

# EFFECTIVE USE OF TEACHING METHODOLOGIES IN SCIENCE, TECHNOLOGY AND MATHEMATICS IN NIGERIANS' CLASSROOMS

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## ABSTRACT

The performance of Nigerian students' in Science, Technology and Mathematics (STM) is disheartening and appalling due to ineffective teaching methodology. This paper thus focuses on the effective use of Teaching Methodologies in science, Technology and Mathematics to enhance students' learning outcomes. It x-rays the various teaching methodologies used by Instructors in Science, Technology and Mathematics classrooms that could be of significant impact on students' academic performances. It highpoints the components of effective teaching methodology as one that take cognizant of learners abilities, hands-on-mind-on, heuristic active teaching, It concludes that teaching STM in Nigeria classrooms can be enhanced the more if the teacher adopts the active learning, critical thinking, creativity and innovations as elements of good teaching and this can be achieved via effective use of teaching methodologies in Science, Technology and Mathematics. It thus recommends that Government and Non-Governmental Organization should collaborate with teachers towards making materials available for effective and pragmatic STM teachin and learning,

**Keywords:** *Effective Teaching, Methodologies, Science, Technology, Mathematics*

## Introduction

Teaching and learning in Nigerians' classrooms has been appalling and disheartening over the past decade as many Nigerian primary pupils lack numeracy and literacy which is the main cause of such level of education, the secondary students are grossly inadequately prepared for tertiary education as many are unrefined and dross when it comes to scientific, technological and mathematical skills and knowledge which invariably impaired and hampered their effective as well as efficient tertiary education leading to half-baked and incompetent man-power production in the nation. Meanwhile, the same poorly tutored man-power will handle all the national production processes; what do we expect of such incompetent man-power if not inefficient products and the cycle continues in a vicious pattern of poor input, poor output arrangement. How can the vicious cycle of poor teaching and learning be broken in Nigerian's classrooms? What is the right intervention to input quality or sustainability into the teaching and learning at all levels of education in the country? Shall we send for experts from western world or call on educational emissaries from neighboring African nations for our aid?

The issue is endemic, the recurrent utilization of ineffective and inefficient teaching methodologies, the so called conventional strategies is the cod in the wheel of educational progress in Nigeria (Okebukola, 2007, 2013; Obanya, 2010; Adedibu ,Olagunju, Bolaji & Adesina, 2013; Adebisi, 2019; Ige & Oke, 2019).

To start with what is teaching?

## Teaching

The teaching process in Nigerians' classrooms are too didactic, non-heuristic, unpragmatic and too theoretical leaving the learners at the mercy of cramming, pouring and regurgitation of scientific, mathematics and technological facts, concepts, hypotheses, theories and laws without a corresponding practical skills which tran the mind and the hands for productive activities. Teaching is a process of imparting knowledge, skills, understanding, aspiration, aptitude and competency in an individual using appropriate strategies or teaching methods. It entails somebody more knowledgeable, skillful and efficient trying to influence the less experienced ones to change in knowledge, skills or attitude. Moronkola and Adegoke (2013) perceived teaching as a personality task that is both an art and science of guiding and inspiring learners through appropriate teaching methods

and materials that takes into consideration peculiarity of each learner (in terms of needs, interest, age, socio-cultural background etc.) in a conducive learning environment to make them critical thinkers, problem solvers and have inquiry minds to make their world a better place. The authors affirmed that teaching can be effective by: Making the learners' hands and brain to be adequately engaged in teaching - learning process; Enthusiasm of the teacher to the teaching tasks and materials, making it fun, interesting, wanting to learn more and laying solid foundation for complex learning in the future; Interconnecting what is learned in a topic to what other subjects topics have to present in the school; Integrating science, mathematics and its products (technology) with other learning areas to demonstrate the usable and practicable science of teaching; Teachers being facilitators of learning opportunities where learners are guided to be a discoverer for selves uniqueness of what they are learning and why it is important to learn the content for sustainable development of their community; Putting their emotion under control especially when dealing with exceptional students that are difficult to facilitate their learning; Teachers being sound academically, prepare their lessons ahead of teaching period, well dressed, effective

manager of their classes, firm but flexible, discipline and not punish, read, prompt learners to excel, give appropriate incentives to motivate learners and current with world and national events especially one relating to their subjects and current events attracting young people attention.

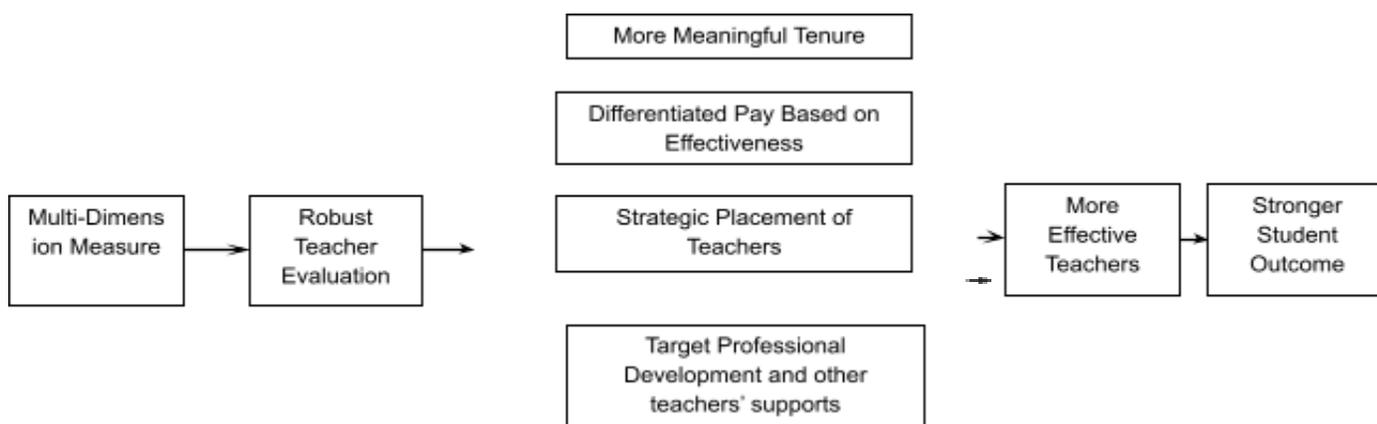
For effective teaching to be enhanced in science, mathematics and technology, Salami (2013) posited the qualities of effective and creative teaching that the teacher always start from where the students are, recognizing that pupils learn at different rates and in different ways, allow learners to reflect on their own thinking and learning, involving learners actively in their own learning process through the use of group discussion, guided inquiry technique, projectile and problem solving activities; encouraging learners to use their imagination; conveying wholeness of the learning experience. Teacher should recognize the importance of risk for teachers and learners; using varieties of teaching methods, making use of available and appropriate technology e.g. projector, computer, recognizing that the school is not an isolated learning environment and as such, learners can make use of excursion, homework, visit local community, markets,

hospitals (making learning outside the school environment); using a range of assessment procedures to constantly monitor the effectiveness of learning and teaching. Teacher ought to be slightly firm (not too lenient nor too strict), explain things clearly; having a sense of human and not sarcastic; enthusiastic and stimulating, showing interest in the learners; employ language clearly and efficiently; well involved and comfortable with knowledge frontiers in their discipline and should always give periodic feedback so that students can know how well they are doing and what they need to improve upon.

Akinsolu (2013) in Adesina and Adesina (2017), provided a pathway to effective teaching through school management. It entails the teacher effectively interacting with the learners

over sufficient time period and receives payment reward based on the teaching efficiency; likewise, place teachers based on their performance and support their professional development. When effective, teaching is carried out, using robust evaluation, it produces stronger students' outcome with efficient cognitive, affective and psychomotor skills that anticipate the attainment of science, mathematics and technology goals. Adedibu, 2009 says theoretical teaching in STM must be minimal and more effort be placed on practicals

The model in Figure 1 shows the multidimensional nature of teacher evaluation, relating to effective teaching, efficient learning and effective students' outcomes in science, mathematics and technology.



**Fig.1:** A Pathway to Effective Teaching and Learning science, mathematics and technology

**Source:** Adapted from Akinsolu (2013) in Adesina and Adesina (2017).

Figure 1 succinctly put effective teaching as being multidimensional, with appropriate teaching contents, objectives (goals), methodology and robust teacher evaluation. It identified that teaching should allow more meaningful tenure, differentiated payment of teachers based on effectiveness, strategic placement of teachers, targeted professional development and other teachers' supports to produce more effective teachers and stronger students' outcome. It means that effective teaching is a sine-qua-none to meaningful learning (stronger student outcome) which dovetail to functional education that instill in the recipient the pragmatic use of the hand, the mind, the brain and all other parts of the body in order to be self-reliant and self-sustaining. The aggregate of sustained individuals through efficient teaching, learning and education culminates into the overall SDGs attainment. For teaching content to achieve its predetermined objectives, Olagunju and Ige (2013) pointed nine different methods teaching can proceed; viz: laboratory/investigative method, discovery/guided inquiry, projects, field trips, demonstration, individualized, problem-solving, case studies and assignment methods. In all the

enunciated methods, the duo identified the common trends as teacher set cognitive, affective and psycho-motor based behavioural objectives for the learning contents, select relevant instructional materials and texts to attain the set objectives; map-out different activities for the students, either individually or in groups; plan the instructions into skills and techniques; organize discussion debates, quizzes and illustrations and examples for teaching – learning process; give students assignment and projects to clarify topic difficulties in order to encourage students' exploration of new knowledge and skills. Apart from the above identified methods, Adu (2013) added game and simulated strategy, dramatization, role-play, resource person, concept mapping, erudition indenture, mentorship and enter-educate strategies as media to facilitate effective teaching-learning process, noteworthy, as teaching becomes more effective, so learning.

### **Concepts of Science, Technology and Mathematics (STM)**

Past researchers have viewed and defined the term 'technology' from many perspectives and this has influenced the research design and

results, negotiations around a transfer and government policies in general (Reddy and Zhoa, 1990). Thus, the term technology has been given various definitions by previous literatures. According to Kumar et al (1999) technology consists of two primary components: 1) a physical component which comprises of items such as products, tooling, equipment, blueprints, techniques, and processes; and 2) the informational component which consists of know-how in management, marketing, production, quality control, reliability, skilled labor and functional areas. The earlier definition by Sahal (1981) views technology as 'configuration', observing that the transfer object (the technology) relies on a subjectively determined but specifiable set of processes and products. The current studies on the technology transfer have connected technology directly with knowledge and more attention is given to the process of research and development (Dunning, 1994). By scrutinizing the technology definition, there are two basic components that can be identified: 1) 'knowledge' or technique; and 2) 'doing things'. Technology is always connected with obtaining certain result, resolving certain problems, completing certain tasks using particular skills,

employing knowledge and exploiting assets (Lan and Young, 1996).

The concept of technology does not only relate to the technology that embodies in the product but it is also associated with the knowledge or information of its use, application and the process in developing the product (Lovell, 1998; Bozeman, 2000). The early concept of technology as information holds that the technology is generally applicable and easy to reproduce and reuse (Arrow, 1962). However, Reddy and Zhoa (1990) contend that the early concept of technology contradicts with a strand of literatures on international technology transfer which holds that "technology is conceived as firm-specific information concerning the characteristics and performance properties of the production process and product design". They further argue that the production process or operation technology is embodied in the equipment or the means to produce a defined product. On the other hand, the product design or product technology is that which is manifested in the finished product. Pavitt (1985) suggests that technology is mainly differentiated knowledge about specific application, tacit, often unmodified and largely cumulative within firms. Thus, based on this argument, technology is regarded as the firm's

'intangible assets' or 'firm-specific' which forms the basis of a firm's competitiveness and will generally release under special condition (Dunning, 1981). Tihanyi and Roath (2002) propose that technology can include information that is not easily reproducible and transferable. Based on this argument technology is seen as "tacit knowledge (Polanyi, 1967) or firm-specific, secrets or knowledge known by one organization" (Nonaka, 1994). Technology as the intangible assets of the firm is rooted in the firms routines and is not easy to transfer due to the gradual learning process and higher cost associated with transferring tacit knowledge (Rodasevic,1999). Valuable technological knowledge which is the intangible assets of the firm is never easily transferred from one firm to another because the technological learning process is needed to assimilate and internalized the transferred technology (Lin,2003). Rosenberg and Frischtak (1985) also consider technology as firm-specific information concerning the characteristics and performance properties of production processes and product designs; therefore technology is tacit and cumulative in nature. Burgelman et al. (1996) refer technology as the theoretical and practical knowledge, skills, and artifacts that can be used to develop products

and services as well as their production and delivery systems.

Technology is also embodied in people, materials, cognitive and physical processes, facilities, machines and tools (Lin, 2003). Based on Sahal's (1981) concept, Bozeman (2000) argues that technology and knowledge are inseparable simply because when a technological product is transferred or diffused, the knowledge upon which its composition is based is also diffused. The physical entity cannot be put to use without the existence of knowledge base which is inherent and not ancillary. MacKenzie and Wajcman (1985) define technology as the integration of the physical objects or artifacts, the process of making the objects and the meaning associated with the physical objects. These elements are not distinctive and separable factors but form a 'seamless web' that constitutes technology (Woolgar, 1987). In defining the term technology, all the three elements must be understood as being inter-connected to each other and a change in one element will affect the other two elements. The latest definition given by Mascus (2003) has broadened the concept of technology where technology is defined as 'the information necessary to

achieve a certain production outcome from a particular means of combining or processing selected inputs which include production processes, intra-firm organizational structures, management techniques, and means of finance, marketing methods or any of its combination'. Other scholars such as Tepstra and David (1985) suggest that technology as a cultural system concerned with the relationships between humans and their environment. From the systems perspective

Afriyie (1988) defines technology as encompassing: 1) the basic knowledge sub-system; 2) the technical support system (software); and 3) the capital-embodied technology (hardware). This perspective views that technology recognizes the need to identify the different elements of a particular country's technology that are complementary and mutually reinforcing. The previous studies done by the researchers have offered various definitions and concepts of technology from different disciplines, contexts and perspectives. Table 1 below shows a list of definitions and concepts of technology (in a chronological order) which was gathered from the previous literatures. [www.ccsenet.org/ibr](http://www.ccsenet.org/ibr) International Business Research Vol. 5, No. 1; January 2012

*Published by Canadian Center of Science and Education* 63. Apart from understanding the concept of technology, the classification of technology is also crucial in explaining the various kinds of technologies that embody in the product, production processes and human capital of the firm. Reddy and Zhoa (1990) in their extensive review of technology transfer literature have constructed taxonomies of technology from the previous literatures. The early taxonomy of technology was developed by Mansfield (1975) who used "embodied" and "disembodied" technology classification. The classification was later further extended by Madeuf (1984) to include capital embodied, human embodied and disembodied technology. Hall and Johnson (1970) suggest the use of "product-embodied", "process-embodied" and "person-embodied" technology classification rather than the classification based on "general", "system-specific", and "company specific" technology. General technology includes technical information which is common to companies in the same activity. System specific technology corresponds to knowledge and know-how develops for solving particular industrial problems. Company specific technology covers the corporate skills and capabilities from general activity and experience

of each individual firm. Robock (1980) and Chudson (1971) have constructed technology taxonomy by separating product designs, production techniques and managerial functions. Madeuf (1984) suggests a distinction between “alienated’ technology and “socialized” technology. Alienated technology includes information which is not free such as secret know-how. Conversely, “socialized technology” does not imply any specific transaction.

Mathematics is an essential discipline in today’s world. It is a powerful tool for understanding the world around us and our perspective of the important issues facing us as individuals, families, businesses, and Nations. Mathematics develops critical thinking, quantitative analysis skills and the ability to work in a problem-solving environment. Mathematics helps the man to give exact interpretation to his ideas and conclusions. It is the numerical and calculation part of man’s life and knowledge. It plays a predominant role in our everyday life and it has become an indispensable factor for the progress of our present day world. The production of technicians and technologists in any society depends on the level of the study of mathematics in the society. Hence, it has been

asserted that the gap in the level of development between the advanced countries and the developing countries is as a result of the gap in the level of the teaching and learning of mathematics (Ukeje, 2002). Out of all the problems affecting the teaching and learning of mathematics in schools, the teacher factor in terms of quantity and quality appear most prominent. Hence, no nation can achieve effective teaching and learning of mathematics in schools without adequate number of qualified of teachers and pragmatic instruction in the society. Therefore, it can be said that no nation can achieve meaningful development without adequate number of qualified mathematics teachers and pragmatic teaching of mathematics in the society. For the general development of any nation, mathematics has central roles to play. The effective Teaching and learning of Mathematics cannot be achieved without adequate number of qualified and motivated teachers in the school system. Irrespective of the provision of classrooms, instructional materials, facilities and general administration in any school, the effective teaching of Mathematics cannot be achieved without sufficient number of qualified and motivated mathematics teachers and pragmatic instruction. Therefore, one sure strategy for

ensuring a sustainable development in any nation is to sincerely address the problem of theoretical teaching of mathematics in any society.

Applications of mathematics from Centuries: Historically, it was regarded as the science of quantity, either of magnitudes (as in geometry) or of numbers (as in arithmetic) or of the generalization of these two fields (as in algebra). The importance of mathematics has been found to be understood after advancement of computers, computation and data handling. Many people stresses on more responsibility of mathematics educators ensuring that their mathematics teaching is relevant to the particular society in which they found themselves. Mathematics teaching should not be away from the economic, cultural and political context of the society. Society will be influenced by mathematics teaching and learning through pragmatic instruction. Bishop et al stressed on mathematics curriculum an instrument to be determined by mathematicians alone and politicians, economists and stake holders are needed to enlist the needs of society.

### **Significance of Science, Technology and Mathematics**

In the recent past emphasis in Nigeria education has shifted to educating its citizens in science, technology and mathematics (STM). This mode was reflected in the National Policy of Education when it directed and recommends the Nigerian Universities to observe an enrolment ratio of 60:40 in favour of STM and related courses. This particular action confirmed the call made during the World Conference on Science in Budapest in Hungary in July 1999 aimed at promoting the professional development of teachers and educators and to develop new curricula, teaching methodologies and resources in response to the changing educational needs of societies (Earnest and Treagust, 2002) Making their contribution on science, technology and mathematics (STM) Education in Nigeria, Ukeje, (as cited in Aguele and Agwagah (2007)) observed that „Without mathematics there is no science, without science there is no modern technology and without modern technology there is no modern society“. This is a clear point that science, technology and mathematics (STM) Education are the essential tools for every nation's development and they are equally essential tools for sustainability of every national development. There has been rising global consciousness both at the grass roots and policy levels regarding the importance of STM

Education, National development and how to sustain the development in which Nigeria is not left out. There is also the growing need to evaluate the Nigerian STM Education to see if the planned objectives have been achieved. Ukeje (as cited in Aguele and Agwagah (2007)) asserted that the development of any nation is properly accessed by the level of Education of its citizens in STM. Now the central question is „Do Nigerian citizens have the access to STM Education? “ Giving the answer to the above question we believe there are distinctive opinions from individual. .... but responding, (Wasagu, 2009) opined that “in order to produce an open access to STM learning and encourage a broader spectrum of students to pursue studies in STM, we as teachers and lecturers must begin to rethink and address the diversity of learning styles among the students in our classroom”.

### **Methodologies of teaching science, Technology and Mathematics**

Methodologies are set or system of methods, principles and rules for regulating a given discipline. Science, taught badly, not only degenerates into superstition, but makes a negative contribution to education. To learn science is to do science. In this context, teaching

of science gain significant importance and it needs an appropriate method. So it is important to know about the different methods of teaching science and to be able to choose the appropriate method in a classroom. The methods are namely lecture method, demonstration method, lecture cum demonstration method, laboratory method, heuristic method, assignment method, project method, problem solving method, question and answer method, role playing method, brain storming method and innovative method. It is up to a teacher's discretion to choose the method which is most suitable for a certain topic in a certain class and sometimes a teacher should introduces different methods in a lesson plan to address the learning styles of the students.

### **Lecture method**

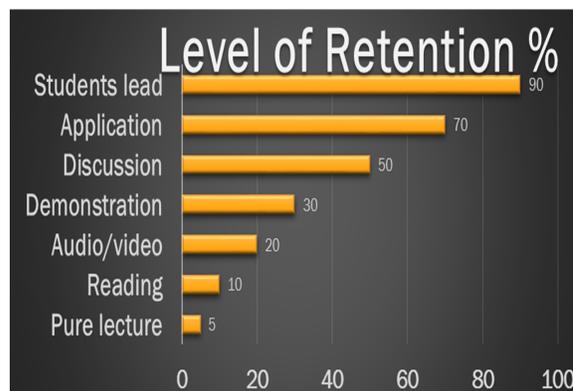
Lecture means speech or talk. In a lecture method, the teacher is the speaker most of the time and the students just passive listeners. The teacher prepares the talk on a topic and delivers in the class. Students tend to lose concentration after some time of listening but this can be taken care of by asking questions in between the lecture and often citing interesting examples during the lecture. This method is very

economical because a single person can give knowledge to a large number of students at the same time. Also no apparatus or materials is needed. Lecture method is simple, short and fast, thus saving time. This is a very effective method for fact based knowledge and historical explanations and also in certain situations such as introduction of a topic, instructions for some activity, revision of the content, etc. This is a method very useful for higher classes where large amount of knowledge needs to be transferred in a short span of time. Over to the demerits, lecture method is not a psychologically sound method as more emphasis is laid on the content. This method does not provide opportunity for active involvement. It does not give time to the students to grasp the matter as it is delivered very fast. Also lectures cannot be given by everyone and anyone. Only some people are effective speakers.

### Demonstration method

Demonstration means to show. In this method, the teacher only shows certain phenomena, concepts or principles to provide concrete experience to the students. It may include the use of specimen, film slides, chemicals, equipment and experiments, etc. Students

remain active during the demonstration. Sophisticated and complicated apparatus can be used by the teacher which cannot be handled by the students. As only the teacher is handling the equipment, only less time is consumed. Scientific facts, principles and theories can be effectively proved through this method. Demonstration method is a teacher centered method, the principle of learning by doing is neglected as students do not get a chance to experiment. It is not effective if done in a large classroom. Also the individual differences of the students cannot be taken care of.



**Fig.2:** Shows level of Attention and Retention of students in Effective Teaching and Learning science, mathematics and technology

**Source:** Adapted from Adebisi (2019)

### Lecture-cum-demonstration methods

Only the lecture method or only the demonstration method is practically not feasible. If a lecture is given in a Proper sequence with illustrations or concrete experiences, it is helpful in learning. Any demonstration combined with discussion and questioning is an effective technique. Lecture-cum-demonstration method is thus, a combination of these methods. Also this method has the same merits and demerits as that of the demonstration method.

#### **Laboratory method**

There is a talisman in science education which states "I heard and I forgot; I saw and I remembered; I did and I understood." Science is a subject which can be best learned by doing. Laboratory method is one such method which is based on this principle of learning by doing. The teachers acts as a guide and supervisor and gives instructions including required materials and equipment. The students perform the experiment, records observations and draws inferences. The teacher goes to the students, observes what is being done and corrects them if something is wrong. During the process the students learn by doing to gain permanent knowledge. The students are active throughout the class and they are learning on their own by

doing. The knowledge gained is permanent. Weakness of each student can be identified and required help can be provided. This method also facilitates training in scientific method i.e., training in performing experiments, observing, recording data, interpreting results and drawing conclusions. The demerits of this method is that it is an expensive method as separate equipment are needed for each students. For this method to be useful, teacher-student ratio has to be low, otherwise. The teacher cannot pay attention to each student individually. This method is suitable for some specific type of topics only. It also needs more effort on the part of the teacher as she is expected to prepare the instructions and observe each student.

#### **Project method**

Project may be any purposeful activity like the preparation of a working or static model, a chart or performing an experiment. In this method, a group of students select a problem after discussing with the teacher and formulate the hypothesis. They develop the plan of action, list the needed equipment, and conduct the experiment for testing the hypotheses. Then they notes down the observation, collects the data, interprets it and finally they reach the conclusion. This method basically aims to

provide the students with the opportunity for extended learning. Moving on to the merits of the project method, this method helps in giving clarity to various concepts of science. The knowledge Gained is permanent. The qualities of self-confidence, co-operation and leadership are also developed in the students. This method is a psychological method based on learning by doing. Over to the demerits, project method is a very difficult method for teachers as lot of planning and effort is required. It is also not economical method as more material and equipment are needed. The method is very time consuming and the syllabus cannot be completed in a systematic and sequential manner.

#### **Problem solving method**

Problem solving method provides the students an opportunity to solve problems on their own by following some scientific steps. The lessons starts with a problem and some possible solutions are thought by the students on the basis of their previous knowledge. The problem is first identified, stated and then explained through discussions, self-study, practical work, etc. Next is the delimitation of the problem concentrating only on those parts of the problem which are within the reach of the

students. Now a hypotheses is formulated for investigation, the hypotheses is tested through experiments and the conclusion is reached finding out the best hypotheses. Through this method, the habit of self-learning is developed and the students develop problem solving skills. A scientific attitude is also inculcated in them each time when they follow the steps in solving a problem. Also this method have same demerits as that of the project Method.

#### **Question answer method**

Since ancient times, educationalist have realized that teaching is incomplete without questions. It's a major component in lessons to invoke curiosity among the students. The questions needs to be framed in a systematic and organized manner and these questions are placed before the students. Co-relating various answer provided by students paves way for developing new knowledge. It is widely used for purposes like introduction, content presentation, revision, etc. Merits of this method includes that the students remain active throughout the class and the response can be used for evaluation. It arouses curiosity and enhances the power of logical thinking,

reasoning and expression .The question answer method in itself is not complete and it should be combined with other methods .Also framing and asking proper questions require social skills among teachers.

### **Brain storming method**

In brain storming method, a problem is given to the students. Everybody gives their views on the problem and discusses it. Points emerging from the discussion are noted on the black board .Through the discussion and debate, a solution is found. This method gives a chance to everyone to express their thoughts and contemplate on it. This method is useful in higher classes and encourages students to express themselves and to think independently, logically and critically .It also encourages creativity. This method is suitable for a very few topics. Also it is not suitable for junior classes. The method is again a time consuming method.

### **Heuristic method**

Let us start by looking at the ninth method .The Heuristic method was given by Prof H.E.Armstrong,a professor of chemistry in London. In heuristic method, students are given a problem and all the necessary instructions to solve it. All the aspects off the problem are

discussed with the students and then they are given the freedom to find the solution. They themselves carry out experiments, make observations and draw conclusions .This method does not intend for being a separate method but it incorporated any method which enables the development of scientific enquiry. Some merits of this method are that the students are actively involved, the spirit of enquiry is developed and the acquired knowledge is permanent. The habit of self-study and hard work and a scientific attitude are developed in the students with teachers only for guidance. The students are also bothered with very less home work load. Heuristic method cannot be used at the primary level. Also the expectations are high from the students as they are demanded to discover science on their own. It is time consuming and the syllabus cannot be covered, if only this method is used. Efforts on the teachers are also high as they have to plan and give proper instructions to the students.

### **Assignment method**

Assignment method can be used for teaching theory as well as practical aspect of the syllabus. In this method, the whole course is divided into various parts according to the topics, as assignments. These assignments are given to

the students to be completed within a stipulated time. After completing theory of one topic, the student moves on to the practical aspect. After this they move on to the next topic. In assignment method, each student works according to his/her capacity. The individual differences are taken care of. Habits of self-study, decision making are inculcated in students. There is ample freedom of work as duration of assignment is dependent on the student's capability. This method is also financially viable. In the case of this method, responsibility of a teacher increases manifolds as they are required to prepare the assignment, write the instructions, allot the assignments, provide guidelines, ensure the availability of equipment and evaluate the assignments too. But students with lower intelligence may not be able to comprehend the guidelines and the method may not be suitable for all the students. Also this method is not practical in the existing school conditions as the textbooks in this format is not available.

### **Role playing method**

Role playing method is based on the imitation of a role. This method is very helpful in bringing out changes in the personalities of students including developing their social skills. It can be

used for various purposes. It can also be used to teach some simple topics to younger children, e.g., solar system, balanced diet. No time is given to practice the role as they are given in the class itself. The topics to be taught are divided into topics and an outline to the play is prepared by the teacher. The roles are allotted to the students. After giving a briefing on how to play the roles, the roles are enacted. The teacher observes the role playing and reviews it. Later on, a discussion is held between the students and the teacher to summarize the learning. This method gives proper chance for expression of feelings and is very useful for primary classes. This method is very interesting and enjoyed a lot by the students. The demerits of this method includes that it is suitable mainly for junior classes and often creates an artificial atmosphere in the class. Also this method cannot be used to teach all the topics.

### **Innovative method**

The last and final method is namely innovative methods. This methods include taking the students for field trip, organizing science exhibitions which provides concrete experiences as well as enhances the creativity of the students and also using two or more methods clubbed together to cater the different learning styles of the students in a class. For example,

project-cum-laboratory method can be used to develop different process skills and science skills in the students. This method is useful in a diverse class with different learning styles. It helps to develop process skills and creativity. This method can be customized to classrooms and lessons, making it very effective.

### Conclusion

Effective use of teaching methodologies enhances learning and improves students' attention and retention, irrespective of the method adopted, the ultimate goal is to ensure that intended learning outcomes are achieved. As instructors, our main objective is to make our learners to learn from hands to mind. Nigeria as a nation needs more Scientists, Technologists and Mathematicians to meet up with developed nations in the world. This can be achieved through effective use of appropriate teaching methodologies in Science, Technology and Mathematics which can enhance effective instructional delivery in the classrooms.

### Suggestions

From the above discussion, the following suggestions were made in order to achieve the effective use of teaching methodologies in Science, Technology and Mathematics:

Instructors should make their lessons to be;

- (i) hands to mind;
- (ii) use visual aids and images;
- (iii) find opportunities to differentiate learning;
- (iv) ask students to explain their ideas;
- (v) incorporate story telling to make connections to real world scenarios;
- (vi) show and tell new concepts;
- (vii) let your students regularly know how they are doing;

Governmental and Non-Governmental Organizations (NGOs) should provide well equipped Science, Technology and Mathematics laboratories to enhance effective use of teaching methodologies.

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