



Innovative Teaching: The Crux of Mathematics Teaching and Learning in schools

¹Agbo, Chinenyenwa Mabel, ²Chika C. Ugwuanyi*, ²Guma, Ngozi Nwamaka and Onah ²Emmanuel Nnabuike

¹Department of computer Science Education, Faculty of Education and Art, Madonna University, Nigeria, Okija, Anambra State

²Department of Science Education, Faculty of Education, University of Nigeria, Nsukka

***Corresponding Author:** chika.ugwuanyi@unn.edu.ng

Abstract.

The development and use of novel ideas, products, services or processes add value to our understanding of unconventional mathematics education. It explains the need for creating something original or making a substantial improvement to what already exists. Innovation comes in many forms from traditionally expected technological advancements to more innovative business models, process efficiencies or thinking outside the box problem solving. It is a key engine of advancement and economic development in civilization, and it is at the heart of problem solving, competitiveness, and responding to new challenges. Innovative learning is the provision of new or better practice, technology or ICT tool and method into how students are taught. In view of the above, this paper x-rayed the following: Innovative teaching, innovative teaching strategies ICT tools and resources for mathematics instruction, benefits of innovative teaching, challenges to innovative teaching solutions or way out of the challenges and summary.

Keywords: Innovation, Mathematics, Mathematics education and innovative teaching.

Introduction

In an era of fast advancement, the classroom teaching has to go for a change to meet with the pace and struggles of 21st century learning. Nowadays innovative teaching is meant to upgrade students' learning about subject mathematics. Recent research also reinforces the value of two key practices in making their learning deeper, active learning with digital tools (e.g., technology integration) and real-life or hands-on applications which helps to make for deeper conceptual understanding of math content as students are linked to the content more significantly. For example, the National Council of Teachers of Mathematics (NCTM) suggests using technology thoughtfully to provide high-quality mathematics and help students develop their understanding and appreciation for realistic and meaningful mathematics

by incorporating interactive simulations and digital data analysis tools that engage learners in these authentic practices (NCTM, 2020). Authentic tasks and cooperative problem solving can also have a beneficial impact on how students think about mathematics and their attitudes towards DOSOL (Vale, & Barbosa 2020). To add on, more recent research also emphasizes importance of personalized digital learning and virtual mentorship for mathematics via AI-driven tools which provide personalized feedbacks, extra practice problems and interactive directions after the class. It allows them to have continued, personalized instruction and guidance that can help make difficult things like math more understandable (Mouboua, Atobatele & Akintayo, 2024). The usage of technology and innovative

pedagogies, in doing so, will allow educators to create a dynamic expectation community that accommodates 21st century skills of critical thinking and creativity (Safi et al., 2022; Heffernan & Heffernan, 2021).

Innovation

A modern perception of innovation in education is based on targeted application of the New Pedagogies and Technologies for Advances Learning. The cutting edge is creating learning contexts that are nimble and responsive to intellectual as well as socionormative advancement. This approach involves the application of learning technologies including AI and personalised adaptive systems which individually adapt each learner trajectory based on real time personal adaptation to students' psychological and emotional state in order to support an inclusive and personalised lived educational experience. In education speak, innovation is thus often about the development and delivery of new teaching strategies or tools that make a genuine difference to how students learn. For instance, the Organisation for Economic Co-operation and Development (OECD) identifies educational innovation as “the purposeful introduction of new or different teaching activities or innovative learning practices” such as untapped digital tools and a student-centred, collaborative approach to education (OECD, 2019). Practically, innovation is the implementation and generation of new ideas, products, services or methodologies that are either useful to a business or improve some aspect of its offering. It is frequently about creating something new or dramatically improving on what already exists. Innovations can be delivered in many other ways from technological, to business model, or process” to problem solving innovator! An innovation has to be conducive to the aims and purposes of the educational systems which normally express societal needs, interests, values etc. There are also some criteria that the innovation should be suitable, cost effective (in terms of time, space and material), consistent with the philosophy of the society and school work based on sound educational theory.

Innovative teaching

Innovative teaching is a dynamic and changing discipline which is responsive to the new challenges that face Indigenous students, and the possibilities provided through recent changes in technology and pedagogy. It is motivated by the need

to create more fun, effective and relevant forms of education in a fast-changing world. Definitions of innovative teaching in recent literature stress that it is novel forms of educational practice which are sensitive to student needs, technological development and the changing education context. Research suggests that innovative teaching is characterised by variety in student activity, degree of use of technology and promotion of critical thinking and collaboration (Gilbert et al., 2020; Major et al., 2014). It is a method of incorporating new approaches, tools or technologies into learning that improves the outcome and fosters cognitive as well as social and emotional abilities. In higher education, pedagogical innovation is often seen in response to discrete problems and demand for 21st century skills. The emphasis is on modifying content, pedagogy, assessment and learning environment to be dynamic and student-centered (OECD, 2020; Gilbert et al., 2020). For the purposes of Operationally, A 'new and improved' way is sometimes called innovative teaching as it describes the method of introducing new or improved practices technology or ICT tools into how Students are taught.

As we hark back, many of the memorable & inspiring movies are indeed centered on teachers and professors who utilized creative pedagogy to make a difference in student's lives. Such developments probably only existed on screen back then, today however, with the advent of technology-teachers world-over have revolutionized their teaching techniques & are utilizing a slew of tools that makes learning tailored, universal & living one. No two teachers are the same, from the old school to the cutting edge. With 21st century skills in mind, every teacher should resort to innovative teaching or innovative methodologies to keep the children engaged with a continuous process of doing and understanding.

Innovative teaching strategies

Under the current situation with COVID-19 pandemic, it has become compulsory for teachers to teach through automatic distance learning and e-learning. It has caused schools and teachers to rethink how they deliver instruction. Now teachers in that state are teaching remotely to students, and holding meetings and seminars over videoconferencing services, such as Zoom or Google Hangouts or Skype. A few of these teaching strategies that any Math teacher can use and somehow make the students to like about it, and even enjoy on with the topic.



Smart Board's usage- because it makes Visualization better? The contents of the course are all visual and interactive. It fosters a sense that teaching is a team sport.

A Teacher's Desk Blog- I use it to post handouts and such. Other educators are probably able to offer some helpful pointers as well.

Scope of Socialization in Online Teaching- This is a good way to prevent demotivation of some students while learning on the internet. The teachers might implement forums where they and students can be present for help on trouble shooting. Meet-ups and tutoring appointments via web can be set up.

Finding real life examples for learning - Relating teaching topics with practical example will be more interesting and fun to learn experience for the students.

Cloud Computing – Students do not need to be at home in order to access their homework assignment.

3D Printing as Learning Process: A highly increasing a relatively new teaching technique is accepted and used in whole world 3d- printing machine are utilized for print sample models where big tough theories are delivered very easily.

All of these maneuvers are in service to bringing innovation and artistry into the classroom. Teachers of mathematics and teacher educators must be trained on how to utilize new pedagogies. Reimagining how we teach is no small matter. “For us, it is really scary, because you’re like our students, and then we’re in a place where we do not feel comfortable anymore,” he continued. We feel very unsure of ourselves when that happens.” This has been implemented in some ICT tools.

ICT tools and resources for mathematics instruction

Many ICT tools can be used in the math classroom. Here are some of the most popular tools in math education:

GeoGebra: GeoGebra is a dynamic mathematics software for all levels of education that joins geometry, algebra, spreadsheets, graphing, statistics and calculus. It is a flexible math tool for the applied visualisation of mathematical data.

Desmos: Desmos is a graphing calculator online that is great for visualizing functions, creating interactive math activities and inspiring ideas in math.

Wolfram Alpha: An ‘answer engine’. Get students to use it side by side with equations, to think through

steps and computations, as well as access and understand vast amounts of math knowledge.

Khan Academy: Khan Academy’s math video tutorials run the gamut from basic arithmetic to differential equations.

Prodigy: An interesting math game for the students of P1-P6 to play. It is half math workout, half cool game, and bonus for you.

Microsoft Math Solver: Students can use this app to help them solve math problems step by step. It’s also a useful when helping with algebra or calculus.

Quizlet: Find and create digital flashcards and quizzes that can be shared with students to practice math formulas or concepts.

Google Workspace for Education: Google workspace has a suite of tools- Google Docs, Sheets, Slides and Forms that can be used to have hands on math projects assignments created jointly.

Scratch: A visual programming language that the user can use to code through math projects and games.

PhET Interactive Simulations: PhET offers a whole bunch of virtual math and science simulations (eg physics, chemistry, math).

Mathway- Billed as a math problem solver, Mathway gives you step by step answers to solve problems.

Coolmath: Coolmath features a few levels worth of fun math games, lessons and activities.

CK-12: This non-profit provides free online textbooks, and customizable lessons, from students and for teachers in math.

Quizizz- Fun Quizzes for Every Subject: This is a great interactive quiz game where you can have math quizzes and formative assessment & student engagement!

YouTube: Khan Academy, Numberphile and 3Blue1Brown are just a few of the great math-focused channels that offer video lessons as well as explanations.

Digital Math Texts It is convenient to have the PDF or EPUB of one's maths textbooks available with interactive features, quizzes and multimedia in them.

VR/AR Technology: The use of VR environments to create the sense of being ‘in’ a mathematical representation in 3D and real world situations can be used via apps.

When choosing the ICT tool for math class, consider what purpose you have at your age of students and ability of them, and usage environment of technology. These can all contribute to making mathematics learning EASY, dynamic and appropriately challenging to all.

Benefits of Innovative Teaching

There are numerous benefits of innovative teaching which includes:

- It involves creativity and makes learning interesting.
- Through innovative technology methods children can explore the world and fulfill their curiosity.
- Innovative Learning is more engrossing through technology as keeps the children focused versus in the classroom where they may be distracted.
- Makes collaboration easier as students, teachers and parents can communicate effectively.
- Students learn early on as they build technology-based skills.
- Reduces the need of textbooks thus lowering costs incurred by students and schools.
- Faster and more effective delivery of lessons.
- Innovations in teaching besides technology also include areas such as child psychology, learning theories, and different teaching methods. Teachers should also focus on:
- Teaching every child to be innovative thinkers and creative prepares them for the real world.

Even with the numerous benefits of innovative teaching, there are still has some challenges to this teaching strategy.

Challenges to innovative teaching

Schools or teachers who dabble with mathematics will not find it easy to understand new methodologies of teaching. Some of the challenges are:

- The resistance to change: This is both perhaps the biggest of all challenges, with students and teachers resisting change. The spread of pedagogy is difficult, and in some cases there may be resistance to changing how we teach.
- No Resources: Team teaching requires new technology, materials and training, which cost money. But not every school or facility can afford to do so.
- Time: It is difficult for teachers to find time and the willingness to implement new, time-consuming types of teaching.
- Assessment and Accountability: Standardised tests and measurements may not reflect

innovative teaching, making it challenging to evaluate students' actual performance.

- Professional Learning: There might be many teachers who must be trained to use technologies and/or teaching innovations... and this may be in short supply.
- Diversity of Student Population: When you are trying to innovate, one shoe doesn't fit all. If you design one size solution for multiple students it becomes problematic as needs and learning styles vary.
- Administrative Support: This is vital to make cutting edge teaching models work. Lack of support from colleges or facility management has also been a hindrance.
- Classroom Management: Unorthodox styles of pedagogy may require fresh approaches to classroom management, which is often a challenge for teachers skilled in more conventional methods.
- Access and Equity: Not all students or families have equal access to technology and home resources, creating equity issues when implementing pedagogical practices that rely on technology.
- Technology Overload: Whereas technology is a place where we can get ahead of the curve, if we lean too heavily on it other essential elements of teaching will fall by the wayside, things such as making that personal connection with individual students and actually getting our hands dirty with experiences.
- Evaluation & Research: New approaches are frequently assessed and developed as part of the evaluation systems cycle. Some of these techniques can be time consuming to research and experiment with.
- Cultural and Institutional Blocks: there are very few cultural or institutional blocks that prevent schools, institutions to accept "Novel Teaching".
- Teacher burnout: Rapid change in the service of instructional innovation is exhausting, and leads to teacher burnout if not managed thoughtfully.
- Absence of Clear Models: Also for many educators, there's a lack of clear models or best practices to incorporate innovative instruction in their content area or grade level.

- **Sustainability:** It can be hard to keep up innovative teaching practices over the longer term. Some things are no longer cool once they are no longer new.

These creative education problems won't arise when you look for the solution or the way out.

Solutions or way out to the challenges

Creative pedagogies: A few ways forward, a little hard work and some co-operation between teachers, educational institutions and policy makers are required to respond to the demands for creative teaching. Below are some treatment and techniques to help ease the challenges:

Top-Quality Teachers and Other Educators: Not have the best teacher and other educators; support a focus on ongoing professional development to teach educators how to prepare for innovative instruction. There's the useful workshops, training programs and mentorship.

Leadership Support: School leaders must create a culture conducive to experimentation and innovation. Allow teachers the freedom to experiment with new approaches if they wish, and support them.

Flexible curriculum: Develop open and flexible curriculum and learning resources, applicable for various teaching styles to enable educators to easily integrate new practices.

Technology. Simply make sure that students and teachers have the technology and supporting resources they need. This could take the form of funding, equipment or helping to ensure better connectivity.

Inclusion of Students: Do not steal students' ideas as if it was your work. They might also be able to provide input and guidance about what works, and does not in the classroom.

Matching Assessments: Modify the assessments to reflect the new style of instruction. Use valid and authentic assessments that capture the full array of students' abilities and knowledge.

Start with Modest Changes: Your goal is to help teachers make small, "doable" changes in their practice before you begin multiplying them. Experimenting in lower-stakes settings can be a source of confidence.

Community of Practice Hubs: Establish communities of practice centers that allow teachers to collaborate, share best practices and work together on new teaching approaches.

Diversity and Inclusion (Academic Quality): Appreciate the value of diversity, equity, and

inclusion in teaching and learning. Recognize diversity among groups of students and create new options, accessible to and working for all students.

Research and evaluating: "Support research to measure the effectiveness of new forms of teaching." Use data to make decisions and then close the loop by optimizing performance.

Academic Organisation Global Support: The policies and support of universities should reward new ways to teach. Value Innovative Pedagogy in Tenure and Promotion Criteria.

Time: Set aside time and provide teachers assistance to develop and design courses. Cutting down administrative burden may free up more time on innovative teaching.

Mentoring: Create a mentoring program in which veteran teachers mentor and coach their colleagues on transitioning to new practices.

LOD students: Engage students in change by introducing them to new methods of teaching and the impact those may have on quality, expectations and stakeholders' feedback.

External Partnerships: Collaborate with other institutions, organizations and companies to create shared resources and add expertise.

Adaptive Leadership: Adapting to new models of learning in education and be ready to pivot as new problems and solutions arise.

Therefore, by attacking these problems with a combination of such remedies, those that belong to mathematics' teaching community can create a conducive climate simpatico to modern pedagogy thus contributing both themselves and the educational system at large.

Summary

Creative teaching is the foundation of successful mathematical education and gives its practitioners the keys to good teaching: ways to engage students; methods of increasing understanding and critical thinking. However, it is not just memorization but also uses of higher-order thinking, such as application to real-world problems, use of technology, and cooperative learning. The teachers use the smart board, projectors, Teacher Blogs, etc. in a hope to bring a change to teaching and learning by "making complex ideas something students can get more comfortable with". This helps teachers to address different learning styles and keeps the students active, but most importantly, it makes students feel safe trying to solve problems. Ultimately,



an innovative moment in teaching really means a classroom where students learning mathematics of higher value and are learning in ways that encourage them to use math in creative and meaningful ways.

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