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The Impact of Using Interactive Program Cabri 3D in Teaching Geometry on Developing some Geometrical Proof and Lateral Thinking Skills among Secondary Stage Students

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Abstract

Thesis Title: The Impact of Using the Interactive (Cabri 3D) Program in Teaching Geometry on Developing some Skills of Geometric Proof and Lateral .Thinking among Secondary School Students

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Abstract

The aim of the study is conspicuously to reveal the impact of using the Cabri (3D) program on developing the skills of geometric proof and lateral thinking among students of the second year of secondary school. In order to achieve the study objectives, the researcher redesigned the "Geometry and Measurement" unit in light of the principles, characteristics and abilities of the Interactive (Cabri 3D) Program. Besides, the researcher prepared two tools; they are the test of geometric proof skills, the other is the test of lateral thinking skills. Moreover, the study sample consisted of two groups, one of them was experimental and consisted of (30) students and taught the "Geometry and Measurement" unit for second-year secondary students, according to the use of the Cabri 3D Program, and the other was a control group and consisted of (30) students who are taught the unit by the usual traditional methods. The study tools were pre-applied to the two groups (experimental and control), then the field application was carried out, then the study tools were post-applied. The results of the study found out that: the students of the experimental group outperformed the control group in both the test of geometric proof skills and the

test of lateral thinking skills. Besides, it was proven that there were statistically significant differences in favor of the experimental group in the post application of both tools. In light of the results of the study, the researcher recommends the necessity of holding training courses for mathematics teachers on how to use the Interactive Cabri 3D Program in teaching mathematics. Additionally, Using interactive software such as Cabri 3D in teaching and learning mathematics at all educational levels.

Keywords: *Cabri 3D Program - Geometric Proof - Lateral Thinking*.

Summary of the Study

This summary deals with presenting the study problem, its objectives, limits, importance, tools, hypotheses, procedures, and results. This is in addition to presenting recommendations and proposed research in light of the findings.

Introduction

The current era is conspicuously witnessing many changes in various fields. All of these changes were like revealing a new set of concepts and challenges, which requires us to prepare minds capable of innovation and creativity, in order to face these challenges that burden the responsibility on the shoulders of educators, especially those working in the field of mathematics teaching, because mathematics has a special nature. Mathematics is the language of the age of information in which we live today, as it is related to all aspects of human life.

Mathematics as a branch of science has contributed greatly to the development of technology and human civilization and many applications of mathematical concepts that have become the basis of scientific and technological development today. Geometry is also one of the important parts of mathematics used in daily life. Besides, the study of geometry enables students to analyze and solve problems and establish a connection between mathematics and life. Geometry gains its importance from the fact that it helps to develop thinking, and to bring about learning for fun. At the same time, many complain about learning mathematics in general and geometry in particular; because it depends on abstract symbols, which led to the formation of a negative image of the subject among the learners. Therefore, the teacher must use what facilitates the process of teaching it to change students' mental image, and make them realize the usefulness of geometry in their scientific and practical life.

The study of geometry also aims to identify the properties of geometric shapes in the plane and space, find the relationships between them, describe the geometric location, explain the transformation, and prove geometric arguments. The emergence of geometry science, its development, and the coherence of its

knowledge is linked to the existence of justifications, arguments, and proofs between its structures, and the interest in proof is as old as geometry itself. This is in addition to the importance of proof in the growth of the edifice of knowledge, as well as providing a natural environment for building geometry thinking and proof.

Proof in mathematics helps to verify the correctness of a given statement and explains why the statement is correct. This is in addition to connecting with mathematical knowledge and reveal new mathematics and creativity in it, which is an essential component of mathematics. Learning proof also enables students to make deductive reasoning in mathematics, which is very important for a career successful later in life. Proof serves as a means of explaining, communicating and organizing mathematics into an organized axiomatic structure, a tool for discovering and creating new knowledge, and a means for enhancing understanding.

Geometric proof is of great importance in mathematics in general and in geometry in particular. As it aims to prove the individual to a particular case or provide evidence of the truthfulness of this case through the use of postulates, theories, and laws or rules that support this proof in the light of logical justifications. Therefore, any mathematical statement should prove its validity in all circumstances and cases before it is considered mathematically theorem.

The development of thinking skills is one of the necessary things to stimulate the student's thinking and challenge his mental abilities, especially when he is learning mathematics, because mathematics is the language of thinking, and thinking is the language of mathematics. If the student's ability to think mathematically is not available, then mathematics becomes a subject consisting of a set of imitated or fictitious procedures without understanding its source. The study of mathematics is one of the fertile fields for the development of thinking among students, as it seeks to raise students an intellectual education that gives them the ability to analyze, study, make judgments and reach

conclusions. Lateral thinking is one of the many forms of thinking, and its importance lies in the fact that it represents a fundamental goal of mathematics teaching.

Lateral thinking is a very basic part of thinking and one can develop some skills in it instead of just hoping for insight and creativity. Besides, one can use lateral thinking in a thoughtful, practical and scientific way. Lateral thinking is not a new magic system. Rather, there have always been cases where people have used lateral thinking to achieve some results; there have always been people who are naturally inclined towards lateral thinking.

As a result of the rapid and successive developments of the computer and its dynamic interactive software, it became necessary for those in charge of the educational process to take advantage of these developments, in order to improve the educational process by focusing on the use of dynamic interactive software as an effective and impressive tool in preparing many educational programs in order to facilitate the students' understanding and comprehension for many curricula, especially mathematics.

The use of dynamic geometry software in mathematics education and learning has become a necessity in response to the developmental cries calling for a qualitative shift in the formation and practices of school mathematics, and many researches indicate that such software contributed to improving students' understanding of geometry concepts.

Several dynamic geometric environments have been created to enrich the teaching and learning processes in the mathematics classroom, the most famous of which are Cabri, Geometer's Sketch Pad (G.S.P). these programs are about means and tools that enable the user to display and establish geometric shapes, discover properties and develop any guessing.

Cabri can be used as an attempt to improve the ability to arrange geometric proof. Moreover, Cabri 3D is one of the programs that can be used in learning geometry (with which we can create automatic animation of shapes by

creating a moving point on the circle, one can animate all shapes associated with that point. Besides, we can, for example, increasing the size of the circle and making a triangle vibrate and the results can be amazing.

In light of these interactive programs, the contribution to the development of lateral thinking and geometric proof has become an absolute and urgent necessity in the modern era to graduate a generation capable of dealing with the changes of the age and facing its problems and solving them. Hence, the need to use modern teaching methods and approaches appears to that develop lateral thinking and geometric proof for students. Therefore, the researcher tried to contribute to the development of geometric proof skills and lateral thinking through the use of an interactive geometry program such as Cabri 3D.

Problem of the Study

The study problem is conspicuously determined by the presence of students' weakness in the skills of geometric proof. Despite the importance of geometric proof and its skills for students at different levels of education, students have weaknesses in geometric proof and its skills. It is indicated by a number of studies, including the following: (Maher Muhammad Salih, 2008; Shorouk Gouda Ibrahim, 2018; Fayza Ahmed Muhammad, 2013; Jasser Hassan Shwehi, 2009; Sultan Ali Muhammad, 2000; Saud HabadDhafiri, 2010)

There is also a weakness in lateral thinking skills among students. Despite the importance of lateral thinking and its skills for students in different stages of education, students have low lateral thinking and skills. It is indicated by a number of studies, including the following: (Mohammed Jabr Al-Quraishi, 2014; Maha Al-SayedBehairy, and IbtisamEzz Al-Din Mohamed Abdel-Fattah, 2019; Mahdi Awad Al-Dulaimi, 2017; Heba Muhammad Mahmoud, 2018; HamadKhamisSaeed, 2012; Abdul Karim Ali Al-Eidani, and Muhammad Hikmat Abdel Hamid, 2018; Yasser Khalaf Rashid, 2014; MuradHaroun Suleiman, 2017; Hamad bin Khamis bin Saeed, 2012).

The exploratory study also confirmed a weakness in the skills of geometric proof and lateral thinking.

The current study also attempts to confront this weakness in the geometric proof and lateral thinking by answering the following main question:

What is the impact of using the interactive (CABRI 3D) program on teaching geometry to develop the skills of geometric proof and some lateral thinking skills among secondary school students?

The following questions emerge from this main question:

- What is the impact of using the interactive (CABRI 3D) program in teaching geometry on developing geometric proof skills for second year secondary school students?
- What is the impact of using the interactive CABRI 3D program in teaching geometry on developing lateral thinking skills for second year secondary school students?

Objectives of the Study

The current study aims at:

1- Addressing the shortcomings and weaknesses in the skills of geometric proof and lateral thinking among students of the second year of general secondary school.

2- Detecting the impact of using the interactive (CABRI 3D) program in teaching geometry to develop the skills of geometric proof for students of the second year of secondary school.

3- Detecting the impact of using the interactive (CABRI 3D) program in teaching geometry to develop lateral thinking skills for second year secondary school students.

Importance of the Study

The importance of the study is that it may be useful in:

1- Providing teachers with a guide that includes a set of activities and tasks that may help them in using the interactive (Cabri 3D) program in teaching geometry.

2- Curriculum planners and developers using the interactive Cabri 3D program in mathematics curricula.

3- Curriculum planners and developers arrange and display academic content in a way that contributes to the development of geometric proof skills and lateral thinking.

4- Developing students' skills of geometric proof and lateral thinking.

5- Providing researchers with some tools that have been prepared, such as: the geometric proof test and the lateral thinking test.

6- This research may contribute to overcoming the difficulties that students face in learning space geometry.

Hypotheses of the Study

1- There is no statistically significant difference between the average scores of the experimental group and the control group in the post application of the geometric proof skills test.

2- There is no statistically significant difference between the average scores of the experimental group and the control group in the post application of the lateral thinking skills test.

3- There is no statistically significant difference between the average scores of the experimental group students in the two pre and post applications to test the skills of geometric proof.

4- There is no statistically significant difference between the average scores of the experimental group students in the pre and post applications for the lateral thinking skills test.

Limitations of the Study

:The current study was limited to the following

1- A group of students in the second year of general secondary school from the Martyr Muhammad Sayed Abu Shakra School, and the Secondary School for Girls in Tamiya Educational Administration in the Directorate of Education in .Fayoum

Geometry and Measurement" unit for the second year general secondary " 2- .students

3- Geometric proof skills; They are (the skill of drawing the issue - the skill of determining the data and what is required - the skill of imposing assumptions - the skill of deducing geometric relations - the skill of conducting additional work - the skill of determining the appropriate plan for the solution - the skill of)formulating proof - the skill of verifying the correctness of the solution

4- Some lateral thinking skills; It is (generating new perceptions - generating)new ideas - generating new alternatives - generating new creations

:**Study Tools Materials**: The study tools consisted of

- Educational materials, namely:
  -) Teacher's Guide. (Prepared by the Researcher •
  -) Student's Brochure. (Prepared by the Researcher •
- Measurement tools, namely:
  -) Geometric proof skills test. (Prepared by the Researcher •
  -) Lateral thinking skills test. (Prepared by the Researcher •

Methodology of the Study

The Experimental Approach: where the study relied on a quasi-experimental • designwith two groups:whereThe study sample included two groups, one experimental studying the unit "Geometry and Measurement" according to the interactive Cabri 3D program, and the other control group studying the unit .using the usual methods and applying the test to the two groups

Procedures of the Study: To answer the study questions, the following procedures were followed:

1) Reviewing the educational literature related to the interactive (Cabri 3D) program and how to use it and its capabilities, as well as literary studies related to both the skills of geometric proof and lateral thinking skills.

2) Analysis of the content of the unit "Geometry and Measurement" assigned to students of the second year of general secondary school, with the aim of:

Preparing a list of geometric proof skills included in the unit.

Preparing a list of the lateral thinking skills included in the unit.

3) Re-formulation of the selected unit in light of the characteristics and capabilities of the interactive (Cabri 3D) program.

4) Preparing educational materials (student's brochure - teacher's guide) according to the interactive (Cabri 3D) program and controlling them scientifically.

5) Preparing measurement tools (geometric proof skills test - lateral thinking skills test) and controlling them scientifically.

6) Choosing a group of students of the second year of general secondary school, and dividing them into two groups, one experimental and the other control.

7) Applying the geometric proof skills test, lateral thinking test, on the two study groups

8) Teaching the unit under study to the students of the experimental group using the interactive (CABRI 3D) program, and teaching the same unit to the students of the control group using the usual methods.

9) Post-application of the test of geometric proof skills and lateral thinking skills on the two research groups.

10) Monitoring and analyzing the results, and statistically processing and interpreting them.

11) Presenting recommendations and suggestions in light of the research results.

Results of the Study

In light of the procedures that were followed to solve the problem, it was found out that:

1- There is a statistically significant difference between the average scores of the experimental group and the control group in the post application of the geometric proof skills test.

2- There is a statistically significant difference between the average scores of the students of the experimental group and the control group in the post application of the lateral thinking skills test.

3- There is a statistically significant difference between the average scores of the experimental group students in the two pre and post applications for testing the skills of geometric proof.

4-There is a statistically significant difference between the average scores of the experimental group students in the two pre and post applications to test the lateral thinking skills.

Recommendations of the Study

In light of the study results, the researcher recommends the following:

1- Training students to use the interactive Cabri 3D program because of its ability to attract attention and increase students' motivation to learn.

2- Using interactive software such as Cabri 3D in teaching and learning mathematics at all educational levels.

3- Activating the mathematics lab and providing it with computers, software and display devices for use by mathematics teachers.

4- Holding training courses and workshops for in-service teachers to train on how to teach geometry using the Cabri 3D program because of its positive impact.

5- Taking advantage of the capabilities and features of the Cabri 3D program in teaching geometry of all kinds, especially 3D spatial geometry, to create an attractive dynamic environment that helps the student to see shapes and models

from more than one angle as well as they are open in order to realize the third dimension, which is difficult for students to understand using traditional .methods

:Suggested Research

In light of the study findings, the researcher suggests conducting the following :research

1- The impact of using the Cabri 3D program in developing other aspects of secondary school students, such as developing creative and generative thinking .skills

2- Conducting research on teaching methods and approaches and other interactive programs such as Sketchpad that may contribute to developing geometric proof skills for secondary school students and other educational .stages

3- Studies on developing educational programs for preparatory school students .using the Cabri 3D program in order to develop lateral thinking skills