

Use of Instrumental Enrichment strategy and its impact on achievement and thinking skills in mathematics

First grade students have average

¹Dr.Hassan kamil risen Al-kinani

²Dr.Sahar Jabbar dawod alyasri

¹University of Baghdad / College of Education for Pure Sciences - Ibn Al-Haitham

²Directorate of Education, Baghdad, Rusafa /2

Summary:

The aim of the research is to know the use of the means of enrichment strategy and its effect on achievement and thinking skills in mathematics among first-graders middle school students, and to achieve the research goals the researchers adopted the experimental approach, and given the current research included an independent variable and two dependent variables, I used the experimental design with two groups (experimental and control) with The post-test, the experiment was applied to the first intermediate class students in (Al-Ma'ali Secondary School for Girls) / for the academic year 2017-2018 and the research sample consisted of (81) students who were randomly divided into two groups, experimental consisting of (40) students and was studied according to the strategy Tharaa Al-Wasaili) and a control group consisting of (41) students who studied according to the usual method, the two groups were rewarded in the variables (time age calculated by months and test of previous mathematical knowledge and previous achievement in mathematics), the experiment was applied in the second semester (second course) for the academic year (The research resulted in a statistically significant difference at the significance level (0.05) between the mean scores of the experimental group and the control group in the achievement test in favor of the grades of students of the experimental group and there is a statistically significant difference at the level of significance (0.05) between the mean scores of the experimental group and The control group in the test thinking skills for the benefit of the experimental group grades students, and researchers presented a number of recommendations and suggestions.

First: Research Problem:

Mathematics is one of the basic subjects that are taught to the learner from his admission to school until the end of it, and it accompanies most learners even in university studies, it is the basis of science and from them all operations begin in life, and despite the extreme importance that this subject possesses, it constitutes the greatest challenge to the proportion Large of educated people all over the world, and this is not due to being a difficult or incomprehensible subject as much as it is due to the lack of easy and easy access to sports information.

Since mathematics has an important place among other sciences because of its importance and role in all aspects of life and the dependence of all other sciences on it in one way or another, and because of its important role in helping learners to solve many different problems and for these and other reasons, the primary goal of learning mathematics has become Developing the ability of learners to solve different problems and developing thinking about their different patterns

(N.C.T.M , 1989,23)

The sense of the research problem for the researchers stemmed from their observation of the low achievement in mathematics and through their work in the field of teaching, noting that achievement is the primary and only goal in teaching mathematics based on following the traditional method of teaching, which led to weakness and decline in thinking skills, problem solving, and inability Many of them use what has been studied in specific life situations in public life or transfer the impact of learning to new situations, and also by looking at the literature and previous studies such as (Al-Dahan, 2012) and (Al-Yasiri, 2013) study, also note that most of the students do not have The A lot of thinking skills, especially in the field of mathematics, and this may be due to their lack of love for the subject due to a sense of its difficulty and intensity, which leads to a loss of desire to study it. Among these and other reasons, the necessity of helping the learner to see mathematics is an interesting topic of thinking and the development of appropriate solutions and work to develop thinking skills from Learning is built on experience and work, not on memorization and memorization. The research problem can be summarized by the following question:

What is the effect of using the instrumental enrichment strategy on achievement and math thinking skills among middle school students?

Second: Importance of the Research:

The process of teaching mathematics is an organized, purposeful, and not random process, because both the teacher and the learner use the mentality that must keep pace with modern trends of contemporary education, as teaching strategies are an effective and important tool in the educational process because of their importance in organizing the lesson and in dealing with the scientific subject and he cannot The teacher dispensed with and without choosing the appropriate teaching strategy, the educational goals of the lesson cannot be achieved. (Attia, 16: 2008)

The goal of using a modern teaching strategy is to contribute to raising the level of the educational process as a whole as well as helping to create a generation that is up to date with modern scientific developments and is able to think and take the leadership role all of this is achieved through following modern teaching strategies and adopting modern and innovative approaches so that the learner is the focus Educational process

As teaching mathematics to learners at different educational levels is not easy for both the teacher and the learner, and this involves several reasons, including varying achievement capacities between learners and different teachers themselves in terms of preparation and qualification, as well as varying levels of education for all of this and other major gap in math education, the matter What required reconsidering the nature of the mathematics curriculum and the nature of the methods and strategies used in teaching this subject. (Salama, 2005: 70)

The main goal of using any teaching strategy is to achieve meaningful and meaningful learning among learners, and the Waseli Enrichment strategy is one of the important strategies that has been accepted in the field of education because it focuses on the ideas of structural theory that focuses on the active role of the learner in building knowledge through Trying to link the learner's past experiences with new experiences. (Attia and Al-Surour, 2011: 452)

The goal of this strategy can be considered to help learners to increase learning and the ability to adapt to the environment and transform the educational process from the

process of indoctrination and re-memorization of information to the development of mental skills and the use of those skills to understand the problems facing them present and future and work to solve them.

The importance of the research can be summarized in two aspects:

Theoretical side:

1. An attempt to increase the motivation of learners towards the learning process through positive interaction with the subject matter through the use of modern teaching strategies.
2. Mathematics teachers may benefit from this research by examining more modern teaching strategies that contribute to raising the level of learners' achievement by looking at their strengths and weaknesses.

2) The Practical Side:

1. The results of this research can be used by the Ministry of Education when building curricula through the development of teaching methods used using modern teaching strategies.
2. Knowing the effect of using the (Enriching Enrichment) strategy on achievement and thinking skills of middle intermediate female students.

Third: Research Objectives

The research aims to know the effect of using the strategy (instrumental enrichment) in achievement and thinking skills of middle school students in the middle of mathematics.

Fourth: Research Hypotheses

For the purpose of achieving the objectives of the current research, the following zero hypotheses have been developed:

1. There is no statistically significant difference at the significance level of 0.05) between the average scores of students of the experimental group (who study mathematics subject to them using the method of enrichment method) and the scores

of students of the control group who study the same subject using the usual method in the achievement test. $H_0: \mu_1 = \mu_2$

$H_1: \mu_1 \neq \mu_2$

2. There is no statistically significant difference at the significance level of 0.05) between the average scores of female students of the experimental group (who study mathematics subject to them using the means of enrichment strategy) and the scores of students of the control group who study the same subject using the usual method of testing thinking skills.

$H_0: \mu_1 = \mu_2$

$H_1: \mu_1 \neq \mu_2$

Fifth: Research Limits

The current research is determined by the following:

1. Students of the first intermediate class for the academic year (2017-2018) in the morning and middle schools and high schools in the city of Baghdad of the Baghdad Education Directorate / Rusafa 2.
2. The fifth and sixth semesters of the book of mathematics, the second part, to be taught for the first intermediate grade of the second course, which includes:

Sixth: Determination of Terms

Teaching Strategy

He knew it (Odeh, 2014): (It is a group of means that came out of a series of tests used to achieve and achieve the goals set) (Odeh, 2014: 7)

- Instrumental enrichment strategy

It was defined by:

(Martien and Jonas: 1988): It is (a set of structured procedures that the teacher performs in the classroom previously planned by him and its purpose is to correct the

weak knowledge functions of the learner and provide him with the important necessities of the learning process). (Martien and Jonas: 1988: 1)

He defines it (Al-Masoudi, 2013): "It is a set of codified and organized procedures previously planned by the teacher that includes (goals, content, activities, evaluation) and works together to achieve a general goal."

(Al-Masoudi, 2013: 54)

The researchers define it procedurally: that it is (a set of organized steps previously planned and the basis of its work is to provide learners with a variety of educational experiences in subjects or activities not mentioned in the school curricula.

Achievement: known by:

- (Abu Gado, 2003): It is the result of what the learner learns after passing a specific time period for learning to know the success of the strategy that the teacher used and plans to achieve his goals and can be measured by the degree obtained in the achievement test. (Abu Gado, 2003: 469)

- (Hamadenah and Khaled, 2012): "It is a structured procedure that is carried out according to specific criteria set in advance aimed at learning about the facts, concepts and skills acquired by the learner after studying a specific study subject."

(Hamadenah and Khaled, 2012: 147)

The researchers define it by procedural definition as (the final total score obtained by the student through her answer to the achievement test prepared for the purposes of the current research).

Thinking Skill

He knew it (Habib, 1996): (It is the ability of the learner to explain, define, understand and practice the mental processes required of him easily, accurately and thoroughly, and thinking skills include many sub-skills).

(Habib,

1996: 20)

He knew it (Al-Karmi, 1998): (it are basic requirements to crystallize the learner's thinking towards a correct way, his ability to perceive relationships in the situations facing him, and the ability to choose alternatives and organize available ideas and experiences to reach new ideas). (Al-Karmi, 19: 1998)

The researchers define it procedurally as a mental activity that the learner performs to help him form an idea or solution to a specific problem or make a decision about a specific problem in mathematics.

Theoretical background:

Waseel Enrichment Strategy:

The Waseli Enrichment Strategy is one of the strategies that are based on cognitive theory as it views intelligence as the learner's ability to adapt to the educational situation and can change as a reaction that requires this change (Khazaleh et al., 2011: 8)

This strategy contains (15) enrichment methods that the teacher can use a part of them to teach in the classroom, and each of these methods includes a set of exercises of the paper and pencil type (grades and paper) that are graded in their difficulty levels, so that the lower levels are pre-requisites To reach the higher levels, these exercises focus on developing a specific cognitive function for the learner, but at the same time it may develop other cognitive methods automatically and thus all of this contributes to helping the learner to think actively. (Al-Banna, 2000: 18)

The most important enriching methods used in the field of mathematics can be summarized as follows:

1) Organization of Dots:

In this medium, the teacher provides the learner with a set of geometric shapes, graded in complexity, and is called the model. After that, these forms are presented to

the learner in the form of a set of separate points, and he is asked to use the points to form a specific shape and does not repeat using it in another form.

The importance of the means of enrichment strategy:

Bransford, et.al, 1985,195-196 (1985) summarized the importance of the means of enrichment strategy in the following steps:

- 1) Converting the learner from a negative recipient of the information to an active and effective approach to the new information.
- 2) Helping the learner to create real motives in order to accomplish the task in an atmosphere of confidence and pleasure, and thus help in creating a positive direction towards the subject.
- 3) Helping the learner in contemplative thinking and foresight by facing his learning results
- 4) Helping the learner to acquire concepts and realize the relationships and skills necessary to perform cognitive tasks in response to self or internal needs.

Steps of the Enriching Strategy:

The steps of this strategy can be summarized as follows:

First: the lesson planning stage:

In this step, the procedural goals of the lesson are defined, aspects of learning are organized, the time of the lesson is determined, the enrichment methods used are established, and a lesson assessment plan is established.

Second: The implementation phase of the lesson:

This stage includes a number of steps, namely:

- 1) Introduction: Here is presented the problem that learners work to solve and define their own goals, as well as arouse the interest of learners towards the problem in order to reach the appropriate solution.

2) Independent work: In this step, each learner solves the exercises and exercises related to the problem, which is the subject of the lesson in the textbook or that is presented by the teacher.

3) Discussion: Here, the teacher discusses all the solutions that the learners have reached and try to apply the concepts mentioned in the subject of the lesson in new situations.

4) Summary: This step is specific to the teacher as he presents the main ideas of the lesson to learners.

5) Evaluation: In this step, the lesson is evaluated by knowing the goals that were previously set for the lesson. (Al Banna: 2000-20-21)

Advantages of the Enriching Strategy:

We can summarize the most important positive points of this strategy as follows:

- Using this strategy helps the learner to develop and advance in thinking.
- To use this strategy a major role in developing the skills of analysis and problem solving through knowledge building.
- It has a huge role in adding an atmosphere in the classroom far from routine and boredom.
- It contributes to raising the level of motivation among learners and developing and developing mental and cognitive skills.
- Using this strategy inside the classroom contributes to enriching the learner with information and experiences, not only in the subject area of the lesson. (Muhammad and Issa, 2011: 238)

Disadvantages of the method of beneficial enrichment:

Some of the negatives that occur when applying this strategy can be summarized as follows:

- 1) Most teachers do not have sufficient knowledge or skill to provide the necessary enriching experiences for learners when applying this strategy in the classroom.
- 2) Applying this type of strategy requires special plans and programs when preparing the teacher, as well as a limited number of learners within the same classroom and preparing additional educational materials and not to adhere to the prescribed course only (Feuerstein et. Al. 1985, 66-75)

Thinking:

In the current era, the world is experiencing a broad knowledge and cultural explosion in all spheres of life, as it gives the developed peoples a wide interest in thinking, its skills and operations and the direction towards caring for it, and on this basis the learner must possess the basic skills of thinking and help him to develop and develop them, and there are many views on thinking and his skills Different, as some think that thinking consists of three basic components, the first of which is complex cognitive processes, the most important of which is problem-solving, and the other component is understanding and application, and the last component is complete knowledge of the content of the material with availability of preparations and Mio Personal factors. (Happiness, 2003: 40)

From the point of view (Edison, 1997) that thinking is the most complex type of human behavior and represents the summit in the levels of mental activity and that most of what a person learns occurs by thinking through association with the problem of what the individual faces which calls for thinking and trying to find the appropriate solution. (Edison, 1997: 32)

thinking skills :

Sternberg has stated that thinking skills are the learner's ability to explain, define, understand and practice mental processes quickly and proficiently. Mental processes are the ability of the learner to perceive relationships in situations and the ability to choose alternatives and foresight and organize ideas and experiences available in order to reach new ideas.

(Khairallah:

1981, 16)

Studies and researches have proven that R skills often do not work separately individually, but work together in an integrated system so that in a particular situation one of these skills is prevalent and responsible for the rest of the skills and in another position this skill is a subsection so that the process of exchanging roles with the rest Skills and thus a interaction occurs between these skills, a according to the goal and purpose of the situation until the learner reaches his goal. (Abu Zina, 1994: 243)

(Marazano, 2004) has indicated that the curricula are concerned with the process of developing thinking skills, with a certain disparity, using different methods and strategies, and that mathematics curricula exclusively are a fertile field for training in different thinking methods and the ability to develop them and develop them, given that mathematics is a mediator between ability The development of thinking and the ability to solve problems and the fact that mathematics is a constructive construct that starts from the elements of a Muslim in its sincerity and derives results from it according to the rules of logic. All this and others are considered factors that help in developing the skills of thinking and directing them towards sound paths. (Marazano, 2004: 32)

(Dhiab, 2000) mentioned that thinking skills are divided into two parts, which are higher thinking skills and minimum thinking skills, and there is general agreement that a distinction can be made between higher and lower thinking skills through some of these differences and these differences are present in the learner himself as he may use some higher thinking skills In facing a specific situation, and perhaps another person uses some minimal thinking skills in facing the same situation.

(Thiab: 2000,62)

(Jarwan, 2009) mentioned that there is agreement among researchers about thinking skills, being:

- It is very important to teach thinking skills and create appropriate opportunities for learners at different stages of education.

- Educational institutions should keep in mind that learning thinking skills are among the basic goals that must be achieved during the different stages of education.
- Thinking skills develop and improve with training.
- There is no underlying premise that higher-order thinking skills appear naturally on the basis of growth and development. (Jarwan, 2009: 29)
- As (Shawaheen and Badandi, 2010) indicated, thinking skills can be used and applied in multiple fields such as solving problems faced by learners in daily life and these problems are either standard or complex through the use of mathematical strategies such as translating problems into mathematical relationships or searching for cases Specific or search for specific patterns. (Shawaheen and Badandi, 2010: 116)

How to learn thinking skills:

Despite the agreement of scholars and specialists in the field of education on the need to teach thinking to learners by the teacher in an organized and planned and intended within educational institutions (school, university or academic), but they differed about the method or method that follows to learn thinking and in the end they agreed that the appropriate method for learning Thinking takes shape in three approaches that can be summarized as follows:

The first perspective: The supporters of this perspective see the necessity of learning thinking skills independently from the content of the subject matter taught by the learners, so the content of daily lessons is not used in the teaching of thinking, and according to this perspective, the learner's mother learns the classification skill, for example, directly and explicitly, and through certain activities and training that contribute to the development of this skill He has, without including teaching him about this skill, any content that is directly related to what the learners study from classification subjects, and the processes of learning any of the thinking skills are done sequentially one after the other where the teacher allocates to a specific lesson or a number of lessons a specific skill that is subject Education This perspective is called direct education for thinking skill Direct of Struction of Thinking Approach.

The second perspective: The owners of this perspective advocate the necessity of learning the thinking processes implicitly during the process of teaching school subjects through doing some specific teaching practices such as creating a classroom environment and using certain teaching and evaluation methods, methods and strategies that contribute to the process of developing these processes among learners, and the owners of this perspective see The teacher can teach and develop a number of thinking skills together in one lesson. This perspective is called the Teaching For Thinking Approach.

The third perspective:

The owners of this perspective advocate the need for the learner to learn one of the thinking skills directly and explicitly in the context of the content of the lessons of the subjects they are studying within the framework of their regular curriculum and this requires the teacher to employ the content of daily lessons in order to teach the targeted thinking skill directly and intended for learners, and this perspective is called Teaching Infusion Approach of.

(Olives, 2006:

100-102)

The role of curricula in developing thinking skills:

He reminded you from (Lavie, 2006) that the process of developing thinking skills is not an easy job and cannot be taught to the learner in a specific number of lessons or through a specific subject or unit of study, but that requires continuous practice through knowing and defining what is important for the process of thinking, analyzing facts, comparing them, reviewing the content of the curricula on an ongoing basis, and preparing them in a logical, sequential manner, all of which are done by observing the following:

1. Transforming educational goals into behavioral procedural goals that can be measured and achieved within a single classroom.

Reconsidering preparing curriculum content based on the active participation of learners by discovering knowledge and skills and developing the habit of sound

thinking for them, as mathematics is a fertile field for training in various thinking methods because mathematics is an inferential construct that begins with the foundations of a sincere Muslim and derives results from it using the rules of logic and this is considered One of the most important factors that help clarity of ideas.

(Lavi,
2006: 32)

2. The school environment must provide information in the curriculum characterized by diversity, accuracy, safety, ease of presentation and style, as the diverse knowledge and experiences represent the main content of thinking.

3. There must be real interaction between the school, the community, and information in the school curriculum because all of this represents exciting and helpful elements for developing the learner's thinking. (Thiab, 96: 2000)

The teacher's role in learning and developing thinking skills:

1. The teacher must try and strive in order to provide the appropriate opportunities for the learner to train in thinking skills and develop them, for example, by stimulating learners' motivation to meet the situations that require thinking and creativity by the learner.

2. That the teacher work inside the classroom to provide a study environment that raises research and thinking for the learner by presenting problems or situations from the surrounding environment and can only be solved through thinking processes.

(Thiab, 2000:
98)

Mathematics Thinking Skills:

Thinking skills multiplied until they exceeded twenty, and thinking skills related to mathematics were defined as follows:

- The skill of observing and realizing relationships: This skill is the ability of the learner to analyze the information obtained from various learning sources, to understand the relationship between the parts, and to know the principles and

provisions that govern these relationships. The goal is to prepare learners and motivate them to learn the skill.

- Estimating skill: The basis for the work of this skill is through the learner's use of information that is within his previous domain of knowledge to judge a new position or work in light of an accurate standard he knows.
- Classification skill and concept building: The basis for this skill's work is the ability of the learner to place objects in groups based on the characteristics common to the elements of those groups.
- The skill of producing results and making generalizations: This skill is that the learner acquires the ability to observe a set of characteristics or molecules that are called common characteristics or features that enable the learner to establish a general rule or generalization that applies to all molecules that have the same common features, and extends the process of developing Generalizations to another process is the discrimination process, as each of them is a face of one phenomenon, as generalization is related to the appearance of the response when a set of stimuli similar to the original stimulus are available, while discrimination is related to the lack of response to stimuli that differ from the original stimulus significantly.

(Homsy, 1996:

101)

- The skill of employing induction: This skill enables the learner to process the process of induction, which is a mental process in which the learner contemplates a set of partial cases and examples, and a general rule is drawn from them that applies to all particles. (Thiab, 2000: 71)

And when the learner uses these skills to solve a specific problem, those skills must pass as follows:

- 1) Analysis: Here the learner splits the information available to him about the problem into real parts and other parts that can be perceived so that it can be dealt with.
- 2) Abbreviation: Here the most important points that can be dealt with in order to solve the problem are analyzed and the learner will resort to following this skill in

order to record the information available to him in a brief way instead of dealing with a huge amount of information and data. (His Excellency, 2003: 46)

3) Composition: According to this skill, the learner connects the parts and aspects that can be linked with each other when solving a specific problem, by linking information with each other according to specific relationships.

4) Production of solutions: Here a number of experimental solutions and alternatives are implemented to solve a specific problem or when proposing guesses for a solution. (Rusbult, 2002: 36)

Search procedures :

First: Research Methodology:

Depending on the nature of the research and its hypotheses, the researchers used the experimental research method, and it is defined as designing an accurate plan for the research before the start of the experiment.

Second: Choosing an experimental design:

The experimental design was partially adjusted for two equal groups with dimensional and appropriate testing for research purposes, as the strategy of the variable variable mean means in the experiment represents both achievement and the variable thinking skills of the experiment, and table (1) illustrates this design:

Table (1) Experimental Design for Research

Measurement of the dependent variable	Dependent variable	Independent variable	Equivalence of the two groups	the group

Achievement test	Collection	Waseel Enrichment Strategy	Previous mathematical knowledge chronological age calculated in months, previous achievement in mathematics	Experimental
		traditional way		Control

Third: Research Society:

The accuracy of the research depends on procedures that precisely define its society (Al-Hailah, 2001: 184). The current research community was determined by all students of the first intermediate class in the middle and secondary schools of the day affiliated to the General Directorate of Education in Baghdad / Rusafa the second for the academic year 2017-2018. To the research community (16325) students

Fourth: Research Sample:

The researchers chose (Al-Ma'ali Secondary School for Girls) after it was agreed with the school administration to conduct the experiment in the aforementioned school and for one of the researchers to be a teacher in it, as the Division (A) represented the experimental group and the number of its students reached (43) students and (B) to represent the control group and reached The number of female students is (45) female students. After excluding the female students from the two groups who were (7) students, the research sample became (81) female students, as shown in Table (2) the following:

Table (2) Distribution of female sample students between the two research groups (experimental and control)

Number of female students			Division	the group
After exclusion	Excluded	Before exclusion		

40	3	43	a	Experimental
41	4	45	B	Control

Fifth: Control procedures:

Before starting the research experiment procedures, the researchers made sure to control all factors and variables that they believe may affect the safety of the experiment application and the sincerity and accuracy of its results, my agencies.

A) Interior safety of experimental design:

To verify the internal integrity of the experimental design and for the current research to be true to the standard in which the difference between the two research groups can be attributed to the independent variable and not to any other factor or exotic variable, the previous mathematical knowledge was equalized by preparing a test of (15) paragraphs, Also, the parity in the temporal age, calculated in months, as well as the parity in the previous achievement through looking at the grades of the sixth grade, as well as parity in the grades of the first semester (first zos), and a general test of thinking skills was prepared for the purpose of parity only and applied to the two groups and they were equal in In this variable.

B) Control of extraneous variables (external safety of experimental design):

The researchers sought to control exotic variables and verify the external safety of the experimental design by controlling the conditions of the experiment, and the two research groups not being subjected to experimental extinction (leaving in the experiment) and taking into account the maturity factor, as well as the confidentiality of the experiment because one of the researchers is teaching in the same school, and the study subject itself was also identified For the two groups and the use of the same teaching aids and with a single time period for the two groups, and with equal number of classes and an almost equal time, I used the same test tools in the two groups.

Sixth: Research Requirements:

1. Determination of content (scientific subject):

The scientific subject was determined from the book of mathematics for the first intermediate grade (2017_2018 AD / first edition) and was represented in chapters (fifth, sixth)

2. Content analysis:

The content of the two chapters (Fifth - Sixth) was analyzed according to the components of mathematical knowledge as well as according to Bloom's classification of the cognitive domain, as (196) behavioral purpose, distributed over the two chapters as in Table (3), was formulated.

Table (3)

The distribution of behavioral purposes between levels of the cognitive domain in the content of the scientific material

Total	Cognitive field levels						Chapter title	the classroom
	Evaluation	Installation	analyzing	Application	Understanding	Remember (knowing)		
106	6	3	6	25	23	41	Engineering	Fifth
90	7	12	11	22	6	30	Measurement - spaces and volumes	VI
196	13	15	17	47	29	71	Total	

Preparing teaching plans:

Within the content of the scientific subject for the two semesters (fifth and sixth), (38) teaching plans were prepared for each of the two research groups, and the plans were distributed between the two semesters by (18) plans for the fifth semester (engineering) and (20) plans for the sixth semester (measurement - spaces) And volumes).

Seventh: Research tools:

To verify the research objectives and hypotheses, two tools were built to measure the dependent research variables, namely the achievement test and the thinking skills test, and the following are the procedures for building these two tools:

First: building the achievement test:

One of the requirements of this research is to build an achievement test in the academic subject for the classes included in the research experiment, and this was done by defining the goal of the test, which is to measure the level of students 'achievement in the content determined in the research. And (196) behavioral purposes have been formulated, (38) test items, (30) objective items of multiple choice type and (8) paragraphs of fried type have been formulated, and specifications table (test map) has been prepared depending on the content of the scientific material and behavioral purposes, as in Table (4).

Table (4)

Table of specifications for achievement in mathematics subject for the fifth and sixth semesters

The number of paragraphs	Cognitive field levels						The relative weight of the separation	Number of shares determined	Chapter title	the classroom
	Calendar 7 %	Composition % 8	The analysis 8%	% 24 application	They are 15%	They are 15%				
18	1	1	1	5	3	7	47%	18	Engineering	Fifth

20	0	2	2	5	3	8	53%	20	Measurement - spaces and volumes	VI
38	2	3	3	10	6	15th	100%	38	Total	

After preparing the table of specifications (test map) for the content of the scientific subject, (38) test items were drawn up according to which, as well as a page for test instructions was prepared.

Validate the test:

It means the possibility of testing or its ability to measure the object for which it was intended and does not measure anything else as a substitute for it. (Al-Sliti et al., 2009: 423)

The validity of the test was verified by using some types of validity to suit the research, which are:

- Virtual validity:

The test clauses were presented to a number of arbitrators with a specialization in mathematics and methods of teaching them, to show and know their opinions regarding the validity of the test clauses in measuring what was set for it and the accuracy of its formulation, and observations have been taken.

- Certified content:

The use of the specification table in building the achievement test is considered an indicator of the validity of the test content, and thus the achievement test is considered honest in relation to the extent of its representation of the content of the scientific material and the behavioral purposes that it measures.

- Sample information:

The test was applied to a survey sample of (22) female students from the first intermediate class on Wednesday, 25/25 / 2018AD in the Intermediate Course of the Certificate of the Directorate of Education, Baghdad, the third Rusafa. The

observations of the students were taken on the paragraphs about which queries were raised, and so were Determine the test time with a time average of (60) minutes.

Statistical Analysis Sample:

The test was applied to a second exploratory sample of (100) female students from the first intermediate class in the Intermediate Course Certificate of the General Directorate of Education, Baghdad, the third Rusafa, on Thursday corresponding to 26/4/2018, after making sure of the completion of the students from studying the two semesters covered by the research.

Statistical analysis of achievement test items:

After correcting the female students 'answers sheets and finding the final score for each female student, the grades were arranged in congruence and a higher percentage (27%) and a lower (27%) score were set for the two groups.

Difficulty coefficient for achievement test items:

According to the formula for the special difficulty coefficient, it was found that the coefficients ranged between (0.62-0.62), and the difficulty coefficient was calculated for each of the article's test items, which were (8) items according to the formula for its own difficulty factor, and it was found that it ranged between (0.80 -0.41), since it is good for the coefficient of difficulty for test items as a whole to fall within a period of (0.20-0.80) which is the acceptance period of the paragraphs.

(Al-Dulaimi and Adnan, 2002: 65)

The Discriminative Power of Achievement Test Clauses:

The discrimination factor equation was applied to calculate the discriminatory force for each of the objective test items, and it was found that it ranged between (0.58-0.33), and the discriminatory force was calculated for each of the article test sections according to its discrimination factor formula, and found that it ranged between (It is a good indication of acceptance of all paragraphs, as Ebel (1972)

indicated that the paragraph is considered good and acceptable if the ratio of the coefficient of differential strength has ranged between (0.80-0.20). (Ebel, 1972: 269)

Effectiveness of the wrong alternatives:

The effectiveness of the most attractive camouflage for female students with lower levels was calculated for female students with higher levels for each of the multiple choice subject paragraphs according to the formula of effectiveness of their wrong alternatives, and it was found that they range from ([0.06-] - [0.05] This indicates its effectiveness, and thus it was decided to keep the alternatives as they are.

Achievement of the achievement test:

It is intended to give the test the same results if it is repeated under the same conditions and the individuals themselves, then the coefficient of stability is the statistical indicator of the accuracy of the measurement. (Back, 340: 1998)

The stability coefficient of the achievement test was calculated according to the equation (Elfa - Kronbach), as it is one of the equations suitable to be applied in the test that consists of article and article paragraphs. In 1985: 58), as for the article paragraphs, the researchers withdrew (50) papers randomly, then one of them corrected the papers, and after a period of a week passed, he corrected again, and using the Cooper equation, the agreement percentage reached (0.96). Using the same formula, the papers were corrected by the second researcher. The ratio was (0.98) and the percentages for it were with The hope for stability is high, as he points out (Majeed and Yassin, 2012: 93).

Second: Building a Thinking Skills Test:

A test of thinking skills in Mathematics was built as follows:

1) Determine the objective of the test:

The idea of defining the goal of the test is to measure the level of thinking skills in mathematics among middle school students.

2) Viewing the literature and previous studies:

Previous studies were examined that dealt with thinking skills in mathematics, including a study (Al-Mansour, 2011), and a study (Al-Asmar, 2016). These studies have benefited researchers in the division of skills and the formulation of test items.

3) Determination of thinking skills in mathematics:

Through reference to the literature and translation of some definitions of this variable, and after consulting a number of specialists in the field of methods of teaching mathematics and psychology, five skills were identified to think of a subject

Mathematics is measured by testing among middle school students, to suit the capabilities and capabilities of female students at this stage.

4) Formulation of test items in light of the specified fields:

A number of test items were formulated for each field to be consistent and compatible with the theoretical definition for each of them. The test consisted of (30) paragraphs with (6) paragraphs for each field.

5. Presenting the domains with the clauses to the arbitrators:

After defining areas of thinking skills in mathematics and formulating test items in the light of the areas identified in their initial form, the five skills were presented with paragraphs consisting of (30) paragraphs on a number of arbitrators, for the purpose of knowing their opinions and observations on the extent of consistency of the paragraphs with the specific areas addressed in the test and the validity Drafting the paragraphs and their validity to measure the level of thinking skills of middle-grade students, and in the light of opinions, the amendment was made, and the paragraphs got more agreement (80%) and were retained and distributed as in Table (5).

Table (5): Distribution of paragraphs of mathematics thinking skills test in its fields

Induction employment	Graduating results and generalizations	Classification and concept building	Estimate skill	Observing and perceiving relationships	Skill
25,26,27,28,29,30	19,20,21,22,23,24	13,14,15,16,17,18	7,8,9,10,11,12	1,2,3,4,5,6	Distribute paragraphs between skills

5) Answer and Correction Instructions:

A page has been prepared at the front of the test that includes the instructions for the test and directed to students, as well as instructions for correction, as one degree was devoted to the correct answer to the paragraph and zero for the wrong or left answer without an answer.

6) Validate the test:

The validity of the skills test was verified by using two types of honesty:

الظاهر Virtual honesty:

The apparent honesty was achieved by offering the test to a number of specialists in the methods of teaching mathematics and science, and the paragraphs received an agreement rate of more than (80%).

 Construction Certification:

The internal consistency of mathematical thinking skills test was confirmed by finding the correlation between each of the following:

1) The grades of each paragraph with the grades of its domain:

The correlation coefficient was extracted between the scores for each of the test items and the field scores to which they belong using the Pearson Correlation Coefficient, and the results showed that all the test items were statistically significant, as the values of correlation coefficients ranged between (0.64-0.31) and it is a good indicator On the sincerity of construction to test thinking skills in mathematics.

2) Overall test scores:

The correlation coefficient was extracted between the scores of each field and the scores of the total test using the Pearson Correlation Coefficient, and the results showed that all the test items were statistically significant, as the values of correlation coefficients ranged between (0.71-0.43), which is a good indicator of the validity of the construction of the test .

7) The sample of information and the sample of statistical analysis to test thinking skills in mathematics:

Sample information:

To ensure clarity of the test items and instructions, and to determine the time required for students to answer all test items, the test was applied to a sample of (30) students, and the time spent in answering ranged between (45-55) minutes, and then the average of this time was calculated to be (50) minutes the time limit for female students to answer all paragraphs of this test.

Sample of statistical analysis:

After applying the thinking skills test to the information sample and making the appropriate adjustments to the test, the test became ready to be applied again for the purpose of conducting statistical analyzes of the test paragraphs, as the test was applied to a second exploratory sample of (100) female students from the first intermediate first grade students in the medium of the certificate path of the General Directorate To raise Baghdad, the third Rusafa on Thursday 12/1/2018.

9. Statistical analysis of the test items:

After correcting the female students 'answers sheets and finding the final score for each female student, the grades were arranged in congruence and a higher percentage (27%) and a lower (27%) score were set for the two groups.

Difficulty coefficient for achievement test items:

According to the formula for the special difficulty coefficient, it was found that the coefficients ranged between (0.37-0.77).

التمييز The Discriminative Power of Achievement Test Clauses:

The Coefficient of Discrimination formula was applied to calculate the differential power for each of the objective test items, and it was found that they ranged between (0.69-0.43).

Effectiveness of the wrong alternatives:

The effectiveness of the most attractive camouflage for female students with lower levels was calculated for female students with higher levels for each of the test items, and its value ranged between ([0.07-] - [0.06-]) which indicates their effectiveness, and thus it was decided to keep the alternatives as they are.

□ Test stability:

The value of the stability coefficient was calculated for the math thinking skills test according to the Koder-Richardson Formula-20 (K-R20) formula, which depends on the application of the test at once and can be used to verify the homogeneity of all the test items that measure a single feature or trait and are binary degree (0,1). (Allam: 98,2006)

The value of the test stability coefficient (0.86) is considered a good value.

Eighth: Procedures for applying the experiment:

The research experience has been applied in the second semester of the academic year 2017-2018, as it started on Tuesday 20/2/2018 and ended on Thursday 26/4/2018, at a rate of (5) lessons per week for each group. Depending on the teaching plans prepared by the researchers for each of them, and after completing the teaching of the prescribed content, the test was applied on Thursday, 4/26/2018, and the achievement test on Sunday 29/4/2018, after the students were informed a week before the appointment The two tests are to be prepared for them.

Ninth: Statistical means:

The researchers used the following statistical methods after using the statistical program (SPSS) version (22):

Paragraph Difficulty Equation, Paragraph Force Distinction Equation, Wrong Alternative Effectiveness Equation, Effects of Volume Effects, Cooper Equation, Alpha-Kronbach Equation, Kuder-Richardson Equation (K-R20), Pearson Equation, Levin Test (s Test/Levene For two independent samples, this test was used to determine the extent of homogeneity between the two groups (experimental and control) in the variables included in the comparison, and the t-test (for two independent samples). And also to know the significance of the statistical difference between Intercessory grades students groups in the analysis of the results)).

First: Presentation of the results:

The first axis: displaying the results of the achievement test: (the results related to the first zero hypothesis)

For the purpose of validating the first zero hypothesis, which states that:

(There is no statistically significant difference at the significance level of 0.05)) between the mean scores of students of the experimental group (who study mathematics subject to them using the means of enrichment strategy) and the degrees of students of the control group who study the same subject using the usual method in the achievement test)

After applying the achievement test and correcting the female students 'answers and organizing them in special tables, the Statistical Package Program (SPSS version (22) was used to obtain the statistical description of the raw data of the experimental and control groups in the achievement test, and table (6) shows this description:

Table (6) Statistical description of the two groups (experimental and control) in the achievement variable

95 % confidence interval for the mean		The standard error of the mean	standard deviation	Arithmetic average	Number of female students	Division	the group
minimum	the highest rate						
5.76	1.58	0.826	5.23	42.68	40	E	Experimental

5.77	1.57	0.651	4.17	39	41	Dr	CONTROL
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We notice from Table (6) that the average score for female students of the experimental group is (42.68) and with a standard deviation of (5.23), while the average score for female students of the experimental group was (39) and a standard deviation of (4.17), and by applying (s Test'Levene) for two independent samples, To find out the significance of the difference between the degrees of student differences in the experimental and control groups, the Levin statistic (F) (3.46) was at the significance level (0.067) which is greater than the approved significance level (0.05), which means that the two groups are homogeneous in this variable.

By applying (t-test) to two independent samples to know the significance of the difference between the mean scores of students of the experimental and control groups, the T value (3.50) reached at the significance level (0.001) which is smaller than the approved significance level (0.05) and with a degree of freedom (79), and this indicates superiority Students of the experimental group who studied according to the method of beneficial enrichment of students of the control group who studied according to the usual method in the achievement test, and table (7) shows that:

Table (7) the value of (F) and (t) of the experimental and control groups in the (achievement) variable

Statistical significance at (0.05) level	Degree of freedom df	t-test To equal the average		Test's Levene for equal contrast		Number of female students	the group
			t	indication	F		
Statistically significant	79	Statistically significant	3.50	0.067	3.46	40	Experimental
						41	CONTROL

Thus, the first zero hypothesis was rejected and the alternative hypothesis was accepted, which states that: (There is a statistically significant difference at the level of significance (0.05) between the average scores of students of the experimental

group who were studied according to the means of enrichment strategy and the average scores of students of the control group who were studied according to the usual method (In achievement test) and in favor of the experimental group.

To find out the effect of the independent variable on the dependent variable, (t-test) can be used when converting (t to d) directly.

Table (8) reference table to determine the magnitude of the impact

Effect size			the level
Large	Average	Small	
0.8	0.5	0.2	Numerical value

(Muhammad and Abdul-Azim, 2008:

42)

Using the equation ((d) of the effect size, the value was (0.78), which is an average size, meaning that this strategy used had an effect on the dependent variable, mean if it approximated the large effect.

The second axis: presenting the results of thinking: (the results related to the second zero hypothesis)

For the purpose of validating the second null hypothesis, which states that: (There is no statistically significant difference at the significance level of 0.05) between the average scores of students of the experimental group (who study mathematics subject to them using the means of enrichment strategy) and the grades of students of the control group who study the same Article using the usual method of thinking test), after applying the thinking test and correcting the students' answers and organizing them in special tables, the statistical bag program (SPSS version (22) was used to obtain the statistical description of the raw data of the experimental and control groups in the test T think, Table (8) shows this description:

Table (9) Statistical description of the two groups (experimental and control) in the thinking variable

confidence 95% interval for the mean		The standard error of the mean	standard deviation	SMA	Number of female students	Division	the group
minimum	the highest rate						
6.14	1.23	0.87	5.45	22.97	40	E	Experimental
6.14	1.27	0.88	5.62	19.29	41	Dr	CONTROL

Control Panel D 19 19.29 5.62 0.88 1.27 6.14

We note from Table (9) that the average score for female students of the experimental group is (22.97) with a standard deviation of (5.45), while the average score for female students of the experimental group was (19.29) and with a standard deviation of (5.62), and by applying (s Test'Levene) for two independent samples, To find out the significance of the difference between the degrees of student differences in the experimental and control groups, Levin statistics (F) (0.38) reached at the significance level (0.537) which is greater than the approved significance level (0.05), which means that the two groups are homogeneous in this variable.

By applying (t-test) to two independent samples to know the significance of the difference between the mean scores of female students in the experimental and control groups, the T value (2.98) reached at the significance level (0.004) which is smaller than the approved significance level (0.05) and with a degree of freedom (79), and this indicates superiority Students of the experimental group who studied according to the method of enriching the means on the students of the control group who studied according to the usual way in the thinking test, and table (10) shows that:

Table (10) value (F) and (t) of the experimental and control groups in the (thinking) variable

Statistical significance at (0.05) level	Degree of freedom df	t-test To equal the average		s Test' Levene for equal contrast		Number of female students	the group
		Significance of the two parties	t	indication	F		
Statistically significant	79	0.004	2.98	0.537	0.38	40	Experimental
						41	CONTROL

Thus, the first zero hypothesis was rejected and the alternative hypothesis was accepted, which states that: (There is a statistically significant difference at the level of significance (0.05) between the average scores of female students of the experimental group who were studied according to the means of enrichment strategy and the average score of female students of the control group who studied according to the usual method In thinking test) and in favor of the experimental group.

To find out the effect of the independent variable on the dependent variable, (t-test) can be used when converting (t to d) directly.

Using the equation (d) of the effect size, the value was (0.66), which is an average volume, meaning that this strategy used had an effect on the dependent variable (thinking).

Interpretation of the results:

1) Results related to the first hypothesis:

The superiority of the experimental group in the achievement variable and the size of a large impact may be attributed to the diversity in teaching procedures according to this strategy, which clearly contributed to tightening the learner's mind to the scientific subject and his effective contribution in the search for information and reaching as an evaluation of what he learned in every step which led to Attracting attention and continuing communication and follow-up of what he learned from the

subject matter, and thus an organized knowledge structure was formed for the learner to invest in other situations, and this is consistent with a study (Abdel Qader, 2004).

2) Results related to the second hypothesis:

The superiority in answering the thinking skills test for students of the experimental group may be attributed to the fact that the use of this strategy in teaching contributes to the development and promotion of many variables among the learner, such as thinking about its different patterns, as the use of this strategy contributes to acquiring and searching information instead of memorizing and re-memorizing it. Once again, in addition to the clear role that appears as a result of using this strategy, which is to increase the interaction within the classroom between the learners themselves on the one hand and between them and the scientific subject on the other hand, in addition to the learner's ability to use what he learned in very situations. Dah other This is consistent with the study (Banna, 2000), (Zahran, 2004).

Research Recommendations:

1. Reconsidering the content of mathematics curricula for the intermediate stage so that the topics included in the textbook contribute to developing the thinking skills of learners.
2. The necessity of middle school mathematics curricula to contain various types of higher and lower thinking skills in a balanced manner and in a manner consistent with the developmental characteristics of learners at that stage.
3. Upgrading the level of the learner by paying attention to how not to the quantity, and focusing on developing understanding and thinking, not memorizing and teaching.
4. Preparing special training programs and courses to increase teachers' awareness of thinking skills and the importance of providing them to learners.

Research proposals:

1. Work to develop the mathematics curriculum for all levels of education in the light of thinking skills.

2. Carrying out more studies to know the extent to which other textbooks include thinking skills.

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