PalArch's Journal of Archaeology of Egypt / Egyptology

The Effect of Using the Creative Solution Model for Mathematical Problems (CPS) in Generative Thinking Skills for Second Intermediate Grade Female Students

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Dr. Mudrika Salih Abdullah, Zainab Hassan Wahab. The Effect of Using the Creative Solution Model for Mathematical Problems (CPS) in Generative Thinking Skills for Second Intermediate Grade Female Students-- Palarch's Journal of Archaeology of Egypt/Egyptology 18(4), 7912-7929. ISSN 1567-214x

Keywords: creative problem solving (cps) and generative thinking skills.

Abstract

The current study aims at identifying the effect of using the creative solution model for mathematical problems (CPS) in generative thinking skills for second intermediate grade female student.

This sample consists of (65) female student from the second intermediate class, which was randomly distributed into two groups, one is experimental with (33) female students, and the other is (32).

An experimental design with two equivalents was used, a test for generative thinking skills prepared consisting of (25) paragraphs, (15) including multiple choice paragraphs with four alternatives distributed on three components (hypothesis setting, prediction in light of data, identification of errors and inaccuracies) and (10) of these article paragraphs are divided into two components (fluency & flexibility).

The validity of the instrument and the psychometric properties were confirmed, and stability was calculated via using the kuder-richardson equation 20, and the results were treated by using the t-test equation for two independent sample, and the results showed a statistically significant difference (0.05) between the mean scores of the two groups experimental and control in the test of generative thinking skills.

Introduction

Mathematics is considered one of the main pillars of any scientific development as it is considered one of the most important subjects because it contains knowledge, concepts and skills that help students think to face

different situations. Acquiring mathematical skills that help in studying other subjects is very important. (Obaid et al. 1989: 40).

In light of the need to think among students and use new teaching methods, models and strategies that help diversify the use of thinking skills, as relying on traditional ways of thinking does not leave a long-term educational impact in addition to boredom. Therefore, the need to teach thinking of all kinds has arisen. The most important type is generative thinking, as learning generative thinking skills in mathematics has become greatly necessary as a result of the problems facing students that require them to face them and take an active role in solving them. (Al-Khatib and Al-Ashqar, 2013: 63).

Therefore, the Creative Problem Solving (CPS) model was used in mathematics teaching to generate many ideas for the second intermediate grade female students.

The Problem of the Study:

The weakness in mathematics is clearly expressed by teachers and specialists at all educational levels, and parents, educators and mathematical teachers realize that and this weakness appears in the learner's ability to think, and this has led to teachers 'reliance on routine procedures and neglecting understanding, research, investigation and exploration and being content with memorizing facts, information and concepts in an meaningless way . (Al-Kanani, 2009: 2), and the researcher believes that the reality of mathematics education in Iraq has suffered from many things for students and teachers alike, through the difficulty of mathematics, low achievement and poor thinking about it, and this is what the results of female students have shown in most stages of general education, And the lack of interest of some teachers in pursuing new teaching methods if they did not give their students problems that provoke their thinking, desire, suspense, and interest in learning mathematics, and this is what we find among subject teachers who are accustomed to giving book problems as they are without giving problems that require generating many ideas that increase students' understanding of the subject And their awareness of it, so the researcher decided to use the creative problem-solving model in addressing the low achievement in mathematics and the weakness of generative thinking skills of second-grade intermediate students.

In light of the above, the problem of the current study is formulated in an answer to the current question:

Does the Creative Problem Solving (CPS) model have an effect on the generative thinking skills of second-grade intermediate students?

The Importance of the Study:

The importance of the current study stems from the following:

1- This study contributes to improving the level of mathematics students and providing them with information about the creative process and the skills and strategies involved in generative thinking for solving problems that achieve integration between divergent thinking that shows finding multiple, varied and original solutions, and convergent thinking that is evident from the ability to evaluate, analyze and develop to reach the best Possible solutions.

2- It will be of help to curriculum developers and specialists in the field of education, especially mathematics teachers, by reconsidering the mathematics curriculum and developing it by generating many ideas commensurate with students' levels and taking into account the principle of individual differences.

The Purpose of the Study:

The current study aims to identify:

The effect of using the Creative Problem Solving Model (CPS) on the generative thinking skills of mathematics among second-grade intermediate students.

The Hypothesis of the Study:

To achieve the goal of the study, the following null hypothesis was developed:

• There is no statistically significant difference at the level of significance (0.05) between the average grades of the experimental group students (who will study the prescribed subject according to the CPS model) and the control group (who will study the prescribed subject according to the regular method) in the generative thinking skills test.

And we derive from the hypothesis the following sub-hypotheses:

• There is no statistically significant difference at the level of significance (0.05) between the average grades of the experimental group students (who will study the prescribed subject according to the (CPS) model) and the control group (who will study the prescribed subject according to the regular method) in the skill test of hypothesis.

• There is no statistically significant difference at the level of significance (0.05) between the mean scores of the experimental group students (who will study the prescribed subject according to the CPS model) and the control group (who will study the prescribed subject according to the regular method) in the prediction skill test in light of the data .

• There is no statistically significant difference at the level of significance (0.05) between the average grades of the students of the experimental group (who will study the prescribed subject according to the (CPS) model) and the control group (who will study the prescribed subject according to the usual method) in the skill test of identifying errors and fallacies .

• There is no statistically significant difference at the level of significance (0.05) between the average grades of the experimental group students (who will study the prescribed subject according to the (CPS) model and the control group (who will study the prescribed subject according to the regular method) in the fluency test.

• There is no statistically significant difference at the level of significance (0.05) between the average grades of the experimental group students (who will study the prescribed subject according to the CPS model) and the control group (who will study the prescribed subject according to the regular method) in the flexibility skill test.

The Limits of the Study:

1. Female students of the second intermediate grade in the secondary and intermediate morning schools for girls of the General Directorate of Education in Baghdad Governorate / the second Rusafa for the academic year (2020-2021).

2. Mathematical Topics, Chapter One (Relative Numbers), Chapter Two (Real Numbers), Chapter Three (Boundaries) and Chapter Four (Equations and Inequalities) of the Mathematics textbook scheduled for the second intermediate grade (F2) year (2018 CE).

3. The first semester of the academic year (2020-2021).

Defining terms:

- Creative Problem Solving Model (CPS): it is defined procedurally as a framework of processes that enables second-grade students (the research sample) to use them in mathematics (educational material for research) in order to understand the problem, generate ideas, develop and evaluate possible solutions.

- Generative thinking: it is procedurally defined as a set of skills that enable second-grade intermediate students to generate ideas and reach answers to solve the problems they face through (developing hypotheses, predicting in light of data, recognizing errors and fallacies, fluency, flexibility).

Theoretical Background and Previous Studies

Creative Problem Solving Model (CPS)

Introduction

The Creative Problem Solving Model (CPS) is one of the best models in creativity training, and it is one of the models in which research and studies have been most concerned over a period of (50) years, and it has been refined and chosen by many researchers, and these studies have made clear the necessity of employing creative abilities in Solving many problems that require multiple and non-traditional solutions, which are supposed to exist the

current reality in which we live, and its change and renewal, which are problems that we face daily, and we do not have ready-made solutions that can be used, but we have to search for new, diverse and implementable solutions, so they require Creative skills and the ability to analyze, evaluate and develop in order to bring the solution to implementation (Okasha and others, 2011: 18).

Components of Creative Problem Solving (CPS)

These components, including the stages they include, are as follows:

1) Understanding the Problem:

The first component, understanding the problem, focuses on understanding the language and tools of CPS, in order to focus on the results that the individual seeks, and it helps to identify and understand the gap between the current reality and what is desired (Isaksen, etal…., 2011, P.55), and works to focus Individual efforts to solve problems, and it contains three stages. One or more stages can be used in understanding problems (Treffinger, etal., 2010), and these stages are:

A- Defining Problem:

This stage helps clarify and define the problem and goals when it begins with a general task or challenge, which is very broad and allows individuals to focus effort on positive trends and move forward with confidence and enthusiasm (Treffinger, etal., 2010) (Treffinger, etal., 2006).

B- Exploring Data:

This stage includes gathering facts, opinions, impressions and observations that must be taken into account through (5 W & an H) questions (who, what, when, where, how, why), and then convergent thinking is used to help problem solvers in developing an understanding of the situation. By identifying the most important data that help in a better understanding of the problem (Treffinger, etal., 2006).

C- The Framing Problem Stage:

This stage helps generate many, varied and unusual ways of posing the problem. In the divergent thinking stage in formulating the problem, many questions can be asked (in any way can ... ..., how can ... ..., how ...), and then focus on a specific sentence It works on invoking creative ideas, so that it stimulates enthusiasm for discovering and forming creative ideas, and thus focusing the task helps in forming the entrance to the problem framework, taking into account the integration between divergent and convergent thinking at this stage (Treffinger, etal., 2010), (Treffinger, etal. , 2006).

2) Generating ideas:

It is the second component of Creative Problem Solving (CPS) and has one stage, which focuses on generating many different, new, or unfamiliar ideas to solve the problem, and we usually start with pre-defined questions in the stage of understanding the problem as an input, and then the generation process

begins. Ideas with divergent thinking tools such as SCAMOER, brainstorming is used in order to generate ideas. Idea generation is the work that includes the production of ideas that are characterized by:

-Fluency

-Flexibility

-Originality

-The details

A brainstorming tool was used in this component, which starts with the questions that were identified in the previous step for creative problem solving.

3) Preparing for Action:

The goal of this component is to make decisions about alternatives, develop or enhance them, and to plan for their successful implementation, and is mainly concerned with transforming ideas into action, and it includes two stages, namely developing solutions and building acceptance (Treffinger, etal., 2004), (Treffinger, etal. , 2006), which are as follows:

A- Developing Solution:

It includes working on the aspired ideas to analyze, refine and improve them, with the aim of converting them into possible solutions, and it helps to develop solutions using the tools of the process of converting new ideas into effective elucidations.

B- Building Acceptance:

It includes searching for sources of aid and potential resistance, and identifying factors that may affect the successful implementation of solutions, the goal being to assist in the preparation of solutions of value (Treffinger, Isaksen, 2005).

4) Planning your Approach:

The planning component for your entry is an administrative component, and it is present in the Creative Problem Solving Framework (CPS) centers (graphically and scientifically) (Treffinger, etal., 2005), and it includes tracking your thinking as it occurs, to ensure that you are in the right direction to achieve your goal (Isaksen, etal). ., 2011), and includes two phases:

A- Appraising Task

This stage is used to find out whether CPS is a promising option for dealing with a particular task, and to evaluate the obligations, limitations and conditions that must be taken into account while implementing the CPS effectively (people involved, results to be achieved, the context in which you work, and available methods) (Isaksen, etal. , 2011).

B- Designing Process:

It is the stage of using your knowledge of the mission and your needs to plan the CPS component, stages, and tools that will be best suited to help you reach your goals (Isaksen, etal., 2011).

Generative Thinking:

Generative thinking is one of the most important types of thinking that our teachers and schools must work on developing and taking care of, and the definitions of generative thinking have varied, including: -

Knows it (Chin, 2000) "is a group of mental abilities that enable students to generate and derive answers when presented to them a question they have never heard before or poses an unconventional problem, especially when these questions and problems are not similar to what they have learned before and after that they can evaluate their answers and judge On his health (chin, etal., 2000, p. 52)

Generative thinking skills:

(Al-Titi, 2014) sees generative thinking skills as the skills that make the thinking process take place in an open format, in which production is characterized by a unique feature, which is the diversity of productive answers that are not limited by the available information (Al-Titi, 2014: 51).

Generative thinking skills include two dimensions, namely: After generation and after discovery, after generation the structures that prepare for creativity or structures occur. As for creativity in it, cognitive representations occur, and it includes cognitive characteristics that are considered as a preparation for creative discovery. Of building structures that prepare for creativity and can be a basis for generating these ideas and modifying them during the creative discovery phase (Al-Zayat, 2001: 356).

After reviewing the literature, research and previous studies that dealt with generative thinking skills in the field of curricula and teaching methods as a study (Al-Zayat, 2001), (Munir, 2008), (Muhammad, 2014), it was found that generative thinking skills are divided into two aspects: -

First: The Exploratory Aspect, which includes:

Hypotheses Setting:

(Al-Khatib, 2013) believes that the skill of setting hypotheses "is the student's skill in formulating preliminary conclusions that are subject to examination and experimentation in order to arrive at an answer explaining the problem or situation" (Al-Khatib, 2013: 88).

Prediction in Light of the Date:

(Al-Khatib, 2013) believes that the skill of prediction in light of the data “is the skill of the student in reading the available information and inferring

through it on what is beyond that within the limits of time, subject, sample and society" (Al-Khatib, 2013: 88).

Learn about errors and miscalculations:

(Al-Afoun and Abdel-Saheb, 2012) believes that the skill of recognizing errors and fallacies "is the ability to identify gaps in the problem, by identifying incorrect or illogical relationships, or identifying some wrong steps in the completion of educational tasks (Al-Afoun and Abdel-Saheb, 2012). : 217).

Second: the creative side and it includes:

Fluency:

(Mustafa, 2011) defines it as the ability to generate a large number of alternatives, synonyms, or problems when responding to a specific stimulus and the speed and ease of its generation (Mustafa, 2011: 78).

Among the forms of fluency he mentioned (Saadeh, 2011 AD):

• **Verbal fluency:** it is the ability to rapidly produce words and spoken expressive units and recall them in a manner appropriate to the teaching-learning situation, such as the largest number of words composed of letters beginning with the letter W, for example.

• **Intellectual fluency:** the ability to come up with large numbers of ideas at a specific time, regardless of the type of these ideas, levels, or aspects of novelty in them, such as giving the largest possible number of titles suitable for a painting of paintings drawn or for a story from short stories .

• **Fluency of shapes**: the ability to change shapes with simple additions, the ability to quickly draw a number of examples, preferences or modifications in response to a specific visual stimulus.

• **Collusion fluency:** it is the ability to produce the largest possible number of words with a single meaning.

• **Expressive fluency:** the ability to ease expression, formulation, and ideas in words so that they relate between them and make them all compatible with each other, such as giving the largest possible number of five-word phrases or sentences (Saadeh, 2011: 277-278).

Flexibility:

Saadeh, (2011 AD) defines it as that skill which is used to generate patterns or varieties of thinking, develop the ability to transfer these patterns, change the direction of thinking, and move from the normal or usual thinking process to response and reaction, and to perceive things in different or varied ways. (Saadeh, 2011: 291).

Among the forms of flexibility he mentioned (Saadeh, 2011 AD):

• **Automatic flexibility**: the individual's rapid ability to produce the largest possible number of different types of trends and ideas related to a problem or a specific situation.

• **Adaptive flexibility:** the ability of the individual to change the golden direction in facing the problem and developing solutions to it, thus the student has adapted to the situations of the problem and with the images that she takes or shows this problem (Saada, 2011: 291).

Previous Studies

The first axis: Studies on the use of the (CPS) model

The study of Al-Deeb (2018) that was conducted in Gaza aimed to reveal the effectiveness of a technical program based on the Creative Problem Solving Model (CPS) in developing thinking skills in mathematics in its three patterns (visual, inferential, and creative) among students of the seventh grade. The study sample was formed of (97) female students in the basic stage; the study concluded the clear effect of the Creative Problem Solving Model (CPS) on the development of thinking skills in mathematics among the seventh grade female students.

As for the study AMuin, et al., (2018), which was conducted in Indonesia, it aimed to analyze the effect of the Creative Problem Solving Model (CPS) on adaptive mathematical thinking, and the study sample consisted of (80) students in the basic stage, the study concluded the clear effect of the solution model Creative Problems (CPS) on the development of adaptive mathematical thinking among elementary school students.

As for Abdel-Majid's study (2013 AD) that was conducted in Egypt, it aimed to study the effectiveness of using a strategy based on Creative Problem Solving (CPS) to develop creative thinking in mathematics among middle school students. The study sample consisted of (87) middle school students to illuminate the clear effect of the Creative Problem Solving (CPS) model on the development of creative thinking among second-grade middle school students.

The second axis: Studies on the use of generative thinking skills

The study of Al-Badri (2020 AD) that was conducted in Iraq aimed to know the effect of using the strategy of electronic thinking maps in the achievement and development of generative thinking skills among the fifth-grade students of the scientific branch (biological) in mathematics, and the study sample consisted of (66) middle school students, the conclusion of the study The clear effect of the strategy of electronic thinking maps on achievement and development of generative thinking skills among middle school students.

As for the study of Abu Sharkh (2017), which was conducted in Gaza, it aimed to know the effect of employing the Landa model in developing generative thinking skills in the science subject for sixth-grade students, and

the study sample consisted of (68) students in the basic stage, the study concluded the clear effect of the model Landa in developing the generative thinking skills of elementary school students.

As for the study of Diab (2016 AD), which was conducted in Egypt, aimed at identify the effectiveness of the metacognition strategy in teaching mathematics in developing generative thinking and motivation for achievement among the first intermediate students. The study consisted of (79) middle school students. The study concluded the clear effect of a strategy Metacognition in developing generative thinking skills and achievement motivation for first-year middle school students.

Indications and indicators related to previous studies:

The following is evident from the presentation of previous studies:

- The dearth of previous studies looking at (CPS) and its impact on critical thinking that is part of generative thinking.

- The dearth of previous studies investigating generative thinking, regardless of teaching methods.

- There is no study that investigated the study variables (CPS model and generative thinking skills) together, according to the researcher's knowledge.

Methodology and Procedures

• The study of Methodology: The experimental design of two groups (the experimental group - and the control group) was relied on, as shown in the following chart:

The experimental design scheme adopted in the study

<table>
<tr><th>The Dependent variable</th><th>The Independent variable</th><th>Equivalence</th><th>The group</th></tr>
<tr><td rowspan="2">Generalive Thinking Skills</td><td>Model (CPS)</td><td rowspan="2">Previous Knowledge
Previous achievement in math
Intelligence
Chronological lifetime in months
Parent Collection</td><td>Experimental</td></tr>
<tr><td>The used method</td><td>Control</td></tr>
</table>

The Study of Community

The current study of community consists of female students of the second intermediate grade in the morning secondary and middle schools of the General Directorate of Education in Baghdad Governorate / Rusafa II for the academic year (2020-2021) and their number is (277,264) students and distributed to (45) schools, and the approval of the Directorate was obtained in Tasheel The study mission is to conduct the experiment in one of its affiliated schools.

- **The study sample**

A school (Oran Intermediate School for Girls) was chosen intentionally to represent the study sample, and it was found that the school includes seven classes for the second intermediate grade, so the random drawing method, Division (A) to represent the experimental group, and Division (B) to represent the control group, and the number of students of the study sample after excluding (65) female students distributed among (33) experimental students and (32) female officers, and the equivalence of the two study groups was checked in the extraneous variables and the results were shown in the table:

Table (1)

T-test results for parity of the two study group

T value		Control		Experimental		The group
T able	Calculated	Standard deviation	Arithmetic Mean	Standard deviation	Arithmetic Mean	Equivalence Variables
1.998	1.573	1.816	15.84	1.277	16.45	Previous Knowledge
1.998	1.550	13.254	45.13	16.017	50.79	Previous achievement
1.998	1.220	5.858	19.65	4.805	21.18	Intelligence
1.998	1.612	3.358	172.38	5.158	174.12	Chronological lifetime in months

Not significant at the level of significance (0.05) and degree of freedom (63).

• Study Provisions

1) Determining the educational subject: The subject that will be taught to the students of the study sample is defined as four chapters of the mathematics book for the second intermediate grade for the academic year (2020-2021).

2) Formulation of behavioral goals: Behavioral goals were formulated based on the content of the educational material for the content of mathematics, and their number reached (194) behavioral goals according to Bloom's

classification in the cognitive domain and for the six levels (remembering, comprehension, application, analysis, structure, evaluation)

They were presented a group of experts specializing in methods of teaching mathematics to state their views on the extent of its clarity, formulation, and its suitability for cognitive levels. Some of them have been amended according to what the arbitrators have approved, and all behavioral goals have been retained.

3) Preparing the generative thinking skills test: The generative thinking skills test was prepared, which consists of (25) paragraphs, (15) of which are objective with four alternatives and (10) essays and in light of its five components (developing hypotheses, predicting in light of the data, identifying errors Fallacies, fluency, and flexibility), and the test was presented to teachers of mathematics teaching methods and subject teachers to demonstrate their opinions on it and determine its validity.

4) Preparing the teaching plans: The teaching plans were prepared according to the CPS model for the experimental group and the other according to the usual method for the control group, and two plans were presented to a number of arbitrators.

Study tool (test of generative thinking skills)

1) Determining the purpose of the test: This test seeks to measure the extent of generative thinking skills of (among the students of the research sample).

2) Determining the content of the test: After the researcher reviewed many studies and through the procedural definition adopted by the researcher, the generative thinking skills test was prepared in light of its five components (developing hypotheses, predicting in light of the data, identifying errors and fallacies, fluency, flexibility).

3) Drafting of the test paragraphs: The test paragraphs consisting of (25) paragraphs were prepared, (15) thematic and (10) essays, where the principle of consensus was taken in the opinion of experts as a criterion for the validity of the paragraphs as the passage is accepted if approved by (80%) or more From the experts.

4) The validity of the test: The researcher used to verify the validity of the test

A- Apparent truthfulness: One of the two researchers presented the test items to a number of experts in methods of teaching mathematics, as 80% of the referees 'opinions were relied upon as a basic criterion for accepting the test items and in light of their instructions and observations, some paragraphs were amended and no paragraph was deleted. Of the test items.

B - Constructive honesty: The validity of the test construction was verified by extracting the difficulty factor, distinction, and the effectiveness of the wrong alternatives.

5) Formulation of test instructions:

* Test Instructions: The two researchers clearly formulated instructions for answering the generative thinking skills test.

* The typical answer to the test: The two researchers explained the answer to all the test items.

6) The Exploratory Sample:

A- Sample time calculation and clarity of test paragraphs and instructions: One of the researchers calculated the time taken to answer the test, and the answer was recorded for all students and divided by their total number, and thus the time taken for the answer reached (55) minutes, so the test instructions were clear and its paragraphs understandable to female students.

B- The sample for analyzing the test items: one of the two researchers analyzed the test items on an exploratory sample consisting of (100) students (other than the research sample), and the answer sheets were corrected and then arranged in descending order, the upper (27%) and the lower (27%) were selected for the analysis of the items. The test is as shown: -

* Difficulty coefficient for the paragraphs: The difficulty factor was calculated for each of the test items, and the difficulty coefficients for the objective items ranged between (0.74 - 0.35), and the difficulty coefficients for the essay paragraphs ranged between (0.35 - 0.36), which is an acceptable ratio, so the paragraphs are considered to have met this condition.

* Discrimination coefficient for the paragraphs: The discrimination coefficient was calculated for each of the test items, and the values of the differentiation coefficients for the objective items ranged between (0.33 - 0.70), and the differentiation coefficients for the article paragraphs ranged between (0.76 - 0.39), and this means that all the paragraphs have the ability to distinguish between Female students of the study sample.

* The effectiveness of the wrong alternatives: The effectiveness of the wrong alternatives was calculated for each paragraph of the test, and it was found that the effectiveness of the wrong alternatives were all negative and thus it was decided to keep the alternatives as they are without change.

7) Stability of the test: The reliability coefficient was calculated using the (Keoder - Richardson 20) equation, where it was found that the test reliability equals (0.81) and thus the reliability coefficient is acceptable.

8) The final version of the test: The test consists in its final form of (25) paragraphs, from the substantive and essay paragraphs, and after confirming

the statistical analysis of its paragraphs and the validity and reliability of the test, and thus the test is considered ready for application.

Presentation and Interpretation of Results

For the purpose of verifying the null hypothesis that states: “There is no statistically significant difference at the level of significance (0.05) between the mean scores of the experimental group students (who study the prescribed subject according to the CPS model) and the control group (who study the prescribed subject according to the regular method) In the test of generative thinking skills.

To verify the validity of this hypothesis, the "T-Test" was used for two independent samples to reveal the significance of the difference between the average performance of the experimental and control groups. The results are shown as follows:

Table (2)

The results of the t-test for two independent samples between the mean scores of the experimental and control groups in the test of generative thinking skills as a whole.

T value		Degree of freedom	Standard deviation	Arithmetic Mean	Number of female students	The group
T able	Calculated					
1.998	7.981	63	3.005	75.30	33	Experimental
			2.889	69.47	32	Control

Table (3)

The results of the t-test for two independent samples between the mean scores of the experimental and control groups in each skill of generative thinking skills.

T value		Standard deviation	Arithmetic Mean	The number	The group	Skill
T able	Calculated					
1.998	2.655	1.621	11.58	33	Experimental	Hypotheses Setting
		1.646	10.50	32	Control	
		1.353	11.73	33	Experimental	Prediction in Light of

1.998	2.654	1.518	10.78	32	Control	The data
1.998	2.331	1.519	11.06	33	Experimental	Learn errors and inaccuracies
		1.609	10.16	32	Control	
1.998	5.036	1.622	20.45	33	Experimental	Fluency
		1.503	18.50	32	Control	
1.998	3.589	1.409	20.79	33	Experimental	Flexibility
		1.414	19.53	32	Control	

This indicates the existence of a statistically significant difference between the mean scores of the experimental group students and the scores of the control group students in the test of generative thinking skills in favor of the experimental group, thus rejecting the null hypothesis and accepting the alternative hypothesis, that is: “There is a statistically significant difference at the level of significance (0.05) between the mean scores The students of the experimental group (who studied according to the (CPS) model) and the control group (who studied according to the regular method) in the generative thinking skills test.

• Interpretation of Results

The results indicated that there is a statistically significant difference at the level of significance (0.05) between the mean scores of the students of the two groups (experimental and control) in the test of generative thinking skills in mathematics and that this difference is in favor of the experimental group, which means that there is a remarkable improvement in the performance of the students of this group compared to the performance of the students of the control group took the same test.

The researcher explains why the performance of the experimental group students improved according to the CPS model, which increased their abilities to understand the problem, generate many different ideas, develop solutions and evaluate them, which helped to receive information faster and in a shorter time and then store it In memory and recall at any time, and that the students who were taught according to the model of creative problem solving will have greater abilities to answer the test than those who were not taught according to the model, so the generative thinking skills increase the students' ability to (put hypotheses, predict In the light of the data, identifying errors and fallacies, fluency, flexibility).

Conclusions

In light of the research results, the following can be concluded:

- There is an effect of the Creative Problem Solving Model (cps) on generative thinking skills as a whole and in each of the generative thinking skills of second-grade intermediate students.

- The use of the Creative Problem Solving Model (CPS) contributed to raising the educational level of the students, increasing their understanding of the subject, and then fixing it in the students' minds.

Recommendations

In light of the results of the current research, the two researchers recommend the following:

Conducting training courses to train mathematics teachers on the procedural steps of the Creative Problem Solving Model (CPS), and other teaching models.

- Developing a mathematics book using the Creative Problem Solving Model (CPS) in all educational stages in line with students' mental levels, as it is not the preserve of excellent students only and this is what the sources and studies agree with

Proposals

In light of the results and recommendations of the research, the two researchers suggest the following: -

-Conducting studies that use the Creative Problem Solving (CPS) model in generative thinking skills in other educational stages and classes.

- Directing comparative studies between the Creative Problem Solving Model (CPS) and another teaching model in generative thinking skills for mathematics.

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