The Role of the Teacher and Methods of Teaching Science in Secondary Schools in Nigeria

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Citation

Abstract
This paper focused on the role of Teachers and Methods of Teaching Science in Secondary Schools in Nigeria. Science involves the acquisition of knowledge and a procedure for investigating a phenomenon. In a scientific and technological world, every citizen should have basic knowledge of what Science is and if man is to live intelligently and productively in an age in which Science determines the tune of technology. This work was discussed under the following headings: the role of the teacher, aims of teaching Science, the methods of teaching Science in Secondary Schools and conclusion.

Although a lot of changes have taken place globally in the Teaching of Science, in Secondary Schools in Nigeria, a big lapse has been observed which needs to be addressed, this has to do with the use of media facilities and Information Communication Technology (ICT) which has not been harnessed fully in the Teaching of Science in Secondary Schools in Nigeria. This may be as a result of some environmental constraints such as lack of power supply and poor funding of Secondary Schools.

1. Introduction

The role of teacher in the acquisition of scientific knowledge in Secondary School Science class cannot be underestimated. Harrison and Killion (2007) defined the roles of a teacher as a leader, resource provider, instructional specialist, curriculum specialist, classroom supporter, learning facilitator, mentor and school leader. In other words, roles consist of set of expectations and the teacher in any Educational enterprise performs several roles. Having enumerated these roles, an attempt would be made to define the term “teaching” and “methods”. Genome (2012) defined the place of the teacher in Science as ‘making the science come alive by illustrating how classroom Science applies to the professional laboratory and make the students aware of the relevance of science to their lives”. Uzoka (2002) defined teaching as the guidance of students through planned activities so that they may acquire the richest learning possible from the experiences. The author also added that, learning is the result of experiencing and it requires the active participation of the child. Thus, the implication of this definition is that no teacher can give Education to the child; neither does the student learn because he is exposed to a teacher’s knowledge, to the content of textbooks, to visual aids, or to laboratory equipment. Rather, learning is an active process which goes on within the students by guiding the learning experiences through planned activities.

The word “method” can be described as a strategy or a way something is done. Uzoka (2002) defined teaching method as a strategy the teacher uses to impact knowledge by directing and guiding the learning process, while Cyril (2013) described teaching methods as a process, planned and followed during teaching and learning to enhance
delivery of the subject matter. These authors see teaching methods as a system of communication between a teacher and a learner with the intention of bringing about certain cognitive and psychological changes in the learner. They described teaching methods as a recurrent pattern of teacher behaviour, applicable to various subject matters, relevant to learning and can bring about changes in learners behaviour. Therefore, this work seeks to examine the role of the teacher, the aims and methods of teaching Science in Secondary Schools in Nigeria.

2. The Role of the Teacher

The teacher is part and parcel of the teaching and learning process in any educational system. A teacher is a person who teaches or instructs students, especially as a chosen profession. The teacher is one of the key factors in the actualization of the goals of teaching Science in the Secondary Schools as stipulated by the National Policy on Education (2004). Orlando (2013) sees a great teacher as a skilled leader. Teachers have crucial roles to play in the effective teaching and learning of Science in the Secondary Schools. Orlando (2013) opined that “a great teacher creates a sense of community and belonging in the classroom, provides supportive, collaborative environment for learning” Ibole (2000) and Arubayi (2003) opined that Science involves the acquisition of knowledge and a procedure for investigating a phenomenon. They explained that Science rules the universe, serves man and ensures human survival. From the forgoing, the Science teacher not only needs the knowledge of the subject matter, but an in-depth knowledge of the organization of the contents of the subject matter. Apart from this, every good teacher should seek to be efficient and try to look for new ways of making their lessons interesting. In this wise, the teacher’s philosophy of what Science is, will determine his methods of teaching. Okoro (2006) opined that there are obviously much more to good teaching than learning to construct attractive visual materials and run complicated instructional equipment. For effective teaching of Science, the teacher needs to have a deep understanding of human nature, individual behaviour, group interaction and the phenomenon of learning itself. Apart from the active involvement of Science Teachers in their professional bodies, Inomiesa (2009) encouraged Science Teachers to be up to date and current in their knowledge so as to avoid traditional approaches to teaching Science, which requires students to listen, and regurgitate facts. Furthermore, Science Teachers should use textbooks that encourage students to develop scientific understanding through observation, classifying, counting, measuring and interacting with scientific objects and events. Scientific thinking through experimenting and explaining scientific data and manual skills through manipulation and using of tools.

The role of a Science Teacher is broad based at the junior Secondary Schools; Science is taught as integrated Science while at the Senior Secondary School, Science is subdivided into specialized areas such as: Biology, Physics, Mathematics and Chemistry. Importantly, Science Teachers require specialized knowledge or competence in their field of study to enable them plan and select appropriate teaching methods. Teacher competencies relates to a teachers’ fitness to teach, their ability to do their job well. A competent teacher in Science should be able to facilitate student’s emotional, intellectual, social and physical growth which is an aspect of teacher quality.

Arubayi (2010) believes that the ability of the teacher to exercise his role is conceived as teacher qualities, such as: confidence, personal appearance, commitment to duty, proper attitude to teaching and respect for students. Apart from these qualities mentioned, the teacher needs other qualities, such as: relevant qualifications, competent knowledge of subject matter, ability to prepare and plan lessons adequately, ability to use teaching aids/materials or improvise when the need arise and the ability to motivate and sustain student’s interest. Zeiger (2012) summed up the role of a teacher as “perhaps, the most important roles teachers play involve interacting with students” Sue (2013) said that “the teacher is a kind of walking resource centre ready to offer help if needed” the teacher acts as a coach when students are involved in a project, work or self study. The inquiry process of learning evokes the joy, excitement and fun necessary to induce the students to continue to work to bring the teaching to the intelligence range (level) of the learner and helping the student to understand. Apart from the above, the Science teacher is expected to be cooperative, democratic, patient, show kindness, considerate, show interest in the subject and the learner.

Afe (1996) graphically represented the functions of Teachers as follows:
In figure 1, the teacher performs several roles as indicated above. For the teacher to perform the first role listed he has to be well informed in Science, he must have good command of language to impact knowledge through explaining, informing and showing the students through practice session. Another function of the teacher is to initiate, organize, direct and make decisions during every lesson, every day and to involve the learner effectively in the learning process. Again, the teacher needs the ability to make students identify with each other and help them relate well as individuals and as a group, by so doing, group or team spirit is developed. For learning to be effective, the teacher needs to provide an atmosphere of warmth, friendship, love and affection to promote a conducive learning environment for students. Another function of the teacher is to provide a conducive atmosphere for learners to reveal their attitude, interest, problems, purpose and aspirations. Opportunities should be given to enable the students compare, observe, classify, interpret, analyse, criticize and summarize activities.

The teacher should be able to help the Science Students to acquire problems solving skills for daily survival through the use of media facilities. Akale (2003) described media facilities as television, chalkboard, whiteboards, magnetic boards, bulletin display boards, non-projected aids, two dimensional aids, picture diagrams, wall charts, flip charts, time charts, maps, atlas, mobiles, models, global diagrams, templates specimen, films stripes, slides, micro projectors, opaque projector, overhead projector, radio, tape recorder, video films, educational television and computers. Onomiesa (2010) stated that the use of media and ICT facilities for teaching Sciences in Secondary schools are very valuable. Despite the value of media and ICT facilities, the author enumerated some constraints to the adequate usage of these facilities such as: lack of adequately furnished laboratories, small sizes of classrooms, lack of power supply, lack of water supply in some laboratories, large class size and poor funding, and lack of competent teachers to utilize the modern methods of teaching. Looking at the value and usefulness of media and ICT facilities to the acquisition of scientific skill, Inomiesa and Uneuro (2011) opined that the usage of these facilities has not been fully harnessed in the teaching of Science in Nigeria as a result of the constraints enumerated. Inspite of the numerous roles of the teacher, having a harmonious working relationship between the school and community is an added advantage for teaching Science in the Secondary Schools. Therefore what are the aims of teaching Science in Secondary Schools?

3. Aims of Teaching Science in Secondary Schools in Nigeria

The Secondary School Education in the Nigerian system falls within the second tier in the educational process. At this stage in the educational process, a solid scientific foundation should be laid to prepare the students for their chosen career in Tertiary Institutions. The goals of Science Education as stipulated by the National Policy of Education (2004) are as follows:

- To cultivate inquiry, knowing and rational mind for the conduct of a good life and democracy
- To produce Scientists for National Development
- Service studies in technology and the cause of technological development; and
- To provide knowledge and understanding of the complexity of the physical world, the forms and the conduct of life.

Looking critically at the stipulated goals of Science Education in Secondary Schools in Nigeria, these goals cannot be actualized without the teacher performing the role of teaching. Therefore, one can deduce that, no meaningful teaching and learning can take place without the teacher. The
role of the teacher in acquiring Scientific Knowledge for technological advancement of the nation cannot be underestimated. The National Policy on Education document (2004) has emphasized amongst others; the laying of sound basis for Scientific and Reflective Thinking, developing in the child the ability to adapt to his changing environment, equip students to live effectively in the modern age of Science and technology and giving the child opportunity for developing manipulative skills to enable him function effectively in the society. To achieve these objectives of teaching Science in the Secondary Schools, the methods of teaching adopted by the teachers are important consideration for the actualization of the goals of the National Policy on Education.

4. Methods of Teaching Science

A method can simply be described as the way in which one does something. The method a teacher uses to bring the desired outcome in the teaching and learning process cannot be over-looked. There are various methods available for achieving effectiveness and the teacher has full responsibility for selecting the most appropriate method for the prevailing circumstances in order to achieve the aims of teaching Science in Secondary Schools. The methods of teaching Science in the Secondary Schools discussed in this write up are laboratory, practical work, demonstration, project, guided discovery and inquiry methods.

5. Laboratory Method

The laboratory is an indispensable tool in the teaching of Science which provides students with a place or setting, to attack and solve problems, collect data, prove ideas and carry out investigations which emphasizes learning by “doing”. Arubayi (2009) opined that, the laboratory method of teaching comprised of variety of activities ranging from the experimental investigations to confirmatory exercises and skill learning. Arubayi (2003) summarized the major objectives sought in laboratory work, as the development of skills, concepts, cognitive abilities and understanding of the nature of Science. Skills such as manipulative, inquiry, investigation, organizational and communicative, can be developed from laboratory experiences. Also, concepts such as hypothesis, theoretical models and taxonomic category are developed. Cognitive abilities such as critical thinking, problem solving, application, analysis, synthesis, evaluation, decision making, and creativity are developed through laboratory experiences. Through well planned and carefully executed laboratory work the participant is able to gain a better understanding of the nature of Science. The laboratory method of teaching Science assists learning and it is the true nature of Science which teaches practical skills; help to develop some desired traits such as appreciation which are necessary for problem solving and skill acquisition. Unfortunately, Operation Reach all Secondary Schools (ORASS) 2006, findings revealed that less than 10% of Secondary Schools in Nigeria have well equipped laboratories. Again, Inomiesa (2010) opined that most of the laboratories are empty and equipment for the laboratories are seldomly bought and it is not uncommon for Secondary Schools Students to migrate from one School to the other for external examinations such as West African Examination Council (WAEC) and National Examination Council (NECO), in search for equipment and chemicals for laboratory work.

6. Practical Work

Another method of teaching Science is Practical Work. Science Community Representing Education (SCORE), 2008 in the report “Practical work in science: A report for a strategic framework” admits that, “good quality practical; work can engage students, help them to develop important skills, help them to understand the process of scientific investigation and develop the understanding of concepts. Students understand scientific concepts better through the full adoption of practical works in science teaching. Woodley (2009) said that “practical science supports skills development, experimental learning, independent learning, learning in different ways and the development of personal learning and thinking skills”. The concept of practical work may be extended to include simulated experiences and even students exercises involving pencil and paper calculations. Practical work may be done in the laboratory but not strictly at the laboratory. Inomiesa (2010) opined that practical works are carried out to help the learner, clarify and extend the learner’s experience of natural phenomenon. It provides opportunities for students to practice the correct use of apparatus. Students develop manipulative skills; develop ability to form concepts and the ability to communicate the results of the finding. If practical method of teaching Science is carefully and properly planned and utilized, it will enhance effective teaching of Science in Secondary Schools.

7. Demonstration Method

Another method of teaching Science is the Demonstration Method. Enemali (2006) described this method of instruction as a showing procedure, to explain, teach and inform students, while Arubayi (2009) described demonstration method as a visible presentation of ideas, skills, attitudes, processes and other intangibles. Demonstration lessons include facts and principles used along with materials for showing or teaching someone else. For demonstration methods to be effective, the lesson should be planned ahead of time, have all necessary materials and equipment needed for the demonstration lesson. Participants should be given clear and simple instructions. The sitting arrangement for the demonstration should be organized so that participants can see and hear clearly. After demonstrating generally, the students should be given opportunity to practice individually or in groups. The teacher should provide assistance and guidance to students who have not gasped the basic concept yet. Demonstration method of
teaching Science has many merits and demerits. One very important merit of using demonstration method is that it aids learning, as the students see, hear and do. Despite this very valuable merit, a poorly planned and executed demonstration lesson will not promote optimum learning and may not make room for individual differences.

8. Project Method

Another method of teaching Science in Secondary Schools is Project Method. Uzoka (2002) described project method as an activity unit that learners do usually mentally and physically in a real life situation under the guidance of a teacher. The main purpose is to allow students first-hand experience on how to do something. A student may select a project from a prepared list of projects given by a teacher, or the learner may submit an idea to the teacher for approval. The project method of teaching can only be effective if the learner selects a problem the learner is interested in, which will motivate the learner to complete a selected project. The learner should be aware of the duration of the project, the point for which marks will be awarded and the type of report expected. The learner with teacher’s supervision decides and plans activities for completing his project. The project method of teaching Science can provide practical experience to students and help to make learning from that particular experience permanent. Thus, furnishing real-life setting for the person doing the project which will motivate students and sustain the interest in the learning situation. Project work encourages independent thinking and teaches the participants the ability to make decisions on their own. The project method of teaching can require a large amount of time to complete a project, and if students' works are not properly supervised it can create problems. The teacher’s role is to ensure that the project work is well planned and the student must clearly know what to do. The curiosity of students will be awaked thus creating a demand for new information.

9. Guided Discovery

Guided discovery is another method of teaching Science in Secondary Schools. Inomiesa (2010) recommended the use of guided discovery approach in teaching Science in schools. This recommendation is in line with the suggestion from the Federal Government as enshrined in the National Policy on Education (2004), that guided discovery approach should be adopted for teaching Science. It is the hope of the Federal Government that through this method, students will learn Science better. Activity based Science teaching allows students to explore their environment and discover nature. To successfully adopt the guided discovery approach, students must perform certain mental processes, such as: observing, classifying, measuring, predicting, inferring, and hypothesizing. Thus, a lot of inquiry goes on in the class room where the teacher mainly serves as a moderator, moving from point to point to guide the learning of students and help them to overcome difficulties. The teacher is the resource person who guides students’ sources of information. To be successful, an inquiry based classroom should operate in a free and democratic atmosphere in which discipline is relaxed but not laxes. The students may work in a variety of locations while the classroom is filled with a variety of instructional materials, these could be real objects or models, pictures or diagrams. These could help students to concretize the information gathered from the learning situation.

10. Inquiry Method

The method of inquiry is adopted in the teaching of Secondary School Science which evolved from man's inquiring ways, which are refined by the development of attitudes and methods which became part of the scientific enterprises. Stephenson (2011) opined that “the power of an inquiry-based approach to teaching and learning of Science is its potential to increase intellectual engagement and foster deep understanding through the development of hands-on, minds-on and research based disposition towards teaching and learning” The nature of inquiry is complex, the complex nature of inquiry technique, has accounted for the minimal use of this method of teaching Science. The inquiry method of teaching can be most effectively used when students are actively involved in the learning process and the learning environment permit freedom of movement and expression. The teacher must provide this kind of climate so that students can collect data, form and test their theories using their own methods. Inquiring technique can help the learners develop ability to think critically and aid in the development of skills such as defining, questioning, observing classifying, generalizing, verifying and applying. These skills are very vital in the acquisition of the knowledge and nature of Science.

11. Conclusion

The focus of this work is the roles of teachers and the methods of teaching Science in Secondary Schools in Nigeria. Teaching is very significant to the acquisition of scientific skills for technological advancement of any nation. This paper has highlighted the numerous roles of the teacher, the aims of teaching and methods of teaching adopted by teachers. To fulfill the goals of teaching Science in Secondary Schools, the Science teacher needs competence to adequately plan and select appropriate teaching methods geared towards the actualization of the national goals of teaching Science. A closer look at this study showed that although the teaching of Science has gone beyond the rudimentary way of teaching to a more inclusive and dynamic methods of teaching Science, some short falls were observed. That the use of media and Information Communication Technology which has not been fully harnessed as a result of some personal and environmental problems such as lack of knowledge of the use of ICT and the problem of lack of electricity to power the ICT gadgets. It is hoped that this work may be useful in stimulating
professional bodies like Science Teachers Association of Nigeria (STAN) and the Federal government to provide the necessary facilities and environment for teaching Science in Secondary Schools.

**Recommendations**

The Teacher of Science must be vast in knowledge and open to new-learning opportunities to enhance his teaching style and methods. Method adopted should help the teacher motivate and sustain student’s interest in Science.

That the Science teachers should acquire skills in the use of media facilities and Information Communication Technology (ICT) in the teaching of Science in Secondary Schools in Nigeria.

That the Science teacher should not only be knowledgeable in subject matter but provide an atmosphere of warmth, friendship, love and affection to promote a conducive learning environment for students.

**References**


