

## The Effect Of Using The THELEN Model (Group Investigation) In Solving Mathematical Problems Among Female Students Of The First Intermediate Grade In Mathematics

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**Abstract:** The current research aims to identify the effect of using the THELEN (group investigation) model in solving mathematical problems of first-grade intermediate students and their achievement in the mathematics subject, in order to verify the goal of the research, the researcher formulated the following null hypothesis (There is no statistically significant difference at the level of significance (0.05) between the average scores of the students of the experimental group who studied on according to the THELEN model (group investigation) and the average scores of the control group that studied on the usual method for the mathematical problem solving test), The research sample included (51) students who were chosen intentionally, as the sample was divided into two groups, one of them is an experimental group consisting of (25) female students who studied according to Thelen (group investigation) model and the other control group was made up of (26) female students who studied according to the usual method, to achieve the goal of the research, the researcher prepared a mathematical problem-solving test consisting of (30) paragraphs of a kind of multiple choice. The validity, reliability and distinction of the test paragraphs were verified, and the researcher used the appropriate statistical means to complete her research, and the results showed that the students of the experimental group who studied according to the model of Thelen (group investigation) outperformed the students of the control group who studied according to the usual method and in light of the result reached by the current research, the researcher developed a set of conclusions, recommendations and proposals.

### First: - The research problem

The interest in the strategies and methods of learning and teaching and the effective role they play in improving learning and teaching began in order to reach educational products that keep pace with the spirit of the times and achieve the aspirations of educators (Al-Hashemi and Al-Dulaimi, 2008: 29)

The mathematical problem and the study of methods for solving and analyzing it occupied workers in the field of teaching mathematics; And those interested in it and the methods of teaching it for a long time and up to the present time. Educators believe that the ability to solve a mathematical problem is one of the most important skills that an individual must master; this is because the solution of mathematical problems is directly related to the scientific method, that is, to the method of problem-solving (Al-Kubaisi, 2008: 100)

The researcher believes that the reality of teaching mathematics in our schools (middle school) is unsatisfactory. In most cases the teaching takes place in a spontaneous and unplanned way from the school, therefore, the process of solving mathematical problems in this way may be irregular, which prevents students from absorbing them and integrating them into their cognitive structure. The researcher did not stop at this point as she surveyed the opinions of many female teachers in mathematics in middle schools through the questionnaire distributed by the researcher to them because they are the closest in the field and they confirmed the weakness of their students in mathematics, especially in the subjects of solving mathematical problems. Through the researcher's access to literature and studies such as a study (Fattah, 2003) and a study (Hassoun, 2007), she found that there is a weakness among students in solving the mathematical problem.

For this reason, the present study proposes to experiment with a model of constructivism theory; it is the Thelen model and its effect on solving mathematical problems by answering the following question: What is the effect of the THELEN model (group investigation) in solving mathematical problems for female students of the first intermediate grade in mathematics?

### Second: - Research importance

The great interest in the mathematical problem and its solution has called on specialists in educational mathematics to place the method of solving the problem at the top of the priorities in the developed curricula, with the need to conduct more studies and investigate everything related to the mathematical problem and its solution. (Al Majnoui, 2007: 5)

The Thelen model (group investigation) is one of the teaching models that help to end the routine in the classroom and create real education where the aim of the model is to achieve democracy among students and in a scientific manner on the basis that the classroom is a mini-society that resembles a large society and that calm, listening, discipline, and complete obedience to the teacher's orders are all rejected matters. (Mari and Ahmed, 2005: 195)

The importance of the (group investigation) model is that it is one of the models directed towards group interaction that is concerned with human interaction and the social relationships it contains as educational goals, and it means how people think about other people and how they relate to them and their society as a social institution. (Al-Farhan et al., 1984: 66)

**The importance of the current research can be summarized as follows:**

- 1- The importance of the THELEN (group investigation) model, which makes the learner the center of the educational process.
- 2- The importance of the THELEN (collective investigation) model is that it is one of the models that keep pace with the spirit of the modern age, which is based on the principle of democracy in education and the field of teaching.
- 3- The importance of using the THELEN (group investigation) model in solving mathematical problems for female students in mathematics.
- 4- The current study may contribute to the teachers' research in adopting modern methods for the development of the educational process.

**Third: - Research objective:** The aim of the current research is to identify:

The Effect of Using THELEN (Group Inquiry) Model on Solving Mathematical Problems among First Grade Intermediate Students in Mathematics

**Fourth: - Research hypothesis:** There is no statistically significant difference at the level of significance (0.05) between the average scores of the students of the experimental group who studied according to the THELEN (group investigation) model and the average scores of the control group who studied according to the usual method in the mathematical problem solving test.

**Fifthly: - Research limits**

- 1- The current research is limited to the first intermediate grade female students in the morning middle schools of the Second Rusafa Education Directorate in Baghdad governorate.
- 2- The first academic semester of the academic year 2020-2021.
- 3- The first chapter (the correct preparation), the second chapter (the relative preparation), the third chapter (the polynomial) of the mathematics book scheduled for the female students of the first intermediate grade for the year 2018

Sixth: Search terms

The THELEN model

✚ (Joyce and Weill, 1986) that: The process of social interaction begins with presenting a topic or problem that stimulates students' interest and thinking and asks to address it and offer their opinions and the student's role is determined by the role of investigator and investigator of the problem's dimensions to reach solutions and extrapolation within dynamic collective conditions" (Joyce and Weill, 1986, p: 227)

**Solve mathematical problems**

✚ Defined (Stalters, 2006) "those kinds of problems that require students to use mathematical knowledge that they previously learned, and written information provided to them in the problem to reach a solution to the mathematical problem, often these mathematical problems represent real-life situations presented to students in Written scientific picture "(Stalters, 2006: 22).

**The researcher knew mathematical problem solving by procedure**

✚ It is the new sports position that first-grade female students are exposed to, and it is measured by the score obtained by the female students in the mathematical problem test.

First: The THELEN (group investigation) model

Model Designations:

- ❖ Thelen model.
- ❖ Collective research.
- ❖ The social family model.

The idea of Herbert Thelen's model, group detective, goes back to the famous educator (John Dewey) in his book (Democracy and Education) in 1916, Dewey recommended that the entire school be organized on the basis of a mini-democratic life in which students participate in the development of the social system through experience, so they learn gradually how to apply scientific methods to improve the human society. (Farhan, 1984: 153)

(John Dewey) confirms that research and investigation of a confusing problem is one of the best scientific methods of research and leads to the transformation of schools into institutions in which students learn how to conduct their own investigation and research, not to accept the results of others' research. (Qatami and Nayfa 1998: 249)

Herbert Thelen's assertion that group investigation is a mode of negotiation in society and the student interacts with society through cognitive domains and that classroom life is a series of investigations and each case includes an exciting position for students by giving the opportunity to think that leads to the launch of the largest number of Ideas and Solutions (Chiyld, 1983: 138).

THELEN model assignments (group detective)

1- The learner fully understands each information he learns.

2- Compare information and take into account its interconnectedness.

3- An organized classification of information in the form of specific concepts.

4- Applying the information obtained by the learner during his life.

5- The educational process goes through five phases, which are the introduction phase, the presentation phase, the balance and linkage phase, the deduction phase and the implementation phase. (Salameh et al. 2009: 309)

#### **Teaching steps according to the THELEN model (group investigation)**

First step → Presentation of a problem for the students that includes a planned confusing situation.

Second step → knowing the students' reactions regarding the situation.

Third step → Defining the problem and formulating it in an important way that can be addressed and researched, and determining the roles and responsibilities of female students in working within the group.

Fourth step → Group therapy.

Fifth step → Monitor the progress made by female students.

Sixth step → Stimulation of group research; and encourage several types of activity to cope with other situations

#### **Teaching steps according to the Thelen model**

Third: Solving mathematical problems

The solution of the mathematical problem is one of the most important issues that have occupied workers in the field of teaching mathematics and those interested in it and methods of teaching it for a long time, and the question is a new and distinctive position facing the learner and it does not have a ready solution for the learner at the time, Also, not every word issue is a mathematical issue, and mathematical problems are not limited to verbal problems only the consideration of a question is a mathematical issue that depends on the level of knowledge and experience that the individual possesses, and what is an issue for a particular individual is not the same for another individual, as the verbal problems that the individual solves routinely It is direct to a specific rule studied by the student that is not considered mathematical problems. (Abu Zina, 1994: 219)

#### **Previous studies**

1- **Al-Lami study (2007):** The study aimed to know the effect of teaching using the Thelin model (collective investigation of achievement and attitude among students of the fourth year of the year in geography) the study was conducted at Al-Mustansiriya University / College of Education, the research sample consisted of (70) students who were divided to two groups (experimental and control), the experimental group included (35) female students, and the control group (35) female students. The experiment was applied for two months, and for the purpose of performing equivalence, the researcher used (t-test) for two independent samples.

The researcher believes that the reason for the superiority of the experimental group over the control group is due to more than one reason: Thelin model makes the students more effective in finding facts and information and creates an atmosphere of familiarity and cooperation among the students and led to the enhancement of positive confidence and the elimination of their negative aspects, which affected the increase in their achievement in the subject Geography. **(Al-Lami, 2007: i-k)**

2- **Al-Issawi's study (2010):** The study aimed to know (the effectiveness of the group investigation model in the achievement of second-grade intermediate students in biology and their skills in scientific thinking) The study was conducted at the University of Baghdad / College of Education / Ibn Al-Haytham and the research sample consisted of (49) A student, and by random assignment, Division (B), the experimental group that was studied according to the group investigation model, was chosen and consisted of (24) students, and Division (C) the control group that studied according to the traditional method and consisted of (25) students, and the researcher began applying the experiment from the date of 14/14. 2/2010 and ended on 6/5/2010, and after the end of the experiment, the achievement test was applied to the students of the two groups, and the scientific thinking skills test was re-applied to both groups, After correcting the students' answers and treating them statistically by using the t-test for two

The Effect Of Using The THELEN Model (Group Investigation) In Solving Mathematical Problems  
Among Female Students Of The First Intermediate Grade In Mathematics

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independent samples, the experimental group showed the superiority of the students' performance over the control group of the second grade intermediate students in biology. (Al-Issawi, 2010: A)

**Foreign Studies:**

**3- Judy's study (1995):** The study aimed to know (the effect of some cooperative learning strategies and the group investigation style on students' achievement in the subject of science). The study was conducted in Eastern Virginia and the study sample consisted of two divisions of the fifth grade, selected from an elementary school, and a pre-test for the two divisions was conducted with the aim of determining basic learning on the subject the dichotomies were studied two units, one focused on the lower Bloom levels and the other on the higher Bloom levels through my strategy Cooperative learning and the group investigation style a post-test was conducted after the completion of the teaching of each unit, the results of the statistical analyzes showed that there were no significant differences between students' achievement in science at the lower and higher Bloom levels due to the teaching method (cooperative learning and the group investigation style) (Judy, 1995)

**4-Lewin's study (2000):** The study aimed to "compare the style of bilateral cooperative learning and group investigation and their effect on learning French as a second language." The study was conducted in Canada the study sample consisted of two French language classes in the liberal arts bilingual college and the number of (54) students, the researcher used a set of qualitative and quantitative tools to measure students' linguistic achievement, and used an oral and other written test, observation models, and an interview for the analysis of students' linguistic achievement and their responses to the teaching methods used the results showed that there were no statistically significant differences between the two groups in acquiring language skills, but the level of the two groups improved in the skills included in the methods used. (Lewin, 2000)

**Third chapter**

**First: - Research methodology:** The researcher followed the experimental method to achieve the goal of her research, because it is an appropriate approach for research procedures and access to results. The term "experimental" means changing one thing and noting the effect of change in another thing. (Abu Hawajj, 2002: 59)

**Second: Experimental design:** - "It is the first step that the researcher implements. Each experimental research must have its own design to ensure its safety; and the accuracy of its results. Determining the type of experimental design depends on the nature of the problem and the conditions of the sample; and the choice of experimental design is a scheme or program of work to how to implement the experiment. " (Abd al-Rahman and Adnan, 2007: 487)

Table (1) experimental design

The group	Equalization of groups	Independent variable	Dependent variable	Search tool
Experimental	Examining the previous information for mathematics	Thelen group investigation model	Solve mathematical problems	Test of solving mathematical problems
	Mathematics previous achievement test			
	IQ test			
Control	Chronological age in months	Usual way of teaching		

**Third: - The research community and its sample:** - The step of defining the research community is one of the main important steps in educational and psychological research, as the conduct of the study depends on it (Muhammad, 2001: 184). The research community consisted of female students of the first intermediate grade at (Al-Yarmouk Basic School for Girls) 2020-1021, of which (51) students were excluded from them. Table (2) illustrates this

Table (2) The number of female students in the experimental and control groups

the group	The hall	The independent variable	Number of female students before exclusion	Number of students excluded	Number of female students after exclusion
Experimental	1(A-B)	Thelen model	28	3	25

Control	2(C-D)	The usual way of teaching	31	5	26
The grand total		2	59	8	51

**Fourth: - Equivalence of the two research groups (experimental control):** - Experimental control is intended to know all the conditions surrounding the experiment and its variables and their organization; or fix it so that it does not have an effect on the dependent variable (Anwar and Al Safi, 2005: 168). Therefore, the researcher was keen to control a number of variables that may affect the results of the experiment, and these variables are:

- 1- Mathematics previous knowledge test.
- 2- Mathematics previous achievement test.
- 3- Intelligence test.
- 4- Chronological age in months.

**Eighth: - The research tool: (Dwidari, 2002)** defined the research tool as "the means by which the researcher collects his data in order to be able to solve the research problem and verify his hypotheses (Dwidari, 2002: 305) therefore, the researcher prepared a research tool which is the test of solving mathematical problems in a course. Mathematics consists of (30) items of multiple choice.

**Ninth: - The validity of the test:** "The validity of the test is one of the most important characteristics of the achievement tests, and the test is valid to the extent that it measures the characteristic or characteristic that it was prepared to measure" (Al-Qamish, 2001: 109). Therefore, the researcher made sure of the apparent validity and validity of the content by presenting paragraphs the test and its instructions and the extent to which it represents the content of the subject to be studied by a group of experts and referees in the field of curricula and methods of teaching it and in the field of measurement and evaluation, all of which got more than (90%)

• **Tenth: Analysis of the test items:** The aim of the statistical analysis of the test items is to improve its quality by identifying weaknesses in the paragraphs in order to reformulate, delete or add them. "(Scannel, 1975: 214) After applying the test to the pilot sample consisting of (100) students from a school (Al-Khansa High School for Girls) on 01/30/2021, which falls on Saturday,. The results of the students 'answers to the test questions were analyzed, in order to know the difficulty factor, and the discrimination coefficient, so that the ambiguous paragraphs, if any, were deleted. After that, the scores were treated statistically as follow:-

**A- Calculating the difficulty factor for the paragraph:** The difficulty factor is the ratio of students who answered correctly for the paragraph to the number of students in either group. " (Odeh, 1999: 289)

The researcher calculated the difficulty factor for each paragraph using the paragraph difficulty treatment. Its value ranged between (0.63 - 0.31), which indicates the acceptability of the difficulty of the test items. Thus, all the items of the test with the difficulty factor are acceptable, as many specialists in the measurement and evaluation subject see that the acceptable range of the difficulty factor is the one whose value ranges between (0.20 -0.80). (Odeh, 1998: 297)

**B- Paragraph discrimination coefficient:** - What is meant by the discrimination coefficient is the paragraph is "the ratio of the difference in the number of those who answered the paragraph correctly from the two categories to the number of students in one of the two categories" (Odeh 1999: 287); Means "the ability of the paragraph to distinguish between the upper and lower levels of individuals with respect to the characteristic that the test measures. A good question is what serves this purpose (Stanley, 1972: 45); Acceptable limits, meaning that the test items are valid in terms of the coefficient of discrimination.

**C- The effectiveness of the wrong alternatives:** - "The wrong alternative is effective when more students from the lower group are attracted to it than the higher group students who are attracted by that alternative" (Al-Baghdadi, 1998: 129)

The researcher calculated by using the false alternatives efficacy equation for each of the test items and they were all negative, which indicates their effectiveness.

**Eleven: Stability of the test:** The researcher used the Keoder-Richardson equation (KR-20) to calculate the test's reliability. Where it relied on the results of the exploratory sample of the secondary school (Al-Khansa for Girls), the stability factor was (87%), which is the acceptable value' According to Gronlund (1965), the tests are considered good as their stability factor is more than (0.60). (Gronlund, 1965: 195)

**Twelfth: The finalized test:** After completing the statistical procedures related to the validity of the test items from the validity, consistency, distinction and effectiveness of the alternatives, the test consists of (30) items of the multiple choice type with (four alternatives), and the test is ready for application.

Thirteenth: Procedures for implementing the experiment

- Refer to the competent authorities to obtain an assignment facility to the Yarmouk Elementary School for Girls, on 7/12/2020

- Conducting a parity process between the two research groups.

- Organizing a mathematics course schedule for the experimental and control groups, in agreement with the school administration.

- The researcher began applying the experiment to the prescribed subject in the first half of the academic year 2020/2021; And that on Saturday, 12/7/2020, and ended on Saturday, 2/13/2021

- The researcher studied the experimental group for the three semesters (first, second, and third); From the book scheduled according to the THELEN group investigation model; And according to the goals, activities, plans and tests designed by the researcher.

- The researcher studied the control group for the three semesters (first, second, and third). From the book scheduled according to the usual method; And according to the goals, activities, plans and tests designed by the researcher.

- The researcher used the same educational aids for the two groups (experimental and control)

- After completing the teaching of the three semesters, the researcher informed the students of the experimental and control groups of conducting an exam in the three semesters electronically on Monday 1/2/2021 in order to preserve the safety of the experiment.

With regard to the mathematical problem solving test and the achievement test for the two research groups, the researcher did the following

- ◆ The ultimate application to test solving mathematical problems.
- ◆ The researcher applied the final test for solving mathematical problems on the two research groups on 6/2/2021.

**Fourteenth: Statistical means:** The researcher used the appropriate statistical means to achieve her research objectives, including the T-TEST (for two independent samples) - the paragraph difficulty equation - the discrimination equation - the effectiveness of wrong alternatives - and the Keoder-Richardson equation (KR-20).

#### Chapter four

After the researcher completed the research experiment according to the steps that she referred to in the third semester, the researcher presents the results of the research to know the effect of using the THELEN Mathematical Study Model in the Study Group<sup>4</sup> and to know the significance of the statistical differences between them; and then verify the research hypotheses; and the disclosure of whether the research results support these hypotheses or not, as well as the interpretation of the result and the most important conclusions, recommendations and proposals, as follows:

#### First: Presentation of the results

**- For the purpose of verifying the null hypothesis, which states that:**

There are no statistically significant differences at the level of significance (0.05) between the average scores of the students of the experimental group who studied mathematics according to the model of Thelen (group investigation) and the average scores of the students of the control group who studied mathematics according to the usual method for the test solution. After applying the test, correcting the students' answers, and calculating the total score for all the students of the two groups, the arithmetic mean and standard deviation of the two groups were calculated and the T-TEST was approved for two independent samples to show the difference between the averages of the two groups on the test, the solution of mathematical problems, as shown in Table (3)

**Table (3) results of (t-test) for two independent samples for applying the mathematical problem solving test for the two research groups**

S	group	number	Arithmetic average	standard deviation	variance	Degree of freedom	T-value		Significance is at the 0.05 level
							Calculated	Tabular	
1	Experimental	25	20.68	3.727	13.893	49	3.904	2	A function in favor of experiment
2	Controll	26	16.88	16.88	10.266				

It is clear from the above table:

The average differences for the scores of the students in the experimental group in the Thelen (group investigation) model are (20.68) with a standard deviation (3.727) and a variance (13.893), while the average differences for the scores of the control group students are (16.88) and with a standard deviation (16.88) and a variance (10.266) by relying on T-TEST for two independent samples; That the calculated value (3.904) is higher than the tabular value (2) at the level of significance (0.05) and with a degree of freedom (49). This indicates the existence of statistically significant differences between the mean of the experimental group's scores and the average of the control group's scores in the mathematical problem solving test; For the benefit of the experimental group, which adopted the model Thelen (group investigation) in teaching, while the control group adopted the usual method of teaching; Thus, it rejects the second null hypothesis, which states that:

There are statistically significant differences at the level of (0.05) between the average scores of the students of the experimental group who studied mathematics according to the model of Thelen (group investigation) and the average scores of the students of the control group who studied mathematics according to the usual method in the test of solving mathematical problems in favor of the test.

#### **Second: Interpretation of the result**

The current study has found that the students of the experimental group who are studying according to the model of Thelen (group investigation) are superior to the control group students who study according to the usual method, and the results of the research came in agreement with some of the results of studies that dealt with the model of Thelen, and this result can be attributed to several reasons, including:

- 1 - The suitability of Thelen model (group investigation) for the subjects studied during the experiment, which led to an increase in the students' achievement level in solving mathematical problems.
- 2- Teaching according to Thelen model (group investigation) makes the student the focus of the educational process, making her in a positive, effective and active role.
- 3- Teaching according to the Thelen model (group investigation) contributed to changing the students' attitude towards the subject from a negative attitude to a positive attitude through helping the students in solving the problems facing each group.
- 4- Increasing students' motivation towards the subject and stirring up competition between groups to obtain a higher degree
- 5- The researcher believes that the Thelen model (group investigation) helped students to clarify and know some educational facts and concepts for students through the intermediate school education subject.

Third: - Conclusions: In light of the results of the research, the researcher reached the following conclusions:

- 1- The use of Thelen model (group investigation) in teaching mathematics helped in raising the level of students' achievement in the experimental group.
- 2- Correspondence of the model with the mathematics subjects studied during the experiment.
- 3- The use of the (group investigation) model depends mainly on the students' activity and cooperation in the investigation of facts and information, mainly in a cooperative manner.
- 4- Thelen model (group investigation) helped in teaching mathematics because it provides educational situations that interest students and help them use the investigation process in the problems they face.
- 5- Using the Thelen model (group investigation) in empowering students who studied according to the Thelen model (group investigation) in solving mathematical problems and their ability to face and solve mathematical problems and share opinions about them, collect information, think and conclude, then reach the law and find the right solution more than the usual way.

#### **Fourth: Recommendations:**

1. Adoption of the model of TELEN (collective investigation) in teaching mathematics for the first grade
2. Include educational models, including the TELEN model, in the curricula of teaching methods in education and curriculum preparing teachers and teachers for all stages.
3. Preparation of training programs for teachers during service and opening continuous training courses on modern methods and methods in teaching such as the THEIN model and other models.
4. Preparation of training programs to assist in increasing mathematical schools' awareness of the importance of the humanitarian and social relations and their active role in the education process.

**Fifth: Proposals:** Completion of the Research proposes the following future research:

1. A study to identify the use of the TELEN model (collective investigation) in mathematics with other variables.
- 2 - A similar study of the current research to identify the use of the TELEN model (collective investigation) in other materials and stages.

3. Conduct a comparative study between the TELEN model (collective investigation) and other models in solving sports issues.

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