Investigating the Impact of GeoGebra on STEM Students' Employability Skills: A Comparative Study

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ABSTRACT

Engineering education is a critical area that requires the integration of innovative teaching methods and tools to enhance the learning outcomes of students. In addition, STEM Education provides innovative way to problem solving. One such tool that has recently gained significant attention in engineering education is the GeoGebra tool, which provides a dynamic and interactive environment for the teaching and learning of mathematical concepts.

This research aims to investigate the impact of the GeoGebra tool in engineering education in the context of Oman Vision 2040. The research will use a mixed-method approach consisting of a comprehensive literature review and a case study analysis of GeoGebra implementation in engineering education.

The literature review will examine the existing literature on the use of GeoGebra in engineering education, including the benefits, challenges, and limitations of this approach. The case study analysis will involve the examination of an engineering program that has integrated GeoGebra into its curriculum to support the teaching and learning of mathematical concepts.

The findings of this research will contribute to a better understanding of the potential benefits of GeoGebra in engineering education and provide insights into the challenges and opportunities for its implementation in the context of Oman Vision 2040. The results of this research will be of interest to policymakers, educators, and researchers interested in the integration of technology in engineering education to support the development goals of the country.

Introduction

Nowadays many educational software is created to support and help students to understand mathematics better such as GeoGabra App. This software can be used for problem solving to understand the concept of calculus, geometric and algebra. It is a Dynamic Mathematics Software (DMS) for learning and teaching mathematics from foundation level to undergraduate level. Where it is more powerful and helpful for mathematics and engineering students. Geogabra is freely available software at www.geogebra.org and easy to sing up on it (Hohenwarter & Preiner, 2007). It also has many free lectures to help students to understand the consequences of mathematics. In addition, it allows users to explore any mathematical concepts and the user can create interactive visualization of mathematical relationships. However, it can be a valuable tool which helps civil engineering students by analyzing and visualizing complex data and for creating models to simulate various scenarios.

GeoGebra is used to analyze and design various types of civil engineering structures, for example roads, buildings and bridges. Also, some engineers used GeoGebra to simulate stresses and load to determine their stability and strength and structure them.

Students take action to learn the concept of mathematical engineering by using collaborative tools like GeoGabra which allows gains and develop the employability skills. Some researchers suggest that to use the collaborative learning such as GeoGabra in training to view the theoretical practice (Caridade, et al., 2023). In other words that the collaborative learning enhancing the critical thinking (Gokhale, 1995). On of the case study in Oman for using the technology in teaching and learning finds that the e-learning is the powerful tool which can lead to innovative practice

for quality of mathematics education through teaching theoretical parts (Thottoli, Islam*, Marniati, Ahamad, & Hassan, 2023).

GeoGebra in Civil Engineering

GeoGebra tools work in an integrated manner with the concepts of Building Information Modeling (BIM), which are tools that use technology and mathematics to obtain a clear visualization of various buildings and constructions such as bridges, tunnels, railways, etc. The process of combining several technologies has many benefits that avoid material losses as well as increase the safety of users of these constructions. These technologies add many advantages to civil engineering students and engineering in general, for example:

These techniques work to link different concepts in civil engineering with the design of the construction project, for example, it compares the amount of concrete that will be used in the construction and the amount of expected dead and live loads that will affect on this building, this helps in predicting the assumed safety margin for the project and helps in cost calculations for the project. This strong connection between various concepts enables the student to visualize them faster and easier instead of writing them in the form of mathematical equations that not everyone may be able to understand. (Dimitrov, 2018).

These GeoGebra, in addition to the Global Information System (GIS) technology, enable civil engineers to deal with complex mega-data that includes moving maps, such as linking streets to the number of cars, to understand the best traffic light system and the most appropriate planning for streets and how it can be linked to the topography in that area. These technologies, in addition to the Global Information System (GIS) technology, enable civil engineers to deal with complex data that includes moving maps, such as linking streets to the number of cars, to understand the best traffic light system and the most appropriate planning for streets and how it can be linked to the topography in that area. This enables students to better deal with mathematical problems related to traffic and how these concepts relate to each other. (Tomic, 2019, p.1366)

There are cases that cannot be predicted, including natural disasters such as hurricanes, floods, and earthquakes, but the effects resulting from these situations can be analyzed. GeoGebra gives engineers the possibility to make different expected scenarios of such disasters and how they might affect buildings. Engineers analyze the disastrous history of these areas and set safety standards appropriate to that area through the help of computerized intelligence technologies such as GeoGebra and BIM. (Tretyakova & Voronina & Merkulova, 2019)

Effective communication is considered one of the most crucial parts for the success of work in any project, but sometimes engineers face a problem in conveying their perceptions to the different parties that they deal with in working on different projects. For example, it is difficult for the structural engineer to explain the idea of loads and its relation to buildings without the use of Computer Aided Design (CAD) to other engineers who specialize in also in building industries, so how if the structure engineer wants to explain these ideas and perceptions to non-engineers' parties that participate with them in the work? Here comes the active role of computerized intelligence technologies such as GeoGebra and others, which enable engineers to create many three-dimensional visualizations to make them easier to see and understand more effectively. Not only does it give you a 3D visualization, but it also enables you to perform variable arithmetic operations by adding some programed codes into it. (Pantazis & Priavolou, 2017).

GeoGebra in employability skills

According to some researcher for examine and improve the students critical thinking by using the GeoGebra software found that there are vary change in students' performance. Where students who use the GeoGebra while study are much better than who do not assisted GeoGebra in blended learning (Samura & Darhim, 2023).

Result

According to the sources we found the using the GeoGabra for understanding the concept of the mathematics engineering will be more beneficial to enhance study engineering module and gains the empolblity skills which will be supported to develop the countries.

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