

Summary of the Research

This summary deals with a brief overview of the current research. It sheds light on the problem, the employed method, the procedures, and a summary of the findings of the current research. In addition, the recommendations and suggestions for further research are also highlighted.

Research problem and questions

The problem of the current research is identified in the low level of the first grade secondary school students of mathematical proof and creative thinking skills in mathematics. Hence, the current investigated the effect of a proposed enrichment program using the computer- programming language in the development of each of the skills of mathematical proof and creative thinking among first grade secondary school students.

The current research attempted to provide answers to the following main questions:

“What is the Effectiveness of a proposed enrichment program for developing mathematical proof and creative thinking skills among students in the first grade secondary using computer-programming language?”

The main question is divided into the following sub-questions:

- (1)** What are the mathematical proof skills necessary for first grade secondary school students?
- (2)** What are the creative thinking skills in mathematics necessary for first grade secondary school students?
- (3)** What are the theoretical foundations of the proposed enrichment program using a computer-programming language for developing the mathematical proof and creative thinking skills in mathematics among first grade secondary school students?
- (4)** What is the proposed enrichment program using computer-programming language?

- (5) What is the effectiveness of the proposed enrichment program using computer-programming language skills in developing first grade secondary school students' mathematical proof skills?
- (6) What is the effectiveness of the proposed enrichment program using computer-programming language in developing creative thinking skills in mathematics among students in first grade secondary school?

Hypotheses of Research:

The current research sought to validate the predictive hypotheses following:

- (1) There is a statistically significant difference at the level of significance (≥ 0.05) between the mean scores of students of the two groups (control - experimental) in mathematical proof skills test as a whole - and for each skill of the experimental group in the post- administration in favor of the experimental group.
- (2) There is a statistically significant difference at the level of significance (≥ 0.05) between the mean scores of students of the two groups (control - experimental) in the creative thinking test in mathematics as a whole - and for each skill for of the experimental group in the post-administration in favor of the experimental group.

The research sample

The researcher chose sample first grade secondary special schools students (Elsharek special schools, 6 October educational zone). The sample consisted of a group of (53) students. It is divided into two groups, namely , the experimental which consisted of (28) students who have studied the selected lessons through the use of the proposed enrichment , and the control group which consisted of (25) students who have studied the selected lessons traditionally.

Research Limitations

• Content Limitations:

- A set of lessons (Algebra, Trigonometry and Geometry) of the math book prescribed by the Ministry of Education on the first grade of secondary school students (second semester)and these lessons are :

Firstly: Algebra

- Solving the equation of the second degree in one variable.
- Searching Type of radical equation.
- The relationship between the radical equation and transactions.

Secondly: Trigonometry

- Solving trigonometric equations.
- Solving right triangle.
- Circular sector.

Thirdly: Geometry

- Theory ⁽¹⁾ The Proportionality
 - Theory ⁽²⁾ General Thales
 - Theory ⁽¹⁾ in Similarity
 - Theory ⁽²⁾ in Similarity
- Some creative thinking skills in mathematics including the mathematical fluency, mathematical flexibility, mathematical originality, and sensitivity to the mathematical. such skills have been choose because of their consistency with the nature of the content selected lessons.
 - Visual Basic.Net programming language of the advanced programming languages was chosen because of its appropriateness of the level of first grade secondary students. In addition, this language is taught to them in the prescribed book of the computer (subject) during the second semester. Hence, it is thought that this language would be more effective.
 - Choosing a specific enrichment style adopted which is regarded as the most suitable form in terms of the nature of the computer-programming language.

•Spatial Limitations:

Elsharek special school, 6 October educational zone, was chosen for implementing the experimental part of the current research.

• **Temporal Limitations:**

It is expected that the application of current research will be undergone during the second semester of the academic year (2010/2011 A.D)

Research Methodology:

In order to achieve the objectives of current research, the current research employed the following:

(1) **Descriptive approach:** through Reviewing some previous studies and literature in the areas of; enrichment activities in mathematics, develop the skills of mathematical proof, creative thinking skills in mathematics, computer- programming languages.

(2) **Quasi-experimental approach**

Two intact classes were randomly selected to represent the experimental and the control groups. The experimental group students received treatment through the proposed enrichment program using computer-programming language as for the control group, no treatment took place. A pre-post test was administered to both groups.

Experimental design to search

(Before - After) × (Experimentation - Control)

The research sample has been divided into two groups, as follows:

- **Experimental group:** was from first grade secondary school students who have studied by using the proposed enrichment program based on computer-programming language (Visual Basic Dot Net) (VB.NET), with a total of 28 students.
- **Control group:** was from first grade secondary school students who have studied t in a traditional (usual) way, with a total of 25 students.

Research procedures:

In order to answer the first and second questions which are

1. What are the mathematical proof skills necessary for first grade secondary school students?
2. What are the creative thinking skills in mathematics necessary for first grade secondary school students?

, the researcher had to

- Survey the previous studies and research related to the construction of the enrichment programs in mathematics for students of first grade secondary school students. In addition, the researcher had to review studies that dealt with the development of the mathematical proof and creative thinking skills in mathematics. Hence , the researcher was able to locate the position of the current research among them and to identify the most important methods of developing the mathematical proof and creative thinking skills in the mathematical field, and to know the measurement tools for mathematical proof and creative thinking skills in mathematics,
- Analyze the content of math lessons (Algebra – Geometry - Trigonometry) ascribed for the first grade secondary school students and prepare two lists of all the mathematical proof and creative thinking skills in mathematics, respectively , that are necessary for the first grade secondary school students in terms of the following steps:
 - Identifying the objective of each of the two lists,
 - Identifying the skills of both lists,
 - Stating the skills of each of the two lists,
 - Preparing the initial version for each of the two lists,
 - Validating each of the two lists (estimating the applicability and reliability of the list),
 - Preparing the final version for each of the two lists,

- Present the list of mathematical proof skills (prepared by the researcher) to a group of experts and specialists to give their opinion, and then to make the necessary adjustments in the light of their views.
- Present the list of creative thinking skills in mathematics (prepared by the researcher) to a group of experts and specialists to give their opinion, and then to make the necessary adjustments in the light of their views.

In order to answer the third question which is?

(3) What are the theoretical foundations of the proposed enrichment program using a computer-programming language for developing the mathematical proof and creative thinking skills in mathematics among first grade secondary school students?

The researcher derived the foundations of the proposed enrichment program from the following sources:

- (a) The nature of the first secondary grade students.
- (b) The list of mathematical proof skills prepared by the researcher.
- (c) The list of creative thinking skills in mathematics prepared by the researcher.
- (d) The computer-enhanced education.
- (e) The computer-programming language philosophy.

In order to answer the fourth question which is?

(4) What is the proposed enrichment program using computer-programming language?

, the researcher had to

- (1) Prepare the proposed enrichment program where its features are determined according to the following steps:
 - (a) Identifying the philosophy of the program
 - (b) Determining the objectives of the program
 - (c) Determining the content of the program

- (d) Identifying the methods of teaching and learning
 - (e) Identifying the educational media
 - (f) Determining ways of the assessment.
- (2) present the program to a group of jury members to ensure of its validity, and to make the necessary adjustments in the light of their views,

In order to answer the fifth and sixth questions which are

- (5) *What is the effectiveness of the proposed enrichment program using computer-programming language skills in developing first grade secondary students' mathematical proof skills?*
- (6) *What is the effectiveness of the proposed enrichment program using computer-programming language in developing creative thinking skills in mathematics among students in first grade secondary school?*

, the researcher had to

- (1) Prepare a mathematical proof skills test and present it to a group of jury member to ensure its reliability,
- (2) Prepare a creative thinking skills test in mathematics and present it to a group of arbitrators to ensure its reliability.

The previous tests were prepared in accordance with the following procedures:

- Identifying the objective of each test
- Preparing the table of specifications for each test
- Identifying the vocabulary of each test
- Setting the vocabulary for each test
- Preparing the initial version for each test
- Implementing the expeditionary experience for each test
- Validating each test (estimating the applicability and reliability of the test)
- Estimating the time for each test
- Preparing the final image for each test
- Setting the grading system for each test.

- (3) calculate the reliability of each of the two tests,
- (4) Select a sample of first grade secondary school students, and divide it into two groups (experimental and controlling).
- (5) Applying the pre-administration of the mathematical proof skills test on the two groups of research.
- (6) Apply the pre-administration of the creative thinking skills test in mathematics on the two groups of research beforehand,
- (7) Teach the selected lessons by using the proposed enrichment program by using a computer-programming language for the experimental group of students while teaching the same lessons for the control group in the traditional way.
- (8) Apply the post-administration of the mathematical proof skills test on the two groups of research.
- (9) Apply the post-administration of the creative thinking skills test in mathematics on the two groups of research.
- (10) make statistical analysis, interpretation and discussion the results.
- (11) Provide recommendations and suggestions in the light of the results of the search,

Research Results and interpretation

The results of the research in relation to the hypotheses can be represented as follow:

- (1) There is a statistically significant difference at the level of significance (≥ 0.05) between the mean scores of students of the two groups (control - experimental) to test the skills of mathematical proof as a whole - and for each skill separately for the experimental group in the post free from the impact of the application of tribal.

This means that the proposed enrichment program using computer-programming language skills is effective in developing the mathematical proof in the first grade secondary students (experimental group).

- (2) There is a statistically significant difference at the level of significance (≥ 0.05) between the mean scores of students of the two groups (control - experimental) in a test of creative thinking in mathematics as a whole - and for each skill separately for the experimental group in the post free from the impact of the application of tribal.

This means that the proposed enrichment program using computer-programming language is effective in developing the creative thinking skills in mathematics among students in first grade secondary school (experimental group).

Research Recommendations:

In light of the outcome of the research results, the following can be recommended:

- (1) Taking advantage of the two lists of mathematical proof skills, and creative thinking skills in mathematics while preparing the mathematics curricula for the secondary schools.
- (2) Taking advantage of the mathematical proof test and creative thinking in mathematics test in the process of evaluating learning and teaching mathematics in the secondary school.
- (3) Taking advantage of the proposed enrichment program by using a computer-programming language (Visual Basic. Net) (VB.NET) which is represented in the form of models of interaction between teacher and student in the classroom while preparing the mathematics curriculum for the secondary school.
- (4) Considering each of the mathematical proof skills and creative thinking skills in mathematics and presenting them in the content of the mathematics curriculum for the secondary schools.
- (5) Using computer- programming language in the curriculum methods of teaching mathematics in faculties of education, and in the field of teaching mathematics in schools.
- (6) Rewriting the content of mathematics curriculum for the students of first grade secondary schools in the light of modern technology, which is represented by math-programming through using advanced programming languages. It would help achieve the integration between mathematics and computer which makes the student's possession of a new technology in solving math problems easier.

- (7) Activating the role of the curricula of methods of teaching mathematics during the Bachelor's degree stage in relation to the nature of deductive mathematics, its logical construction, patterns of mathematical proof and proofing skills whether by using direct or indirect ways. In addition, clarifying the role of mathematical proof as a tool of utmost importance for the construction and development of a mathematical mind, reasons behind considering mathematical proof, and the difference between a proof and a mere means of persuasion. It can be said that mathematics is to solve problems by using a series of logical steps to prove the sincerity of the case presented by the problem, and these logical steps are similar to the steps upon which the steps of computer programming are to build. This necessitates the inclusion of the computer programming in teaching mathematics, so that students feel the flexibility of mathematics and the role of modern technology in solving mathematical problems such as the mathematical proof.
- (8) Mathematics teachers should be keen, during stages of public education, on the student writing an explanation (justification) for each step carried out during the process of mathematical proof. Such step shows how far the student understands and gets information, facts, knowledge and mathematical generalizations that are used to justify the steps of proof, and would work on the development of mathematical communication in the future.
- (9) There is a necessity to design programs for student teachers that provide them with teaching skills that help developing creativity in mathematics, and to adopt methods, techniques and approaches of creative teaching.
- (10) Paying attention to the computer-programming teaching strategies while discussing methods of teaching mathematics or during the implementation of the micro-teaching sessions.
- (11) Inclusion of the topics of mathematical proof and creative thinking in mathematics and their relationship to solving problems in the curricula and methods of teaching mathematics in faculties of education.
- (12) Providing different tests to measure creative thinking skills in mathematics at the Ministry of Education, and in the mathematics student teachers' hands to assist them in developing mathematical creativity of students.

- (13) Not providing mathematical information to students in its final form, because this works on reducing their thinking, and places restrictions on the creative process they have. They should reach it by themselves (i.e. any mathematical information) through the issues and problems presented to them
- (14) Focusing on providing enrichment programs in mathematics at various levels of education, which helps to show and discover top talents
- (15) Considering more the integration of advanced technology and teaching mathematics which helps to develop the mathematics curricula and creativity

Research suggestions:

In light of the research results, the following future research suggestions can be proposed:

- (1) The effective use of enrichment program in mathematics by using a computer-programming language (the language of Visual Basic. Net), as an advanced programming language in the development of some multiple intelligences in mathematics among students in secondary school
- (2) A proposed program in the light of mathematics programming for the development of mathematical proof for preparatory school teachers
- (3) The effective use of enrichment program in mathematics by using a computer-programming language (the language of Visual Basic Dot Net), as an advanced programming language in the development of logical thinking and a tendency towards mathematics among secondary school students
- (4) A proposed complementary curriculum between mathematics and computer and its impact in the development of creative thinking skills and problem solving for student teachers,
- (5) The evaluation of secondary school mathematics textbooks in the light of the requirements of mathematical creativity,
- (6) The effectiveness of a proposed strategy based on programming in the development of critical and creative thinking skills in mathematics among secondary school students.

- (7) The effective use of a proposed enrichment program based on the use of computer-programming language in the development of skills beyond the knowledge and self-regulation of learning in mathematics among secondary school students
- (8) Having evaluating studies - constantly - for mathematics curricula at the secondary stage, to know the extent of their impact on the development of creative thinking skills in mathematics at school,
- (9) Carrying out further studies on the development of creativity in mathematics for teachers before and during the service,
- (10) Carrying out studies to evaluate the performance of mathematics teachers and teaching skills of mathematical proof,
- (11) Conducting similar research to the current one on other relevant variables, such as: critical thinking, motivation to learn, mathematical communication, decision-making, the transfer of the impact of learning.

What has the current research added?

The current research provided some important contributions, including

- (1) Analysis for the content of mathematics textbook: the second semester of the three branches (Algebra – Trigonometry - Geometry) for the first secondary grade students
- (2) A list of mathematical proof skills for the first grade secondary school students
- (3) A list of creative thinking skills in mathematics for first grade secondary school students
- (4) A proposed enrichment program by using computer-programming language (Visual Basic Dot Net) (VB.NET) for first grade secondary school students
- (5) A new teaching method based on using modern advanced technology, represented in using advanced programming languages in teaching mathematics
- (6) A test in mathematical proof representing the mathematics branches (Algebra - Trigonometry - Geometry) for first grade secondary school students
- (7) A test of creative thinking in mathematics for first grade secondary school students