

The Effect of Mediator Teaching Strategy (M.I.T) in the Productive Thinking of Fourth Grade Student in Chemistry Subject

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ABSTRACT

The purpose of the study is to determine how the mediator's approach affects the fourth-grade chemistry students' ability to think critically. In order to clarify the study's objectives, the following zero hypothesis was proposed::

The mean scores of the experimental group's students who studied using the mediator strategy and the control group's students who studied using the standard method on the productive thinking test did not differ statistically significantly at the level of significance (0.05). The sample of the research consisted of (70) students from the fourth scientific grade, they were split into two groups: an experimental group and a control group, and each group received rewards in the following variables:

(Age in months, prior knowledge of chemistry, and prior chemical-related accomplishments and productive thinking test), the productive thinking scale was adopted as a research tool, which consists of critical thinking of (15) items distributed over five abilities, each ability has three positions, and creative thinking that It consists of nine positions distributed among three skills. Each skill has three paragraphs. The data were treated statistically by statistical means (the t-test, the Kueder-Richardson-20 equation, and the alpha-Cronbach equation).

The outcomes led to a statistically significant difference. In light of the findings from the research, the researcher recommended a variety of suggestions and recommendations.

Research Problem:

The use of modern and new effective teaching methods contributes to improving the learning process and makes it more flexible and smooth. Due to the experience of the researcher in the field of teaching and teaching at all secondary levels for eighteen years, and his exposure to many studies, he found that most students suffer from finding the correct way to read scientific subjects, including chemistry. The problem of reading here lies in the students' lack of knowledge that reading has many dimensions, which most of them found to not go beyond the stage of reading the written alphabet only. Therefore, this problem limits students' ability to deeply understand, reflect, analyze, and be creative in the subject matter, and that the students' lack of reading comprehension as well as the traditional style of teaching has shown the reason why students are unable to understand the material and not receive the information correctly and in an orderly manner, which constitutes for them what is called unproductive thinking. Hence, all of this affects the level of students' achievement in chemistry and their productive thinking, and this is confirmed by most of the studies that dealt with chemistry, that traditional teaching methods are a major reason for the low level of students, and among these studies is a study (Al-Tamimi, 2016). And a study (2021, Kadam & Suzan), and a study (Al-Qaisi,

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2022). In support of the idea for the study problem, the investigator distributed a questionnaire comprised of three questions distributed to teachers who have teaching experience of not less than five years, which are as follows.

1. How familiar are you with the broker's strategy?
2. Did you find productive thinking among your students?
3. Do your students suffer from study pressure, which makes it difficult to understand some concepts?

The answers to the first question were that 95% of them did not know this strategy, 90% for the second question, and 98% for the third question.

Therefore, the researcher found that it is necessary to find a teaching strategy that gives students the correct way of reading scientific materials while giving them the opportunity to develop their creative and critical thinking, which makes learning more organized and useful. Teaching medium to answer the subsequent query:

What results does mediator strategy on the productive thinking of fourth pupils in grades chemistry?

Research importance:

In the midst of the rapid scientific and technological developments, the development of education and the improvement of its inputs and processes has become an irreplaceable strategic choice for any country seeking to have a foothold under the sun of this era (Sultan, 2010: 147). Chemistry is one of the broad fields of science due to its many branches and its direct connection to life Man and society, and this calls for the need to pay attention to teaching this scientific subject, in which students encounter a problem in learning and understanding its concepts, by finding modern teaching strategies that are compatible with each stage and its requirements (Salman and Dhamia, 2020: 925).

This development showed us modern strategies and methods in education, and among these strategies is the mediator strategy, which is suitable for all educational stages, as the teacher was able to direct the lesson through a set of questions asked by the learners during the lesson time that revolve around the subject, and the role of the teacher is to show skills Metacognitive thinking by solving the problem and explaining the reasons behind each step and the method of implementing each process. The teacher can, through these strategies, lead the students in planning to reach the answers he wants, and then carry out the task with an explanation of the reasons for the task being achieved (Jarwan, 2002: 394), that the use of mediator strategy is important in moving from the level of quantitative education to the qualitative level, which aims to prepare and qualify the learner because it is the focus of the educational process, and this emphasizes the importance of mental preparation and the development of thinking and providing the teacher with the means and tools that make him able to deal effectively with Information from its various sources, in an effort to achieve a better level of comprehension of this information (Hajjaj and Abdullah, 169:2022). Literature and studies indicate that students who actively use the mediator strategy are aware of their behaviors and realize the extent of their productive thinking when performing a specific task, as they become more in control of what they do, and teachers have to help students learn according to the mediator strategy, helping them to plan and advance the process Learning, to make them more effective and active, and to improve their performance and capabilities (Broyon, 2004: 125), and (Al-Tamimi, 2012) believes that the occurrence of the learning process according to the use of meta-knowledge strategies and teaching models was done through the facts and experiences from the past gained by the learner as he attempts to integrate and link the information at his disposal in his cognitive structure. with the new information gained through the practice of mental activities and finding new and innovative solutions and information (27: 2012, Al-Tamimi). Hence, we see that the recent trends paid attention to teacher preparation programs, with great interest in the performance competencies that enable the teacher to perform the requirements of the work. If it remains dependent on providing students with knowledge in theoretical and verbal form only, then it is not sufficient to prepare a skilled teacher (Zayer and Muhammad, 2015: 50-51). As reaching the development of many cognitive and metacognitive strategies on which the educational process is built has increased the learner's ability to understand written information, thus developing his productive thinking and then helping him to understand the courses. Therefore, interest has increased in metacognitive strategies, or some call them meta-thinking strategies and their role in education, including in reading comprehension at its various literal, deductive, creative and evaluative levels. He teaches it to the learner in accordance with his age and the stages of his mental and cognitive development, and that the use of metacognitive strategies can play a major role in the development of higher mental skills, including teaching reading comprehension and critical thinking, and making the learner possess the means and procedures to control and conduct the learning process, and how to deal with it With the information, whether he has or that he gets from the new educational situation, and makes him contribute himself by asking questions before, during, and after reading, focusing on his previous experience on the topic of the lesson, including chemistry lessons (Salima, 2022: 33-34). Therefore, building cognitive schemes for students, including Fourth-grade scientific students, which is one of the classes of the

preparatory stage, helps in learning effectively and distances the learner from the psychological factors of remembering, especially since physical and mental maturity is in the direction towards integration, and perceptions begin to expand and depend on himself, and then the students' tendencies and desires take By crystallizing and appearing, and their ability to abstract imagination based on words increases, and the secondary stage may be the last opportunity to train students in linguistic and creative skills (Tamim, 2007:88). pupils in the scientific fourth grade, the researcher summarizes the significance of the following research points:

- 1- This research is the first research that deals resulting from the mediated teaching strategy's effects (MIT) on the productive thinking of chemistry.
- 2- The current research is a response to what educators are calling for at the present time to keep pace with modern trends of interest in improving teaching methods and experimenting with new strategies.
- 3- It is an attempt to find out the level of productive thinking among fourth grade students.
- 4- This research may open the way for other studies in the field of teaching science in general and chemistry in particular, and experimenting with new strategies in other dependent variables.
- 5- The research may help those in charge of developing the curricula, especially chemistry, to develop future plans to adapt the curricula and make them more suitable for the students' levels.

Research Objective: The purpose of the study is to determine how the mediated teaching approach (MIT) affects students in the fourth scientific grade of chemists' ability to think critically.

Research hypothesis: To verify the objective of The following null hypothesis was proposed in the study:

The mean scores of the experimental group students who will study using the intermediate teaching strategy (MIT) and the average scores of the control group students who will study using the conventional method do not statistically differ at the level of significance (0.05).

Research limits: The search was only for:

- 1- Human limits: All students of the fourth grade in science one of the day middle schools affiliated to the Baghdad Directorate of Education, Al-Karkh / 3.
- 2- Time limits: the 2022–2023 academic year.
- 3- Scientific subject: All chapters of the chemistry textbook for the fourth stage Republic of Iraq, 7th edition, 1439 AH - 2018 AD, approved for instruction by the Iraqi Ministry of Education for the academic year (2022-2023).

Define terms:

Effect: The Effect: It was known by:

- 1) (Saleh, 2014): "It is the worker's capacity to provide a favorable outcome that is being examined. (Saleh, 2014:14).
- 2) (Al-Tamimi et al., 2018): It is "a collection of learned knowledge and abilities demonstrated by test results and developed through study materials." (Al-Tamimi et al., 2018: 32). Theoretical definition: The researcher adopted a definition (Al-Tamimi et al., 2018).

The operational definition: "It is the positive cognitive change in productive thinking that occurs among the students of due to the experimental group's their influence on the independent variable, which is (MIT strategy) and is measured by the productive thinking test."

• Strategy

• (Hamadneh and Obeidat, 2012): It is the teacher's movements in the classroom, his actions and activities that he performs in a regular and coherent manner that are integrated and harmonized to achieve the objectives of the lesson. (Hamadneh and Obeidat, 2012: 4).

• (Zayer and Samaa, 2013): The development and progress of the learner as a result of exposure to effective educational variables" (Zayer and Samaa, 2013: 157).

Theoretical definition: The definition was used by the researcher. (Hamadneh and Obeidat, 2012) as a theoretical definition of the strategy.

Operational Definition:

A set of pre-planned steps and procedures and what the teacher does to achieve a specific goal in the long term depending on the means, tools, activities and resources available in order to achieve the learning outcomes specified in the desired study plan in the shortest possible time and with the least effort and in the short term and depends on reading comprehension skills.

Productive Thinking: Known by:

Razzouqi et al. (2019) defines it as: "a scientific methodological tool that combines self-regulation, innovative thinking and critical thinking, and the learner deals with it with high quality and quality with what he encounters in his environment and helps him reach new outcomes that deviate from the ordinary." (Razouki et al., 2019: 15)

Hurson, 2008)) that: "a type of thinking that combines thinking abilities, including critical, creative, and analytical thinking and employs them to produce new ideas" Hurson, 2008, 45))

Theoretical definition: The researcher adopted Hurson (2008) definition as a conceptualization of productive thinking.

For the purpose of operationalizing constructive thinking:

It is one of the mental models that combines the skill of creative thinking with the skill of critical thinking, and includes the following skills: (Assumptions, interpretation, and argument evaluation), Fluency, adaptability, elicitation, deduction, and originality) and is measured by the degree obtained by fourth grade scientific students in the productive thinking test. adopted by the researcher in order to achieve this.

Theoretical context:

- Mediated Teaching Strategy (M.I.T)

It is among the most crucial things metacognitive strategies in reading comprehension and teaching reading. It was developed by Langer & Neal in order to be general and of a sufficient degree to make it feasible and applied with any subject, from history to science to music, and it is a strategy that makes the teacher lead his students. To success by increasing their reading skill (Langer & Neal, 1992, p230), the intermediate teaching strategy is used before, during and after reading the text, and its philosophy assumes that the teacher is responsible for developing the interaction between the learners and the information of the textbook so that they can absorb Reading creatively, and with regard to content, requires two conditions, the first: flexibility, because teaching takes place in various different specializations, and the second: it is to look clearly to help the teacher to the students to learn from the text (Maysa 22: 011), and (Patterson & Risko, 1989) explains that intermediate teaching can To help students develop organized sets of skills and knowledge, to comprehend the material, and the ability to apply information strategically, and that the teacher's job description in the learning process is essential for the educational process to be successful in the classroom (Patterson & Risko, 1989, p116).

As the comprehension theories confirm the fact that in understanding the text, the efforts of the teacher and the learners must be shared together. Through the mediated teaching (MIT) strategy, the teacher will be able to direct his students to an optimal comprehension of the read text (Hanafi, Isnadi, 2015), and (Patterson & Risko 1989) indicates Teachers, as mediators, provide learners with tangible experiences that influence their cognitive development and meaningful learning. They help them separate relevant information from irrelevant information by activating and stimulating anticipation of events, helping them to connect parts of their experiences, or providing questions about the text they read. They arrange an environment Learning As students can face a specific experience, effective mediators should focus on processes such as selecting text ideas and evaluating them (Patterson & Risko 1989:p226).

This strategy is flexible because it includes a large number of strategies to make it easy to adapt to the educational goals, the different backgrounds of the learners, as well as the different skill levels of teachers and learners. The MIT strategy also helps to clarify the responsibilities of the teacher (Bahloul, 2003: 245). The meaning of intermediate teaching is the teacher's actions to guide the learners before, during and after the reading process, to guide and direct

the learners on how to perform a specific task, and that these interactions are in a way that balances between the learners' knowledge stores and the content of the read text, or encourages students and pushes them to use what they read in new and varied ways. This strategy works to implement the role of learners in educational situations and raise the level of their interaction between them and the richness of the read text in order to make the reading process a success by strengthening learners' understanding of the contents they read and anticipating the meanings between the lines (Atiyah, 2010: 239).

Every learning process is transmitted through instruments such as: signs, symbols, and language. These tools are acquired by kids through social engagement with other people, and they absorb Utilize these resources as intermediaries for more complex learning (higher cognitive processes like concept acquisition and problem solving).

• Steps to implement the M.I.T strategy

1- Pre-reading stage

The goal of this stage is to prepare for reading, and it involves two comprehension processes:

A/ Activating previous knowledge by using brainstorming strategy, self-questioning, role-playing, raising and presenting the problem, and The teacher's role in this process is to probe the learners and their knowledge backgrounds on the subject or issue.

B / Predicting the content of the text by reviewing and clarifying ideas or formulating occasional questions with a general view and the role of the teacher here is leadership for the learners (Atiyah, 2010: 240).

2- Reading stage (while reading)

Two things are achieved:

A / Achieving understanding: It is building meanings in the text by answering the previous occasional questions, verifying the validity of predictions, talking about ideas, recording notes or short tests, extracting and writing answers or discussion, etc., and at this point, the teacher's responsibility is guidance and guidance educated.

Memorizing or remembering: here the process is to process ideas using experiments, projects, or creative work, and the role of the teacher here is to advise the use of specific structures or formulas that increase the motivation of learners to retain ideas and knowledge (Bahloul, 2003: 240).

3-Post-reading stage:

The aim of this stage is to consolidate the learners' learning, and the process is to use the knowledge that The students have reached with new circumstances, and the teacher's role here is to make observations and direct the process of applying students and evaluating their outputs in partnership with the learners (Atiyah, 2010: 240).

Advantages of Mediated Teaching Strategies (M.I.T):

Identify the main ideas in the read text, as well as its sub-ideas.

• Coherence between the ideas of the read text.

Finding types of relationships in the read text.

Developing some higher mental skills, such as inference, prediction, and conclusion, on the existence of relationships between the ideas of the text read.

Understanding the sequence of meanings, ideas and events. (Al-Issawi, 2017: 27).

Product Thinking:

Liebman presented his important ideas regarding this type of thinking by preparing an effective program in teaching productive thinking. In his opinion, there are three types of thinking: critical thinking, creative thinking, and cautious thinking. Likewise, Lippman assumes that productive thinking is equivalent to merging critical thinking with critical thinking and creative thinking. The matter is quite clear when the creative and critical aspects support and reinforce

each other, as is the case when the critical thinker creates new premises or new standards, or when the creative thinker gives the artistic tradition a new turn (Razouki et al., 2018:99).

According to Attia (2015), it is a mental process in which sensory perception interacts with experience, calls for a specific set of skills, and strives to uncover novel connections or uncharted avenues to accomplish a given objective with either internal or external motivations, or both. (Atiyah, 2015: 131).

Razuqi et al. (2019) defined it as a style of thinking that combines critical thinking and creative thinking and employs them to produce new positive and practical ideas (Razuqi et al., 2019: 15).

As for Al-Zayyat (2019), he defined it as part of the knowledge structure of the learners. Life is a set of situations, and the teacher must confront them, accepting his theoretical work without separating them for any reason whatsoever that pushes us to the process of change, and to take small steps on the road and at intervals until we reach the desired goals, which is compatibility. between work and production, as productive thinking reaches the means and solves all the problems we face (Al-Zayyat, 2009: 239).

B. Conditions for Productive Thinking: For productive thinking, a set of conditions are as follows:

- 1) Think of many ideas.
- 2) Thinking of generating diverse and unusual ideas.
- 3) Students add new ideas to become better. (Al-Surour and Thaer, 2010: 10).

Characteristics of Productive Thinking:

1. It includes elements of divergent and convergent thinking, putting solutions into groups and using selection criteria as the best solution to the problem.
2. It is considered one of the pillars of creative thinking, in which students possess capabilities that enjoy a scientific method that leads to the ability to produce new and diverse ideas.
3. Emphasizes the creative side of thinking.
4. It is part of the students' knowledge building.
5. Discovering new relationships and ways to solve the problem accurately and objectively in an organized manner.
6. An organized mental activity based on evidence and evidence to deal with problems in an organized manner.
7. Reformulating ideas through mental and cognitive structures in a different framework.
8. It is characterized by diversification and the ability to achieve social acceptance through new production.
9. The problem should be left for a period of time to allow internal insight to find solutions and unfamiliar ideas. (Razouki et al., 2019: 25).

RESEARCH METHODS AND TECHNIQUES:

Design of the experiment: The researcher used an experimental design for two equal groups with partial control and a post-test Table (1)

Table (1): (For the two research groups' experiments)

Dependent variable	independent variable	_ equivalences	the group
product thinking	strategic MIT	Age in chronological months Previous information for the subject of chemistry successes in chemistry product thinking	Experimental
	as is customary		control

The research community is the second.:

The scientific fourth of all government day high schools in the Directorate of Education's student body made up the research community., Baghdad Al-Karkh / 3, for the academic year (2022-2023 AD), including the secondary leadership for outstanding students was intentionally appointed for the following reasons:

- 1) The fact that the researcher is one of the teaching staff in the secondary school.
- 2) There are three classes for the scientific fourth, which enables The researcher will select two groups., the first is control, whereas the second is experimental.

The study sample:

To choose the research sample, the researcher randomly selected the study's control and experimental groups by means of lots, so division (B) was the témoin group and division (C) was the experimentation team.) students for (c) the experimentation team (35) students for (b) the control group. As in Table (2)

Table (2): Distribute the students in the two study teams

number of students	div	the group
35	c	Experimental
35	B	The female officer
70	The total	

Procedures for equivalences of the two groups:

1. The students' ages in months:

After getting the students' birthdates from their official school identification cards, the researcher estimated the students' ages in months. The calculation was made from the kids' birthdates to Tuesday, January 11, 2022, which is the date the experiment will start to be applied. The significance of the t-test for two independent samples is (0.05), which is smaller than the tabular value of (2) at a degree of freedom. As a result, there are no statistically significant differences between the samples. The two groups' average ages in months are equal, and the age variable is the same for both groups., as shown in Table (3):

Table (3) Group Number of students Arithmetic means Standard deviations Variation Degree of freedom T value Type of significance (at the 0.05 level)

Previous attainment in Chemistry:

The results of the t-test for two independent, unequal samples were used to determine the differences between the students' scores in the two research groups' final exams for the prior academic year (2021–2022) in order to determine

Indication type (at the level of 0.05)	t value		degree of freedom	variance	Standard deviations	Arithmetic averages	The number of requests	the group
	Tabular	calculated						
non function	2	.952	68	151,371	12,303	158.9211	35	Experimental
				169,260	13,010	161.7027	35	The female officer

the equivalencies of the two groups. It was discovered that the calculated t-value is (0.391), which is less than the tabular value (2) at a higher level of statistical significance.

Table (4): The experimental and control groups' arithmetic means and standard deviations from the prior Chemistry accomplishment.

Indication type (at the level of 0.05)	T value		degree of freedom	Contrasts	standard deviations	Arithmetic averages	Number the students	the group
	Tabular	calculated						
non d	2	0.391	68	227,135	15,071	74,514	35	Experimental
				202,350	14,225	73,142	35	control

Previous information test:

For the purpose of equivalence in this variable, an objective test With four options in chemistry, an exam with thirty questions covering material that had previously been studied by students in earlier academic years in relation to the experiment was adopted. To ensure the validity of the exam, it was shown to a panel of expert arbitrators. After making the necessary changes and taking notes, it was based on the opinions of those who had 80% or more of their ideas in accord.

The test was administered to the two research groups on Sunday, June 11, 2022, the same day. The answers were changed by using the common responses key, awarding one point for each right answer and zero for any that were incorrect, omitted, or for which more than one option was selected. Then, all of the students' grades were arranged in descending order. Using the t-test for two independent samples, it was determined that there were no statistically significant differences because the t-value for the two independent, equal samples was (5400), which is less than the tabular value (2) at a degree of freedom (68) and a level of significance (0.05). As a result, there is no statistically significant difference between the means of the groups of students.

Table (5): The experimental and control groups' arithmetic means and standard deviations from the prior information test

Indication type (at the level of 0.05)	T value		degree of freedom	Contrasts	Standard deviations	Arithmetic averages	Number the students	the group
	Tabular	calculated						
non d	2	5400.	68	3,572	1,890	11,114	35	Experimental
				4,359	2,088	10,857	35	control

Productive thinking test:

After reviewing the available educational literature for productive thinking and in the light of the opinions of experts and arbitrators, the productive thinking test was adopted for (Hilal, 2018), where the total number of situations was 24 situations, the results were processed statistically and based on the t-test for two equal and independent samples. As it happens, the computed t-value is (0.310), which, at a degree of freedom (68) and a level of significance (0.05), is lower than the tabular value (2). As a result, there is no statistically significant difference between the two groups' average results on the thinking test, indicating that both groups are equal in this regard. as seen in Table 6, varies.

Table (6): The productive thinking test's experimental and control groups' arithmetic means and standard deviations:

Indication type (at the level of 0.05)	T value		degree of freedom	Contrasts	Standard deviations	Arithmetic averages	Number the students	the group
	Tabular	calculated						
non d	2	.310	68	20,933	4.5753	14.6579	35	Experimental
				22.3918	4.7320	14.3243	35	control

Methods for modifying some auxiliary (non-experimental) variables

The following steps were taken by the researcher to control the extraneous (non-experimental) variables that might have an impact on the study's findings:

Duration of application for trial:

The time period for both groups was the same and started on Tuesday, which corresponds to the time the researcher conducted the experiment. (1/11/2022) to Tuesday, corresponding to (25/4/2023).

Experimental extinction:

There was During the application of the experimental period, there was no loss among the sample students.

Topic instructor:

In order to prevent differences brought about by educating students through several teachers, the researcher taught the two groups (experimental and control) himself.

Physical circumstances (physical circumstances):

The two groups' physical conditions were completely similar, because the classroom was located in the same laboratory, and therefore the classroom space, location, type of study seats, type and number of lighting, ventilation, number of windows, and type of blackboard were the same.

Search tool:

At the same time and location, the researcher gave the two groups the productive thinking test..

Scientific discipline:

To guarantee that all students receive an equal amount of information, the two groups studied the same material from the Chemistry Book for the Fourth Scientific, 7th Edition, 2018, Republic of Iraq/Ministry of Education. Daily lesson schedule:

Since there were (6) classes per week, with three classes for each part, the researcher instructed the two groups in accordance with the daily lesson plan created by the school administration in consultation with the researcher to ensure equal class periods for the two groups. on a regular basis, as shown in Table (7). following:

Table (7): Daily lesson plan for the control and experimental groups

Wednesday	Tuesday	Sunday	
B	c	c	the second lesson
c	B	B	the third lesson

prerequisites for study:**Determine the academic subject:**

The first through fifth chapters of the chemistry course for the fourth scientific year were where he recognized the scientific material that he taught throughout the experimentation phase., 7th Edition, 2018, academic year (2023-2022) also comprises the following:

1. Chapter One: Basic Concepts in chemistry
2. Chapter Two: Gases
3. Chapter Three: Chemical Equations and Calculations
4. Chapter Four: Organic Chemistry
5. Chapter Five: Nuclear Chemistry .

Preparing lesson plans:

Based on the study material consisting of five chapters for the subject of chemistry The researcher supplied (48) lesson plans for the experimental group using the (M.I.T) technique and (48) lesson plans for the control group using the conventional approach for the scientific fourth. To demonstrate the validity of the teaching plans, a model of both was shown to a group of experts and arbitrators. The researcher then used their feedback to make any necessary revisions.

Search tool:

The investigator took on the productive thinking test for (Hilal, 2018) because it fits the research sample.

Experiment application:

The investigation was applied on Tuesday corresponding to (1/11/2022) the end of Tuesday, corresponding to (4/25/2023). The steps used to carry out the experiment were divided into stages based on their respective objectives.

Data-based measures:

The T-test, Kueder-Richardson-20 equation, and the alpha-Cronbach equation were only a few of the suitable statistical techniques used.

Show results:**Validating the null hypothesis:**

For the purpose of confirming the accuracy of the null hypothesis, which states: "There is no statistically significant difference between the average scores of the students in the experimental group who study using the (M.I.T) strategy and the average scores of the students in the control group who study using the traditional method on the productive thinking test at the level of significance (0.05)."

Both groups took the dimensional productive thinking test, and the results were statistically analyzed by using the t-test for two independent, equal samples and extracting the arithmetic means for the two groups. As demonstrated in Table (8), there is a statistically significant difference between the averages of the thinking test created for the two groups in favor of the experimental group at a degree of freedom (68) and a level of significance (0.05).

Table (8): Means, standard deviations, and t-values for the two groups in the productive thinking test

Statistical significance at the level of 0.05	T value		degree of freedom	Contrasts	Arithmetic averages	Preparing students	the group
	Tabular	calculated					
D			68	74,934	46,633	35	Experimental
	2	5,332		55,570	35,970	35	control

Results and their interpretation:

The presented results showed the superiority of the experimental group's students who studied using the M.I.T. strategy outperformed the control group's pupils who studied using the standard method on the exam of creative thinking. This superiority could result from:

- 1- The use of the mediated teaching strategy facilitated the content of the material for students, made it more understandable and simple, and removed the complexity from it, which made their productive thinking greater.
- 2- The use of the intermediate teaching strategy provided the students with easier ways to memorize and remember the material and then increase their creative thinking.
- 3- It turned out that changing the teaching method using the intermediate teaching strategy is more appropriate and useful for students than the usual method, which contributed to raising their critical thinking.
- 4- The use of the intermediate teaching strategy made the exam questions more clear, less complex, and more appropriate with the time allotted for the students, and then they did not need explanation or clarification, and this contributed greatly to increasing their productive thinking.

CONCLUSIONS:

This strategy had a positive impact on the productive thinking of fourth-grade scientific Students are guided by the glaring statistical discrepancy that analyzing the results statistically. It also developed in students the talent of reading in its written, analytical, creative, critical and evaluative dimensions.

Recommendations were given in light of the findings and include the following:

- 1- Emphasizing the importance of including metacognitive strategies, especially reading comprehension strategies, including intermediate teaching (M.I.T) in teaching chemistry and other scientific subjects.
- 2- Emphasizing the need to use metacognitive strategies, including the intermediate teaching strategy for all preparatory stages, for its effective role in developing productive thinking.
- 3- The need for the Ministry of Education to review the chemistry curricula for the preparatory stage, reconsider their content and make them more understandable to the student.
- 4 - The need for preparation and training centers affiliated with the directorates of education to conduct workshops for male and female teachers of chemistry to clarify and explain strategies for metacognition, especially reading comprehension and its role in making the student more understanding and aware of his subject.

Suggestions:

- 1- Conducting comparable research on other areas (like physics and mathematics) at various academic levels.
2. Investigating this tactic using additional factors, such as scientific rigor and different forms of thinking (systemic and divergent).
- 3- A comparison of the (M.I.T.) technique with other strategies to see how much of an impact it has on high school students' creative thinking.

4-Conducting similar research on a sample of females and comparing them with males in the effect size scale.

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