been achieved

These and other processes are the essence of the discussion about sub-learning, as will be stated in the theoretical framework (Al-Fatairi, 1996: 223). The basic principle on which the teacher's role depends during reciprocal teaching is the principle of gradual reinforcement in diminishment, and this principle is one of the most important principles on which metacognitive teaching programs and strategies depend. Many results of studies have emphasized the importance of using the reciprocal teaching strategy because of its many advantages for students, the most important of which is the acquisition of social skills such as cooperation, bearing responsibility towards the goals of the reference group, commitment to the education process, and autonomy within it.

Students also acquire appropriate information, new models of thinking, and strategies

Through their interactions and dialogues with their peers, they acquire strategies through their collective exchanges (Hassan, 28, 2006.)

Foundations of reciprocal teaching

Acquiring the sub-strategies involved in reciprocal teaching is a shared responsibility between.

1-The teacher and students.

2- Although the teacher bears the initial responsibility for teaching and modeling sub-strategies, responsibility must be gradually transferred to the students.

3- All students are expected to participate in the included activities, and the teacher must ensure this, provide support and feedback, or adapt and modify assignments in light of the level of each individual student.

4- Students should constantly remember that strategies that include useful media help them develop their understanding of what they read, and by repeatedly trying to build meaning for what is read, students achieve that reading is not only the ability to decode words, but also to understand, distinguish, and judge them as well.

(Jeffrey, 2000, 92) This strategy takes the form of sub-strategies or activities that the teacher employs in a sequential manner, each of which is handed over to the other. The educational literature in this field is almost unanimous in stating that this strategy consists of four types of activities(Hussain, 2007, 2-3).

Summarizing Activity One: Summarizing

In it, students are directed to summarize this piece in their own words in a sentence or paragraph that expresses the core of the topic and its main, basic ideas in an understandable and meaningful way.

What to consider when summarizing

1-Emphasize the use of students' own words, not quotations, in order to enhance reading comprehension.

2-Delete duplicate information.

3-Focus on important titles or terms.

4-Delete unnecessary information.

5-Determine a time period for summarizing; To ensure that students have judged relative importance For ideas. (Donald, et al., 503, 2003).

Question Generating Activity Two: Generating Questions

In it, students are directed to ask their colleagues questions related to what they read in the text, through which they test their ability to understand the text. Whenever an idea comes to them in the text, they ask themselves (what - Why - How - Where - When ...) ask a question about it and try to answer it, and when the reader generates questions about what he reads, he thereby determines the degree of importance of the information included in the text and its suitability to be the focus of questions. He also acquires the skill of formulating questions with higher levels of thinking, It also helps in analyzing the reading material and developing his skills between important and unimportant information. One of the criteria for generating good questions is that it stimulates students to answer and helps them generate new questions. A good question provokes another good question, and one of the criteria is that questions help group performance and not just the individual answer. From a specific student, answering good questions may require reviewing the reading of the topic to search for the appropriate answer, and this is also one of the criteria for its quality. Self-questions work as a form of self-test that helps the student monitor his understanding of the subject. He analyzes the content, works to link it to previous knowledge, and evaluates it in a continuous cycle of questions - answers - questions (Shabib, 2000: 110).

Activity Three: Clarifying:

In it, the students are asked to explain any difficulty they may face in understanding the text, and it is presented.
They ask questions such as What are the difficult words to understand in this text? What are the new, unfamiliar concepts that.
You have passed through the text, and this strategy is intended to identify what may represent an obstacle in understanding the information Contained in the text, whether they are concepts, expressions, or ideas, which helps the reader discover the ability The writer uses words and methods to express meanings.

Predicting Activity Four: Anticipation/Forecast

In it, students are directed to put forward some of their expectations/predictions about what other ideas the author of the text will present in the next part of the text that they have not read yet, which provides a goal for the reader and ensures focus during reading. The teacher can help his students anticipate what a text will cover through the following aids:
1-Read the original title and subtitles.
2-Using the questions that the writer includes in the text.
3-Read some sentences in the first paragraph.
4-Read the first line of each paragraph in the text.
5- Read the last sentence of the last paragraph.
The teacher must make it clear to the students that he can be satisfied with only one of these aids.

Steps of the reciprocal teaching strategy:

1- In the first stage of the lesson, the teacher leads the dialogue by applying sub-strategies to a paragraph of a text.
2- The class is divided into cooperative groups (each group has five members), according to the sub-strategies included.
3- The following roles are distributed among the members of each group, so that each individual has one role: summary - questioner - clarifier - expectant.
4- Appointing a leader for each group (who plays the role of the teacher in managing the dialogue), taking into account that he exchanges his role with other members of the group.
5- Starting the interactive dialogue within the groups with the leader/teacher managing the dialogue, and each individual within each group presents his task to the rest of the group members, and answers their inquiries about what he has done.
6- Students are trained by the teacher to practice the aforementioned activities for four successive days. Each day, the students are introduced to one of these activities and how to implement it through a practical demonstration by the teacher, then training on its practice by the students.
A piece of reading from a book...a newspaper...is distributed, and the text used in reciprocal teaching should be appropriate in terms of breadth, especially with students in grades 1-4 of basic education, and in the level of understanding of the students so as to allow freedom of intellectual movement and the completion of the stages well.
8- Giving each member of the group the opportunity to read the piece silently and put whatever lines he wants below the basic ideas, or write on a separate sheet of paper some of the ideas that he will present to his colleagues in the group, followed by the summary in turn, then the questioner, then the clarifier, then the expected, and this is interspersed with a discussion between Members of one group, while the teacher follows what is happening in each group, listens to the conversations taking place, and provides help and support when necessary.
9-Assign one individual from each group to begin reviewing and answering the evaluation questions .
10- To apply this teaching for a long period of time (about 20 sessions) in a sequential manner until it is achieved Its desired effectiveness (Hussein, 3- 2007, 2).
An example of some of the plans that the researcher used is the topic of solving a first-degree equation with one variable for an equation with an equal sign (=) and the equation consists of letters, according to what you studied, called variables, such as letters (x, y, z,....) and numbers as you took in groups. i (numbers
natural) and r (the set of integers), as in the following examples:
Example 1: 3x + 5 = 11
Example 2: 4y + 3 = 2y + 9
Example 3: x-5x=6
Example 4: x + y = 6
How to solve the equation
The equation is like a charade. When we notice the equation x + 5=, it means any number that we add to (7) so that the result is (12). To solve this puzzle or charade, you might think of a number that you add with 5 to become 12.
You are thinking about subtracting the number 5 from the number 12. In both cases, we are trying to get rid of the number 5, leaving x alone. We know that if equal quantities are added or subtracted to both sides, it will not affect the equation, so the solution will be by subtracting the number 5 from both sides, as follows:
5- 12 = 5 – x + 5
x = 7
In t, the solution is by adding + 4 to both sides = 12. Example: Solve the equation 2x - 4
4 + 12 = 4 + 2x - 4
2x = 16 2x x means 2 x x, and we get rid of this by division, not addition or subtraction.

$$\frac{16}{2} = \frac{x2}{2}$$

x=8' i
So we say the set of solutions = 8
activity:
Read the text critically and summarize it in your own style Write as many examples as possible and try to solve them Identify the points that need clarification from your point of view Is it possible to expect more difficult questions than what was mentioned? Try writing them down and discussing them with your group colleagues.
Advantages of reciprocal teaching:
1- Ease of application in classrooms in most subjects
2- Developing the ability to dialogue and discuss
3- The possibility of using it in classes with large numbers
4- Increasing student achievement in all academic subjects
5- Developing reading comprehension ability, especially among students with low ability in reading comprehension and beginners in learning to read.
6- It agrees with the contemporary view of reading as an activity in which the reader interacts with the text.
7- Encouraging the participation of shy students in the four reciprocal teaching activities mentioned above, as it increases the student's self-confidence (Hussein, 3- 2007, 2).

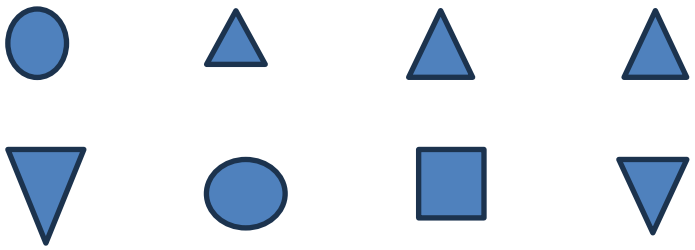
Previous studies of reciprocal teaching and mathematical thinking

1- (Al-Harithi study, 2008): This study aimed to determine the effectiveness of using the reciprocal teaching strategy in developing metacognitive skills in reading, "planning reading, monitoring and controlling reading, and evaluating reading," separately and together, in the reading subject of secondary school students. These hypotheses were tested by conducting a quasi-experimental study on a randomly selected sample of the study population, which included second-year Sharia secondary school students at Jarir High School in Jeddah Governorate. The study sample consisted of (60 students) who were distributed into an experimental group that studied using the reciprocal teaching strategy, numbering (30). Students) and a control group (30 students) studied using the traditional method. He also prepared an achievement test that confirmed its validity and stability, and it was applied to the experimental and control groups (pre-test).
Later, using analysis of variance as a statistical method, the following results were reached:
There are statistically significant differences at the level (0.05) between the average scores of the two groups in skills. Planning for reading, as well as skills for monitoring and controlling reading, skills for evaluating reading, for the benefit of experimentalism.
2- (Al-Khazraji study, 2008): The study was conducted in Iraq and aimed to: find out the effect of the Hilda Tapa model on the mathematical achievement and thinking of second-year middle school female students. The total research sample was (64) female students distributed between two groups, with (32) female students in the experimental group and (32) female students were in the control group, and equivalence was conducted for the two groups. To achieve the objectives of the research, it was necessary to provide two tools, one of which was an achievement test for the female students in mathematics (50 items), and the other was a scale to measure the mathematical thinking of the female students (38) essay and objective items. The most important results reached by the current research were:
There is a statistically significant difference between the average scores of female second-year intermediate students in the achievement test for the two groups: the experimental group (which studied according to the Hilda Tapa model) and the control group(which studied according to the usual method) and in favor of the experimental group(Al-Khazraji, 2008, i-k).

Second: Mathematical thinking

It is the thinking that takes place by solving mathematical problems mentally and through the premises in the question, and it has manifestations including:
A- Conclusion: It is arriving at a special result from a known or imposed principle, or it is a process of derivation.
Facts from general rules for arriving at results.
Example: Arrange some students so that one of them stands between two students, behind two students, and in front of two students, so
The number of students is: .....
B- Induction: It is arriving at a general rule through examples and special cases (Abu
(21- Tuberculosis 1999, p. 20
Example: Notice the following examples and try to come up with a fifth example in the sequence:
111 = 3 x 37
222 = 6 x 37
333 = 9 x 37
444 = 12 x 37
T- Generalization: A mathematical expression that applies to a group of things (Abu Shindi 1985, p. 20).
Note: 1 odd number + 3 odd numbers = 4 even numbers
Also 3 odd numbers + 5 odd numbers = 8 even numbers
Also, 5 odd numbers + 7 odd numbers = 12 even numbers

Also, 7 is an odd number + 9 is an odd number = 16 is an even number
So any number is.
D- The formal approach: extracting the necessary implications from the premises (Abu Zeina 1994, p. 19).
Example: Which of the following cards agrees with the rule :If a triangle appears in the upper half of the card, a circle appears in the lower half.



A b c d

C- Relational thinking: Understanding the relationships between the various factors in the situation facing the individual (Hindam, 1982 .p. 14).
Example: Three people, Zaid, Ammar, and Hassan, sit in one straight position, such that: Zaid is to the left of Ammar and Hassan is to the left of Zaid, so the one in the middle is…

Study Approach

First: experimental design
For the purpose of achieving the research objectives, the researcher adopted the experimental design, which is called the design
Experimental with semi-tight control, as shown in Table (1) below

Dependent variable	Independent variable	Equality of the two groups	the group
Remote testing Mathematical thinking	Reciprocal teaching strategy		Experimental
	The usual method		Control

Table (1) (Experimental design of the study)
This design requires creating two groups that are equivalent in some of the variables that may affect the dependent variable. The researcher was keen to control these variables by making the two research groups equal in (chronological age, previous knowledge in mathematics, the student's general average in the previous year, intelligence test, and academic achievement). for parents).

Second: The study population

The research population includes second-year middle school students in the center of Maysan Governorate (the city of Amara), distributed in secondary day schools. For the academic year (2021-2022).

Third: Choosing the study sample

Tahrir Middle School was chosen from among several middle schools in the Amara District, the center of Maysan Governorate, with official approvals. The school includes (80) students in the second grade of average, distributed among three classrooms whose numbers are respectively (28, 27, 25). Two classrooms were chosen randomly (A, B). One of them was experimental and the other was control, as the number reached (52) students and after statistically excluding (10) teaching assistants from the previous year, for the purpose of ensuring parity in the research. Thus, the sample members were (42) students, including (21) students in Section (A) And (21) students in Class (B). Class (B) was randomly chosen as an experimental group taught using the reciprocal teaching strategy, and Class (A) was chosen as a control group taught using the usual method, as in the following table:

The remaining number	The excluded number	the total number	the group
21	6	27	Experimental
21	4	25	Control
42	10	52	The total

Table (2) The total number of students, those excluded, and the final number of the research sample.

Fourth: Equivalence of the two research groups

Although the students are from one residential area and study in one school,
The same gender. However, the students of the experimental and control groups were statistically equal in these variables (age, general average, previous knowledge from the previous year, mathematical thinking, and intelligence). The researcher relied on a scale consisting of 10 items, which he made appropriate to the Iraqi environment and stage level

Study And Table (3) Shows This:

T value		Control (21) students		Experimental (21) students		The group Variables
Calculated	Tabulation	variance	Arithmetic mean	variance	Arithmetic mean	
0.028	2.021 At 40 degrees of freedom	114.243	14.254	156.75	14.152	Mathematical thinking
0.648		146.625	171.526	139.712	169.132	Chronological age
0.436		58.675	63.483	59.444	61.387	General Average
0.205		212.922	52.057	287.46	51.98	Previous knowledge of mathematics
0.039		6.112	5.016	5.356	4.987	IQ degree

Table (3) shows that all the calculated values are not statistically significant at the level of (0.05), as they were less than the value.
The tabular value is (2.021) and at a level of freedom (40), so the two groups are considered equivalent in the variables mentioned above.

Fifth: Study requirements:

1- Scientific subject: The researcher determined the scientific subject that he would teach based on the mathematics book scheduled to be taught to second-grade intermediate students in schools in Qatar for the academic year (2021-2022) and for the fourth and fifth semesters.

- The fourth chapter included the following subjects: (Foundations, multiplying an algebraic term by an algebraic expression, dividing an algebraic expression by an algebraic term, analyzing an algebraic expression by taking the greatest common factor, adding and subtracting terms, the degree of the term, multiplying a term by another, the square of the term, analyzing the difference between two squares).
- The fifth chapter included: (a first-degree equation in one variable, a second-degree equation in one variable, solving the first-degree equation in one variable, translating the verbal expression into an equation and vice versa, applications to solving the first-degree equation, solving the equation from... Second degree in one variable).

2- Formulating behavioral objectives: After the researcher analyzed the content of the academic material specified in chapters (four and five) of the prescribed mathematics textbook, and identified the concepts, generalizations, and mathematical skills for these chapters, the researcher formulated a set of behavioral objectives. The researcher formulated behavioral objectives in light of the two chapters, and the objectives General, and the researcher adopted the first three levels: (knowledge, understanding, which (Krathwohl) and Krathwohl (Bloom) application) from the cognitive field of Bloom's classification, which is considered one of the most common and useful classifications in the field of identifying and setting behavioral goals, and these three levels are considered in this field. More investigated and more accurately measured than other fields. The number of behavioral objectives for the subject to be taught according to the study procedures reached (64) behavioral objectives.

3- Preparing teaching plans:

The researcher prepared teaching plans for the two research groups in accordance with the research strategies. He prepared teaching plans for the experimental group using the reciprocal teaching strategy. He also prepared teaching plans for the control group using the usual method. Examples of these experimental and control plans were presented to a group of experienced and specialized arbitrators, and in light of their opinions and observations, some amendments were made to them, if they were adopted in teaching the topics decided during the experiment.

4- Distribution of lessons: The two groups were taught by a mathematics teacher in the same school in which the experiment was conducted so that the students would not feel any change affecting the conduct of the experiment. The researcher assigned him after explaining to him the nature of the experiment and continued throughout the experiment period to control the factor of teaching experience, and to ensure equal time, the researcher organized The weekly schedule is in agreement with the school administration and is 5 classes per week.

Fifth: Search tool

Testing mathematical thinking and extracting validity and consistency:

After reviewing the literature on the subject, the researcher prepared a test for mathematical thinking similar to previous Iraqi tests, after making some simple modifications according to five skills that the researcher adopted in the study, consisting of (42) items.

Validity of the test:

The researcher presented the test in its initial form to a court committee with experience and expertise in the field of mathematics and its teaching methods, in order to ensure the soundness and correctness of the wording of the paragraphs and their connection to the content of mathematical thinking. The researcher took an agreement rate (80%) or more as a criterion for accepting the paragraphs or not, and most of the paragraphs achieved this. The percentage is more, taking into account the simple modifications to the wording of some paragraphs, as (80%) of the arbitrators agreed on 39 paragraphs. Thus, the researcher achieves one type of apparent honesty.

Logical validity (validity of concept):

The researcher achieved logical honesty. This type of honesty was achieved by developing a definition of mathematical thinking and its skills, and through the logical design of the paragraphs so that they cover an important area for these skills in a balanced manner, and it was presented to the arbitrators to state their opinions.

Test stability:

The researcher applied the test to an exploratory group consisting of (20) students from a middle school other than the research sample, and repeated the test again two weeks after the experiment. He found that the Pearson correlation coefficient was equal to 0.82, and this represents the reliability coefficient.

Statistical analysis of the mathematical thinking test items:

The researcher applied the test to a sample of (30) students from the second intermediate grade from a non-school, which he researched as a exploratory sample to analyze the test items, find out the clarity of the test and its instructions, the time required for it, and find the coefficient of ease and difficulty, and the distinctiveness of the test.

1- Test time and clarity of test items and instructions

The researcher reported from the exploratory sample to extract the test time by calculating the test completion rate Of the three students at the beginning and the end, and it was (45) minutes. Then determine whether the test instructions were clear to the students, as some paragraphs were reformulated according to what was explained to the survey sample.

2- The difficulty of the paragraph: (Item Difficulty)

After correcting the papers, arranging them, dividing them into a high and low group, and applying the equation for the difficulty coefficient, the difficulty coefficients reached the range (0.50 - 0.80), which is considered appropriate because it is within the acceptable range mentioned above, with the exception of one paragraph whose difficulty level was higher than 80% and was delet.

3-The discriminating power of paragraphs: (Item Discrimination Power)

After applying the equation for the discrimination coefficient, the discrimination coefficients for the items in the range reached (38). Thus, the test was stable and ready to be applied to the two groups. It consisted of (0.45 - 0.25) items, compared to four alternatives, only one of which was correct.

secondly. Show results for (mathematical thinking)

For the purpose of analyzing the results of mathematical thinking, the researcher used the T-test for two independent samples in order to verify the second null hypothesis, which states: There are no statistically significant differences at the level of (0.05) between the average scores of the mathematical thinking test in the posttest between the experimental group. Which is taught using the reciprocal teaching strategy and between the control group which is taught in the usual way.

After calculating the arithmetic mean and variance for both groups in the mathematical thinking and arithmetic test The T-value and reviewing the tabular value at a significance level (0.05) and with a degree of freedom (40) and as (shown in Table 7)

The significance level is 0.05	T value		variance	Arithmetic mean ratio %	Arithmetic mean	The number Experimental	The group Experimental
	Tabulation	Calculated					
Statistically significant	2.021	2.715	49.32	58.395	22.19	Control	Control
			60.54	42.052	15.98	The group	The group

(Table 7)

T-test results for the difference between the average achievement scores of the two groups (experimental and control) in the mathematical thinking test

It is noted from Table (7) that the calculated value (2.715) is greater than the tabulated value (2.021) at a degree of freedom (40), so there are statistically significant differences at the level (0.05) between the arithmetic mean of mathematical thinking between the two groups (experimental and control) and in favor of the experimental group, which is attributed The researcher makes this difference to:

1- The reciprocal teaching strategy draws conclusions from what is observed and sometimes predicted, and thus it is close to mathematical thinking skills.

2-The research showed that there is a positive effect between the reciprocal teaching strategy and its association with mathematical thinking in learning mathematics.
3-The research showed that the method of organizing content through the reciprocal teaching strategy is appropriate for developing the mental abilities of students at this stage.
4- This result was consistent with what was mentioned in the theoretical framework of the study that using the reciprocal teaching strategy can be achieved by developing metacognitive thinking among students, which in turn contributes to developing their mathematical thinking, as well as developing the ability to see relationships between things more than things. It also develops the ability to predict some relationships between concepts before studying them, link previous and subsequent concepts, and develop the ability to analyze.
The general level of mathematical thinking among the experimental group was relatively weak, as the arithmetic mean was only (15.98), which is below the hypothesized mean (50%). The reason for this is that the students were not accustomed to such methods for measuring this type of thinking. He wondered: Numbers of students. Is this also like a mathematics test that we see as different from it? Does it have grades? Why are you testing us with that? And although some of them described some of its paragraphs as beautiful and enjoyable and calling the student to think, there are other questions, and this amazement suggests what was mentioned, in addition to the duration of the experiment in implementing the reciprocal teaching strategy that may be relatively short (one semester), but despite that As mentioned above, statistically significant differences were found at the level of significance (0.05) between the averages of the mathematical thinking test among the students of the experimental and control group.

CONCLUSIONS

In light of the results of the current research, the following conclusions were made:
1-The effectiveness of the reciprocal teaching strategy and its positive impact in teaching mathematics to students in the second intermediate year of general education.
2- Preparing and presenting the study material in a good, organized and organized manner, which leads to delivering the scientific material to the students with ease and ease.
3- Teaching using the reciprocal teaching strategy leads to the development of mathematical thinking.
4- Second grade students' average weakness in mathematical thinking in general.

RECOMMENDATIONS

In light of the results of the research, the researcher presents the following recommendations:
1- Urging faculty members in general education to use the reciprocal teaching strategy to teach subjects in general and mathematics in particular.
2- The need for the general directorates of provincial education to pay attention to training teachers to use the reciprocal teaching strategy through continuing education courses.
3- Developing the ability to think mathematically among students so that the student is able to have a comprehensive vision and understand the relationships between concepts through teaching subjects in general and mathematics in particular.
4- Preparing materials and methods that include the reciprocal teaching strategy and including it in teacher preparation programs so that its impact reaches students and they learn about its theoretical foundations and methods of applying it.
5- Developing the curriculum in general and mathematics in particular according to the reciprocal teaching strategy, especially organizing the content of the curricula in light of developing mathematical thinking skills while displaying the content in a coherent, integrated and meaningful form.

PROPOSALS

To complement the current research, the researcher proposes to conduct future research that aims to:
1-The effect of the reciprocal teaching strategy on developing middle school students' attitudes towards mathematics and the acquisition of mathematical concepts.
2- A comparative study between two methods: reciprocal teaching strategy and metacognitive strategies in developing engineering skills and geometric thinking in the study of mathematics.
3- Conduct similar studies in mathematics at other stages of general education.
4- A proposed program to train mathematics teachers on the reciprocal teaching strategy in teaching and learning mathematics.

REFERENCES

Arabic References

1- Abu Zeina, Farid Kamel, 1994, School Mathematics Curricula and Teaching, 1st edition, Al-Falah Library, United Arab Emirates.
2- Abu Al-Sal, Muhammad Abdul Karim, 1999, Curricula for Teaching Mathematics and Teaching Methods, Dar Al-Furqan Library, Irbid, Jordan.
3- Abu Saleh, Muhammad Sobhi and others, 1996, Mathematics Curricula and Teaching Methods, 1st edition, Sana'a School Book Press.

4- Abu Shindi, Rushdi Ahmed, Al-Naqa, Mahmoud Kamel, 2008,: Training the one-class teacher, Arab Organization for Education, Culture and Science.
5- Abu Mallouh, Muhammad Mahmoud, 2002, Scientific Design, Theory and Practice, 1st edition, Amman, Jordan.
6- Ahmed, Naima Hassan, 2006, The effectiveness of the reciprocal teaching strategy in developing understanding and reading awareness of scientific texts and decision-making regarding environmental problems among female secondary school students, Jordanian Division, Tenth Scientific Conference for Scientific Education, Challenges of the Present and Visions of the Future, July 30.
250- Volume One, p. 205
7-Bani Arshid, Ali Hussein, 2002, The effect of teaching engineering using the cooperative inquiry strategy on the achievement of seventh grade students and their levels of thinking, unpublished master's thesis, The Hashemite University, Zarqa.
8- Al-Harthi, Jamil Salem, 2008, The effectiveness of reciprocal teaching in developing the scientific reasoning skill of primary school students in the Kingdom of Saudi Arabia, in the Egyptian Journal of Educational Evaluation.
9- Al-Khazraji, Nidal Taha Khalifa, 2008, The impact of the Hilda Tapa model on achievement and mathematical thinking among middle school female students, unpublished master's thesis, College of Basic Education. /Al-Mustansiriya University, Iraq
10- Hassan, Mahmoud Hassan, 2006, The effectiveness of reciprocal teaching strategies in alleviating speech anxiety among a sample of primary school children. Unpublished master's thesis, Faculty of Education, Menoufia University.
11-Hussein, Medhat Muslim, 2007, Reciprocal Teaching, a working paper submitted to: The Forum of Early Teachers, Islamic Culture and the First Field (in private schools, March.
12- Donald, Orlich, et al., 2003, Educational Strategies (Guide to Better Training), Translated by: Abdullah Abu Nabaa, Al-Falah Library for Publishing and Distribution.
13- Zaitoun, Hassan Hussein, 2003, A, Teaching Strategies (A Contemporary Vision for Teaching and Learning Methods), World of the Book - Cairo - 1st Edition.
14- Zaitoun, Hassan Hassan, B., 2003, Teaching Thinking, World of Books, Cairo.
15- Shabib, Ahmed, 2000, The effect of training on the strategy of self-questions (independent-cooperative) on university students' understanding of lectures and their appreciation of the degree of their self-efficacy, Journal of Education, Al-Azhar University, Issue (95), Part One.
16- Al-Sharqawi, Abdel Fattah, et al., 2009, Mathematics for the second intermediate grade, Dar Al-Salam Press, 16th edition, Baghdad, Iraq.
17- Al-Fatairi, Sami Muhammad, 1996, The effectiveness of the metacognition strategy in developing text reading skills and philosophical tendencies in the secondary stage, Journal of the College of Education, Zagazig University, 280: Issue (27), Part One, September, 223
18- Al-Qaisi, Tayseer Khalil Bakhit, 2001, The effect of using concept maps on basic stage students' achievement and critical thinking in mathematics, doctoral thesis (unpublished), University of Baghdad, College of Education (Ibn al-Haytham).
19- Al-Kubaisi, Abdul Wahed Hamid, 2007, The effect of using the constructivist education method on the achievement of middle school students in mathematics and systemic thinking, Basra Research Journal of Science 52- Humanity, Volume 32, Issue (1), Part (B), p. 28
20-Measurement and Evaluation (Renewals and Discussions), Jarir Publishing and Printing House, Amman, Jordan.
21-Methods of Teaching Mathematics, Arab Society Library, Amman, Jordan.
22- Al-Naimi, Hamdiya Mohsen Alwan (2002), The effect of using two strategies to master learning on the achievement and retention of middle school female students in mathematics, Master's thesis (unpublished), University of Baghdad, College of Education (Ibn al-Haytham).
23- Hindam, Yahya Hamed (1982), Teaching Mathematics, Dar Al Nahda Al Arabiya, Cairo.
24-The Institute's Supervision Board, 2005, Research Methodology, National Institute for the Training of Educational Employees, Ministry of National Education Press, El Harrach, Algeria.

Foreign References

25-Alderman, M. Kay, 2007, Motivation for Achievement: Possibilities for Teaching and Learning, second Edition.
26- Butkawski, Jean (1994): "Improving Student Higher-Order Thinking Skills in Mathematics", Action Research Project, Saint Wavier University- IRS
27- Carter, c. (2001).Reciprocal teaching: The application of a reading improvement strategy on urban students in Highland Park, Michigan. (Eric Database, No.ED454498).
28- Frances's. Eckart J (1992) : The Effects of Reciprocal Teaching on Comprehension,EDRS Document Details for – ED350572.
29-Ghaith, Ghazi. Relationship between reading attitudes, achievement and learners perceptions of their Jigsaw 2 cooperative learning experience. Reading Psychology. 24 (2): 1-6, 2003.
30-Hashey, J. M, & Connors, D. J. (2003). Learn from our journey: Reciprocal teaching action research. Reading Teacher, 57(3), 224-233.
31-Hertzog, H & Lemiech J, (1999) : Reciprocal Teaching and Learning : What Do Master Teachers and Student Teachers Learn from Each Other ? Paper Presented at the Annual Meeting of the American Educational Research Association (Montreal, Quebec, April 19-23).

32- Jeffrey, M (2000): Reciprocal Teaching of Social Studies in Inclusive Elementary Classrooms, Journal of Learning Disabilities, Austin, Jan/Feb.
33- Dienes , L. V, (1972) :Reciprocal Teaching Effects Upon Reading Comprehension Levels on Students in 9 th Grads , in:http://wwwlib.com/dissertations/search.page/3077709