

INTEGRATING GEOGEBRA SOFTWARE IN TEACHING AND LEARNING OF MATHEMATICS: A REMEDY TO STUDENTS' DECLINING INTEREST IN MATHEMATICS.

By

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Abstract

Students' attitudes towards mathematics tend to be on the negative range. Most of the students have developed a sense of low self-confident in studying mathematics. These negative beliefs are unfortunate as mathematics is a field of science with endless possibilities that can take an individual very far intellectually and professionally. It is our goal as teachers to lead students away from these negative attitudes that can be unfavorable to their learning and educational future. One way to do this is to introduce students to a variety of learning methods. Dynamic geometry software such as GeoGebra can help students improve their perceptions and learning of mathematics. This work discussed the Integration of GeoGebra software in teaching and learning of mathematics: a remedy to students' declining interest in mathematics.

Keywords: Mathematics, Geogebra Software, Interest

Introduction

Mathematics is one of the subjects that are suitable for integration of information and communications technology (ICT) during teaching and learning process. This is because it requires students to see how any changes in the variables could affect others. Providing students to visualize what they are learning could help them to understand mathematics better compared to just manipulating numbers to get the final answer; which only the bright students could master.

According to the National Council of Teachers of Mathematics (NCTM, 2011), it is essential that teachers and students have regular access to technologies that support and advance mathematical sense making, reasoning, problem solving, and communication. Effective teachers optimize the potential of ICT to develop students' understanding, stimulate their interest, and increase their proficiency in mathematics. When teachers use ICT strategically, they can provide greater access to mathematics for all students (NCTM, 2011). The transformative view of ICT in mathematics education requires us to examine what new ways of pedagogies and curriculum are appropriate for a new generation working with new tools. ICT can support students to investigate in every area of mathematics, such as geometry, statistics, algebra, measurement and number (NCTM, 2000).

The use of content specific and content neutral ICT tools in the classroom can support the learning of mathematics. Choosing which tools are suitable and effective is important. "In mathematics education, content specific ICT tools include: computer algebra systems, dynamic geometry environments, interactive applets, handheld computation, data collection, analysis devices, and computer-based applications" (NCTM, 2011). These tools support students in exploring and identifying mathematical concepts and relationships. Content neutral technology tools include communication and collaboration tools and web-based digital media. These technologies increase students' access to information, ideas, and interactions that can support and enhance sense making (NCTM, 2011). NCTM (2000:22) emphasizes the use of dynamic geometry software in mathematics classrooms and states the following goals that are aimed to achieve;

- Exploring properties of shapes using dynamic software.
 - Learning about length, perimeter, area, and volume of similar objects and measuring of angles using interactive figures.
 - Learning about properties of vectors and vector sums using dynamic software.
 - Understanding ratios of areas of decorated figures using interactive diagrams.
- One such ICT tool under dynamic mathematics software is GeoGebra software.

Statement of the problem

Students declining interest in mathematics education has been a serious issue in mathematics educational system. This has been attributed to mathematics teachers' inability to apply innovative instructional materials in teaching and learning of mathematics. It is in view of this that the researchers has decided to carry out this research to find out if the use of Geogebra will be to students declining interest in mathematics. Therefore the problem of this study is: How can Geogebra software be used in teaching and learning to remedy the students' declining interest in mathematics.

Method

The study adopted true experimental research design. The population of this study consisted of all students in Junior Secondary One (JS1) in Nsukka local government area of Enugu State. Sample of two schools that have functional computer laboratory were drawn using simple random sampling. The instrument used for the study was Geogebra software. The instrument was used to teach the students in order to sustain their interest in teaching and learning of mathematics. The instrument was validated by two experts in mathematics education from the Department of Science Education and one expert in educational technology from the Department of Art Education, University of Nigeria Nsukka. The comments made by the validates guided the researchers in carrying out the research.

GeoGebra Software as an instrument for the study

GeoGebra was designed to combine geometry, algebra, and calculus in one dynamic environment. GeoGebra is free mathematics software created by Markus Hohenwarter in 2001 for his master's thesis project at the University of Salzburg, Austria. The most recent version of the software can be downloaded at the official GeoGebra website (www.geogebra.org). GeoGebra is a dynamic mathematics software that provides for an interactive learning environment, enabling users to create mathematical objects and interact with them. GeoGebra users, mostly teachers and students, can use this environment to explore, explain, and model mathematical concepts and the relationships between them (Hohenwarter & Jones, 2007).

The use of computers or dynamic software in geometry teaching helps make the learning of abstract concepts easier. Previous research has shown that the use of computer software in teaching some mathematics contents is more effective than traditional teaching methods (Zengin, Furkan, Kutluca, 2012; Ross & Bruce, 2015; Reis, 2015; Tatar, 2012; Reis & Ozdemir, 2014; Bakar, Ayub, Luan, & Tarmizi, 2010; Tezer & Kanbul, 2009). Researchers like Ross & Bruce (2015), Reis (2015) & Tatar (2012) found that GeoGebra helped students conceptualize the operations in addition and subtraction and students who learned the integers with the software had a more permanent learning than the students who did not use GeoGebra (Reis, 2015). The researchers agree that making more use of GeoGebra in mathematics teaching is a factor in effective mathematics teaching and permanent learning.

The basic facility of geogebra is that students put formula into algebra view and their graphical representation is presented in graphics window. Many numbers of researches suggests that these software packages can be used to encourage discovery, experimentation and

visualization of traditional method of teaching mathematics (Tezer & Kanbul, 2009; Ross & Bruce, 2015; Reis & Ozdemir, 2014). However, many research works suggest that, for the many number of teachers, the main problem is how to provide the use of technology necessary for the successful integration of ICT into teaching and learning of mathematics (Ruthven & Hennessy, 2012; Zengin, Furkan, Kutluca, 2012; Reis, 2015). Therefore, there is need to integrate geogebra software in teaching and learning of mathematics to improve student's maximum interest in the subject. The figure 1 below shows geogebra window.

GeoGebra window

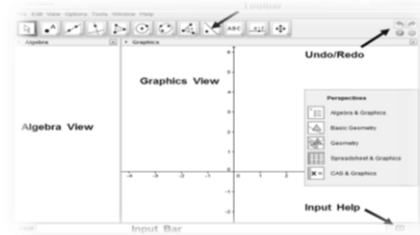


Fig 1

Guide to the use of Geogebra software

To start, download geogebra software in your computer by typing www.geogebra.org in the web page.

1. To construct a triangle and measure the sum of the interior angles

Construction tool



Fig 2

- Go to the Construction Tools: select the Polygon tool
- In the Graphic View area: create a triangle by selecting three points which will be the vertices of the triangle. (Remember to click the first point again in order to close the triangle)
- To measure the interior angles: Go to the Construction Tools & select the Angle tool

Angle tool



Fig. 3

- Select the three vertices counter clockwise

To calculate the sum of the interior angles, go to the **Input bar** and type:



Fig 4

The sum of the angles (which is 180°) will appear in the Algebra window as shown below

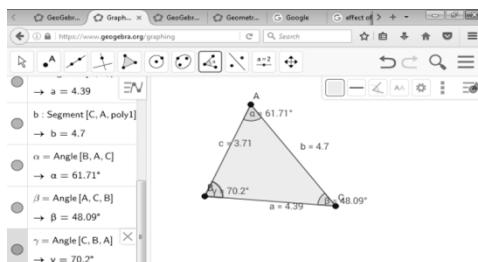
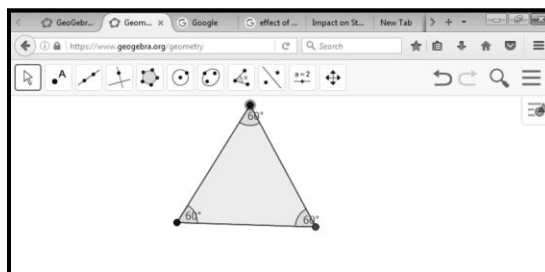
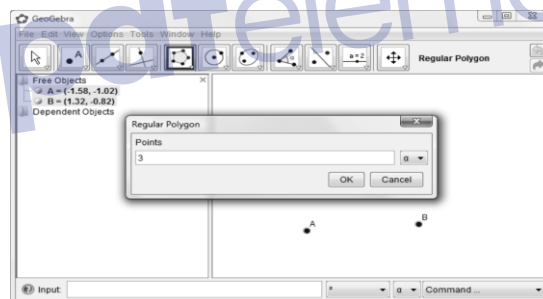


Fig. 5

The question that any mathematician will ask is if what is shown in Fig 5, is a special case or is it always true?

- Go to the Construction Tools and select the Arrow
 - Drag the vertices (A, B and C) of the triangle. (to increase or decrease)
GeoGebra will measure the angles immediately and also update the sum of the interior angles.
2. Construction of a regular polygon
- Hide the axes: select View / Click Axes button
 - Select the Regular Polygon (click the small arrow in the bottom right hand corner of the icon to see all the options)
 - Create an equilateral triangle by selecting the two base points. A window will open: type the number of vertices (in the case of a triangle 3, square 4, regular pentagon 5) and hit the enter key. An equilateral triangle can be observed in fig 7 below



- Measure an interior angle: select the Angle tool / Select the three vertices counter clockwise (the measured angle second).

Fig 7

- Repeat the steps 1 to 5 to construct a square, regular polygon, etc.
- Other Applications of GeoGebra**
- ✓ GeoGebra has a range of statistical uses which can be used with or without the Spreadsheet View. It has a number of statistical functions and graphing tools.
 - ✓ Creating and modifying algebraic coordinates and equations by using the Input Bar at the bottom of the GeoGebra window.
 - ✓ Creating and modifying trigonometric equations by using the Input Bar at the bottom of the GeoGebra window. You can use radian measure or degrees.
- Etc.

Conclusion

Teaching and learning of Mathematics should not be focused on purely theoretical, but also a variety of learning approaches that involve the use of teaching aids confirmed to help stimulate students' interest in Mathematics. By integrating dynamic mathematics software, like *GeoGebra*, teachers can be able to make graphical representations of mathematics concepts. As the concepts are introduced with pictorial representations, teachers and their students are able to make the connections between the pictures, the concepts, and the symbolic representation.

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