The Effect of a Proposed Program Based on the Theory of an Innovative Solution to Problems in Achievement in Mathematics among Middle School Students

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The current research aims to know: The effect of a proposed program based on the theory of an innovative solution to problems in the achievement of middle school students in mathematics. The effect of a proposed program based on the theory of an innovative solution to problems in the direction towards mathematics. In order to achieve the aim of the research, the researcher formulated the following two hypotheses: There is no statistically significant difference at the level of significance (0.05) between the average levels of achievement of students of the experimental group who are studying using the proposed program and the degrees of students of the control group who are studying using the usual method in mathematics. There is no statistically significant difference at the level of significance (0.05) between the mean scores of students of the experimental group who are studying using the proposed program and the scores of students of the control group who are studying using the regular method in the measure of the trend towards mathematics. The middle class was chosen for the boys, in which there are three divisions for the first intermediate grade, and two divisions were chosen randomly, distributed into two groups, one is experimental and the other is a control. 2019 - 2020, The researcher prepared two types of teaching plans, the first for the control group, according to the usual method, and the second for the experimental group that was studied according to the proposed program. The results of the research showed that there is a statistically significant difference in the achievement test and in the measure of the trend towards mathematics in favor of the experimental group.

Key words: *Program, innovative solution, achievement, mathematics.*

Introduction

The theory of the innovative solution was born in the former Soviet Union by the scientist Altshuller 1926-1998 when he worked as a consultant in the Department of Invention Documentation in the Russian Navy, *(Doaa ,2015)* and when he was trying to satisfy his curiosity in answering many of the questions that seemed to him when Watch the large amount of information about creative ideas to solve problems, and he took for himself the task of knowing how it was used to solve problems (*Oliveria, 2000*) and was known as the theory of innovative problem solving and written an abbreviation (TRIZ) which is the initials of the Russian language for the phrase (Teoria Resheiqy Izobreatatelskikh Zadatch) and meets it In a language English (Inventive Problem Solving Theory of), which was based on the knowledge base included a wide range of methods of solving technical problems, and the beginning of the work of this theory to the world Altchelor 1946 *(Salih, 2005)*

Literature Review
The Traditional TRIZ Stage (1946-1985)

In 1945, Alchler noticed that patent applications were weak and ineffective, and he quickly realized that the solutions to problems posed ignored the main characteristics of problems that arise in systems related to the problem, and also noted that the most brilliant inventions were mostly routine as a result of focusing on the problem to the point of exhaustion. *(Amer, 2008)*

The Traditional Post TRIZ (1985-1990)

By 1985, Alchler had published more than 14 books on theory, forming the set of ideas and principles that are known today as the traditional (TRIZ) and which included a summary of his field analysis. Traditional subjects, as this theory and its methods have been used in science, mathematics, social studies, and others. *(Siyam, 2013)*

The Contemporary Teresa Stage (1990_ .....)

In 1990, Alchler and his followers were able to teach the TRIZ theory in about (200) schools through courses that were held sometimes in official laboratories and others in the private sector, until the number of those who studied this theory reached more than (7000) students throughout the Soviet Union (*Abujaado, 2005*)

Sources of Theory

The most important sources of TRIZ theory are technical information and patents. So far, specialists in this theory have been able to analyze almost two million patents worldwide, which represent 10% of patents in the world, and the other source of the theory is to analyze the problem-solving process itself, *(Dima ,2013)* This analysis showed the psychological obstacles that have a major impact in solving problems. (*Savransky, 2000*)

Creative Principles in TRIZ Theory

Through the huge database that he analyzed, Alchler realized that there are a few principles that are repeated across many different experiences, and after a deep study of these general models it was found that there are (forty principles) creatively used repeatedly to reach creative solutions to problems. *(Ashtiyeh, 2010)*

Levels of Creative Solutions in TRIZ Theory

Savransky showed that both Chiller and Shapiro pointed to the idea of arranging levels of creative solutions, an old idea shared by many fields, including the world of innovations, ideas and creativity that he worked on at the beginning of TRIZ, and *(Al-Rawadia, 2012)* they classified levels of innovation based on three foundations: difficulty The problem - the difference between the prototype of the previously known solution and the new solution - the cognitive dimension of the inventor's specialty used in the new solution (*Savransky, 2000*)

Contradictions in TRIZ Theory

It is one of the early ideas of TRIZ researchers. Removing a paradox means solving a problem. If we liken the Therese algorithm to solving problems in a tree, the paradoxes represent the roots of the tree. *(Nafin, 2013)* Types of contradictions: administrative contradictions - technical inconsistencies - material inconsistencies. (*Rantanen, 2008*).

Matrix of Discrepancies

Chiller concluded that the most brilliant inventions are those whose solutions came as a result of overcoming little or no technical inconsistencies, and through the study of patents 40 creative principles were identified that were considered effective means of resolving technical inconsistencies, (*Abdel Moneim, 2011*) and to facilitate the use of these principles were laid out in a matrix to facilitate Any user who is familiar with the principles that can benefit from other inventors facing the same contradiction. *(Mohamed, 1995)*

Sources

Sometimes the clear formulation of the contradiction can suggest possible answers to the problem. Analyzing the sources helps us to find ways to solve the contradiction, and the sources are things, information or characteristics *(Sami, 2012)* that are already close to the problem environment, as it can be used directly or Modify it to make it useful, and with it the problem will seem solvable, and it is initially invisible because we are used to not seeing it when we look at the problem. (*Rantanen, 2008*)

The Ultimate Ideal Output

The individual can remove the contradiction in the problem and obtain the ideal solution by using the sources that help in obtaining the best useful feature or reduce the harmful feature or completely hide it, and the ideal solution represents a measure of how close the system is to the final ideal product, and the more the useful feature in the system increases Idealism or an ideal solution, and optimization also improves when the harmful advantage is weak (*Rantanen, 2010*).

Creative Solution to Problems

Alchler was convinced early on in the possibility of organizing the innovation process after he had reached further developments in each case in which experimental data were used by taking advantage of the abstraction that is frequently applied in engineering and mathematics, and found that the systems that derive their solutions through (TRIZ). (*Stratton, 2000*)

The Stages of the Theory of Innovative Problem Solving (TRIZ)

The stages of Therese theory differed in solving problems in an innovative way in a number of stages according to the type of tools used and their importance in solutions or the age group used for this theory, *(Abdullah, 2010)* where most scientists agreed on four stages, namely: Defining the problem 2) Reshaping the problem by analyzing it 3) Searching for good solutions Similar previous problems 4) Evaluating solutions by looking at similar solutions that can measure and adapt to the current problem (*Gabayen, 2008*)

The Steps Involved in Teaching According to the Theory of Innovative Problem Solving (TRIZ)

Clarifying the principle of innovation used in problem solving, presenting problems from the reality that were solved using the same principle, *(Ihssan ,2005)* formulating the problem by students in their own style while directing them to focus on highlighting the contradiction,

students present their suggestions to the problem using the principle of innovation with supervision and guidance by the teacher and encourage them to invent different solutions. *(Tayseer, 2010)*

Methodology

Table 1: Experimental Design for Research

N	Group		Independent variable	Dependent variable
1	Experimental	Valence	The proposed program according to the theory of innovative solution to problems	1. Achievement test 2. The measure of the trend towards mathematics
2	Control		The usual way	

The research community*:* The research community consisted of middle class students in the middle schools affiliated to the General Directorate of Education in Maysan Governorate for the academic year (2018-2019).

The research sample: The research sample was deliberately chosen from middle students who excel for boys due to the following considerations: 1 - The willingness of the school administration to cooperate with the researcher. 2 - The willingness of a first-grade math teacher to fully apply the experiment, knowing that his teaching experience in teaching this subject is 12 years. 3 - The school's location of the researcher's residence allowed the researcher to sit with the teacher at additional times to give him instructions and clarify some matters related to the teaching plans before and during the experiment. 4- The students 'convergence and parity in terms of social, economic, and cultural levels.

Control Procedures

1. Equalization procedure between the two groups: Some variables that may affect the results of the research have been set, including:

- *Chronological age*: Students' ages were obtained from their school cards.
- *Intelligence*: The Raven matrix of intelligence was applied, and the mean and standard deviation were calculated for both groups to test the difference between them.
- *Previous achievement in mathematics*: means students 'grades in mathematics in the academic year exam (2017-2018) obtained from the general record of the school administration.

- *A measure of the trend towards mathematics*: where a pre-measurement of pre-measurement was applied to the experimental and control groups to know their attitudes toward mathematics before applying the program.

Table 2: T-test of the two groups in the valence variables

variable	the group	Number	SMA	standard deviation	Degree of freedom	Second Value		Statistical significance
						Calculated	Tabular	
Chronological age	Experimental	30	149.3	4.406	58	0.625	1.671	non-significan
	Control	30	152.4	4.989				
Intelligence	Experimental	30	22.08	1.470	58	1.132	1.671	non-significan
	Control	30	21.60	1.155				
Previous achievement	Experimental	30	86.44	10.929	58	0.023	1.671	non-significan
	Control	30	85.96	11.167				
Direction meter	Experimental	30	113.5	16.59	58	0.544	1.671	non-significan
	Control	30	105.2	10.78				

2. Study the experimental and control groups of the same mathematics teacher in the school in order to avoid the difference that may result from the difference of the subject teacher in his ability and personal characteristics and the extent of his knowledge of the nature of the experimental variable at.

3. The number of teaching sessions for the experimental and control groups was equal & the experimental and control groups were assigned the same homework.

5. The experiment took the same time period for the two groups, and this was done in the first semester, as the experiment started on 01/10/2018 and ended on 20/11/2018.

6. Control some exotic variables that may affect the accuracy of the results, and despite the conduct of statistical equivalence between the two research groups in some variables, the researcher tried as much as possible to control some exotic variables, because experimental research is exposed to extraneous factors that may affect internal honesty And the exterior for experimental design, the following are the variables and how to control them.

7. Search tools: Achievement test: The achievement test was prepared, in which the goal of the test was determined, and the content of the material was analyzed, then the specification table (test map) can be summarized. Its preparation can be summarized in a two-dimensional list indicating one of the two dimensions, the content and the proportions determined for its weights, and the second dimension shows the goals and their weights as it shows the number of paragraphs In each cell (*Al-Dulaimi, 2005*), the test consists of 20 paragraphs of a multiple choice type.

Table 3: Test Map

Content	Weight of separation	Behavioral goals			Total
		Remembering 40%	Understanding 28%	Application 32%	100%
Chapter one	43%	4	2	3	9
Chapter II	57%	5	3	3	11
Total	100 %	9	5	3	20

Sincerity of the test: Types of honesty were achieved, including: apparent honesty: The achievement test and behavioral purposes were presented to a group of arbitrators in mathematics and the methods of teaching mathematics, to benefit from their opinions and directions, and he relied on the opinions of the arbitrators, their proposals and their directives with modifications to some passages of the achievement test. All the arbitrators agreed on the validity of the achievement test clauses and their suitability for the level of students and the behavioral purposes assigned to them. Accordingly, the test is counted as an honest investigator to measure the students 'final achievement. The content is true: The content is intended to test the goals set in the subject. The duration of the study, in the sense that the test items are comprehensive for all the subject matter studied by the student (***Kouwah, 2010***), and the specification table is an indicator of content validity, which indicates the number of paragraphs in each cell, as well as the goals and content to be covered through these Paragraphs, i.e. an appropriate distribution of the paragraphs that represent the content covered by the objectives (***Alminzil, 2010***)

The exploratory application of the test: It was in two phases: **The first exploratory application** was applied to a survey sample chosen from Al-Razi intermediate school for boys numbering (40) students with the rate of one division It was found that the answer instructions and the test items were clear, and that the mean time for the answer was (45) minutes, and the second exploratory application: to analyze the test items, where the test was applied again to a sample of (110) students, by three people in Al-Razi's medium for boys without the same research. The origin of answers of the students in the survey sample were corrected, then the grades were ranked in descending order, then the top 27% and the lowest 27% were chosen as a comparison ratio between two different groups for the analysis of the test.

8. The coefficient of difficulty and ease of the paragraphs: The difficulty equation was applied for each of the test items and found them ranging between (0.35-0.71). The test items are acceptable if the difficulty range ranges between (0.20 - 0.75) (***Melhem, 2012***)

9. The discriminatory power of the paragraphs: When calculating the discriminatory power of each of the test items using the formula for the strength of the paragraph discrimination, it was found that the strength of distinguishing the paragraphs ranged between (0.32 - 0.65), and the paragraph can be counted acceptable if its discriminatory ability is (0.20) and above, but in the case Groups are upper 27% and lower 27% prefer preference be (0.30) and more, so all test items are considered acceptable in terms of their discriminatory ability, so it was not removed (***Hussain, 2011***)

The effectiveness of the wrong alternatives: After applying the formula for the effectiveness of the alternatives, it appeared that the alternatives attracted a number of students from the lower group compared to the students of the higher group, and thus it was decided to keep the alternatives as they are without changing.

Stability test: The reliability coefficient of the alpha-Cronbach method was (0.85), and after this procedure, the test became ready for final application.

Achievement test application: As for the left paragraphs, and the reference to their alternatives is not clear, the answer is considered wrong, and for this the higher degree obtained by the student was (20) degrees and the lowest degree that the student can obtain is zero, and the average time spent in answering at the test ranges between (35 - 45) Accurate.

A Measure of the Trend towards Mathematics

The researcher through reference to the literature on the subject of psychology, and after reviewing a number of previous studies that were concerned with building the scale of direction, he was able to formulate paragraphs of scale that represents the attitudes of middle school students (first grade) towards mathematics. The number of paragraphs in their initial form reached (40) forty paragraphs, then the researcher followed the following steps: *The scale validation*: The scale was presented to a group of arbitrators and in light of their opinions, appropriate adjustments were made and some inappropriate paragraphs were deleted, so the scale in its final form became composed of (30) Paragraph. *Experimenting the scale*: Try the scale on an exploratory sample of (45) students from within the research community, before the beginning of applying the experiment. *Stability of scale*: by the stability coefficient using the Alpha-Cronbach equation, where its value was (0.79) and it is a good indicator that indicates the stability of the scale and the homogeneity of its paragraphs (***Muhammad, 2005***).

Application of the trend scale: The scale consists of (30) paragraphs. For the purpose of measuring students 'attitudes, the researcher adopted a method or method of Likert, as it put five alternatives in front of each of the paragraphs of the scale and the alternatives are: - (Strongly agreed - OK - not sure - no Agree - Strongly disagree (I also put the weights of these alternatives, which are (5, 4, 3, 2, 1) if the paragraphs are positive and (1, 2, 3, 4, 5) if they are negative, and the highest score the respondent gets) The lowest degree is (30), and the hypothetical mean of the scale is (90), and the time taken when answering ranges between (20-25) minutes.

The Proposed Program Based on the Theory of Innovative Solution to Problems

The program design model: The researcher chose to design the program in the light of the model (*Gerold Kamp, 2012*

Figure (1) CAMP template for designing and building educational programs
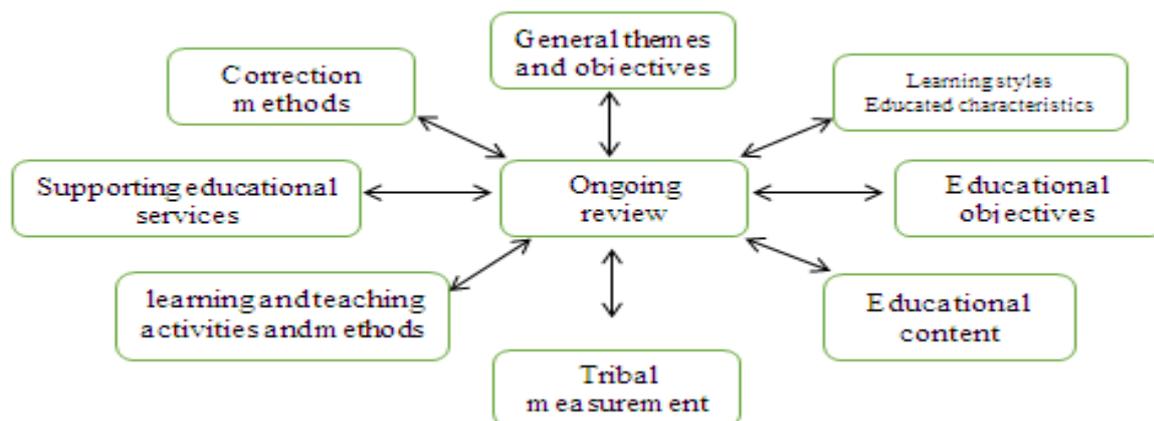
It is worth noting that Kump built his model based on logical sequence and sequence without there being a specific arrangement of steps, and this gives him the flexibility to delete and modify some elements (*Shtioueh, 2010*)

Results

1. The first hypothesis: "There is no statistically significant difference at the level of significance (0.05) between the mean scores of students of the experimental group who are studying in the proposed program and the scores of students of the control group who are studying using the usual method in the mathematics achievement test." After correcting the answers of the students of the two groups looking for the achievement test items, the results showed that the mean of the total scores obtained by the members of the experimental group (17.22) and the arithmetic mean of the total scores obtained by the members of the control group (14.51).

Table 4: Arithmetic mean, variance and T value of the two research groups in the achievement test

Group	Sample individuals	SMA	standard deviation	Degree of freed	Second Value		Indication at (0.05)
					Calculat	Calcul	
Experimental	30	1	4.46	58	2.123	1.671	Statistically significant
Control	30	1	5.88				

2. The second hypothesis: "There is no statistically significant difference at the level of significance (0.05) between the mean scores of students of the experimental group who are studying in the proposed program and the scores of students of the control group who are studying using the usual method in measuring the trend towards learning mathematics." After sorting the answers of the students of the two groups, searching for the paragraphs of the scale of the trend towards learning mathematics, the results showed that the mean of the total scores obtained by the members of the experimental group (125.85), and the mean of the total scores obtained by the members of the control group (95.8) and to know the significance of the statistical difference between these averages, the researcher used the T-test for two independent samples, which indicates the presence of a difference of D. O degrees between the two sets of search in the scale of the trend towards learning mathematics in favor of the experimental group and thus rejects the second hypothesis of zero, as in Table 5.

Table 5: Arithmetic mean, variance and T value of the two research groups in the measure of the trend towards mathematics

Group	Sample individuals	SMA	standard deviation	Degree of freedom	Second Value		Indication at(0.05)
					المحسوبة	الجدولية	
Experimental	30	125.85	7.13	58	9.32	1.671	Statistically significant
Control	30	95.8	10.65				

The level of weak students improved in achievement, as they either provided them with any kind of feedback or explained their behavioral goals.

Conclusions

1- The results of this research showed that there is a positive effect of the proposed program according to the theory of an innovative solution to the problems in students' achievement

and improving their attitudes. Therefore, the researcher recommends using this program in teaching mathematics.

2- Formulating curricula in line with the requirements of modern educational programs in terms of building content, and arranging and sequencing information in small units, each unit includes the behavioral goal and the appropriate questions to achieve it.

3- Training teachers on how to use programs based on modern theories in education and take advantage of the available capabilities in preparation, implementation and evaluation.

4- Attention to the evaluation methods used in our schools so that its results can be used to treat weaknesses in students' learning and to remedy the defects of the method of teaching used and constantly modify them.

5- Determine a good performance level for all students and help them to reach it.

REFERENCES

Abdel Moneim, K. (2011). Measurement and evaluation, Academic Book Center, 1st Floor, Amman, Jordan.

Abdullah, F. and Adnan, Y. A-A, (2010). Research methods in educational and psychological sciences. 1st edition, Ithraa House for Printing and Publishing, Amman, Jordan.

Al-Rawadia, S. and others. (2012). Technology and teaching design. 1st floor, Amman, Zamzam Publishing and Distribution House.

Amer, H. (2008). The effectiveness of a training program based on the Therese theory for developing problem-solving creatively and some creative thinking skills and mathematical communication skills for third-grade middle class students (unpublished PhD thesis), College of Education, King Abdulaziz University, Jeddah.

Tayseer, M, (2010), Measurement and evaluation, measurement and diagnostic techniques in special education. 3rd Floor, Al Masirah House for Publishing and Distribution, Amman.

Ashtiyeh, F. and Alyan, R. (2010). Educational technology (theory and practice). 1st edition, Amman, Dar Safaa for Publishing and Distribution.

Dima, S. (2013), the effectiveness of a training program based on the theory of creative solution to problems (Therese) in developing academic achievement and creative thinking, unpublished Master Thesis, College of Education, University of Damascus

Doaa, M. (2015). The effect of using the Therese theory on developing the creative solution to problems in chemistry among the students 'scientific students in colleges of education, unpublished doctoral thesis, Benha University, Egypt.

Ihssan, A. et al. (2005). Measurement and evaluation in the educational process. 2nd edition, Baghdad, Iraq.

Muhammad, J. A-J. (2005). Mental operations and thinking skills. University Book House, United Arab Emirates.

Nafin, I. (2013). The effectiveness of a proposed program for teaching science in the light of therese theory for first-grade middle school students in developing conceptual comprehension. Creative Thinking Skills, Unpublished Master Thesis, College of Education, Fayoum University, Egypt.

Omar, M. G. (2008). Modern strategies in teaching and learning thinking - inquiry – brainstorming. 1st edition, University Library, Sharjah, Ithraa for Publishing and Distribution.

Rantanen & Domb, 2010. Simplified TRIZ: New problem solving applications for engineers and manufacturing professionals. Second Edition .

Salih, M. A. (2005). TRIZ program for creative thinking development student / trainee guide (4). Debono for Printing, Publishing and Distribution, 1st edition.

Sami, M. M. (2012). Measurement and evaluation in education and psychology, 6th edition, Dar Al Masirah for Publishing and Distribution, Amman.

Savransky,S .D.(2000) .Engineering of creativity : Introduction to TRIZ methodology of inventive problem solving .Boca Ranton .Florida:CRC press LLC

Siyam, M. (2013). The effectiveness of a proposed program in the light of the principles of the Therese theory for developing creative thinking in the subject matter of technology for seventh-graders, unpublished master's thesis, College of Education, Islamic University, Gaza.

Stratton, IM, Adler, AI, Neil HA, Matthews, DR, Manley, SE, Cull, CA, et al. (2000). Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. BMJ 321: 405-412.