

## ***Current Innovations in the Teaching and Learning of Mathematics in Schools***

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### **Abstract**

*Education is a veritable tool for national and global development. Mathematics has been found to be an engine for societal growth and progress, not only to impact computational and numerical skills but to inculcate knowledge, skills, values and a sense of responsibility for building human capitals which drives and sets technological innovations and economic growth. The teaching and learning process of mathematics has however become a subject of discourse due to students' persistent failure in the subject. This paper evaluates the traditional method of teaching mathematics as well as innovative ways of communicating the subject to learners for easy understanding. The use of innovative method of teaching and learning in educational institution has the potential not only to improve education but also to empower people, strengthen governance and galvanize the effort to achieve the human development goal for the country. Several recommendations were made for improvement in order to meet up with global best practices.*

**Keywords:** Innovation, Mathematics, Teaching, Learning, Technology

### **Introduction**

Mathematics teaching and learning process has gradually become a main focus of discourse globally. Societal and educational value placed on mathematics as a subject has made it become imperative that when academic wants to be proven as outstanding, it starts with one's ability to understand and carry out simple computational problems (Zechariah, 1998).

Education is the starting point of every human activity; it is a light that shows mankind the right direction to surge. If education fails to inculcate self-discipline and commitment to achieve in the minds of students, it is not their fault. Education, especially mathematics teaching and learning should be treated like sports including

the learning process in order to generate interest in the students and motivate them to stay back in the institution than to run away from it; it should become fun and thrill to individuals rather than burden and pain.

Mathematics generally is an integral part of human growth and existence. It has existed before creation, thus it does not only impact computational knowledge, skills and value but it is also responsible for organization of self consciousness for building human capitals which breeds, drives and sets technological innovation and economic growth. In today's era, information and knowledge stand out as very important and critical input for growth and survival. This has made the process of communication of mathematics, which will in turn lead to effective teaching and learning, a prime subject of discussion. People seem to be bored with the regular and archaic way of learning mathematics; thus a special need arises for innovative ways of communicating the subject so as to encourage learners to understand the subject and also reduce the level of fear and anxiety that is already attributed to the learning of mathematics.

According to Anyanwu (2002), in a world driven by technology, investing in education would help in building an educated and skilled workforce and to encourage innovation. The greatest innovations we have seen or heard of were made by men and women who have acquired education, formally or informally.

According to the World Bank report, a one-year increase in average tertiary education levels would raise annual GDP growth in Africa by 0.39 percentage points, and eventually yield up to a 12 percent increase in GDP. This therefore means that there is no development without access to and provision of quality education for the people, poor or rich. Most developed nations owe their successes to availability of quality education.

According to UNESCO (2009), there were about 1700 public universities and nearly 2500 private universities (running 4-year and 2-year programs) in the U.S. alone. Meanwhile in the same year, there were around 200 public universities and 468 private higher education institutions on the African continent. Looking at those statistics, one would imagine why a country will have more schools than a continent. Perhaps, there is need to build more schools and spend more on education.

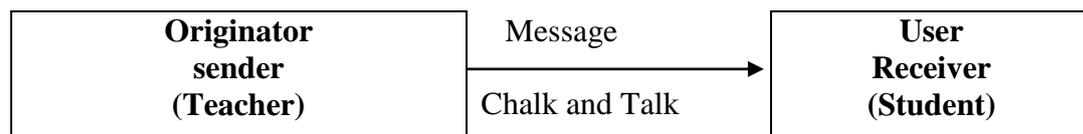
### **Mathematics Teaching and Learning: The Traditional View**

Many people who learned mathematics through the structured or traditional method will undoubtedly find this scene familiar: the teacher comes into the classroom, starts explaining a theorem and writes exercises on the blackboard; the students copy them down, solve innumerable exercises and, finally, time permitting, complete an

example of what they have learned. This scene is not just from the past, but is still being repeated today in many classrooms.

Mathematics teaching and learning in the pre-technological era had a straight down pattern where the teacher is the sender or the source, the subject content is the information or message and the students is the receiver of the information. In terms of the delivery medium, the educator can deliver the message via the “Chalk-and-talk” method and overhead projector (OHP) transparencies. This directed instruction model has its foundations embedded in the behavioural learning perspective; and it is a popular straight down pattern or technique used by mathematics teachers for decades as an educational strategy in many institutions of learning.

However, the teacher in this situation controls the instructional process; the content is delivered to the entire class and the teacher tends to emphasize factual knowledge. In other words, the teacher delivers the lecture contents and the students listen to the lectures. Thus, the learning mode tends to be passive and the learners play little part in their learning process (Orlich, 1998). This traditional method has been found in most learning institutions especially in the universities used by most mathematics teachers and this approach has limited the effectiveness of the teaching and learning process thereby inhibiting assimilation, understanding and application of the content since there is only one-way flow of information.



**Figure 1:** One-way flow of information in a traditional mathematics classroom

This is a straight down one way flow of information practiced for decades and has been found ineffective with the following limitations.

- a) The material presented is only mostly based on the teachers’ prepared lesson note and textbook.
- b) Teaching and learning is concentrated on informative statements rather than a constructive involvement of learners in solution finding.
- c) The teacher knowledge base determines the students’ fate of understanding the subject.
- d) Insufficient student teacher interaction makes the students lose faith in the learning process.
- e) More emphasis is laid on teacher’s prepared mathematics solutions already solved in textbooks rather than practical and real life situations.

- f) Rote memorization is considered more than the students' understanding of content.
- g) Marks are awarded on final answer given by students rather than his/her ability to follow rules and steps in solving the problems.
- h) Mathematical content is narrowed and concise to the teachers knowledge rather than the broad specification by the educational curriculum of what the learners should know.
- i) Assignments and take-home works are encouraged which makes the learners lazy and brings the burden on parents who often times solve the assignments for them in the name of help.

### **Current Trends in Teaching and Learning Mathematics**

Across the world, information technology is the latest and most recent innovative process that has dramatically altered the way students and teachers learn and teach. A notable educationist Confucius said "what I hear I forget; What I see I believe; What I do I understand (Confucius).

Multimedia as a form of information technology is a combination of various digital media types, such as text, images, audio and video, into an integrated multi-sensory interactive application or presentation to convey information to an audience (Daniels, 2002). Traditional educational approaches have resulted in a mismatch between what is taught to the students and what the society and the industrial revolution of the country needs. As such, many institutions are initiating move towards problem-based learning as a solution to a creative, critical and analytical ways to solve problems. Thus, multimedia is emphasized as an innovative teaching and learning strategy in a problem-based learning environment by giving the students ample opportunity to be exposed to better ways of finding solutions to mathematics problems.

Knowledge is no longer an end but a means to creating better problem solvers and encouraging life-long learning. Problem based learning is becoming increasingly popular in education as it addresses the inadequacies of traditional teaching. Since traditional approaches do not encourage students to question what they have learnt or to associate with previously acquired knowledge (Teo & Wong, 2000), problem based learning is seen as an innovative measure to encourage students to learn through real-life problems (Boud & Lletife, 1999).

Multimedia is used to modify the content of the teaching material; it helps the teacher to represent in a more meaningful way, using different media elements. Those media elements can be converted into digital form, modified and customized for the final presentation. By incorporating digital media elements into the project,

the students are able to learn better since there are multiple sensory modalities, which would make them motivated to pay more attention to the information presented and retain the information. Technologies used for creating such multimedia include Adobe Photoshop and Premier to create and edit graphics and video files respectively. Sound Forge and 3D Studio Max are used to create and/or edit sound and animation files respectively. Others include Macromedia Director or Author Ware used to integrate and synchronize all these media elements into one final application as well as add interactive features and package the application into a distributable format for the end user.

Multimedia usage has numerous advantages in the world of teaching and learning of mathematics. Some of these are:

- a) Multimedia encourages learners to participate effectively in class as it stimulates all the human senses, thereby keeping learners alert and alive in class.
- b) Multimedia encourages group work amongst students. Most packages creation and classroom setting cannot be done by only one student, thus group interaction is encouraged.
- c) It brings out in students, talents and skills to work cooperatively and collaboratively.
- d) The student sees himself/herself in the center of the learning process and sees the teacher not as the owner of the knowledge but as a facilitator of the learning process.
- e) By slide shows and video presentation, the learner feels abreast with global standard and can compete favorably with his/her counterparts all over the world.
- f) The students find a sense of independence and satisfaction as he/she is involved in the learning process.

Other innovative tools applied by modern teachers which are improvements on the traditional method of teaching include mind map, teaching with sense of humor, Z to A approach, mnemonics words approach, role playing and scenario analysis based teaching.

Rodrigo (2017) stated that another trend in education is the use of Remote Laboratories, which have overcome the limitations of in-person laboratories, providing a virtual interface, where students can work with real laboratory equipment and observe activities through a computer or mobile device webcam. Moreover, virtual laboratories are web applications that emulate the operation of an in-person laboratory and allow students to practice in a safe environment before using physical components.

At present, students have access to remote experiments conducted in universities in other states and countries, which are carried out with real equipment and managed online. The experience of a remote laboratory allows students to generate significant learning, compared with traditional techniques that use only abstract concepts and equations, without actual hands-on experience with the real phenomena presented.

It is important to note that these changes would not be possible without teacher professionalization. Argentina, for example, has proposed three fundamental areas of professionalization for quality mathematics teachers needed in the new millennium:

**Pedagogical Foundation:** This is necessary since teachers must have scientific knowledge of students' learning and of the current pedagogical methodologies. In other words, just mastering their specific subject is no longer enough.

**Teamwork with colleagues:** This is because sharing activities or working together is important to keep up to date both pedagogically and conceptually in their discipline.

**Classroom quality management:** This is necessary too since the teacher must become a researcher in education, in order to innovate and assess the student learning process. These three pillars will form the basis for streamlining the work achieved by teachers individually and with their colleagues.

## **Conclusion**

If we change the way or method of teaching mathematics, more students would find it easier to learn this subject. In fact, learning and using mathematics develop key skills, including problem solving, which also enhance comprehension in other areas of knowledge, such as science.

Education, the world over has moved from the teachers centered learning to the learners centered learning. Information technology as a tool for effective teaching and learning of mathematics has altered the way traditional method has positioned mathematics learning process, making it uninteresting, un-interactive and one-way. However, internet-ready phones, handheld computers, digital cameras, and mp3 players are revolutionizing the student's life. As the demand for technology continues to rise, students' knowledge base and participation in school activities and classroom programs also rises. Technology has changed the face of classroom learning experience. For instance, in a typical mathematics classroom in New York University, Leonard, the classrooms are wired with cameras for photographing whiteboards, so students can receive the images as digital files. In addition, tablets, personal computers, compact computers that allow students to write notes directly into the screen with a special pen, replaces archaic projector with the tablet

technology allowing professors to make notes on charts and spreadsheets and send them directly to students' personal computers and get feedback from each students (New York University).

From the above, we can conclude that information and communication technology has made many innovations in the field of teaching and learning of mathematics and also makes a drastic change from the old paradigm of teaching and learning making the role of students more important than the teacher, reducing the teacher's role to that of a facilitator. The introduction of multimedia technology has made teaching and learning more interactive and less strenuous.

### **Recommendations**

It is based on the foregoing that this paper recommends the following:

1. Teaching would be more effective if the teacher starts to use the current multimedia technologies like usage of computers extensively or some modifications in the conventional mode of teaching.
2. Adequate provision should be made by government to equip the classrooms to meet the standard of global best practices; this will enhance students' participation in classroom activities.
3. The researchers believe that the core objective of teaching is passing on the information of knowledge to the minds of the students. Any method using computers or modifying the existing conventional chalk-Talk method are innovative if they ultimately serve the attainment of core objective of teaching.

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