

EMERGING TRENDS IN MATHEMATICS EDUCATION: IMPLICATION FOR NIGERIA'S FUTURE

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Abstract: Mathematics education is one of the most important disciplines in the field of education. It is a vital part of the education system that aims to improve the quality of mathematics education. In the last decade, there has been a shift in the approach to mathematics education, which has led to a change in the teaching and learning process of Mathematics. In the era of technology, the teaching and learning process of mathematics is changing. The latest developments in mathematics education have been incredibly successful in improving student engagement and knowledge, while also helping to strengthen the field as a whole. The new trends in mathematics education are transforming the way that modern education is conducted and suggesting exciting new possibilities for the future. This paper aims to provide an overview of the latest developments in Mathematics Education and to highlight the importance of comprehending how students learn and how to design meaningful, pertinent learning experiences that promote individual achievement.

Keywords: Innovation, technology, education trends, mathematics education.

Introduction

Education is crucial to the systemic and sustainable growth of any nation. To completely tap from the benefits of education, incorporating technology into all levels of schooling is critical, especially in subjects like Mathematics (Ani, 2022). It is a sound education that should help one differentiate between the things that are known and the things that are unknown especially with the ever evolving nature of education. The inability of a Mathematics educator to see the need to acquire the skills which would enable one to keep up with the trend of the 21st century will result to breeding an unfortunate generation who will not know mathematics and not know that they don't know mathematics as mathematics is vital for personal and professional success equipping individuals with the ability to analyze data, make informed decisions and provide solutions to problems (Uzochukwu, 2023).

For it is self-evident that actual mathematics education must result in the ability to understand and to perform. In most cases, however, it either disappears or if not, it becomes obsolete as little know-how regarding application of quantitative methods in an ever-evolving environment has been acquired.

In Nigeria and all over the world, educational experience and training in various subject content and vocational skills equip a person to cope with the odds in life. This then enables individuals to reshape the environment as they wish and as they want it, which is in consonance with the policy on education. As in the case of achieving educational goals and the teaching of Mathematics, it is crucial to enhance the quality of education, more so expending and innovating in the technology age. Another of the ways of attaining quality in our education is not to

underestimate the role of technology in our school system as mentioned in the policy document (FRN, 2017). For one, Mathematics Education remains a relatively young discipline, it is possible that there are new trends that can be identified and applied. These trends include the call for a more sophisticated kind of math instruction for learners of different categories, the integration of technology in teaching, enhancement of teacher knowledge and skill, and the utilization of conceptually sound research from different parts of the world. Therefore, these trends represent a new era in the teaching and learning process of Mathematics Education and may result in better chances for student exposure to the subject realm.

As noted by Oginni (2018), Mathematics is accepted globally as a partner to every discipline since it characterizes every pursuit. It is therefore necessary that the teaching and learning process to be more involving through the facilitators and students learning mathematics in the area of data logging, intranets and internet among others. Using the lens of innovation, Mathematics has the possibilities of enhancing the availability or educational delivery as well as making the contents more suitable and excellent in developing nations. Effective utilization of technologies can also improve education for those population which was earlier not able to get it like scattered and rural persons, people whom culture or other social factors does not allow to education, disabled people and aged persons. This is possible because such technologies enable asynchronous learning and this is defined by a gap of time between when instructions are delivered, and when they get to the learners. Information, communication and technology based educational delivery proved the fact that it was not mandatory for the instructor and all learners to be in one geographical location.

THE NEED TO CHANGE WITH THE TREND

With the advent of new technologies, researchers have access to a range of tools to better understand and improve learning experiences in Mathematics from learning analytics to computer aided instruction. The insights gained from research can provide a greater understanding of how Mathematics can be understood and lead to more effective design of instructional materials and learning experiences for students. Ultimately, this can help all teachers and students succeed in mathematics, and become active participants in an ever-changing global society. The new trends in mathematics education have been incredibly successful in improving student engagement and knowledge, while also helping to strengthen the field of mathematics as a whole. With a focus on interdisciplinary approaches, the utilization of technology and data, and the promotion of problem solving and inquiry-based learning, these trends are transforming the way that modern education is conducted and suggesting exciting new possibilities for the future.

The importance of comprehending how students learn and how to design meaningful, pertinent learning experiences that promote individual achievement are highlighted by the latest developments in mathematics education. To adapt to the ever-changing demands of both students and teachers, mathematics education is always changing. Mathematics education is contributing to making sure that students are more equipped for the future by embracing innovation and trends like technology, inquiry-based learning, data-driven instruction, and the development of 21st century skills. The future is a protracted journey rather than a final destination. These include technological

integration, inquiry-based learning, including games and gamification.

Games and Gamification

A game is an activity played for enjoyment or amusement. Additionally, it is a full play time or episode that culminates in a final outcome. It is a sport or competitive activity that is played in accordance with regulations and methods to achieve the desired outcome. A system or action that accomplishes a goal is called a means. It's a process with a goal as well. It is a process used to arrive at a desired location. According to Rutherford (2015), people of all ages like playing entertaining and motivational games that can spark their curiosity and lead them to try new things. Students can investigate basic number concepts including counting sequences and series, numbers and numeration, basic number operations, one-to-one correspondence, and computing procedures with the aid of mathematical games. Students can investigate number combinations, place value, patterns, arithmetic operations, and other crucial mathematical ideas by playing captivating mathematical games. Additionally, students' mathematical knowledge, reasoning, and applications in areas like sets and logic, measurement, geometry, trigonometry, graphs, probability, and statistics are enhanced by mathematical games.

Although game-derived components have been introduced into various aspects of daily life, the concept of gamification, which has been around for many years, is still perceived as novel. The goal of adding games into learning is to increase productivity and quality of learning, particularly in Mathematics, because its core elements include a set of well-defined rules, a quick feedback system, and participation in the games is optional and mostly for enjoyment. Gamification is a system design approach that uses

game elements to increase conceptual understanding, formula ease of use, theoretical application, and physical exercise. Even though an individual difference exists, a collection of research on gamification shows that majority of studies on gamification has positive effects on the individuals.

Game-based learning has been acknowledged as a valuable technique in mathematics education research. It can enhance student engagement and interactive learning experiences. This form of learning has been shown to boost student interest and engagement in mathematics, as well as improve problem-solving abilities and comprehension of mathematical topics (Coştu, Aydın, and Filiz 2019). Furthermore, game-based learning has been demonstrated to improve student collaboration, which can promote creativity and critical thinking.

Gamification in the classroom aims to increase students' enthusiasm and active participation in experiential learning. There are no hierarchies, and the work is done collaboratively and by doing. It is based on the participation of the participants, who do not need any training to participate and must be involved in what interests them the most, allowing them to change the rules as the play progresses while the teacher serves as the game's moderator. Because this strategy requires students to think critically, it also helps them strengthen their visual and cognitive skills, which increases the usefulness of utilizing the game concept in an educational setting. (Hamari, 2019).

Inquiry Based Learning

Students may find it difficult to understand the abstract explanations and rote memorization that are frequently used in traditional math teaching approaches. The abstract character of mathematics and its lack of application to real-world situations cause many pupils to struggle with it. In recent years,

inquiry-based mathematics education has gained popularity as a means of encouraging pupils to think critically and learn more deeply. In their paper for the Encyclopedia of Mathematics Education, Dorier & Maass (2020) state that inquiry-based learning "focuses on student-centered exploration, construction of meaning, and communication of mathematics." Instead of just passively absorbing knowledge from an instructor, this kind of learning environment gives pupils the chance to create their own understanding of mathematics.

Inquiry-based learning can also assist to build a sense of ownership over the curriculum because students are encouraged to ask questions and investigate issues in ways that are relevant to them. This form of learning enables students to try out multiple approaches to problem solving and fosters collaboration among students as they work together to grasp complex issues. Inquiry-based learning has also been shown to boost students' mathematical understanding, engagement, and problem-solving abilities (Dorier & Maass, 2020). In the long run, inquiry-based learning can help students build a solid foundation in mathematics and gain confidence in their abilities to approach and solve complicated problems. Students can utilize dynamic math software to investigate mathematical concepts. Students can create mathematical functions, statements, or diagrams and see how changes affect them. ICT allows teachers to give personalized and tailored instruction to students based on their particular learning needs.

Technology Integration

The twentieth century saw the introduction of digital technologies and computers, which revolutionized many aspects of life, including education. The introduction of computers, the internet and digital devices transformed data processing, communication and information access. Technology has become an

essential component of modern society, and its application in education is no exception. In mathematics education, technology can help pupils learn and understand the topic. For example, research has demonstrated that using computer-assisted training can help students better understand mathematical ideas, leading in greater comprehension and recall of the subject (Munro, 2017). Furthermore, learning activities that emphasize critical thinking and problem-solving skills can be implemented through technology, potentially improving learning outcomes (Jung et al., 2017). Virtual learning environments that give students an immersive learning experience can also be made with technology.

Students may find it challenging to comprehend abstract explanations and rote memorization when learning mathematics. Many students struggle with mathematics because of its abstract nature and lack of relevance to real-world scenarios. Technology opened up new teaching and learning opportunities by providing educators and students with access to a multitude of resources and information. (Onyema and Nworgu 2018). Technology integration in mathematics education addresses these problems and makes mathematics more understandable and engaging by providing interactive activities, real-world applications, and visual assistance. By promoting problem-solving strategies, conceptual understanding, and active learning, technology enhances math education. Fishback and Schlicker (2016) claim that teachers may now better understand how pupils acquire mathematics in a range of circumstances thanks to the use of technology.

Conclusion

It is evident that there are emerging patterns in mathematics education that might be investigated and applied more as the field develops and grows. The increasing use of technology in the classroom, the

drive to diversify mathematics instruction to better serve the needs of a wider range of students, and the emphasis on enhancing teacher preparation and professional development are some examples of these developments. As a result, these developments represent a substantial change in the approach to mathematics education and may result in significantly better chances for students to interact with the material. If the instructor is equipped to support student learning, the following practices, scientific inquiry, student collaborative work, problem-based learning, mastery experiences, positive affective environments, developing strong self-regulation skills, and learning content in context can also boost student interest (Rotgans & Schmidt, 2021).

It is important to note that there are many different approaches to implementing innovative teaching and learning in mathematics. In addition to the approaches already mentioned, riding the shift raises many important questions, including which innovative approach or approaches to choose for a given audience, which is the best approach, how to integrate multiple methods in a coherent way while balancing emergent complexity and the desired enhancement of this integration, what new pedagogies to develop for meaningful use of technology, how to respond to change's impediments, etc. Integration of technology can help foster the growth of 21st century abilities like communication, collaboration, and problem-solving. By giving access to digital tools and resources, the use

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of technology can enhance teaching and learning results.

Recommendations

The latest developments in mathematics education promote personalized instruction and take into account different learning styles by customizing learning experiences to meet the needs of each individual student, which results in increased engagement and comprehension. By promoting greater engagement, collaboration, and understanding of mathematical concepts, game-based learning, for example, can be used to assess student performance and offer feedback that motivates students to keep working with the material. It can also improve the learning environment for research on mathematics education. (Coştu and others, 2019)

There is still a long way to go in how much we can say with certainty on how it originates and develops. However, with that caveat, there are much we as a community can do to consider future directions of research. Government should provide adequate mathematical gaming materials for schools to help equip teachers to relate to student in practical class so that mathematics can be made fun and enjoying for the students. This will help boost their interest in mathematics. Teachers should be at home with the mathematical games to enable them effectively communicate to the students in class because a teacher who doesn't know how to play a game cannot teach a game.

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