

Chapter 12

Innovative Methods/Techniques for Teaching Science, Technology and Mathematics Education

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Learning Objectives

At the end of this chapter, readers should be able to learn the following:

- The differences between innovative teaching methods and teaching techniques;
- The concept of traditional classroom;
- The needs for innovative teaching in science, technology and mathematics;
- The innovative teaching methods for teaching science, technology and mathematics;
- Managing science, technology and mathematics classroom through innovative teaching tools.

Introduction

According to Zaria (2002), teaching is “an effort to help someone obtain or modify some skill, mind-set, knowledge, ideas or appreciation. The main intend of teaching is to bring about the preferred behavioural change in the person. In a general term teaching is defined as a process of imparting or giving knowledge or skill which involves educational activity concerning transmission of knowledge from one person to others (www.sfu.ca). Teaching can be believed to have taken place when a substantial desired change or changes are seen in the learner (Zaria, 2002).

Teaching method and technique are mutually existing terminologies used to describe the pattern which the teacher adopted to enhance effective communication. In particular, teaching method means the way and manner

instructional material, content and approach are organized including activities of both learners and the teacher. Teaching method according to Asuquo (2005), is the professional technique which the teacher adopts in his instructional exercise to enable him to impart the necessary knowledge and skills to his students. In contrast, having in mind the aims and objectives of what is to be taught, teaching technique is a channel of communication or procedure followed to impart knowledge, ideas, skills and values. This is way Obodo (1990) is of the opinion that any approach or process which a teacher adopts to elucidate subject content to a learner is called teaching or instructional technique. Regarding teaching method, Asuquo (2005) has it that "method" refers to the approach by which the teacher meets the learner at his level, starting with his interest and his problems and then establishing conditions that enable him to proceed to his set goals in the most possible and efficient manner. Thus in this perspective, teaching method is seen as an interactive procedure, which the teacher employ in a classroom to impart science, technology and mathematics education concepts.

Gottlieb (2016) stated that science is a logical activity carried out by humans with the intention of discovering information about the natural world in which they live and to find out the ways in which this information can be structured into meaningful patterns through collection of data. Science education is a systematic study or knowledge of the physical or material world gained through observation and experiment. Technology education implies any form of education in technology at any level of the Nigeria education system (Federal Ministry of Education .(FME), 2003). The government of Nigeria for the purpose of functional and administrative differentiation has classified technology education to include four separate categories and levels, thus:

- (i) general vocational education or pre-vocational education which is given in secondary schools, aimed at producing manpower as semi-skilled for particular occupation or advanced formal education;
- (ii) (ii) vocational training, given in technical colleges and vocational centers objectively for producing craftsmen and master craftsmen (low level manpower);
- (iii) (iii) technical training gotten from polytechnics/monotechnics to train technicians/technologists (middle-level manpower); and
- (iv) professional training given in the universities for the purpose of producing professionals (high-level manpower) (FME, 2003).

Mathematics education is the study of science that deals with the logic of shape, quantity and arrangement or the abstract science of number, quantity, and space, either as abstract concepts (pure mathematics) or as applied to other discipline such as physics and engineering (applied mathematics). Mathematics seeks out patterns and uses them to formulate new conjectures. It resolves the truth or falsity of conjecture by mathematical proof (Live Science, 2013).

Science education” and “technology education” are two separate realms of study but mostly recognised in Nigeria’s economy system as existing mutually together. Science and technology education is a research and occupational based study in science and technology that prepares the individual to fit into a known science or technological occupation in practice (FME, 2003 and Federal Government of Nigeria (FGN), 2004). As evidenced in the Federal Ministry of Education (FME) Sector Report (2003) and National Policy on Education Document (FGN, 2004), the main aim of science and technology education is to provide all types and levels of science and technological manpower required by the economy in order to meet up with the nation’s industrial and economy needs through research. In this regard Mehryar (2015) observed that the method of teaching science, technology and mathematics should be such that must involve students in inquiry-oriented investigations for the purpose of promoting interaction with their teachers and peers. He further stated that students establishing connection between their current knowledge of science, technology and mathematics and the world around them for optimum performance requires an interactive teaching technique such that will engage the students in problem solving, planning/decision making; using tools to gather, *Analyse* and interpret data; group discussion; self-spaced learning; apply science, technology and mathematics content to new questions; experiencing assessments that are consistent with an active approach to learning.

In spite of the several efforts to make science, technology and mathematics education effective and attractive to students, there are many problems facing science, technology and mathematics teaching and learning process amongst which is the teaching method often used by the teachers and issues related to practical activities and lack of infrastructure. Farahnaz (2011) in this light noted that lack of infrastructures in schools has compelled teachers to just stick to the traditional way of teaching. In similar vein Irvani and Delfechresh (2011) as well as Abdulwaheed, Jaworski and Crawford (2012) affirmed that the traditional teaching method is prevailing in teaching Science, technology and mathematics education in schools. The traditional teaching method is noted to

be problematic in terms of transfer of knowledge and idea because it is observed to non-interactive way of teaching that hinders students understanding of science, technology and mathematics (Abdulwaheed, Jaworski & Crawford, 2012). They further explained that the traditional approach of teaching is predominantly theoretical and does not address the needs of most students as they take on passive role of listening while the teacher monopolizes the class with talk and sometimes uses the chalk and the board to explain.

In recent times there have been calls for reforming teaching approach of science, technology and mathematics by taking into consideration more innovative pedagogical approaches rooted in constructivist theory, to promote students' conceptual understanding rather than maintain the traditional approach found to hinder learning. Thus, it calls for a need to conceive ideas that will bring about change in the teaching of science, technology and mathematics. Exploring these new ideas or alternative methods or techniques of teaching results in what is known as "innovative technique of teaching.

The interactive pedagogical approach rooted in constructivist theory which paradigm has been significantly influenced by cognitivism is referred to "innovative technique of teaching. The essence of the innovative method of teaching is to yield higher benefits in schools and lead to greater understanding of science, technology and mathematics concepts on the part of the students (Farahnaz, 2011). Specifically, Ndahi (2006) noted that innovative teaching embeds interactive technologies that provide new opportunities and strategies that ease meeting the objectives of providing science, technology and mathematics to all in the society. The innovative method of teaching are strategies initiated and aimed at replacing the conventional form of teaching and inactive learning towards a greater focus on learners centred approach where students are involved to fully participate in learning. This method has been found to benefit not only the students but the teachers and the school at larger sense.

As it concerns the students, innovative method of teaching is found to have transformed the engagement levels of students and has created a greatly enhanced learning experience. Through the use of video, students view as real life scenario making them more alert, motivated and focused on topics in hand thus enhancing connection between visual content and memory knowledge resulting to greater retention of new information (BBC Active, 2010). To the teacher, the application of multimedia components helps the teacher to incorporate sounds, graphics and video into an existing presentation, less time is

therefore invested and reduces the rate of teachers' talking and the stress it takes in explaining the abstract nature and complexity in science, technology and mathematics concepts (Ajunwa, 2014). On the part of the school, a situation where the traditional lecture represents the stereotypical image of an auditorium full of students focusing on a teacher causes the school administration to desire for more infrastructures that will accommodate as much number of such. But with newer innovations in teaching much lesser infrastructure are required since systems such as the cloud computing can provide alternative method to reach prospective students in their locality. Thus cost required to provide infrastructure and other educational materials is minimized. Also since this system has helped to reach learners within their locality distance learning is enhanced.

Undoubtedly, innovative method of teaching when properly applied has greatly helped ease the passive role the students assume in traditional approach of teaching and its dominance by theory. With innovative methods of teaching, science, technology and mathematics, students become highly engaged in class activities through interactive elements or features of innovative teaching such as educational videos, media elements that incorporates sound and video and at the same time provides a question and answer section hence encourages group discussion and self-spaced learning. Such innovations are found to be of benefit also to the teacher in terms of ease to lesson presentation and to the school at large as huge finance budgeting for procuring infrastructure and other instructional materials is minimized.

The Traditional Classroom: Overview

The traditional classroom as explained by Donnelly (2014) is a classroom system organized such that the students sit in rows with the teacher at the front of the room, directing learning and also required to ensuring a disciplined environment. This method of teaching was prevalent in the 1960s. In this system the teacher is the sender, learning or educational materials that the teachers directs is the message while the students whom are committed to the message is the receiver. The instrument or medium which the teacher uses in the delivery of his or her message is the chalk board and talk (Damodharan and Rengarajan, 2016). He further stated that the teacher in this system controls the entire instructional process, delivers the class content to the entire class as he tends to emphasize mostly on factual knowledge. This implies that, the teacher delivers the message (lecture content) and the students sit and listen to the lecture with little or no contribution. Raj (2009) noted that since the students

just sit and listen to the teacher's lecture content, they are regarded as passive listeners. In this regard available evidences and as noted by Damodharan and Rengarajan (2016) shows that the traditional teaching of mathematics, science and technology approach in the classroom is of limited effectiveness in both teaching and learning. In such a classroom, students assume purely passive role which is found by Raj (2009) to hinder learning since students concentrations is generally established to fade off after a time duration of 15-20 minutes into the teaching time. Specifically, Damodharan and Rengarajan (2016) gave some limitations which may prevail in the traditional teaching method that hinders learning of mathematics, science and technology concepts to include:

1. Teaching in classroom using chalk and talk is "one way flow" of information;
2. Teacher often continuously talk for 40 to 80 minutes without knowing students response and feedback;
3. Insufficient teacher interaction with the students in the classroom;
4. More emphasis is given on theory without any practical real life time situations;
5. Learning is often from memorization but into understanding;
6. Marks rather than result oriented;
7. For some of these reasons passive learning is criticized since little or no time is left for discussion and dialogue among students themselves or with the teacher, as the case maybe. In this regard much is therefore deserved of interactive teaching approach of science, technology and mathematics.

Need for Innovative Teaching in Science, Technology and Mathematics

Science, technology and mathematics teaching in schools all over the world more so in Nigeria has long embraced the traditional, non-interactive ways of teaching approach (Balasubramanian, Wilson & Cios, 2016 and Damodharan and Rengarajan, 2016). Patel (2016) observed that though science, technology and mathematics, in particular, being so important subjects and occupying a central position since the ancient days have not been the interest of many students because wide gaps are found between aspiration and achievement. These subjects are abstract, concerned with ideas rather than object which until lower level concepts are mastered, higher level concepts cannot be understood. Students who discover some of these structures are often impressed by their beauty. They note the lack of concentration and appreciate and see how new

concepts or techniques can be derived from the ones that have already been learned (Patel, 2016).

The traditional teaching approach which places more emphasis on speech and texts as the teacher directs the class, gives science, technology and mathematics rules to students, and having them simply to memorize. Patel (2016) noted that the teacher often justifies this method by saying that students would not understand explanations. Hence the aim of helping students understand the cause and effect of science, technology and mathematics phenomenal is defeated. Death of the accumulated knowledge over century meant to be given the students is inevitable.

In another circumstance Damodharan and Rengarajan (2016) noted that the domination of the traditional teaching approach by theory does not address the learning needs of most students because in trying to explain the abstract science, technology and mathematics concepts often lead to series of explanations and the process of students trying to slowly grasp such concepts creates gap between the explanations transmitted by the teacher and time of receive which lead to poor understanding on the part of the students. Consequently most students rather than embrace science, technology and mathematics develop fear of the subject. Amidst these challenges, one is not ignorant of multitude of other responsibilities that the schools have, including teaching the students; observation, thinking, reasoning, communication, attitude and problem solving skills. Overcoming these challenges and rather than base knowledge on memorization known to be associated with the traditional teaching method as noted by Damodharan and Rengarajan (2016) is innovative teaching method known to develop student's conceptual understanding and analytical abilities through doing authentic science, technology and mathematics-based guided inquiry hands-on activities enhanced teaching approach which improves students' self-worth, confidence resulting to high academic achievement. Innovative teaching of science, technology and mathematics, helps students easily fulfil these responsibilities because students can effectively apply or relate the knowledge and skills learned in their academic subjects to solve practical problems in their science, technology and mathematics classes.

Innovative methods for teaching science, technology and mathematics

Learning should not be based on mere memorization of information or concepts for immediate utilization but should be an activity that results in a life lasting experience that will help students to reach their full potentials necessary to meet

the educational needs or goal of the new generation. Memorization, which is known to associate with the traditional teaching method hampers learning as most students base learning for immediate application. In this vein, advances have been made in teaching approaches such as online tools that can be used in innovative manner for enhancing students' learning experiences in science, technology and mathematics. Such teaching approaches are designed for enabling students' autonomy in the learning process. Innovative teaching when properly applied provides support for science, technology and mathematics teaching-learning process. MyMathLab and ALEKS for instance enables teachers to design a customizable e-learning modules that contain many useful features, such as interactive assignment exercises with guided solutions, personalized study plan, multimedia aids including videos and animation lessons (Abdulwaheed, Jaworski & Crawford, 2012). The design may include assessment managers for editing tests and quizzes, and a grade book that automatically tracks students' results.

As enumerated by Northern Arizona (2016) innovative classroom, teaching-learning system utilized in the teaching of science, technology and mathematics course that enhances students centred learning are known to encompass some of the following features;

Blended teaching method

Blended teaching method is a form of instruction that incorporates both traditional face-to-face instructions with web-based multimedia. Blended instructional method is an instructional model that combines the best of teacher-led instruction with the smart use of technology (Izone, 2015). Particularly, Farahnaz (2011) defined blended learning as a coherent design approach that openly assesses and integrates the strengths of face-to-face and online learning to address worthwhile educational goals. He further noted that blended learning as an instructional process is the integration of some of the conveniences of online learning with the traditional face-to-face instruction in the teaching and learning of science, technology and mathematics process.

In using computer based technologies and web based course delivery, science, technology and mathematics teachers use the hybrid model to redesign their lessons or lab content into new online learning activities, such as tutorials, self-testing exercises, simulations, and online group collaborations. In this system, learning systematically incorporates the use of asynchronous teaching

(facilitated by computer based technologies) into the traditional teaching in order to maximize both teaching and learning opportunities.

With blended teaching method, science, technology and mathematics teacher is able to provide some content delivery to students when and where it meets the student's needs. Through the web connection the students are able to access their lessons via school computers or a personal system at set times before, during, or after the lesson period. The interesting aspect about the blended learning is the time it offers classroom teachers to engage their students in classroom discussion, labs, or even project based or problem based assignments (Hinkhouse, 2013). The teacher can then act as the guide on the side helping students with misunderstandings and the applications of concepts. For optimum benefit, a blended learning system should include a committed, sustained, and well thought-out implementation plan, combining appropriate technology with traditional classroom interaction so as to lead to better outcome for students.

Cloud computing instructional method

Cloud learning is a system that involves learning with computer via the internet. As explained by Jou & Wang (2013) and Tablets for Schools (2014) is a process whereby files created are stored in the cloud rather than on the computer where the files were originally created. Through remote server, such files, programme, software or data stored can be accessed by any network client device (i.e a tablet) through a browser or application. Unlike the traditional classroom where students sit and listen to the teacher as the lesson is presented, learning through the cloud allows students access to lessons or lesson materials through secure or public network connections (Woodford, 2015)

Misevicent, Budnikas & Danut (2011) and Sourya (2011) explains that the purpose of cloud learning is to enable the students assess study material and/or participate in distance lectures in organized classroom settings or in their individual study places. The benefits of cloud teaching-learning of science, technology and mathematics are enormous and can never be over emphasised. Staines (2013) opined that the flexibility of learning through the cloud has the interest of all and MultTrend (2013), Staines (2013) and Tablets for Schools (2014) enumerate some of the benefits to include; helping to remove barriers to learning by enabling ease and speed of accessing lecture materials and supporting learning materials leading to increased engagement and collaboration, and hence, students are able to continue schoolwork at individual convenience at home thereby bridging the gap between school learning and

home study. Also the mobility and flexibility of cloud learning leads to greater student-teacher collaboration and engagement learning in the sense that with the help of the cloud data or information, system sharing becomes easy and more mobile rather than the traditional system where the learner must wait for normal lesson hours in the classroom.

Computer aided instructional method

In computer aided instruction (CAI) learning takes place through interactive teaching method in which instructional materials are presented and monitored with the aid of a computer.

The CAI as an instructional approach facilitates the use of a computer to transmit some definite aspects of learning (Soe, Stan and Chang, 2012). In this system, the flow of information is basically from the computer to the students. The CAI is a wide and swiftly growing field of computer technologies that aid the teaching and learning process. Information that encourages interaction can be presented on computers in the form of text or in multimedia format which include photographs, videos, animations, speech and music.

CAI can dramatically increase students' access to information. The programme can adapt to the abilities and preferences of the individual students and increase the amount of personalized instruction a student receives. Many students benefit from the immediate responsiveness of computer interactions and appreciate the self-paced and private learning environment. Moreover, computer learning experiences often engage the interest of students, motivating them to learn and increasing independence and personal responsibility for education.

Types of Computer Aided Instruction:

Drill-and-practice: Drill and practice is offline or online instructional package that is designed such that it provides students the opportunities to repeatedly practice the skills that have previously been presented to them in the classroom. Drill and practice CIA type is essential because it gives the students opportunity for further practice of what is being taught during regular class time for mastery.

Tutorial: Tutorial is a self-paced CAI instructional programme that provides steps by step information in presenting science, technology and mathematics concept or learning unit. CAI tutorials use interactive methods such as hyperlinks, audio and visual presentation of subject matter, and provide feedback through questions-answer exercises.

Simulation: Simulation is a software that provides an approximation of reality that does not require the expense of real life or its risks. It is the imitation of the operation of a real-world process or system over time (Banks, Carson, Nelson & Nicol, 2001). The act of simulating something or concept first requires that a model of that concept be developed. This model represents the key characteristics or behaviours or functions of the selected physical or abstract system or process. The developed model represents the system itself, whereas the simulation represents the operation of the system over time. Simulation is applicable in several contexts. For instance, when used in the context of technology it is referred to as simulation of technology.

Discovery: discovery approach provides a large database of information specific to science, technology and mathematics area using the computer and challenges the learner to analyse, compare, infer and evaluate based on their explorations of the concept or content area.

Computer supported-collaborative instructional method

This teaching method is synonymous with the traditional collaborative teaching method in which the instructor permits learners to come together under his close supervision thereby allowing the learners to discuss and listen to all points of view in the interaction. The Computer supported-collaborative instructional method is a collaborative concept of teaching that brings together the collaborative teaching to terminology; e-learning and networked collaborative learning (Trentin, 2010). This teaching method uses instructional method designed to encourage or require students to work together on science, technology and mathematics tasks by employing technology via the web or networked collaborative learning, allowing social learning. Through the web advances, sharing information between multiple people in a network has become much easier and the use has increased. One of the benefits of the computer supported-collaborative instructional method is that it provides breeding ground for creative and engaging educational endeavours (Trentin, 2010).

The computer-supported collaborative instructional method differs from the old system collaborative method in which the instructor is the principal source of knowledge and skills. In contrast to the linear delivery of content, often directly from the instructor's material, the computer-supported collaborative method uses social software such as blogs, social media, wikis, cloud base document portals such as Google Docs and Dropbox. 74. This instructional method has

been used to foster online learning communities through computer-supported collaborative app that allow students and teacher to interact while studying. MathChat, for instance, allows cooperative problem solving and feedback. Some apps can also provide an opportunity to revise or learn new topics independently in a simulated classroom environment such as Khan Academy. The Khan Academy offers visual and auditory learning materials in mathematics, biology, chemistry as well as exercises and tasks to solve for the kinesthetic learners. With the computer-supported instructional method, learners in one school can communicate and share experiences with learners in another school. When experience is enjoyable, the students become more engaged; progression is therefore encouraged which in turn helps keep students motivated and consistent while trying to improve (Redecker, 2009).

Innovative techniques for teaching science, technology and mathematics

A teaching technique refers to the procedure of communication adopted to impart ideas, knowledge and skills, taking into account the aims and objectives of what is to be learned. According to Obodo (1990), any move or procedure followed by a teacher towards explaining the subject content to a learner is termed teaching or instructional technique. The following are some innovative techniques of teaching:

Flipped classroom

With the ramping awareness of innovative teaching, interest has been increasingly drawn to this teaching approach. In order to maximize the benefit of innovative teaching methods to students and teachers, flipped classroom is necessary. Un-interchangeable term that often associates with a flipped classroom is the flipped learning. The flipped learning is a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space and the resulting group space is transformed into a dynamic, interactive learning environment where the teacher guides students as they apply concepts and engage creativity in science, technology and mathematics (class content) (FLIP, 2016). Talbert (2016) explains that the flipped classroom describes a logistical arrangement, how and when the initial information is encountered by students and the activities scheduled to happen in class. Flipped learning focuses on the processes that students engage in and the outcomes they strive towards within that logistical framework (Talbert, 2014).

In the traditional classroom content it is delivered by direct contact with students in classroom arrangement. Students with homework are required to

solve such problems at home with no help at hand if they get stuck. However, by flip classroom, the pedagogy is inverted, such that students get the content at home and come to class to have concepts reinforced before working on problems for much of the class period (Northern Arizona, 2016). It is in this regard that Institute for Teaching and Learning Innovation (2016) refer to flipped classroom as describing the reversal of traditional teaching where students gain first exposure to new material outside of class, usually via lecture videos, and then class time is used to do the harder work of assimilating that knowledge through strategies such as problem-solving, discussion or debate.

This approach is known to guarantee student engagement as it focuses on students' concept exploration, meaning making and demonstration with more opportunities for discussion, formative assessment and feedback (Institute for Teaching and Learning Innovation, 2016). With teachers' assistance available, there is efficiency in the time spent on learning.

The flipped classroom provides the following learning opportunities (Institute for Teaching and Learning Innovation, 2016):

Capture content: This provides for students through the web-based technology to access at their own convenience and to suit their pace of learning such as science, technology and mathematics lecture materials, reading, interactive multimedia.

Curate content: This provides a platform for students to selectively gather relevant science, technology and mathematics resources for their own consumption.

Present learning materials: This opportunity enables classroom presentation of science, technology and mathematics in a variety of formats to suit different students learning style. This includes the use of video, audio, text and multimedia.

Provide opportunities for discourse: With this teaching approach, student-teacher, student-student (or otherwise) interaction is easily enabled in or/and out of classroom with the aid of polling tools, discussion tools, content creation tools.

Convey timely information: Updates and reminders for students are easily conveyed. It provide immediate and anonymous feedback regarding students learning response.

Capture data: Data concerning students required to analyse their science, technology and mathematics academic progress for their counseling needs is easily possible.

Interactive note taking teaching technique

In most traditional science, technology and mathematics classrooms, as a general religion of the traditional teaching approach, the teacher writes notes, points of concepts and examples on the board while the students copy literally everything down as presented by the teacher. In the copying process, it has been established that many do not try to comprehend what has been said as the teacher presents the lesson while others who attempt to do so are not successful. As a result Northern Arizona (2016) noted that the end product is another version of textbook, this time, in the handwriting of the student.

Innovative teaching presents students an interactive opportunity that allows the students to take their notes even as the lecture progresses. Interactive note taking is a process in which the teacher directs students through the note taking process (<http://goalbookapp.com>, 2016). The teacher in this case may use specific note taking template such as Cornell note taking, t-chats or other graphics organizers. With this modelling system, students are given the opportunity to read science, technology and mathematics document, listen or watch the lecture as the case maybe. As students are engaged in these activities as lecture progresses, the teacher, by recording the main ideas, models how to take notes as he begins with a skeleton of the class notes in the form of a workbook. The students then add to this skeleton during class, adding missing details and their own notes to what is already there. This allows students greater engagement with the material during class, a greater chance of comprehending the material being taught and an alternative to the text in which they have a degree of ownership.

Managing science, technology and mathematics classroom through Innovative Teaching Tools

The goal of every teacher is taking total control of the instructional processes, content delivery with the aim of effective classroom management that will result in getting every student's attention. As known, the traditional approach often employed in teaching science, technology and mathematics has limited effectiveness in both teaching and learning as students assume purely passive roles. In such system, available evidence confirms that majority of student's

concentration fade after minimum to maximum time of 15 – 20 minutes of every lesson after which boredom sets in. The desire of the teacher who employs this teaching method is to get the concentration of every student as the class lasts.

However, brain research as noted by Abudulwaheed, Jaworski & Crawford (2012) has shown that certain methods or approaches to teaching science, technology and mathematics are found to reasonably enhance students' concentration by removing the boredom that results in the process of students slowly trying to grasp concepts during memorization as associate of traditional classroom. Applying innovative methods, students' concentration is significantly increased through its interactive elements. The interactive elements of innovative teaching engage the interest of the students thereby removing the demand the traditional classroom places on the brain trying to grasp concepts since innovative tools allow the students to visualize as if in real life, hence, the desire to learn more brings the class naturally to control. Below are some of the elements of the innovative teaching methods that help in managing the classroom:

Video

Video is the technology of capturing recording, processing, transmitting and reconstructing moving pictures, electronic signals or digital media primarily for viewing on television or computer. It enables concepts to be captured either in moving or still format and viewed through the television or a computer (Atsumbe, Raymond, Umar and Ajunwa, 2014).

The video is an innovative element which use has transformed the engagement levels of students and has created a greatly enhanced learning experiences (BBC Active, 2010). Through the use of video in the classroom, students are noted to be more alert, motivated and focused on the topic of discussion. Evidences available from research shows there are connections between visual content, memory knowledge and students' ability to retain new information (BBC Active, 2010). Watching videotaped lessons, transports the students into the world of the topic under discussion, with expert interviews or demonstrations to bring the topic to life. Students also gain insights relating to skills needed for interviews and benefit from enhanced team working and communication skills (BBC Active, 2010).

Sound

Sound can be described as the vibrations that travel through air and can be heard by human (<http://learningtechnology.wikispaces.com/>, 2012). Sound is used to provide emphasis or highlight a transition from one page to another (Atsumbe, Raymond, Umar and Ajunwa, 2014).

Sound synchronised to screen display, enables teacher to present science, technology and mathematics information at once. Asthana (2012) observed that this approach is used in a variety of ways, all based on visual display of a complex image paired with a spoken explanation.

Animation

Animation concept is a key component of multimedia. This is the collection of independent picture together through a computer to form a continuous motion (Kylie, 2012). Animation is used to show changes in state over time and with science, technology and mathematics education courses, information can be presented gradually to learners so they could have time to absorb it in smaller chunks. Animation, if combined with user input enables students to view diverse versions of change in such information over time based on variables.

Graphics

“Graphics present the main creative possibilities for a technology learning session. They can be photographs, drawings, graphs from a spreadsheet, picture from CD-ROM, or internet or hand drawing work incorporated through the scanner. The capability of recognition memory for picture is almost limitless” (Atsumbe, Raymond, Umar and Ajunwa, 2014). The reason for this is that images make use of a massive range of certain skills: color, form, line, dimension, texture, visual rhythm and especially imagination (Asthana, 2012).

Conclusion/Recommendation

Available and emerging evidences from this study shows that innovative teaching plays a vital role in teaching-learning of science, technology and mathematics. Amongst others, it is established that innovative teaching method and technique is known to arose students' learning interest as it encourages students to take responsibility of their individual learning needs through its interactive features which enable the students to learn at their own pace irrespective of lecture times unlike the traditional classroom where students who are left behind make do with the amount of information they can get from colleagues. Innovative teaching enables students to think critically and apply

experiences gathered to attain academic excellence since they can view real scenario.

Regardless of discipline, it has been established that innovative teaching benefits not only the students but also teachers and the school at large. This teaching approach helps the teacher incorporate sounds, graphics and video in an existing presentation hence reducing the stress it takes in explaining an abstract nature and complexity in science, technology and mathematics. To school administration, the finances required for infrastructure and instructional technology is minimized since explanation of concepts, ideas that need instructional material can be animated, simulated or presented in graphics. This enhances students achievement and efficiency in classroom teacher-student-students activity or otherwise.

The following is therefore recommended:

- Science, technology and mathematics classrooms, laboratories and workshops should be innovated to serve as effective tools to motivate students to become more active learners.
- Science, technology and mathematics teachers should be encouraged and equipped with necessary skills required to adopt innovative teaching approach through seminars and workshops.
- School administrators should channel the huge finance often budgeted for the purchase of instructional materials and equipment to provision of innovative classroom.

Exercises

1. Distinguish between innovative teaching methods and traditional teaching techniques, supporting your answer with live examples.
2. What do you understand by traditional classroom?
3. Explain the needs for innovative teaching in science, technology and mathematics.
4. The importance of innovative teaching methods for the teaching of science, technology and mathematics cannot be overemphasized. Discuss.
5. Highlight the concept of managing science, technology and mathematics classroom through innovative teaching tools.

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