

# The Effectiveness of Using GeoGebra Animations in Mathematics Learning for School Students

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**Abstract:** GeoGebra is a widely used dynamic editing software in learning mathematics. This program utilizes visual effects and animations to facilitate the understanding of various mathematical concepts, allowing for the manipulation of graphs and shapes through animation. Through animations, students are able to visualize themselves and learn to connect between mathematical principles. Such visual impact enhances students' ability to comprehend mathematical sciences among them, aiding both practical and conceptual understanding. In this article, we explore the effectiveness and impact of utilizing GeoGebra animations in the teaching and learning of mathematics for students and educators

**Keywords:** GeoGebra, teaching and learning mathematics, animation.

## Introduction

In the era of digital learning, technology has become an integral part of education, necessitating changes in both students' learning and teachers' teaching methods. Among various education tools, the GeoGebra software stands out as a powerful program that seamlessly integrates algebra, geometry, and statistics, serving as a robust tool. GeoGebra facilitates the development of visualization skills and aids in transitioning from abstract to concrete thinking. Students utilizing GeoGebra are able to achieve favorable results in understanding algebraic concepts and applying them to real-life situations without difficulty.

## Learning and Teaching Mathematics with Dynamic Software

GeoGebra plays a crucial role in piquing students' interest in mathematics and enhancing a deeper understanding of mathematical concepts, while also assisting teachers in conducting classes with the integration of computer science. GeoGebra provides students with the opportunity to learn mathematical principles and analyze them. Moreover, in geometry education, the use of GeoGebra enhances the ease of learning the subject and encourages active participation in the learning process. Students engage with geometry education with higher motivation and interest, resulting in improved learning outcomes. Therefore, scholars and educators in the field of science recognize the psychological and pedagogical impact of GeoGebra software in teaching and learning mathematics.

## Literature Review.

In today's education system, there is a growing emphasis on effective utilization of modern information and communication technologies and incorporating them into teaching and learning processes. Consequently, in various subjects, including algebra and geometry, computer programs are increasingly being used. Among them, GeoGebra software is noteworthy for its ability to provide effective results in interactive teaching and learning [1].

In understanding mathematical concepts, the role of GeoGebra in making the comprehension of complex problems easier is significant. GeoGebra animations play an important role in transforming abstract mathematical concepts into dynamic visual representations and facilitate understanding of relationships among mathematical principles [2]. According to research in the field of science and education, GeoGebra animations contribute significantly to teaching and learning mathematics in schools, enhancing psychological and pedagogical impact on students.

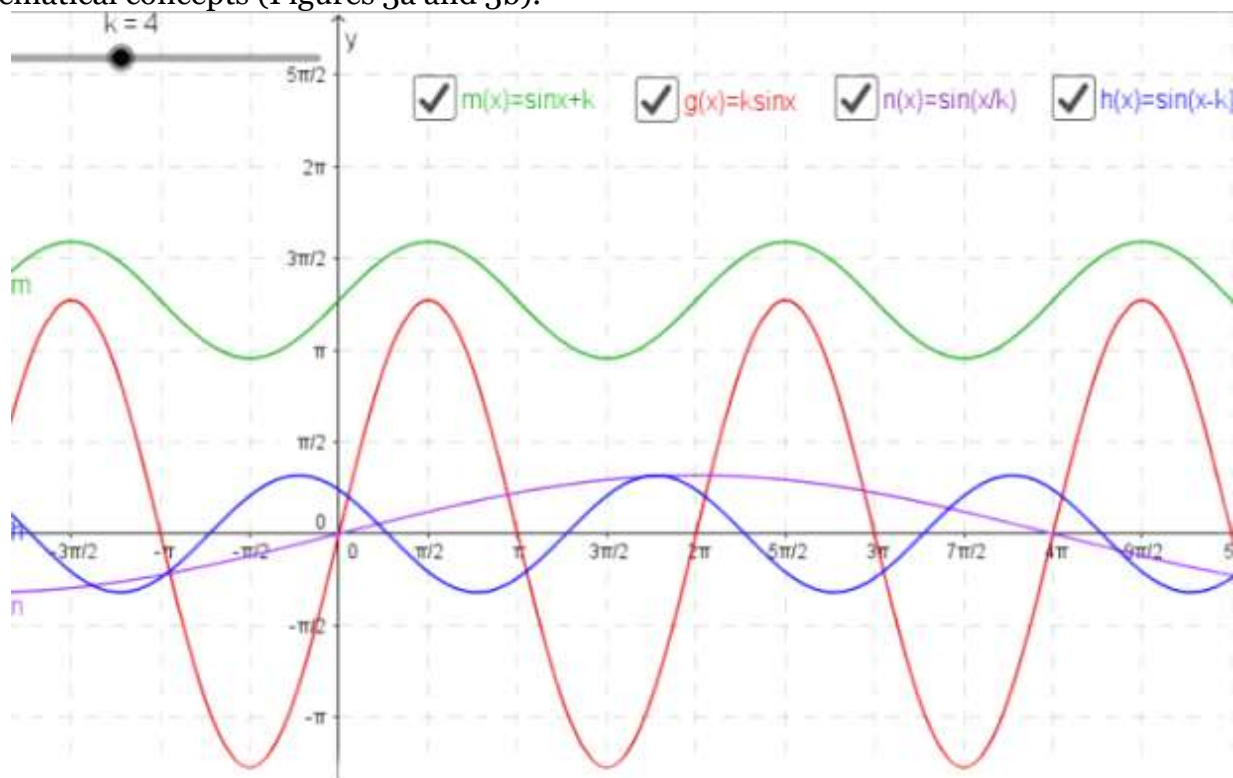
## Research Methodology.

This article discusses the integration of mathematics education for general secondary school students using computer programs. Specifically, it describes the methodological features of using GeoGebra software, which is one of such programs. Through this software, the development of skills in grasping mathematical concepts and analyzing graphical representations and functions is analyzed.

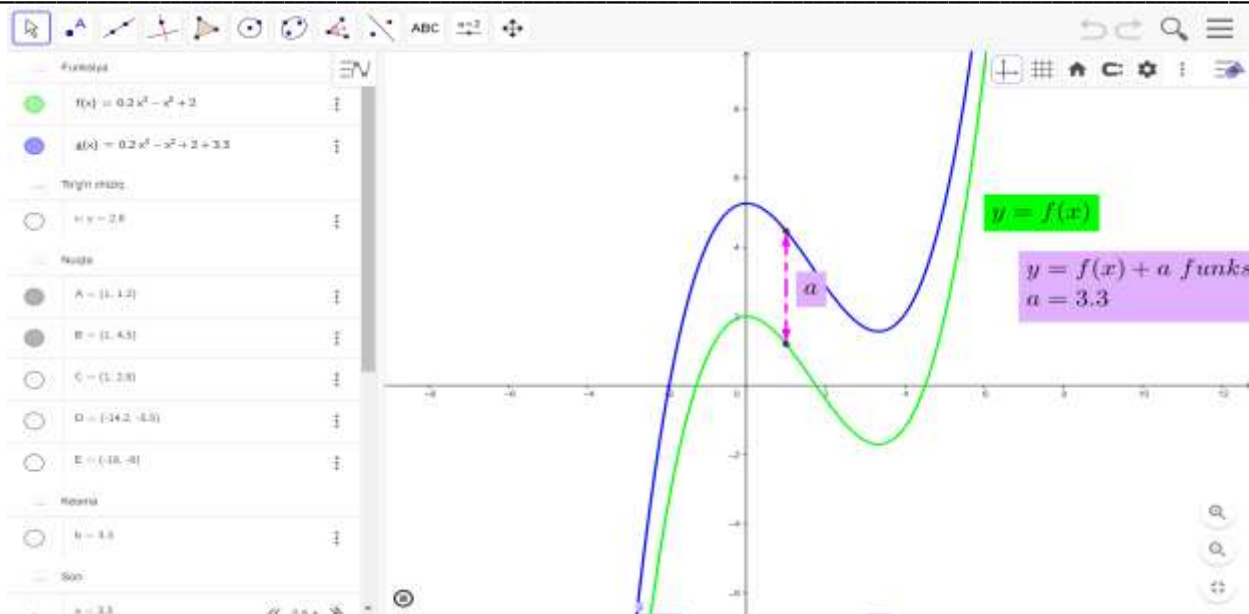
## Analysis And Results.

In today's modern era, computers have entered all fields of the education system and demonstrate the necessity of effectively utilizing them to improve students' mastery of learning materials. In this article, the research of Lepmann T., Albre J., shows the necessity of analyzing the place and stages of the teacher-student-computer triad in the teaching process and developing the integration of modern information technologies into teaching [3].

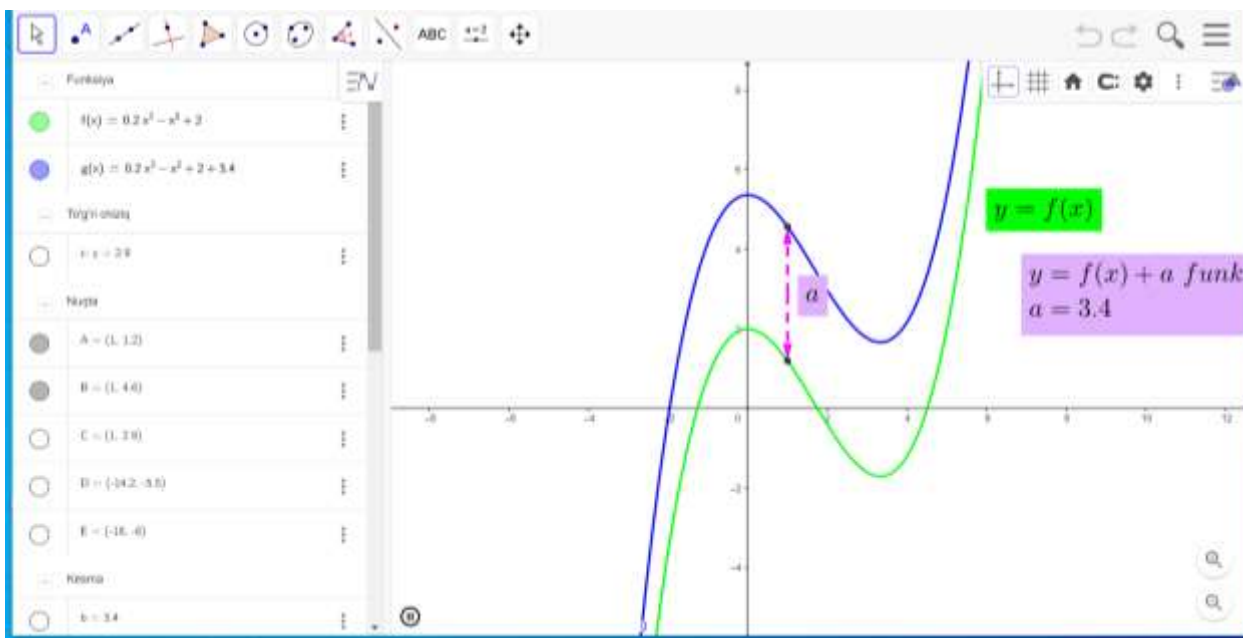
Utilizing new technologies in teaching mathematics transforms the teaching process and enables students to develop on their own. The GeoGebra software is recognized as a dynamic editing program used for this purpose. The effectiveness of teaching mathematics using GeoGebra software has been under observation for many years in comparison with traditional teaching methods. Especially, animations assist students in visualizing mathematical solutions and comprehending complex concepts. For example, visualizing changes in the graph of a function by altering parameters helps in understanding relationships between functions and their graphs (Figures 1 and 2). GeoGebra's graphical representations assist students in grasping abstract mathematical concepts. Observing real-time changes in graphs and shapes enhances students' understanding of mathematical concepts (Figures 3a and 3b).



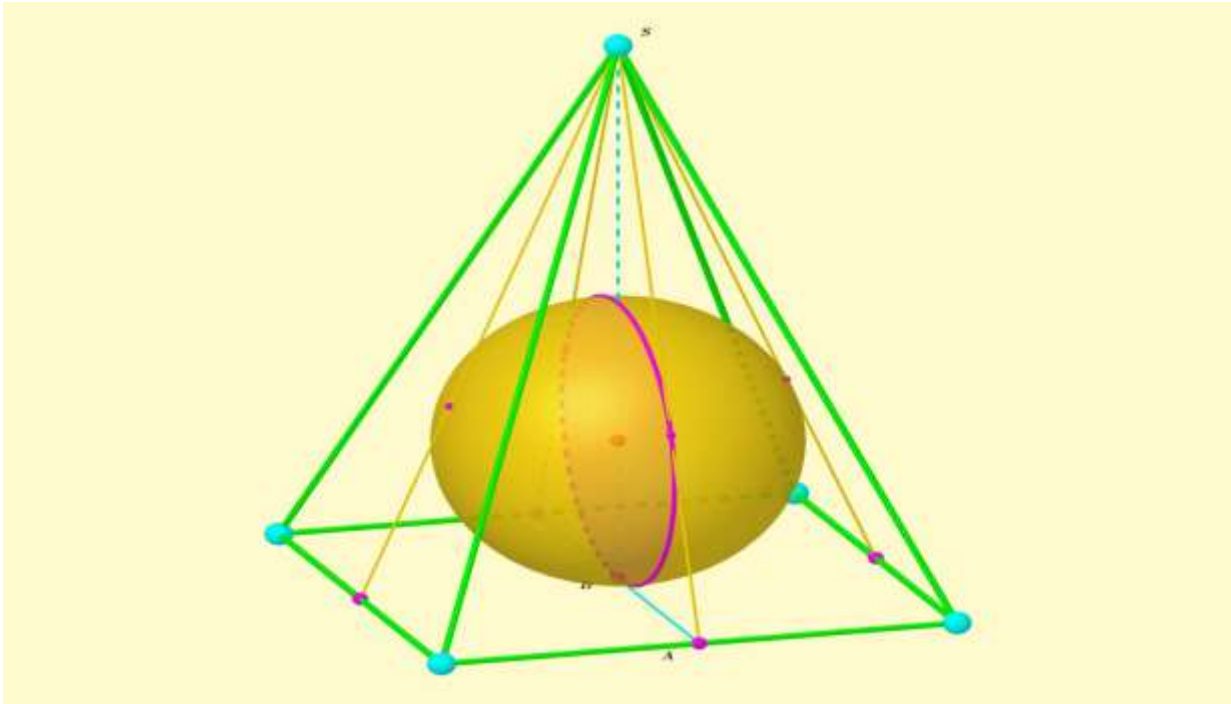
1-figure. Changes of parameters of the  $y = \sin x$  function graph.



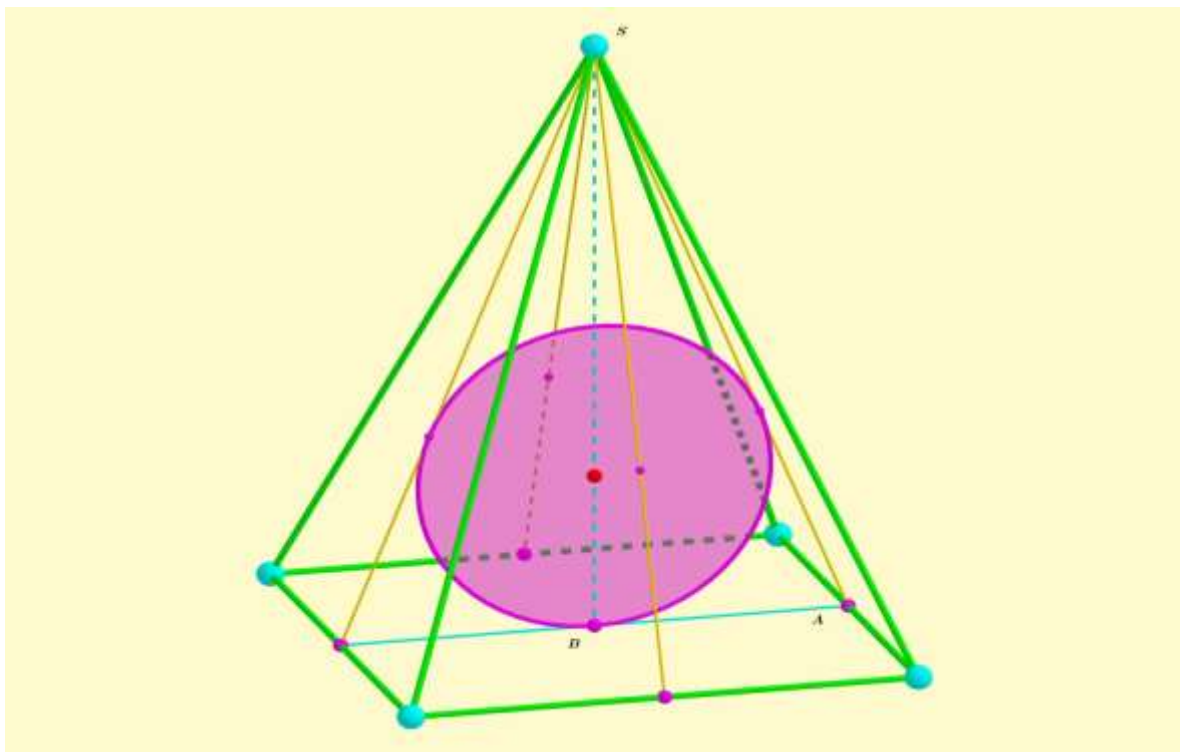
2a-figure.  $y=f(x)$  and  $y=f(x)+a$  functions  $a=3.3$



2b-figure.  $y=f(x)$  and  $y=f(x)+a$  functions  $a=3.4$



3-a figure. Inner carved sphere in the pyramid.



3-b figure. Section of the pyramid showing the cross-section of the inner chamber.

### Teaching Mathematics with the Role of GeoGebra

In general education schools, the teacher's classroom instruction mainly involves transmitting information to students, assessing their acquired knowledge, and retaining it in memory, representing a traditional method. According to Velichov theory, the core essence of "knowledge" is represented as information stored in memory [4]. During the classroom process, students particularly engage well in mathematics through active involvement. Therefore, if the classroom uses GeoGebra animations, students retain the taught materials in memory and easily

internalize them. This can be clearly observed in Figures 3a and 3b, as the ability to visualize complex concepts is predominantly assessed in the solid geometry section.

The general characteristic of utilizing technology in education is associated with the reproductive level of learning, as an example. It's known that reproductive learning corresponds to students memorized and internalized knowledge. GeoGebra's capabilities align well with algebraic and geometric concepts, serving as one of the most effective tools for mathematical proofs and identifying relationships, and thereby fostering students' creative thinking abilities. For instance, visualizing interactive 3D shapes and surfaces in GeoGebra is more comprehensible than static 2D drawings on paper. As depicted in Figures 3a and 3b, understanding problems related to visualizing and solving the intersection surfaces of three-dimensional shapes is facilitated.

In summary, the use of animations in the GeoGebra software enhances the effectiveness of the mathematics learning process. Through animations, students acquire unique insights, leading to improved learning outcomes. Utilizing animations empowers both students and educators to engage with mathematics in a concealed, intriguing, and comprehensible manner. GeoGebra animations contribute to an innovative approach in mathematics education, providing a creative and engaging method for both students and teachers to learn and teach mathematics.

### Conclusion And Recommendations

Animations play a significant role in enhancing students' understanding of the mathematics learning process. Animations created within the GeoGebra software provide the opportunity to visually and dynamically represent abstract mathematical concepts. The incorporation of in the learning process stimulates students' interest in grasping mathematics-related concepts. Animations aid in comprehending both significant and subtle information in education, allowing students to learn more efficiently.

### References

1. Hohenwarter J., Kreis, Y. & Lavicza Z. Teaching and learning calculus with free dynamic mathematics software Geogebra. In 11<sup>th</sup> International Congress on Mathematical Education. Monterrey, Mexico.
2. Hohenwarter M., & Preiner J. (2020) Incorporating Geogebra into teaching Mathematics at the college level. In Proceedings of the International Conference for Technology in Collegiate Mathematics.
3. Lepmann T., & Albre J., (2008) Some possibilities of teaching Geometry with GeoGebra
4. Velichova D. (2011) Interactive Maths with Geogebra. International Journal of Emerging Technologies in learning (IJET)
5. Molnar P. (2016) Solving a linear Optimization Word Problems by using Geogebra. International Journal of Information and Communication Technologies in Education
6. Dikovic, L. (2009). Applications Geogebra into teaching some topics of mathematics at the college level. Computer Science and Information Systems, 6(2), 191–203.