

The effectiveness of the cooperative learning strategy in acquiring mathematical concepts among middle-school students-A case study of first-year students

فعالية إستراتيجية التعلم التعاوني في اكتساب المفاهيم الرياضية لدى تلاميذ التعليم المتوسط-السنة الأولى نموذجاً-

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Abstract:

The study aimed to demonstrate the effectiveness of the cooperative learning strategy in improving the acquisition of mathematical concepts among first-year middle school students.

The sample was divided into two groups: an experimental group that was taught using the cooperative learning strategy, and a control group that received traditional instruction.

The results showed statistically significant differences in favor of the experimental group in the final test of mathematical concepts compared to the control group. In contrast, no significant differences were found in the control group between the first test and the final test.

Keywords: strategy, cooperative learning, mathematical concepts, acquisition, mathematical concepts.

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المخلص:

هدفت الدراسة إلى تبيان فعالية إستراتيجية التعلم التعاوني في تحسين اكتساب المفاهيم الرياضية لدى تلاميذ السنة الأولى من التعليم المتوسط.

اعتمدنا على المنهج التجريبي، حيث قُسمت العينة إلى مجموعتين: تجريبية خضعت للتعليم وفق إستراتيجية التعلم التعاوني، وضابطة تلقت تعليماً تقليدياً.

أظهرت النتائج فروقاً ذات دلالة إحصائية لصالح المجموعة التجريبية في القياس البعدي مقارنة بالمجموعة الضابطة في اختبار المفاهيم الرياضية، في حين لا توجد فروق دالة إحصائية لدى المجموعة الضابطة بين القياس القبلي والبعدي.

الكلمات المفتاحية: إستراتيجية، التعلم التعاوني، اكتساب، مفاهيم رياضية، تلاميذ السنة الأولى متوسط.

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1. Introduction

The transition from primary to intermediate education is considered a fundamental turning point in the student's academic path, as this transformation is not limited to a change in curricula or new subjects only, but also includes a change in teaching and learning methods, an increase in the volume of content, and a rise in the level of abstraction in culture and concepts, especially in mathematics. Many students find it difficult to adapt to this transformation which may lead to poor academic achievement and aversion to the subject.

Traditional teaching methods, which are still prevalent in many departments, rely on direct indoctrination, where the teacher is the main focus of the teaching-learning process, while the learner's role is passive and limited to receiving and memorizing. This model is no longer sufficient to achieve modern educational goals, especially in light of the increasing challenges associated with the difficulty of understanding mathematical concepts and applying them in different contexts.

In this context, the cooperative learning strategy has emerged as one of the modern educational alternatives that aims to make the learner effective in building his knowledge, through group work, exchanging ideas, and bearing shared responsibility within small groups. This strategy is one of the most effective ways to support learning abstract concepts, such as mathematics, as it provides an interactive environment that reduces the burden of difficulties in understanding concepts and thinking and analysis skills.

This study seeks to investigate the effectiveness of the cooperative learning strategy in acquiring mathematical concepts among first-year middle school students by raising a set of questions and hypotheses and relying on a precise field-based applied approach

2 - Theoretical Back Ground

2-1 - Problem Statement

Mathematics is considered one of the core subjects in the school curriculum, and it represents a cornerstone in developing logical thinking and problem-solving abilities. However, in many contexts — especially in the early stages of education — it is still taught using traditional methods

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based on lecturing and individual exercises. This approach negatively affects learners' motivation and limits their ability to build mathematical concepts in an effective and deeper way. This challenge becomes even more evident at the middle school level, where students move from a primary educational environment to one that is more abstract in terms of concepts and content. This makes it more urgent to adopt more interactive and participatory teaching strategies that support understanding and break the rigidity often associated with learning mathematics.

In this context, several modern educational approaches have emerged, including the constructivist ES5 model, which relies on the learner's active participation throughout all stages of learning and has shown positive results in different fields. For example, the study by Abdel Baqi (2024) showed that using the ES5 model helped increase the motivation of fifth-grade students toward learning English and improved their ability to acquire new vocabulary, compared to students who learned through traditional methods. The study also revealed that relying only on the teacher and the textbook was not sufficient, which highlights the importance of moving toward constructivist and cooperative strategies that place the learner at the center of the educational process.

Similarly, the cooperative learning strategy has emerged as one of the educational methods linked to modern constructivist and social theories, which emphasize that knowledge is built better through interaction and participation, especially in situations that involve abstract concepts such as mathematics. It is assumed that this strategy helps improve the acquisition of mathematical concepts by encouraging students to exchange ideas, explain them, defend their thinking, and review their understanding based on their peers' feedback. Despite the importance of this approach, current educational practices and curricula still show weak integration of cooperative learning, both in design and application.

An analytical study by Bani Khaled (2023) revealed that cooperative learning and community participation skills ranked last, with only (3.3%), among 21st-century skills included in the ninth-grade mathematics textbook, which shows a clear absence of these skills in the content. In the same context, the study by Turki Fahd (2025) found that teaching practices supporting mathematical collaboration among primary school teachers are still generally weak, especially concerning the exchange and evaluation of

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mathematical ideas. This raises serious questions about the effectiveness of the traditional classroom environment in supporting deep mathematical understanding.

On the other hand, several experimental studies have provided strong evidence for the effectiveness of cooperative learning. The study by Jaafar Anwar Hussein (2024) concluded that using cooperative tasks based on the integration of fragmented information clearly contributed to developing skill performance and higher-order thinking among middle school students. Likewise, the study by Al-Fataikha Abdel Karim (2024) showed that a program based on collaborative learning effectively helped develop doctrinal concepts among first-year middle school students. Al-Mansouri (2024) also confirmed the importance of collaborative learning in developing linguistic competencies among high school students, showing its wide effectiveness across disciplines and educational levels.

Despite these positive indicators, there is still a gap when it comes to studying the effectiveness of cooperative learning specifically in acquiring mathematical concepts among first-year middle school students within the Algerian educational context. This highlights the need to conduct this research to explore how effective this strategy is in classrooms at this critical stage. Therefore, the main problem this article seeks to address is:

To what extent is the cooperative learning strategy effective in acquiring mathematical concepts among first-year middle school students?

- To what extent is cooperative learning effective in improving the understanding of mathematical concepts among first-year middle school students?
- Are there statistically significant differences between the mean scores of the control group and the experimental group in the post-test of mathematical concepts?
- Are there statistically significant differences between the pre-test and post-test scores of the experimental group in mathematical concepts?
- Are there statistically significant differences between the pre-test and post-test scores of the control group in mathematical concepts?.

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2.2. Study hypotheses:

- Are there statistically significant differences between the average scores of students in the control group and the experimental group in the post-mathematical concepts test?
- Are there statistically significant differences between the average scores of the students of the experimental group in the pre- and post-mathematical concepts test?
- There are no statistically significant differences between the average scores of the control group in the pre- and post-mathematical concepts test.

2.3. Study objectives:

- Revealing the effectiveness of the cooperative learning strategy in developing and acquiring mathematical concepts among first-year middle school students.
- Comparing the level of acquisition of mathematical concepts between students who study according to the cooperative learning strategy and those who study according to normal traditional methods.
- Highlighting the role of the cooperative learning strategy in developing communication skills and positive interaction between students while learning mathematics.
- Knowing the effectiveness of cooperative learning in improving motivation to learn mathematics.
- Determine the extent to which cooperative learning contributes to reducing difficulties in learning mathematical concepts.
- Providing teachers with a practical scientific vision on how to employ modern strategies to improve students' learning in mathematics.

2-4- Defining the concepts

2-4-1-Effectiveness :

Effectiveness in this research refers to the extent to which the cooperative learning strategy achieves the desired educational goals. This is measured by statistically significant differences between the average scores of the students in the experimental group (who received their lessons using the cooperative learning strategy) and the average scores of the students in the control group (who learned in the usual way), in an achievement test that

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measures the extent to which the targeted mathematical concepts are acquired after the end of the application period.

2-4-2- Cooperative Learning strategy:

In this research, it means a teaching method based on organizing students into 6 small, cooperative groups, each group (05) students, whose members work together in a coordinated manner to achieve common learning goals, where roles are distributed among them, and this strategy is implemented according to a methodological plan prepared in advance during the experimental period.

2-4-3- Acquiring mathematical concepts

This research refers to the level of students' ability to understand the targeted mathematical concepts and their ability to employ them in new educational situations. This acquisition is measured by students' performance on an achievement test for mathematical concepts that the

researcher prepared specifically for this purpose and is applied after completing the implementation of the cooperative learning strategy.

3-Theoretical framework of the study:

3-1- The concept of cooperative learning:

Cooperative learning is one of the modern educational methods that is concerned with activating cooperation between learners by dividing them into small groups that are heterogeneous in terms of abilities, working together to accomplish specific educational tasks, and participating in decision-making collectively, which enhances the spirit of cooperation and shared responsibility.

This type of learning is based, in theory, on organizing work within groups in a way that ensures that all individuals are involved in the learning process through specific roles, while emphasizing that each member of the group is responsible for his personal learning and the progress of his group as a whole.

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Table N°1 :The difference between cooperative learning and traditional group learning Advantages of the cooperative learning strategy

Element	Traditional Group Learning	Cooperative Learning
Goal	Focuses only on individual performance, with out considering shared group goals.	Based on positive participation and collaboration among group members, developing shared interest in both individual and group success.
Responsibility	Each learner is responsible only for their own learning, with out caring about others' performance.	Each member carries responsibility for their own learning and for helping their group mates learn as well.
Group Commitment	Learners are not required to take responsibility for their group mates' learning or for the group's overall performance.	There is clear commitment from each member toward the group and toward themselves.
Group Diversity	Usually consists of members with similar abilities.	Consists of members with different abilities and personal characteristics.
Roles	Only one leader is assigned per group to take charge.	Leadership roles are shared and rotated among all group members.
Social Skills	Leadership roles are shared and rotated among all group members.	Learners are trained in skills like leadership, cooperation, trust-building, communication,

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		and conflict resolution.
Diversity	Usually consists of members with similar abilities.	Consists of members with different abilities and personal characteristics.
Educational Focus	No clear emphasis on achieving optimal academic results or improving interaction among members.	Aims to improve each individual's learning to the highest level while strengthening positive work relation ships within the group.
Teacher's Role	The teacher mostly leaves groups to work on their own with out ongoing intervention or guidance.	The teacher monitors group performance, offers feedback, interferes to solve problems, and improves performance.
Reflection and Improve me	No encouragement or systematic process for group reflection or evaluating collective work.	Groups are encouraged and guided to reflect on their work and evaluate their ongoing performance.

Source:(Othman, 2014, p. 230)

In practice, cooperative learning involves forming small student groups that cooperate to achieve common educational goals within the classroom, in addition to training them in necessary social skills such as dialogue, expressing opinions, self-confidence, respecting other opinions, and accepting differences (Aqil, 2003).

Cooperative learning is an active learning style that organizes learners into small groups that are heterogeneous in terms of abilities, working collaboratively to accomplish specific educational tasks, within an environment that stimulates positive interaction and mutual responsibility. This style aims to develop academic and social skills, such as communication, problem solving, building trust, and respecting different

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points of view, which contributes to achieving effective and comprehensive leaning.

3-2- The difference between cooperative learning and traditional group learning:

Table N°1: The difference between cooperative learning and traditional group learning Advantages of the cooperative learning strategy:

***Promoting the principles of modern education in the learning environment:** The cooperative learning strategy contributes to consolidating contemporary educational concepts such as respect for diversity, acceptance of different opinions, and working in a team spirit, which reflects global trends in education based on values and skills.

Roles Only: one leader is assigned per group to take charge. Leadership roles are shared and rotated among all group members.

Social Skills: Leadership roles are shared and rotated among all group members. Learners are trained in skills like leadership, cooperation, trust-building, communication, and conflict resolution.

Educational Focus: No clear emphasis on achieving optimal academic results or improving interaction among members. Aims to improve each individual's learning to the highest level while strengthening positive work relationships within the group.

Teacher's Role: The teacher mostly leaves groups to work on their own without ongoing intervention or guidance. The teacher monitors group performance, offers feedback, interferes to solve problems, and improves performance.

Reflection and Improve me: N° encouragement or systematic process for group reflection or evaluating collective work. Groups are encouraged and guided to reflect on their work and evaluate their ongoing performance.

***Raising the level of interaction within the classroom environment by encouraging dialogue and group discussion.** This strategy develops effective communication between the student and the teacher, and between the students themselves, which enhances a deep understanding of the educational content and creates an active and participatory learning environment.

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*Developing social and emotional skills. This strategy provides opportunities to develop teamwork skills, such as cooperation, shared responsibility, and the ability to resolve conflicts. This is a vital skill that goes beyond the classroom and benefits learners in their personal and professional lives.

*Flexibility in application across educational stages and subjects. Cooperative learning can be easily adapted to suit different educational stages, from basic education to university education, and it can also be applied in all specializations, whether theoretical or scientific, making it a flexible and general framework for effective teaching.

*Improving the educational climate and alleviating psychological pressures, cooperative learning provides a less stressful learning environment compared to traditional methods, as it encourages students to express and participate without fear of failure, which creates an atmosphere of psychological security and stimulates self-motivation towards learning (Qudat, 2015, p. 19).

3-3-Difficulties in learning mathematics in intermediate education:

Mathematics is one of the subjects that students frequently complain about, especially in the first year of middle school. There have been many studies that have dealt with explaining these difficulties, and the possible causes of these difficulties have been classified into several main categories, the most prominent of which are:

Genetic causes: Studies, including that of Shalev and al. (2001), indicate that children from families with previous cases of mathematics learning difficulties are more likely to develop them, as the incidence of these difficulties may reach ten times that of children from families without such cases.

Biochemical causes: Some research has shown a relationship between disturbed levels of certain chemicals and vitamins that affect neural activity, and students' cognitive and comprehension abilities, which affects their cognitive development and academic achievement in mathematics.

Neuropsychological causes: The onset of certain learning difficulties is associated with central nervous system dysfunction, which negatively

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impacts thinking and behavior patterns and, in turn, affects students' academic performance, especially in subjects requiring analytical and logical abilities such as mathematics(Bouqarn, 2021, p. 188).

3-4-The importance of cooperative learning strategy in overcoming mathematics learning difficulties

- By applying a cooperative learning strategy, many obstacles facing students in mathematics can be overcome.
- Reducing fear and anxiety makes the student feel supported within the group, which enhances his self-confidence.
- Enhance understanding through discussion and exchange of opinions and examples within the group.
- Encourage students to actively learn to understand binoculars rather than memorize them. - Taking into account individual differences, as each student learns at his own pace while benefiting from the support of his colleagues.
- Investigation: Students' desire to participate increases when the educational atmosphere is interactive.

3-5- Theories explaining the cooperative learning strategy

The cooperative learning strategy was based on a set of educational theories that attached great importance to the role of social interaction and building knowledge through the exchange of experiences between learners. Among these theories, we find the socio-constructivist theory of the scientist Vygotsky, which emphasizes that learning takes place more effectively within what is known as "the zone of proximal growth", where the learner can develop his knowledge and skills with the help of others, through dialogue and cooperation(Vygotsky, Lev Semenovich· 1978).

We also find Piaget's constructivist theory, which considers that learning occurs when the learner is active in building his knowledge, and faces situations that occur to him " cognitive conflict " that enhances thinking and analysis, which is provided by the cooperative learning environment. In addition, the social learning theory of "Pandora " highlights the importance of learning by observation and modeling, which is clearly evident when learners work in groups, where they exchange strategies and

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learn from each other Behavioral theory focuses on the effect of reinforcement and feedback, which can appear in encouragement within a cooperative group(Piaget, 1977).

Based on the above, we note that the theory most consistent with the spirit and principles of cooperative learning is the socio-constructivist theory, due to its focus on the social dimension of learning, and on the importance of cooperation and interaction in building concepts. Accordingly, we adopt this theory as a frame of reference for studying the effectiveness of the cooperative learning strategy in acquiring mathematical concepts among first-year middle school students.

4- Field procedures for the study

4-1-Study methodology:

This study relied on the experimental approach as it is most appropriate to measure the effect of a specific strategy on an observable change, which is here the acquisition of mathematical concepts. A quasi-experimental design was used, which is based on two groups (the experimental group that studied according to the cooperative learning strategy, and a control group that studied according to the educational method based on indoctrination and direct explanation).

4-2-Study population and sample:

The study population consists of first-year middle school students at Hassan Sharif Middle School in Amrousa - Bouinan

An intentional sample consisting of two academic departments from the first year of middle school was selected from Hassan Sharif Middle School

The experimental group consisted of (35) first-year middle school students who studied the mathematics curriculum using the cooperative learning strategy, and the control group consisted of (35) students from the same year and the institution studied the same curriculum but using the traditional method..

4-3-Study tools:

The researcher built a test in mathematical concepts to measure the extent to which first-year students acquired an average of the target concepts

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within the educational unit studied. The test included (20 questions) that varied between multiple choice questions and short essay questions, and when preparing it, the researcher took into account the gradation in difficulty and the comprehensiveness of the questions for various aspects related to acquiring concepts. To ensure the apparent validity of the test, the researcher presented it to a group of judges specializing in mathematics and teaching methods, and their comments were taken into consideration before final application. The stability of the test was also calculated using Cronbach's alpha coefficient, and its value was (0.88), which is a value that indicates a high degree of stability. The test was used before and after the experimental and control groups, with the aim of measuring the effectiveness of the cooperative learning strategy in acquiring mathematical concepts among first-year middle school students.

The study also relied on classroom observations to track interaction within the cooperative group.

Table N°2 :Formation of the study sample by gender.

Institution	Class	Group	Number of males	% males	Number of Females	%Females	Total
Middle school Hassan Cherif	1	Experimental	16	45.7%	19	54.3%	35
Middle school Hassan Cherif	2	Control	15	42.9%	20	57.1%	35
Total	-	-	31	44.3%	3939	55.7%	70

Source:(Othman, 2014, p. 230)

4-4-Application steps:

The first stage: Conducting a pre-test of the mathematical concepts of both groups to measure prior knowledge and gains.

The second stage: Teaching units of the mathematics curriculum for a semester for the two groups. The experimental group studied using (6) cooperative groups, where each group consisted of (5) students. The teaching method was according to the cooperative learning strategy, while the control group studied using traditional explanation and indoctrination.

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The third stage: Conducting a post-test to test mathematical concepts to measure the difference in performance.

The fourth and final stage: analyzing the test results using SPSS statistical analysis tools.

5- Presenting and discussing the study results:

5-1-Presenting, analyzing and discussing the results of the second hypothesis

It states that there are statistically significant differences between the average scores of the students of the experimental group and the control group in the post-test of mathematical concepts.

Table N°3: Shows the significance of the differences between the average scores of the control and experimental group students in the post-mathematical concepts test.

Group	Number of students	Mean	Standard deviation	Degrees of freedom (df)	Calculated T value	Tabulated t value	Level of significance
Control group	35	13.74	2.55				
Experimental group	35	15.85	2.22	67	3.19	2.66	0.01

Through Table N°3, we see that the arithmetic mean of the experimental group in the mathematical concepts test was (15.85) and the standard deviation was (2.55), and the control group had an arithmetic mean from the same test of (13.74) and the standard deviation was (2.22) It is also clear to us from the table above that the calculated value of (T) (3.19) is a higher value than the tabulated value of (T) (2.66), and this indicates that there are statistically significant differences at the significance level (0.01), and this shows that there are statistically significant differences between the experimental and control groups in the level of acquisition of mathematical concepts, in favor of the experimental group From this we accept the second hypothesis, which states that there are statistically significant differences between the average scores of the students of the experimental group and the control group in the dimensional measurement of the mathematical concepts test, in favor of the experimental group that studied the material using the cooperative learning strategy. We can say from the results obtained that adopting the cooperative learning strategy contributed

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effectively to the acquisition of mathematical concepts, as the superiority of the experimental group that studied according to this strategy was evident compared to the control group that relied in teaching mathematics on traditional, ordinary methods. This is due to the nature of cooperative learning, which encourages positive interaction between students and the exchange of ideas Building knowledge jointly enhances deep understanding and develops the ability to reason and logical reasoning. The effectiveness of this strategy is evident in the fact that it is not limited to improving academic achievement only, but also contributes to developing social skills such as cooperation, accepting the opinion of others, and bearing collective responsibility, which are essential components for the learner's success inside and outside school. Accordingly, it can be said that cooperative learning is among the effective strategies that respond to the requirements of modern curricula in mathematics and support the achievement of the desired educational goals.

5-2-Presenting, analyzing and discussing the results of the third hypothesis:

The hypothesis states that there are statistically significant differences between the average scores of the students of the experimental group in the pre- and post-application of the mathematical concepts test..

Table N°4: Represents the results of the significance of the differences between the average scores of the students of the experimental group in the pre- and post-application of the mathematical concepts test

Measurement	Number of Students	Mean	Standard Deviation	Degrees of Freedom (df)	Calculated t-value	Tabulated t-value	Significance (t)
Pre-test	35	12.80	1.83				
Post-test ()	35	14.76	2.45	33	6.36	2.42	0.01

From Table N°4, it is clear that the average scores of the students of the experimental group in the mathematical concepts test before applying the cooperative learning strategy reached (12.80) with a standard deviation of (1.53), while the arithmetic mean in the dimensional measurement rose to (14.76) with a standard deviation of (2.45). This increase in the averages initially led to an improvement in the students' performance after applying the cooperative learning strategy.

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Test (T) for the associated samples showed a value of (6.36) with a degree of freedom of (33), which is a value that far exceeds the tabulated value (2.42) at the significance level of (0.01). Since the calculated (T) is greater than the tabulated one, the difference between the pre- and post-measurements is a statistically significant difference, meaning that the improvement was not a coincidence, but rather reflects a real impact of the strategy.

Based on these results, it can be said that: The cooperative learning strategy was effective in improving the acquisition of mathematical concepts among first-year middle school students, and the increase in average grades reflects that the strategy contributed to developing the students' mathematical understanding compared to what they were before the experiment. The result we reached supports the third hypothesis, which says that there are statistically significant differences between the pre- and post-measurements in favor of the post measurement among the students of the experimental group. This indicates that the cooperative learning strategy contributed effectively to developing mathematical concepts among first-year middle school students, as their scores increased after applying the strategy compared to before it.

This result is consistent with what was indicated by many studies that highlighted the role of cooperative learning in improving academic achievement and enhancing deep understanding of concepts, such as the study (Ahmed Boutalja, 2021), which confirmed that students' participation in cooperative groups increases their motivation and makes the learning process more effective. The results of the study are also consistent with the findings of the study (Asliman Umm Al-Khair,2022) Interaction between students in educational situations contributes to building shared knowledge and understanding concepts in a deeper way. These results explain that cooperative learning provides students with greater opportunities to communicate, exchange ideas, and explain solutions to each other, which helps them consolidate and understand mathematical concepts better, in addition to developing higher thinking skills such as analysis and reasoning Working in small groups also enhances the student's self-confidence and breaks the barrier of fear of making mistakes, which makes it easier for him to interact and participate positively. Based on this, we can say that applying the cooperative learning strategy in teaching mathematics represents an

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effective educational approach to improving students' results and developing their mathematical concepts in a deeper and more sustainable way.

5-3-Presenting , analyzing and discussing of the fourth hypothesis:

The hypothesis states that there are no statistically significant differences between the average scores of the control group in the pre- and post-measurement to test mathematical concepts.

Table N°5: Represents the significance of individual differences between the average scores of the control group's students in the pre- and post-measurement of the mathematical concepts test.

Data	Number of Students	Calculated (T) Value	Mean	Standard Deviation	Degrees of Freedom	Table (T) Value	Significance Level (0.01)	Indication
Post-test Measurement	35	1.66	12.20	1.42	34	2.41	Not significant	
Pre-test Measurement	35	12.82	12.82	2.38	34			Significant

From Table N°5, it is clear to us that the average scores of the control group's students in the mathematical concepts test increased slightly from (12.20) in the pre-measurement to (12.82) in the post-measurement, but this difference was not statistically significant So that the calculated value of T reached (1.42), which is less than the tabulated value (2.42) at a significance level of (0.05) and a degree of freedom of 34n. Accordingly, and based on the results shown above (Table 06), we accept the null hypothesis, which states that there are no statistically significant differences between the pre- and post-measurement of the control group This indicates that teaching in the traditional, ordinary way did not make a difference in the acquisition of mathematical concepts among the students of this group. This reflects one of the most important shortcomings in traditional education, as it focuses on quantity rather than quality, and on memorization more than active mental processing, which is addressed by modern strategies in the educational learning process such as the cooperative learning strategy.

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- General conclusion

In light of the findings of this study, it can be confirmed that the cooperative learning strategy is one of the effective educational methods in enhancing the acquisition of mathematical concepts among first-year middle school students. The group that learned according to this pattern showed a noticeable improvement in understanding and ability to apply. Actual participation in knowledge construction is due to the shift from learning based on learning, to learning based on participation and group interaction, where the student has become an actor and not just a recipient. This method has also contributed to overcoming many common difficulties in learning mathematics by providing an encouraging learning environment, the student's supplication at the center of the educational process.

Accordingly, this study calls for reconsidering traditional teaching methods and moving towards more interactive and flexible educational practices that support students' abilities and provide them with cognitive and social skills simultaneously.

- Recommendations:

- Adopting a cooperative learning strategy in teaching mathematics, especially in the intermediate education stage, because of its positive impact on acquiring mathematical concepts and understanding them more deeply.
- Forming teachers and training them to employ and apply active learning strategies, especially cooperative learning, through continuous training courses and workshops.
- -Diversify teaching methods within the department and avoid relying entirely on traditional methods that focus on indoctrination, especially in conceptual subjects such as mathematics.
- Encouraging teamwork within classrooms, while organizing groups in a thoughtful manner that ensures positive interaction and equal participation.
- Redesigning curricula and educational activities to be implementable within cooperative groups.
- Improving the classroom environment to make it more suitable for cooperative learning (organizing seats, providing means, encouraging a positive climate among students).

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- Involving students in evaluating their group performance, by evaluating colleagues and analyzing their roles within groups to develop a sense of responsibility and critical thinking.
- Integrating cooperative learning strategies into official curricula and documents (such as the pedagogical guide and annual plans), while proposing targeted applied activities.

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