

Creative Teaching Methodologies and Curriculum Adjustment for Mathematics Courses

Noura Hussein Suleiman Abusalih
Sultan Qaboos University
nabusalih@squ.edu.om

Abstract

One of the most recent technical advances in education is the use of instructional programming languages, which promotes the trend toward modernizing education and improves students' ability to understand and invest in the capabilities of technological equipment. In light of the technological developments and the ineffectiveness of the traditional teaching method in achieving the desired results, this study is based on the importance of investing in programming languages as one of the most important forms of technology in the educational process in general, and in mathematics teaching in particular. This study also intends to suggest a programming language to be used in the mathematical teaching process, which will equip students with critical thinking, solid research methods, analytical reading, and strong IT abilities.

Keywords: Creative Teaching techniques, Mathematics, Python programming language, 21st century skills.

1. Introduction

Many countries are attempting to develop methods of teaching mathematics, recognizing the importance of this subject in creating a modern society and increasing development and scientific advancements. Therefore, data analysis and statistics, as well as the incorporation of technology into mathematics classrooms, have gotten a lot of attention around the world over the last two decades. Especially that Mathematics is the heart of all sciences as it appears strongly in different life stages, sectors, and careers. Hence, it was critical to consider a good methodology for teaching mathematics that is appropriate for the 21st-century students, as the old teaching methods has a detrimental impact on student's performance in the practical reality (Faarinen et al., 2018).

National and international educational standards today focus on mathematical concepts throughout high school, in fact there is an obvious growing desire to move away from a formula-based approach towards mathematics instruction and more data-driven approach that emphasizes conceptual understanding and statistical literacy (Frassia, 2018). So in line with the future vision of the twenty-first century, it is required to integrate technology into mathematics teaching to execute these new methods in the classroom.

Computer programming, in particular, introduces students to computational thinking, which involves problem-solving utilizing computer science principles like abstraction and deconstruction, which is very accessible and valuable in their everyday lives. In reality, and in addition to algorithmic problem-solving skills, computer programming is considered as a vital ability for the development of higher-order thinking, its horizontal integration across all educational levels is recognized valuable and draws researchers' attention (Ramani & Patadia, 2012).

It is worth noting that the adoption of educational technologies in mathematics does not imply a reduction in the importance of the teachers' roles, but rather creating a modern transition and evolution. Based on the proceeding, this paper describes a statistical thinking learning activity that is part of a creative teaching experiment in teaching mathematics. As well as guiding a suggestion of an updated new teaching platform, that employs the Python programming computer language, which focuses on increasing the creativity of both the teacher and students to achieve a required active learning environment which will be reflected on the student's performance and enables them to work on their critical thinking, problem-solving, and creativity.

2. Research Problem & Questions

Despite the strong interest and serious preference for modern teaching methods and the incorporation of technology into mathematics curricula, many educational institutions continue to use the traditional methods of teaching due to numerous obstacles and shortcomings in the use of computerized teaching techniques (Fatlawi, 2020). Therefore, the study's problem is centered on teacher's non-success to adopt modern techniques in teaching mathematics and their preference for traditional teaching methods over computerized ones. Which requires answering the following main question:

"What is the reality of using creative teaching methods in teaching mathematics?"

In addition, the following sub-questions can be posed:

- 1- How can teaching mathematics using new and creative techniques be effective?
- 2- What are the obstacles that prevent applying computer programs in mathematics teaching?
- 3- What programming language can be used in the future to incorporate creative mathematics teaching methods?

3. Literature Review

3.1 Importance of Mathematics

“Mathematics is the language in which God has written the universe”- Galileo Galilei.

Mathematics is called the language of universe particularly because the universe cannot be read until we have learnt its language and become familiar with the characters in which it is written. The universe is written in mathematical language, and the letters are triangles, circles and other geometrical figures.

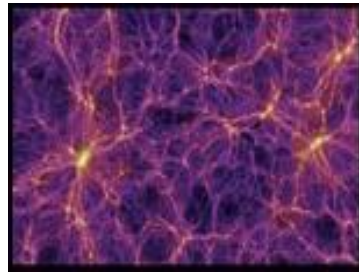


Figure 1. An illustration of the universe shape (Wikipedia).

Mathematics is the study of measurements, numbers, and space; it was one of the first disciplines developed by humans due to its importance and value. In addition, there are various fields of mathematics in science that are related to numbers, such as geometric shapes, algebra, and others (Deepika, 2021).

Mathematics is used in almost every aspect of life, including everyday tasks like timekeeping, driving, and cooking, as well as professions like accounting, finance, banking, engineering, and software development. Thus, these duties necessitate a strong mathematical foundation and techniques (Sarimsakova, 2022).

Mathematical inventions have been numerous throughout history. Some were tangible, such as counting and measuring instruments. Some of them are not as concrete as thinking and problem-solving techniques, and one of the most important mathematical inventions is the use of symbols to express numbers (Deepika, 2021).

3.2 Mathematics Curriculum

Mathematics teachers or mathematicians require a variety of mathematical skills, including knowledge of the entire field, deep flexible knowledge of curriculum goals and key ideas central to their grade level, knowledge of how to represent the ideas effectively, and knowledge of how to assess students' understanding. They also should be familiar with the history and evolution of mathematics curriculum, such as the algebra, geometry, advanced algebra, and pre-calculus sequences taught in secondary schools (Adibo, 2015).

Mathematicians should take on a variety of leadership roles in the development of curriculum and methods in mathematics. Future they can become more active and

informed contributors to mathematics curriculum change in the future by learning about previous mathematicians' contributions to the subject. Knowing the history of mathematics curriculum development will certainly help in a better understanding of the challenges of curriculum change and provide insight into effective ways that they can contribute to a developed educational system (Alsulaiman, 2018).

Educational technologies play an important role in improving teacher performance in the educational process, including the transition from traditional to systemic planning of education, as well as the shift from exaggerated attention to controlling the classroom system to designing an active learning environment, which is what the developed and modern curricula aim to achieve (Elmohammady, 2013).

3.3 The Effectiveness of Using Modern Techniques in Teaching Mathematics

Using modern techniques in teaching mathematics can be very beneficial to the students through the educational process. Some of the benefits are as follows:

- It facilitates the student's learning of computer applications and systems, and ease their use of information technology (Elmohammady, 2013).
- It helps to clarify mathematical concepts and facts easily.
- Integrates mathematical concepts into practical life.

- Encourages scientific thinking by stimulating research and creativity, as well as arousing students' interest in mathematical problems (Ramani & Patadia, 2012).
- Diversification of educational sources for students, as the classical methods of teaching are not the only sources of information, which aids in education efficiency (Faarinen et al., 2018).

3.4 Obstacles to Applying Computer Programs in Mathematics Teaching

The following are some of the most significant challenges that arise when using computerized programs and creative strategies in mathematics teaching:

- The tendency of some teachers to resist educational innovations and modern assessments that are different from what they are familiar with.
- Teachers' anxiety of using information technology and computer programs due to a lack of awareness when using these programs (Alsulaiman, 2018).
- Difficulty in obtaining the educational equipment and tools needed to apply these programs in teaching mathematics in general (Alshammari & Aldwesh, 2017).
- Not implementing modern methods for turning curricula into electronic curricula, which helps in the implementation of computerized programs in education (Elmohammady, 2013).

- Failure to provide electronic training packages to assist in the proper implementation of these software and technologies (Alshammari & Aldwesh, 2017).

3.5 Introducing Python Programming Language into mathematics teaching

The Python programming language was used to help computer science students learn discrete structures. Python is a computer language that may be used to write both object-oriented and functional code. It is simple to read and comprehend, having syntax that is appropriate for algorithm development. In addition, Python may be run in interactive mode, which allows students to explore with abstract notions and gain a deeper understanding of the concepts (Farahani, 2009).

Python is a powerful programming language with a simple, clear syntax and semantics that is both elegant and pragmatic, and it is utilized by both rookie and experienced programmers. Python allows the user to get productive rapidly, it also features a large standard library as well as numerous more modules. And because this programming language is simple to learn, then it is appropriate for beginners in programming (Ramani & Patadia, 2012).

Python is now more widely used in artificial intelligence and machine learning than any other programming language in the world. This is because Python algorithms

rely on data information to allow computers to do a variety of tasks. In addition, students may quickly learn this programming language to handle and process data, as they will be better prepared for future data and information demands because of using Python language in learning mathematics (Farahani, 2009).

Python programming language aims to equip students with many of the logic, mathematical, and algorithm ideas generally covered in a discrete structures course quickly and easily, as well as introducing experiments in order to fully understand mathematics theories. Which leads to helping students solve problems more effectively (Abu-zaqieh, 2017).

4. Conclusion

The use of modern methods in mathematics teaching contributes effectively to upgrading students' and teachers' low scientific and professional levels, as well as improving educational attainment. Useful strategies can be presented through teaching mathematics using these modern technological tools and techniques, such as incorporating the use of Python programming language in math teaching.

5. Recommendations

1. Holding training courses for mathematics instructors in order to provide them with updated teaching approaches in order to keep up with current developments in technology.
2. Employing experts and specialists in the training process for the use of such technological programs.
3. Increasing the financial support to the educational institutions so that they can use modern softwares that facilitates teaching mathematics.
4. Provide and develop both hardware and software required to use programming languages in teaching mathematics.
5. Emphasis on the role of educational institutions in motivating and supporting initiatives that support the educational process and are in line with global trends, such as training in the Python programming language.

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