

## The Effectiveness of the 5555 strategies in the Academic Achievement of the Fifth-grade High School Students of Science –Biology Field in Mathematics and their Transpositional Thinking

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### Abstract:

The current study aims to identify the effectiveness of the 5555 strategies in the academic achievement of the fifth-grade high School students of Biology division in mathematics and their transpositional thinking. The sample consisted of (70) female students from the fifth-grade high School students of Biology and was equally divided into two groups: experimental and control. The researcher conducted two tests: the first test was for measuring the academic achievement and consisted of (30) objective items of multiple-choice questions, while the second was a test of transpositional thinking and consisted of (26) items in the form of attitudes and questions that required transpositional thinking for the answer. The psychometric properties of these two tests were verified. The results showed a significant achievement to the students of the experimental group over the control group students.

**Keywords:** 5555 strategies, academic achievement, transpositional-thinking, mathematics.

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### The Statement of the Problem

Throughout the researcher's wide experience in teaching mathematics in many educational stages, he noticed that there is a great decline in academic achievement and transpositional thinking in this subject, especially among students of the fifth-grade specialized in bio-science. The passing rates in mathematics for the past two years ranged between (44% - 58%). Despite the updates of the Iraqi mathematics curricula in recent years, the achievement level among students in general and female students, in particular, remains low, and this is offset by a decrease in thinking. The reason for this may be the use of traditional teaching methods based on explaining mathematical topics in the form of ready-made examples (as in the textbook) relying on dictation, memorization, rote-memorization, and the lack of any role for the students in the teaching and learning process. Then, the researcher distributed a questionnaire to (20) female teachers who have at least (5) years of experience in teaching mathematics, and asked them the following question: Do you have an idea

about transpositional thinking? So the answer (no) got a percentage of (100%). Thus, how do mathematics teachers teach their students the transpositional thinking? Next, the researcher asked a question to (25) female students from the fifth grade of biology division in high school: What is the result of  $(3 + 4 \times 2)$ , and the wrong answers were of (24) students with (92%) percent, while the correct answers were only (11) students with (8%) percent. This question represents the level of the students' recall process because it depends on the student remembering that the multiplication process precedes the addition process; hence the problem of research was determined and its answer is derived from the following question:

**What is the effectiveness of the 5555 strategies in the academic achievement of the fifth-grade high School students of Biology division in mathematics and their transpositional thinking?**

**Research Value:**

School mathematics and its teaching strategies have witnessed developments made by developed countries such as the United States of America, England, and Japan to fulfill their needs and aspirations towards progress and advancement during the third millennium, as the success of any country depends mainly on the ability of its people to succeed in mathematics. (Al-Zuhairi, 2018 a, p. 25).

Mathematics is the basis for the development of various sciences, whether natural, biological, or social. As such, the American Society for Advanced Science and the National Council of Teachers of Mathematics recommended that mathematics sciences make changes in the goals of teaching mathematics, its curricula and also its teaching strategies (Al-Zuhairi, 2018b, p. 18). As such, educationalists have paid attention to the strategies of teaching mathematics based on cooperative learning principles among learners and urge the students to practice in positive active participation. Therefore, it is necessary to switch from mathematics learning based on listening to the teacher individually to active cooperative learning based on interaction and positive participation of the learner and engage themselves to develop their transpositional thinking capabilities.

Transpositional thinking is a mental ability and an important and essential element in the cognitive mental structure that a student possesses. It is characterized by the social and systemic nature that makes it exchange influence with its building elements that consist of it, which affects and is affected by personal, emotional, and social aspects. (Sweller, 2014, P20).

The transpositional thinking that students use makes them feel stronger and better able to face obstacles or failures they face by supporting and assisting each other and finding solutions to their problems, and the who can use transpositional

thinking are more willing to work in groups. (Berkar, 1992, P4). Given the importance of the academic achievement of the female students in mathematics and transpositional thinking, as well as the importance of learning mathematics through active cooperative learning, the researcher chose the 5555 strategy that requires a deep mental cooperative activity to produce a the number of ideas about a specific problem or question. It works to increase the students' motivation to think to their full potential as being subject to the question by the teacher, especially female students with low achievement in each group of the class. Moreover, it helps to transfer students from the state of listening and indoctrination in learning to think, meditation, and positivity in learning. As such, the result of the active role that each student in her thinking is invested to brainstorm several ideas for the raised question, and discussing to organize these ideas.

It also has the importance in learning the skill of communication and gaining desirable traits such as working in groups, moving away from selfishness, creating a spirit of cooperation with and respecting other students, rejecting fear and shame, avoiding isolation, undertaking multiple discussion roles and positive listening, active interaction, expressing freely on opinions and defending perspectives (Ombo Saeedi and Al-Hosania, 2017, p. 408).

The current research can be considered as the first research in the Iraqi and Arab academia (according to the researcher's knowledge) that handles the 5555 strategy in academic achievement for fifth-grade students of biology and the transpositional thinking; the researcher did not find any study that dealt with the 5555 strategy or mutual thinking in mathematics. Thus the researcher created test of transpositional thinking and for the academic achievement.

### **The Purpose of the Study**

The current study aims at identifying the effectiveness of the 5555 strategies in the academic achievement of the fifth-grade high School students of Biology division in mathematics and their transpositional thinking.

### Research. Hypotheses:

To achieve the research goal, the following two hypotheses were formulated:

1. There is no statistically significant difference at the level of significance (0.05) between the average scores of female students of the experimental group studying mathematics with strategy 5555 and the average score of female students of the control group who study the same subject in the traditional manner in the academic achievement test.
2. There is no statistically significant difference at the level of significance (0.05) between the average scores of female students of the experimental group studying mathematics with strategy 5555 and the average score of female students of the control group studying the same subject in the traditional manner in the test of transpositional thinking.

### The Scope of the Study

The current research is limited to:

1. Participants: Fifth Grade Biological Science Students.
2. Time limits: the second course for the 2017-2017 academic year
3. Spatial boundaries: the city of Ramadi - the center of Anbar province.
4. Thematic limits: Three chapters from the book of mathematics for the fifth year of biomedical science are the sixth chapter (derivatives), the seventh chapter (planar engineering), and the eighth chapter (the principle of counting).

### Terminologies

**1. Effectiveness:** It is defined as:

\* The ability to influence and achieve goals and the desired results in the best possible way (Ibrahim, 2009, p. 17).

Procedural definition: It is the effect of the independent factor (strategy 5555) on the two dependent variables (achievement and reciprocal thinking). This effect is statistically determined by the formula of "square 2".

**2. Strategy 5555:**

\* It is one of the new active learning strategies that make the student's role positive, as it includes the step of thinking and contemplating the problem or question posed with the goal of training students to produce many familiar or unfamiliar and varied ideas to solve a specific problem or question (Ambosaidi and Al-Hosania 2017, p. 407).

Procedural definition: A set of steps followed by the researcher in teaching students of the experimental group to the subjects of the three chapters of the book of mathematics. It is to distribute the students to five groups, each group of seven students, then ask the mathematical question or problem, and allow time of five minutes for individual thinking and discussion among members of each group. Finally, the students come up with five ideas for one group about the question or problem posed.

**3. Achievement: it is defined as:**

\* The result of what the learner learned from the information and educational experiences presented to him using appropriate educational methods and strategies in order to know the extent of which the set of educational goals were achieved. It is measured by the degree obtained in the achievement test (Al-Tamimi, 2018: p. 168).

Procedural definition: It is the result of what the fifth-grade students learn from the subjects of mathematics that they studied in a specific period. It is measured by the degree that the student gets through answering the questions of the achievement test prepared by the researcher.

#### 4. Transpositional Thinking: is defined as:

\* A mental process in which the learner employs his previous experiences, experiences and mental abilities to investigate the corresponding situations or problems in order to reach familiar results or decisions where the learner has a tendency and tendency to examine and excavate in new areas and is organized in his thinking and work and works in order to be understood. (Martin, 2013, p3).

\* The ability of the learner to justify ideas and choose the validity of the strategies of the solutions and accept the feedback, interaction, cooperation and work within groups and contribute to the task (Razuki and Mohammed, 2019, p. 18).

Procedural definition: A mental ability practiced by students of the fifth-grade scientific biology during their studies of mathematics through examining mathematical ideas and testing their validity and effective contribution to finding solutions through work in mutual cooperative groups, and is measured by the degree to which the student gets by answering the thinking test clauses Reciprocal prepared by the researcher.

#### Theoretical background: strategy 5555:

It is one of the active learning strategies that make the student's role positive. It includes the step of thinking and contemplation of the problem, the topic, or the question posed by the teacher individually. Thus, the discussion among the members of the group is focused on in all the thoughts that each member has come up with to discuss them all together to come out with five ideas for the question posed or the problem. The strategy aims to train students to present several

diverse ideas and ramified thinking about any problem they face. the naming the strategy expresses the content of its steps, so each number 5 means a brief step of the strategy steps, as follows:

5: Five groups.

5: Five or more students per group.

5: Five-minute time.

5: Five final ideas for each group.

This strategy is based on principles including:

1. The best solution to any problem or issue comes after many bad solutions or ideas.

2. It is based on the assumption that: If the mind has had the opportunity to think about a problem or issue, then ideas flow without restraint, regardless of the extent of their realization.

3. Postponing review of any idea until after all the ideas are generated by the students. Then, trying to link and develop the ideas given by each student in the group (Umbo Saeedi and Al-Hosania, 2017, p. 409).

4. The researcher informs the students that he will ask them a question and they are given a five-minute time to:

a. Think about the answer individually by each student to come up with several ideas, and write them down on an A4 sheet.

B. Organizing all ideas to come out with five main ideas for the group. This is done through active and positive discussion and dialogue among the students in the group to merge similar and sub-ideas with the main idea and delete inappropriate ones. Then, it is agreed that each group comes out with five ideas whereby each student in the group can answer masterfully and her answer represents the group you belong to.

6. After the time ends and the five ideas are collected from each group, the researcher calls for the name of any group randomly to be the group for the preparation. Then, the question is repeated, and any student from the selected group is randomly chosen to present the ideas of her group and write them down by the researcher on the blackboard under the name of their group.

7. After writing down all the ideas by all groups, the researcher begins discussing the ideas of each group with the group itself and with the rest of the students in the other groups. The opinion of any student outside the group is taken into consideration to amend and arrange ideas to appear in the correct and appropriate final form to the question asked.

8. The researcher continues in the same way in the remaining educational tasks.

## 2. Transpositional Thinking

### Introduction:

Scientists believe that scientific research focuses on transpositional thinking between individuals, and the knowledge that an individual possesses in a field has a real impact on the way he thinks in that field. Studies and research have shown that a person with transpositional thinking has a tendency and inclination to explore and research in new fields and he is also well-organized in his thinking and work and arranges for them to be understood (Martin, 2013, P6).

Transpositional thinking helps the students to organize their knowledge to achieve success and facilitates their information processing to solve their problems, deepening and expanding their thinking and working to achieve their goals. Transpositional thinking is an important basis for success in the fields of learning and life alike. There is a potential for Transpositional thinking in all areas of human activity as it is found that the student in his various activities or behaviors, whether in the field of education or work, needs

Transpositional thinking to accomplish these tasks to the fullest extent. (Nickerson, 2006, P14).

Promoting Transpositional thinking is an effective way to integrate individuals or students into working life to face the responsibilities they encounter, and encourage them to think, quickly, and how high level of motivation and self-esteem. It also provides them with a set of skills that enable them to face the future. (Ross, 2003, p20).

Also, some students need more time than others to develop their ideas with the assistance of their classmates through interaction and making them social by integrating them with others. This interaction work includes a set of activities and actions that lead to the student's association with colleagues, to accomplish their work collectively and work to achieve the desired goals with a kind of integration between them. (Gainen, 2008, P22).

Theories of transpositional thinking:

### 1. (2000) Nightogol Theory:

Nightogole pointed out that the environment in which the individual lives, whether this environment: the family or school environment and others play a major role in building a person's personality and developing his capabilities. The family's interest and parenting practices with the support that the individual receives from his family, whether male or female leads to the control of either the family or school environment. Moreover, an individual using transpositional thinking realizes the large difference in capacity between the two environments by cooperating with others and become much stronger intellectually and financially than individuals who live alone. Working in groups requires the ability to justify ideas and test the validity of the solutions that someone offers to others. This requires the ability of the individual to assess someone's capabilities that he has to support him later to have his work done correctly based on the evaluation that he arrives, whether this evaluation is right or not for

the potentials that he has. One of these capabilities is the ability to think Interactive. (Cotton, 2007, p70).

Knitecool mentioned that individuals with transpositional thinking tend to participate and cooperate, and they can take responsibility and acknowledge their mistakes and enable them to find the appropriate justification for their actions and be very accurate in their actions. Moreover, they try to analyze problems so that they can find the appropriate solution to them, and they can save the information and retrieve it from Long-term memory which allows them to find appropriate intellectual solutions to overcome the difficulties they are exposed to, and they also tend to help others (Covey, 2007, p22).

## 2. Aldon Theory (2003).

Al-Don sees that individuals, in their coexisted environment are present in the form of groups and that they need to cooperate to be able to meet their different needs and solve problems they confront through transpositional thinking to reach creative solutions to problems. This cooperation develops the individual's mental capabilities and makes them reach higher degree because each one of us carries ideas and beliefs that he acquired through the experience he had. This is done by exchanging ideas with the group where the ideas of others will be a criterion for correcting mistakes and enhancing the positivity. Individuals with transpositional thinking can converse with others by presenting their opinions and ideas and communicating their ideas to the societies, whether it is the family community, companionship, or work towards achieving their desired goals (Aldon, 2003, P99).

## 3. Costa & Kallick Theory (2005):

Costa and Calic stated that the most important thing that people in our world need is the ability to interact with others and coexist with them so that

the restrictions that limit a person's ability to work have vanished. We need others and deal with them to work together as they need us, without them, we can do little. The process of merging into groups allows its members to get to know each other more precisely despite the differences in individuals' thinking and other mental ability, which allows developing these capabilities. Furthermore, transpositional thinking is part of the higher mental capabilities that enable the individual to act smart when he does not know the answer to a specific question or when it occurs in a problem. These capabilities help the individual to perform in a smart way that leads the learner to perform productive actions that benefit the individual and others within the society to which they belong to. (Costa & Kallick, 2005, p5-6).

## 4. Kevin Theory (2008):

Kevin believes that transpositional thinking is the ability of the individual to take care of his affairs and the affairs o to achieve his ambitions and goals. It helps the individual to solve the problems that confront him. It is one of the most important types of thinking that enables the individual to interact with others, as all members of society need to succeed in their lives and coexist peacefully. If the members of society are aware of and understand the things that they are exposed to, no one will be able to mislead them or deceive them. Therefore, transpositional thinking must be developed for all individuals. This ability, if confined to a specific individual and incorrectly employed, leads to the individual leading the community through this ability to exploit other individuals to achieve his interests, therefore (Kevin) clarified that transpositional thinking is individual and collective thinking at the same time. Individual thinking in the sense that the individual possesses the ability of transpositional thinking and begins by achieving his goals and caring for his affairs and the affairs of others at the same time. It represents collective thinking because it can be found by most

individuals through its development by training programs specially developed for this purpose. (Kevin, 2012, p4-5).

**5. Morison Theory (2009): Morison Theory**

Morrison believes that the individual during his presence in the environment in which he lives and the pursuit of his goals and success in his life finds himself in need of others and begins with intellectual interaction and follows transpositional thinking to affect their ideas and exchange views with them to find appropriate solutions that enable him to achieve his goals. An individual with transpositional thinking tends to have collective actions and likes to be with others because they are a source of his ideas and tends to help others to overcome the crises facing them and accept criticism from others. Thus, he is not rigid as he deals with matters simply and that his cognitive abilities are affected by family upbringing. Moreover, individuals are exposed to experiences bearing different values and methods used in family upbringing. These methods differ from one

family to another and then the acquisition of scientific knowledge of these individuals varies from one person to another so that this difference is what enables them to outperform others (Morison, 2011, p3-4).

**Research Methodology:**

The researcher used the experimental research method as the only method that can be used to test the hypotheses of the type cause and effect; it is based on fixing all the variables that affect the research problem except one specific variable whose effect is studied by selecting a group of individuals randomly distributed into two or more groups, the first one is called experimental group and the second group is the control (Al-Bayati, 2010, p. 43).

**Experimental design:**

The researcher adopted the partially controlled design, as it is the most appropriate one for the current research. The following Figure 1 below is used to illustrate this:

| The group    | Equivalence of the two groups                                       | Independent Variable            | Dependent Variable         |
|--------------|---|---------------------------------|----------------------------|
| Experiential | * The lifetime is calculated in months                              | Strategy 5555                   | * Academic achievement     |
| Control      | * Test previous information in mathematics<br>* Cross thinking test | The traditional way of teaching | * Transpositional thinking |

**Figure 1 experimental design of the research**

**Research Community and Subjects:**

The research community selected participants from the fifth grade of biology in high schools from the city of Ramadi - the Anbar Governorate for the academic year 2017-2018; The researcher randomly selected the Raja girls' high school as a

sample for his research, because it contains two classes of the fifth year of biology, those two classes A and B represented:

Class (A). The experimental group with 35 students studied mathematics with 5555 strategy.

Class (B) represented the control group that studied the same subject in the traditional manner and were 35 students.

**Equivalence of the Students in the two research groups:**

The researcher selected the students of the two groups with equal variables: in terms of (time age calculated in months, a test background level in mathematics, and test of transpositional thinking), and table (1) below shows that:

**Table (1) Results of the T-test for two independent samples of the three variables for students of the two research groups**

| Group                         | Experiential group (35) |                    | The control group (35) |                    | Degree of freedom | T-Value    |          | Significance level 0.05 |
|-------------------------------|-------------------------|--------------------|------------------------|--------------------|-------------------|------------|----------|-------------------------|
|                               | Mean                    | Standard deviation | Mean                   | Standard deviation |                   | Calculated | P. value |                         |
| lifetime calculated in months | 215.21                  | 11.64              | 214.08                 | 8.56               | 68                | 0.463      | 2000     | Not significant         |
| Pre-Test of mathematics level | 9.30                    | 3.31               | 8.76                   | 3.52               |                   | 0.753      |          | Not significant         |
| Transpositional thinking test | 10.06                   | 4.08               | 9.83                   | 3.52               |                   | 0.242      |          | Not significant         |

**Selection of the study Materials:** The materials of the current study included chapter six (the derivatives), chapter seven (planar geometry), and chapter eight (the principle of counting) from the textbook of mathematics of the fifth grade of the scientific field of biology.

**Formulating behavioral goals:** The researcher formulated (90) behavioral goals according to Bloom's classification of cognitive goals at its six levels (remembering, understanding, applying, analyzing, synthesizing, evaluating), and it was presented to a group of specialists specialized in the methods of teaching mathematics and they agreed on it by (95%) without any modifications.

**Preparing the teaching plans:** In the light of the educational content of the three chapters of the mathematics textbook for the fifth grade of the

scientific field of biology and the deduced behavioral goals, the researcher prepared two types of teaching plans: the first according to the 5555 strategy, and the second according to the traditional method, and it was presented to a group of specialists and they agreed on their validity.

**Academic Achievement Test:** The researcher prepared a table of specifications (the test map) in which the three chapters of the mathematics textbook were represented. The researcher prepared a test for the academic achievement included (30) objective items of a multiple choice type, and it was presented to a group of specialists, whom they agreed upon all of its items without making any modification. It has been applied to a first sample consisting of (20) students to the fifth grade of the scientific field of biology to ensure its

items clarity, time, and understanding of answer instructions.

It turned out that items were clear, and the average time for an answer was (35) minutes. Then it was applied to a second exploratory sample consisted of (120) students for statistical analysis of the items. Their answers were scored and arranged in descending order and then distributed to two groups: higher and lower equally by (60) students in each group, then difficulty level was calculated and ranged between (0.49-0.67), while the coefficient factor ranged between (0.45-0.77). The effectiveness of the alternatives, all the values of the wrong alternatives was negative, meaning that they had mistaken several students with weak levels, any indicated the effectiveness of the items.

#### **Test reliability:**

The reliability coefficient of the academic achievement test was divided by the researcher into two sections (even and the odd number of items), then calculated the correlation value between the two sections using the Pearson correlation coefficient and It was (0.77), then the value was corrected using the Spearman-Brown equation and it became (0.87), which is a good reliability factor from the point of view of specialists.

Thus, the test in its final form became (30) objective items of a type of multiple choice with four alternatives, with a score of (one) was given for the correct answer and (zero) for the wrong or the left item that carries more than one answer. As such, the test was applied to students of the two assigned of the research groups after setting the date for conducting it.

#### **Transpositional Thinking Test:**

The researcher did not find a test of Transpositional thinking in mathematics textbooks appropriate for fifth-grade high school students. Thus, he created a test of (26) items in the form of scenarios or questions requiring thinking of the solution taking

into account formulating the scenarios in a language appropriate for the ages of students and their scientific level. Firstly, it was presented to a group of specialists in Methods of teaching mathematics and they agreed (100%) on all of its items without any modification.

After that, the researcher applied the test to a first exploratory sample of (30) students, and it was found that his items were clear and that the average time of difficulty taken to answer the items was (25) minutes. Then, the researcher applied it to a second exploratory sample consisting of (120) students, and their answers were graded and arranged descending then distributed into two groups: highest and lowest equally, at the rate of (60) students in each group, then according to the level of difficulty, it ranged between (0.43-0.71), and the discrimination factor ranged between (0.42-0.74).

**Test Reliability:** The reliability coefficient of the test was calculated using the Alpha Cronbach method, as this method confirms the positive level of homogeneity of the answers on the general items, because it depends on calculating the correlations between the degrees of the items because each item is an existing test by itself (Al-Kubaisi, 2010); (0.81) It is a good reliability coefficient. Thus, the test in its final form became (26) items, and a score of (one) was given for the correct answer and (zero) for the wrong or abandoned answer that carries more than one answer. Then, it was applied to the students of the two research groups of the current study after informing them of the date of applying the test.

**Statistical means:** In the statistical analysis of the results, the researcher relied on the following:

1. T-test for two independent samples in equivalence of the two groups, and test for the two research hypotheses.

2. Pearson correlation coefficient to find the stability coefficient for the academic achievement test in a half-split manner.
3. Difficulty coefficient for the academic achievement and interchangeability test items.
4. Discrimination factor for academic achievement and interchangeability checks.

**Presenting and discussing the results:**

1. To verify the first zero hypotheses which state: There is no statistically significant difference at the level of significance (0.05) between the average scores of female students of the experimental group studying mathematics with strategy 5555

and the average score of female students of the control group studying the same subject traditionally in the academic achievement test.

The researcher applied the test to the students of the two assigned groups, then calculated the arithmetic mean and the standard deviation of their scores on the test and used the T-test for two independent samples to verify the significance of the difference between the two average scores, as Table (2) shows that:

**Table (2) Results of the T-test for two independent samples to test the academic achievement of students from the two research groups**

| Group        | No. of students | Mean  | Standard deviation | Degree of freedom | T value    |          | Significance level 0.05 |
|--------------|-----------------|-------|--------------------|-------------------|------------|----------|-------------------------|
|              |                 |       |                    |                   | Calculated | P. value |                         |
| Experiential | 35              | 24.12 | 7.13               | 68                | 4.049      | 2.000    | Significant             |
| Control      | 35              | 17.41 | 6.73               |                   |            |          |                         |

It is clear from the table that there is a statistically significant difference between the average scores of female students of both groups on the academic achievement test in favor of female students of the experimental group, and therefore rejects the first zero hypotheses and accepts the alternative hypothesis. The researcher attributes this result to the 5555 strategy which promotes the process of positive and social interaction between the students themselves on the one hand and the Female students and researchers on the other hand. The strategy encouraged the students to participate effectively, and create an atmosphere of familiarity and cooperation between them, and respect for opinion. This interaction and participation by the students reduce the element of shyness and fear, just as

the desire accelerates the speed of memorization, and thus increases the level of their academic achievement. The strategy also helped to link the main mathematical ideas and new and previous sub-structures in their cognitive structure, which made them outperform the students of the control group in academic achievement.

To calculate the effect size of the independent variable "Strategy 5555" on the dependent variable "achievement", the researcher applied the equation of the square Eta of the following t-test:

$$\eta^2 = \frac{\square^2}{\square^2 + \square \square}$$

- Where t refers to the calculated value of the t-test.
- Df= refers to the degree of freedom.

The value has reached (0.194), and it has a large impact size according to (Afana, 2000) criterion for the effect size, and Table (3) presents that:

**Table (3): The effect size and its magnitude according to the value of ETA square**

| Statistical medium type | The value of the effects |           |      |
|-------------------------|--------------------------|-----------|------|
| ETA square $\eta^2$     | 0.01-0.06                | 0.06-0.14 | 0.14 |
|                         | Zero                     | Medium    | Big  |

To verify the second zero hypothesis, which states: There is no statistically significant difference at the level of significance (0.05) between the average scores of female students of the experimental group who are studying mathematics with strategy 5555 and the average score of female students of the control group that studies the same subject in the traditional way in the test of transpositional thinking.

The researcher applied the test to the students of the two research groups, then calculated the arithmetic mean and the standard deviation of their scores on the test. The T-test for two independent samples was used to verify the significance of the difference between the two average scores. Table (4) below shows that:

**Table (4) Results of the T-test for two independent samples for the Transpositional thinking test for the two research groups**

| Group        | No. of students | Mean  | Standard deviation | Degree of freedom | T value    |          | Significance level 0.05 |
|--------------|-----------------|-------|--------------------|-------------------|------------|----------|-------------------------|
|              |                 |       |                    |                   | Calculated | P. value |                         |
| Experiential | 35              | 22.34 | 5.75               | 68                | 4.306      | 2.000    | Significant             |
| Control      | 35              | 15.56 | 7.33               |                   |            |          |                         |

It is clear from the table that there is a statistically significant difference between the average scores of female students of both groups on the academic achievement test in favor of female students of the experimental group, and therefore the first zero hypothesis is rejected and the alternative hypothesis is accepted. The researcher attributes this result to the 5555 strategy that relies on collective and cooperative work between female

students. The students were distributed to heterogeneous groups, which had a clear impact on obtaining positive results. It allowed them to be an effective element in the group through its process of thinking and proposing multiple and diverse ideas, dialogue, discussion, and exchange of views, as well as cooperative discussion style, which helped to raise the level of their transpositional thinking

### Conclusions:

In light of the results of the current research, the following conclusions are drawn:

1. Teaching according to the 5555 strategy gives equal opportunities to all students through their positive participation, and in this way, it takes into account (individual differences), and requires more effort than is required in the traditional way.
2. Teaching following this strategy allowed the students to form good relations as a result of increasing personal contact between them, and by offering opinions and expressing views, which creates familiarity and interaction between them.
3. Teaching procedures are under the 5555 strategy, with what modern trends in teaching focus on making the student the focus of the educational process.
4. The 5555 strategy contributed to an increase in academic achievement and transpositional thinking for female students of the experimental group compared to students of the control group who studied the same subject in the traditional way.

### Recommendations:

In light of the researcher's findings, he recommends the following:

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1. Adoption of the 5555 strategy in teaching mathematics for the fifth year of the biology major.
2. Training teachers of mathematics and teachers on how to use the 5555 strategy in their teaching of the subject through the annual training programs held by the Department of Numbers and Training in the General Directorates of Education in all governorates.
3. The necessity to include the curricula of the program for preparing mathematics teachers in the colleges of education in Iraqi universities and the basic education colleges of the 5555 strategy.

### Suggestions:

On the Completion of the current research, the researcher suggests the following:

1. Conducting a study of the impact of the 5555 strategy on the achievement of fourth-grade students in mathematics and developing their attitudes towards it.
2. Conducting a study of the impact of the 5555 strategy on achievement and critical thinking among students of the sixth grade of biology in the subject of mathematics.
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