

A Proposed Model to Improve the Skills of Mathematical Thinking (C.A.S.M.E) and Its Impact on The Achievement of Students in the Fifth Grade in Solving the Mathematical Problems

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Abstract

The current research aims to design a proposed teaching model to improve the thinking skills of the students in the fifth grade of the primary and to know its effect on their achievement solving mathematical problems. The proposed model was used CASME, which means accelerating mental growth through scientific and mathematical education. Acronym to Cognitive Acceleration Through Science and Mathematics Education.

This model combines two models: the CASE model and the CAME model, as well as the modification of some steps and procedures that help in the process of improving thinking and be compatible at the same time to the process of accelerating thinking. The sample was selected randomly (62) students from the university mixed primary school, and the sample was divided into two, the first experimental group (31) students and the second group control (31) students, and the search tools were three, the first questionnaire for thinking, Second Pre- test and third Post-test, dimension It was sure to have psychometric properties, has been used Cooder Richardson equation 20,(t)test for two independent samples and(t) test for statistical samples interconnecting means, and the results showed .

There were statistically significant differences between the pre and post test of the experimental group, as well as the existence of statistically significant differences between the post-test of the two research groups, both in favor of the proposed teaching model. In the end of the results, a set of recommendations were written.

Keywords: Mathematics, mathematical thinking, CASE model, CAME model, solving mathematical problems.

1. Research problem

It is no secret to many of us that the reasons for the weakness of the collection of many math has been led by the mental ability of students associated with knowledge of the conceptual and procedural knowledge, that mean if the student uses the thinking process to solve mathematical problems of all kinds, and even the thinking of mathematics inherent in the student even while studying mathematical topics.

It is not enough to rely on theories that focused on infrastructure Mentality as theory Piaget, which states that there is a change happening in the mental capacity of an individual age between(12 years – 18 years) this stage is called the transition from thinking sensory to the abstract thinking, but looking at Variables other than genetic variables, for example the variables that accompany the student in the environment and the closest is what happens in the school of learning processes.

(Eduard Debono) also confirms the expert in the field of reflection on the importance of students to look at the process of thinking as a skill that can be improved and attention learning and training (DCTT, 2015,97), and relying on a good teacher and teaching the way we try to influence in the student's thinking and move it wrong to solve mathematical problems to the appropriate thinking and logical and sequential outlook for the development of correct solutions to mathematical problems, and this type of thinking also reminded him (Alharthy,2005, 180) leads to the positive development of the mental structure of the student.

1.1. Research importance

The importance of the current research lies in the following points:

- 1) Proposing a new teaching model to improve mathematics thinking skills for fifth graders, which helps to learn effectively and thus increase achievement.
- 2) To experiment with the proposed model on a sample of fifth grade students and to know the effect of their solution to mathematical problems, which gives a new perception of a teaching model that trains students on how to think logically while facing the mathematical problem and develop correct steps to solve them.
- 3) Explain the theories and models that have been concerned with the process of thinking, development, speed up, improve and linking those models with learning mathematics.
- 4) A new addition to the teaching models that may be used in other subjects that require continuous thinking skills.
- 5) The research contributes to the response to the demands that keep pace with the scientific development and face the digital challenge, developing modern teaching methods that make the learner the focus of the preparation of the revolution of information.

1.2. Research goals

The current research aims to:

- 1) Designing a proposed teaching model to improve mathematics thinking skills for fifth graders.
- 2) To know the effect of the proposed teaching model on the achievement of the fifth grade students in solving mathematical problems.

1.2. Proposed model: (C.A.S.M.E)

It means accelerating mental growth through scientific and mathematical education, and written letters are abbreviated to Cognitive Acceleration Through Science and Mathematics Education.

This model combines two models:

- 1) Adey and Sheyer Model (C.A.S.E)
- 2) Mathematics Model (C.A.M.E)

In addition to modifying some of the steps and procedures that help in the process of improving thinking and be compatible at the same time to accelerate the process of thinking.

1.3. Adey and Sheyer model (C.A.S.E)

It means accelerating mental growth through scientific education, and the letters are shortened to: Cognitive Acceleration Through Science Education.

This model was designed in 1989 by:

- 1) Philip Adey
- 2) Michael Sheyer

The goal was to accelerate the growth of the skills of scientific thinking, has been tested in eight British schools and lasted for (10) years and proved to be effective in the materials of English language, science and mathematics (Alharthy, 2005, 177)

The project was built on the psychological model of Piaget, which states that a qualitative change in the intellectual structure of a student of a given age, as well as the social model of Vygotsky, which states that the environment affects the student's learning, (Alharthy, 2005, 180). Studies have cited the name of the model as "cognitive acceleration", "speeding up thinking" or "stimulating thinking", and in all of these studies (Mustafa, 2012; Al-Abdullah and Rahman, 2012; Hamza and Jawad, 2016; Sahw, 2017) These studies agreed on most educational materials (teacher's guide, laboratory materials, student's bag).

1.4. Educational material for Adey and Sheyer model

- 1) Introduction A - Objectives of the activity. B - Clarifying the main points to focus on. C - List of materials for the activity. D - Procedures for the implementation of the activity and an explanation of each action.
- 2) Student's Bag: a - Business paper \ Multiple copies \ Take notes and results. b - Business card \ Instructions to solve the problem (do not write anything). c - Images, transparencies or slides.
- 3) Method of teaching: a - Development of students' thinking and not knowledge acquisition. b - Special training for the teacher to manage activities. c - Experienced experience in experimentation and observation and record the results and observations. d - Make students looking themselves to reach the end result of the activity.
- 4) Classroom discussions: a - before the experiment. b - during the experiment. c - after the experiment (the teacher source of information, grade manager, facilitator of learning, directed to activities and discussions).
- 5) Conflicts of Knowledge Exposing students to sudden observations that do not match their expectations. Students may be overwhelmed by the fact that they

rethink their cognitive structure and way of thinking to adapt to the new evidence they are seeing.

- 6) Beyond Thinking: The teacher asks the student how she did it, or why she did it? Or could you explain to your colleagues why you thought about it?
- 7) Bridging: It is intended to link the experiences obtained by the students in these activities with the experiences they receive in the rest of the scientific materials. In life experience, it is necessary to extend intellectual bridges of activities to life and from life to activities, as well as to and from other scientific materials, Without these bridges, experience remains confined within the conceptual framework of the project. (Alharthy, 2005, -186-187).

1.5. Mathematics model (C.A.M.E)

It means speeding up thinking by teaching mathematics, and the letters are shortened to:

Cognitive Acceleration Through Mathematics Education. This model is based in a series of events that aim at transferring the level of student thinking in mathematics from its current level to an advanced level. This model has been used recently in many countries and was at the forefront of these countries America and Britain (Alqawas, 2013, 4) This teaching model is concerned with the gradual progression from observation to conclusion, inference, and the formation of relationships in order to improve the student's mathematical thinking and thus develop his achievement (Goulding, 2002, 104).

This model is based on two theories Piaget theory and Figo Tesky theory. Studies on this model include:

All agreed on most of the educational materials for this model, which comes from the previous model (Adey and Sheyer), in addition to how to speed up thinking about mathematics specifically by:

1. Upgrading in solving sports problems.
2. Deepen the student's understanding of mathematical concepts.
3. Replace the steps of the routine solution with others that help in reaching a new solution.
4. Focus on how to use higher thinking skills while solving issues. (Al-Quwas, 2013)

1.6. Improving mathematical thinking skills

(Alodwan and Dawood, 2016) Explain that improving the skills of thinking of all kinds through which the learning of subjects effectively, which leads to the strengthening of mental processes, and this process is done when the student finds a positive link and useful between the skills of thinking and the field of application in daily life, (Alodwan and Dawood, 2016, 117). In this field, educators in general and in the teaching of mathematics in particular have provided many methods, models and teaching methods that stimulate and learn thinking, including SOWM strategy. This strategy is a modern strategy in teaching skills above Knowledge, which aims to transform (Alodwan and Dawood, 2016, 118), but the choice of method of teaching and effective method is related to the characteristics of the students themselves, such as age and the school stage as well as the educational environment and the academic content which helps in making a decision about that choice.

1.7. Objectives of improving mathematical thinking

1. The student's sense of aesthetic taste of mathematics.
2. The student's sense of success in solving problems.
3. Provide an environment conducive to generating ideas.
4. Developing positive qualities of the student thinker.

5. Awareness of the importance of mathematics and its usefulness.
6. Raise interest in the discovery of new in mathematics.
7. Accustom the student to perseverance and hard work in solving problems.

1.8. Methods of improving mathematical thinking

First: re-characterization of the situation:

When a student encounters a mathematical problem, his mind leads him to seek solutions, or to choose between one solution and another, ignoring the data accompanying that problem or situation. (Optimization)

1. Write a mathematical problem.
2. Type all data and requirements.
3. Use drawing or map concepts.
4. Try to link the shares (if any).

Second: Budget Method:

When a student is thinking about solving a mathematical problem, he or she has to make a bold decision to make a law or to choose the equation or order of numbers, which often leads to a wrong solution.

(Optimization)

1. Divide the solution sheet into two sections by placing a line in the middle.
2. The first list of all that is consistent with the right decision and which leads to the solution.
3. The second list of all that is contrary to that decision.
4. At the end, balance the supporting points of the decision with the opposing points, and the choice goes back to the most points.

Third: logical tradeoff:

It is a method that makes the student puzzled. It is a reality between two choices to solve a mathematical problem. If the problem is to find a three-dimensional garden space, the student has to choose a law from the first two, the area of the triangle, and the second parallel space.

(Optimization)

1. Write (variables) each law in detail.
2. The logical view of the geometric shape (whichever is greater when equilateral).
3. Logical view of accounts in each law.
4. Law that shows more result for more space.

2. Methodology and procedures

1. Community and Sample for Research: The research community consists of all students in the fifth grade of primary in the center of the province of Najaf, regular in the official hours of public schools. The sample was selected randomly (62) students from the university mixed primary school, and the sample was divided into two, the first experimental group (31) students and the second group control (31) students.
2. Equivalence of groups: The equivalence of the research groups was done in the following variables:
 - a) Age of student.
 - b) General rate of achievement in the fourth grade of primary.
 - c) Test the previous information in mathematics.
 - d) (IQ).

The statistical results indicated that there were no statistically significant differences in the above variables, which means that the experimental and control groups were equal in these variables.

3. Research Design: The semi-experimental design was chosen for two groups to be suitable for the current research. Where the pre-test for both groups was applied in the first semester of the 2017-2018 academic year, The test was then applied to the two groups.

4. Research tools: The search tools were made up of three tools:

- a. Questionnaire: An open questionnaire addressed to both the student and the teacher with an open question about: (Ideas used during solving mathematical problems). They were presented to teachers in writing on white paper and answered by them. The researcher and the teachers were used to interview the students and ask them about these ideas. A large number of ideas that students have learned during the solving of mathematical problems have been recorded and used in building the teaching model.
- b. Pre-test: The pre- test consists of (20) paragraphs of the article and in the form of verbal questions for the following subjects (groups, rectangles and angles, large numbers, operations on numbers, natural numbers and their characteristics). In order to find a way to think and find a solution. The validity of the virtual test was confirmed by presenting it to a group of specialists from mathematics teachers as well as supervisors and some professors of the mathematics department at the University of Kufa. Many of them expressed their approval for the test except for some modifications to the verbal and linguistic formulation. Order P View and liabilities have been introduced to those observations.
- c. Post-test: The post-test shall consist of (25) twenty-five paragraphs of the type of pans in the form of verbal questions of subjects (geometric shapes, regular fractions, operations on fractions, decimals, operations on decimals, spaces). Is not routine in order to solve it using the mental abilities of the student and avoid the answer as direct as possible, and has been verified the validity of the virtual test by presenting it to a group of specialists in teaching mathematics and have made the following observations:
 - 1) Delete two paragraphs and replace them so that they do not affect the structure of the test by content.
 - 2) Modification of wording (4) four paragraphs.
 - 3) Modify information in (3) paragraphs.

These observations were taken and the two paragraphs were replaced to become (25) paragraphs.

- 5) Research procedures: The research includes the following procedures:

- a) See the literature and previous studies related to the subject of the research.
- b) Review tests for solving mathematical problems, which include multiple ideas during the solution.
- c) See the content of the mathematics book for the fifth grade primary, which is taught for the academic year 2017/2018 and write the annual plan of the subjects and according to time.
- d) Providing the open questionnaire to students and teachers before the end of the first semester, specifically in the month of (12) for the year 2017 because students completed the first semester and conducted two tests by their teachers. The questionnaire was applied to the primary school and two schools in Najaf.
- e) The construction of the test subjects which include the ideas extracted by the researcher as well as see the previous measurements and then apply the test on both groups in the first month of 2018 and before the half-year exam.
- f) Develop study plans for the content of the mathematics book in the second semester with

review the teaching model to improve ideas and train the teacher of mathematics on two models, as well as to develop plans for the same content but in regular teaching without reference to the model of improving ideas.

- g) Monitoring the teaching of the experimental and control groups during the trial period as a supervisor visitor and in agreement with the management of the cooperating school.
- h) The construction of the post-test paragraphs with review the previous literature and standards as well as the level of mental ability of the students as well as the ideas presented in the pre-test, and its application before the final exam.
- i) Tabulation of data and statistical analysis to see the results.

2.1. The Results

1) The first result: the effect of the proposed teaching model on the achievement of the experimental group students in the pre-post tests. The results were shown in Table (1).

Table 1: Results of the Experimental Group in the Pre-Post –Tests

Test	Number of students	Arithmetic mean	Standard deviation	Digress freedom	T value calculated	T value tabular
Pre-	31	64.87	7.26	30	16.34	2.042
Post	31	75.33	3.67			

It is clear from Table (1) that the experimental mean of the experimental group in the post-test is higher than the arithmetic average in the pre- test. In order to know the statistical significance, the t-test of the interrelated samples was applied. The calculated value of t (16.34) is higher than value of T (2.042). Thus, we reject the null hypothesis and accept the alternative that states the existence of the differences and for the benefit of the experimental group studied using the proposed teaching model.

2) The second result: The effect of the proposed teaching model on the achievement of the post-test for the two groups of research. The results are shown in Table (2).

Table 2: Results of the Two Groups in the Post-Test

group	Number of students	Arithmetic mean	Standard deviation	Digress freedom	T value calculated	T value tabular
experimental	31	75.33	3.67	60	2.75	2.021
Control	31	66.51	2.21			

It is clear from Table (2) that the arithmetic mean of the experimental group is higher than the arithmetic average of the control group. In order to know the statistical significance, the t-test of the independent samples was applied. The calculated value of t (2.75) is higher than the t (2.021). Thus, we reject the null hypothesis and accept the alternative that states the existence of the differences and for the experimental group studied using the proposed teaching model.

3. Discussion and interpretation of the results

In both results, the positive effect of the proposed teaching model is shown. The researcher believes that the reasons for this effect may be due to the following:

- a) The teaching model according to the construction of ideas is more interesting and enjoyable for the primary stage students because it calls for the mental properties inherent to him, and try to reach to the higher levels in the pyramid Piaget and not stand at the minimum levels

based on memory, which used to over the previous years, To make a lot of effort to overcome the problems with new ideas that led to the correct solutions.

- b) The current research is consistent with all the studies and research that showed the superiority of the programs, models and teaching methods used to accelerate the thinking but it is unique to the model (improvement of ideas), the process of correcting the misconception of the student and the development of a correct alternative idea during the solution of sports problems and this is what was put in the study plans of the group experimental.
- c) The existence of a stimulating atmosphere to stimulate ideas within the classroom and in the mathematics lesson specifically helps to drip different ideas among students, and this is often in the classroom experimental group, which makes the student keen on the exact answer and choose the correct idea during the solution.

4. Recommendations

The researcher recommends:

- a) Dopting the proposed teaching model in improving mathematical ideas in the teaching of mathematics in the elementary stages as well as the rest of the stages after experimentation.
- b) Using the idea of tests based on different ideas and non-routine formulation of verbal questions and providing them to students and avoid direct answer, which enhances their mathematical thinking.
- c) Training primary students to think correctly while solving mathematical problems in terms of dealing with the data and order and use the appropriate law or the appropriate solution, which likely for the selection of short and accurate.
- d) Train teachers in onthe work training institutions on advanced teaching models, including the proposed current model to keep abreast of development and increase student achievement.

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