

## **A Discourse on Mentoring in Secondary Schools Science and Technology in Nigeria**

**Jane Ifeoma Oliobi, Stella Obianuju Okoli, Churchil C. Okonkwo,  
Felicia Uju Oliobi & Lilian Chinyere Mole**

### **Abstract**

This paper dealt with the concepts of teaching, learning and mentorship in secondary school science and technology. Specifically, the paper highlighted the following: teaching, Learning, methodology of teaching and learning science and technology, and mentorship in secondary schools science and technology. The teacher as a mentor in the use of ICT gargets and other instructional materials was looked at. Secondary school education and objectives, concept of science, aims of science education in Nigeria, concept of technology, and reasons for teaching technology were highlighted. Secondary education and its broad goals were examined. Science and the aims of science and technology education in Nigeria were highlighted. Mentorship and its importance, as well as the ways for improving healthy mentoring in secondary schools were also discussed as well as Safety during science and technology lessons were looked at. Recommendations were made based on the study.

**Keywords:** Science, Technology, Secondary School

### **Introduction**

How teachers understand their work, “teaching”, very much affects what they actually do in the classroom. Also how educational administrators understand “teaching” influences the facilities they provide for teaching and learning. That is the type of buildings, the equipment and materials they supply and the number and quality of teachers they recruit.

Learning is the permanent acquisition and habitual utilization of the newly acquired knowledge or experience. Learning according to Hornby, (2005) is gaining knowledge or skill by studying from experience, from being taught. Learning must bring about permanent and ephemeral changes in the person (Onwuka, 1994). The changes must be in knowledge, character, in skill or in attitude. Learning implies that whatever is said to have been learned is clearly perceived, retained, built over time, and can be put to work. It also enhances and affects behavior more or less permanently.

Learning involves “growing or changing as a result of experience. It is, a modification of personality resulting from experience. It becomes obvious

that learning is some specific achievement such as believing something one did not believe before, knowing something one did not know before, acquiring a habit one did not have before and so on, (Oliobi and Mole 2016). The activities of learning are varied and polymorphous. Learning is a permanent change in behavior. It is the acquiring of new skills, knowledge, ideas, values and experiences. Learning must manifest itself in some observable change in behavior.

**Teaching:** To teach means to give lessons to students in a school, college, university etc to help somebody learn something by giving information about it. In everyday life, there are innumerable circumstances in which people learn without a teacher. Students also learn many things when their teacher is not teaching.

Teaching can refer to a particular occupation or profession in which people may be engaged. Here, one speaks of teaching as a noble profession or people taking to teaching instead of other professions. Teaching denotes the various activities undertaken by a more experienced and more knowledgeable person in order to enable learners learn, (Onwuka, 1994). This definition is in line with mentorship.

The teacher: A teacher is a person who provides education for pupils and students (Onuoha & Nwanorim, 2014). The teachers are the most outstanding and significant factor in education delivery. A teacher is a person who has undergone an approved professional training in education at appropriate level capable of impacting knowledge, skill and attitude to help learners acquire some knowledge, skills, attitude, ideas, and appreciations that influence learners to make desirable change in behaviour. According to Hornby, (2005) a teacher is defined as a person whose job is teaching, especially in a school. Teachers provide education for pupils and students. The teachers are the most outstanding and significant factor in education delivery. They help to direct learning in order to achieve both personal and societal goals. They possess skills and competency vital to teaching and learning. It therefore implies that a teacher is a person who has undergone an approved professional training in education at appropriate level capable of imparting knowledge, facts, skill, and attitude to help people acquire some knowledge, skills, attitudes, ideas, or appreciation that influence people to make desirable change in behavior. Teachers can assume various capacities which are as follows: educator, instructor, tutor, lecturer, operator, a councilor and a mentor.

The quality of instruction is determined by many variables including the quality and quantity of teachers. It is the teacher who translates the objectives, concepts and topics in the curriculum into activities that are

meaningful to learner (Oyetunde, 2002). The teacher takes a number of decisions that are vital to the success of instruction. He interprets the science syllabus, breaks it into units, prepares scheme of work and lesson on daily, weekly or termly basis, utilizes relevant and available instructional materials and employs appropriate teaching strategies.

The teacher is a prime factor of consideration in the curriculum implementation process. He carries out the presentation, coordination and evaluation of learning opportunities. The teacher translates the intended curriculum into active curriculum (Imonivwerha, Obiunu and Pupu 2014).

A quality teacher as a mentor should be knowledgeable and have mastery of subject matter of each lesson to be taught, possess psychological and emotional competencies, acquire a repertoire of teaching skills and methodology and exhibit proficiency in diagnosing students learning difficulties and classroom management for their own benefit and that of the students (Mbakwem, 2005; Sofowora & Egbedokun 2010). Teachers should be encouraged to be a guide and a facilitator, an approach in favour of an active and open learning.

### **Methodology of teaching & learning science in secondary schools**

Teaching method are strategies and approaches which teachers employ to actualize the instructional objectives. There are many methods and techniques at disposal of the teacher for effective teaching and learning, (Haliru & Zuguru 2014). The methods that can be used in teaching secondary school science are many but some are better than others in facilitating teaching & learning. The various methods used in our secondary schools to teach science and technology are: problem solving method, project method, discovery method, demonstration method, inquiry method, lecture method and others.

Smith, cited in Haliru, and zuguru, (2014) criticized that there is sometimes narrowness in the range of teaching methods characterized by over long expositions, over-directed style inhibiting curiosity, initiative and discussion, all of which reduce opportunities for developing thinking in learners. For effective teaching and learning of science, the teacher must be able to select and combine the most appropriate strategies taking into consideration, the nature of the learner, the nature of the subject and the learning needs of the students. The methods that encourage activeness on the part of the students should be used in teaching secondary school science and technology. As teachers use these methods of teaching in teaching, mentoring processes is always in action. The learners learn from experienced teachers who teach, advice and help them over a period of time.

There is therefore need for effective mentoring. The teacher needs better teaching strategy that will provide the learner with concrete and real life experience to exemplify and clarify more meaningfully some of the principles and concepts in science and technology to enable learners solve global challenges.

Any established school curriculum calls for ways and means of implementing it in order to achieve the objectives at the various levels. No discussion of the curriculum is complete without suggestions about method and means of effective implementation. The best way of helping learners to learn is to bring them face to face with the world which education intends to introduce to them through appropriate means of mentorship. Therefore, proper mentoring in the teaching and learning of secondary school science and technology becomes vital to help solve global challenges.

One thing is vital about curriculum materials. Whether they are real or substitutes, they have a common goal. They help the teacher to convey the intended message effectively and meaningfully to the learners so that the learners receive, understand, retain and apply the experience gained to achieve over all educational goals.

**A mentor:** A mentor is an experienced person who advises and helps somebody with less experience over a period of time, ( Hornby, 2005). A mentor is a person who gives a younger or less experienced person an advice over a period of time. He is a guide who can help the mentee to find the right direction and who can help them to develop solution to career issues. Mentors rely upon having had similar experiences to gain empathy with the mentee an understanding of their issues. He is an experienced and trusted adviser. He advises and trains someone especially a younger student or colleague.

**Mentorship:** Mentorship is a relationship in which a more experienced or more knowledgeable person helps to guide a less experienced or less knowledgeable person. The mentor may be older or younger than the person being mentored but he/she must have a certain area of expertise.

Teachers as mentors deliver lessons to students advises, facilitates and guides them in a school, college and university to help them learn something worthwhile by giving information about it. Teaching involves showing somebody how to do something so that they will be able to do it themselves. Teachers teach for years until they reach retirement age.

There are many admirable qualities a teacher must possess for effective content delivery. To Imonivwerha, Obiunu and Pupu (2014) and Kanno, (2012), an effective teacher must be:

( I ). Formally and thoroughly trained in pedagogy and duly subjected to a period of internship before certification as a professional. (ii) . Among other qualities expected of him or her are: ability to exercise authority judiciously. (iii) . Ability to demonstrate sound moral judgment (iv) . Good personality. (v) . Friendliness and ability to perform the roles of an effective professional teacher, creditably well. (vi) . Provisions of emotional support to learners. (vii) . Prudence in time management (viii) . Production of results as he or she matches curriculum contents with the learner ability level of students.

Qualities of a teacher includes being a guide, a communicator, a modernizer (a bridge between generations) a model (example) a searcher (one who does not know), a counselor (a confidant and a friend), a creator (stimulator of creativity), an authority (one who knows) an inspirer of vision, a doer of routine, a breaker of camps, a story teller, an actor, a scene designer, a builder of community, a face of reality, an emancipator, an evaluator, a conservator (redeemer and saviour), a calumniator and a learner. Based on the above qualities of a mentor, he or she supposedly plays important roles in human development through methods of teaching. Some of the rationales' for mentoring include:

1. Providing data for curriculum planning and revision. (ii) . Interpreting and implementing the curriculum. (iii) . Implementing curriculum innovation. (iv) . Providing instructional leadership. (v) . Implementing continuous assessment techniques (vi) . Rendering guidance and counseling services. (vii) . Serving as a mentor and role model. (viii) . He / she trains would be teachers.

### **The role of the teacher in mentoring.**

A mentor is usually a role model, motivator facilitator, inspirer, organizer, initiator, pace setter, confidant, team mate and team leader who always considers the consequences of actions and reactions as regards the attainment of stipulated instructional objectives or even national goals. He / she is a person who advices and helps learners with less experience over a period of time. The advice is usually geared towards greater effectiveness of one's professional and social-political duties. It is therefore taken for granted that the mentor should be a person of unquestionable character who always discharges his or her duties very well. He or she is one who always acquaints himself or herself with distinction, as indicated earlier.

A good mentor who is invariably an effective teacher is primarily charged with the following duties among others: mentoring self, mentoring colleagues, mentoring students and mentoring teacher-interns of teaching practice exercise. One mentors self by being humble, dedicated to duty and

ever willing to learn. In mentoring colleagues one is expected to be very positively disposed towards construction and destructive criticisms. The important thing however, is that a teacher should demonstrate high degree of integrity by putting into overt practice all that which promote professional excellence. For instance, it is not by professing or proclaiming that one is born again, that one's degree of religiousness is measured. Colleagues who themselves, are sincere and professionally conscious will always readily identify, relate to and associate with mentors who practice what they profess despite all odds in the school or outside its compound. One's actions rather than words project one's degree of chastity. "Actions speak louder than words". These aspects of high integrity and transparent honesty, on the part of mentors also determine to a large extent how students heed to their advice and counsel. For it takes a good moralist to preach sound morals. Equally, when one is not a curriculum innovator he or she cannot effectively implement any model of curriculum innovation.

A mentor's mentorship skills is always called to task when ensuring that teacher interns on teaching practice do well in their posted school. It is a well-known fact that preparing teacher-interns for good teaching practice is one of the cardinal objectives of Colleges of Education in Nigeria Kanno, (2012). While still preparing for teaching practice posting, the teacher-interns undergo series of methodology and theoretical courses to equip them towards good conduct. They learn the philosophical, psychological and sociological foundations of education. The mentor therefore serves as a school teacher, cooperating teacher, supervisor and at the same time maintaining high degree of professional friendship and wise counsel at all times.

### **The teacher, a mentor in the use of ICT gargets and other instructional materials.**

Nigeria government embarked on series of education reforms and policies geared towards meeting societal needs. The ICT brought rapid changes in the society which requires skills and competencies for readjustment, and adaptation during mentoring in schools. This will help for update in all fields of life and throughout life for everyone to play an active part in the society. The less experienced learners must acquire and manipulate electronic equipment like the computer system, the internet system, compact disc,(CD ROM), and other electronic media through the teachers help and guidance. The usefulness of ICT and electronic media in the secondary school depends on what the teacher makes out of them during lesson delivery to the learners. Proper mentoring, and handling of

resource materials in the classroom is necessary to enable the less experienced learners to meet up. The teacher needs the basic knowledge and skills necessary to make the fullest use of ICT. Teachers must understand how to use and operate ICT electronic materials for appropriate mentoring during class room lesson delivery. Unless the classroom teachers use these resource materials and direct the learners' attention to what they should look for, the pupils will not learn much as supposed.

### **Resources for teaching and learning of science and technology in secondary schools.**

Teaching resources according to Haliru & Zuguru (2014), refer to bulk of instructional materials, devices, aids or equipment used by the teacher and or the learner to facilitate the act of teaching and learning. The materials when adequately provided and properly used, enhance better teaching and learning in the secondary schools.

However, availability and accessibility to instructional materials appear to be one of the greatest challenges to both science and technology teachers and students during content delivery in secondary schools. Some of the teaching materials that are helpful in secondary school teaching include climate chart, weather chart, temperature chart, rainfall chart relative humidity chart, charts of weather symbols density maps, weather maps, digestive, respiratory and circulatory system maps. Film/video clips, temperature maps, Rainfall maps, Relative humidity maps, charts of weather symbols weather instruments, rain gauge wind vane, barometer, hygrometer, Anemometer, thermometer, test tubes, cylinders, beakers, burette, microscope, lens, models, computers lather machines, milling machines, pliers, work bench, saw, hammer, jack planes, smooth plane, meter and others. These materials must be made available to science and technology teachers in all the secondary schools in Nigeria.

### **The concept of the secondary school Education and its objectives**

FRN, (2014) defines secondary school education as the education children receive after primary education and before the tertiary stage. Any pupil who has graduated from the primary school enters the secondary school provided he / se has passed the common entrance examination

According to Achuonye, (2007) secondary school as the name implies come second. That is the second level of the 3-tier system of education in Nigeria. Secondary school is the bridge between primary and tertiary levels. It is the spring board from where all students of higher education take off and all the primary school leavers in most cases must pass through it to become useful to themselves and society. Secondary education was

introduced in Nigeria in the late 1850s by the missionaries. The broad goals of secondary school education, according to Federal Republic of Nigeria (2014) are to prepare the individual for:

- (i) useful living within the society
- (ii) Higher Education.

For the above goals to be achieved, secondary education shall be of six years duration given in two stages: a junior secondary school stage and a senior secondary school stage each shall be of three years duration Federal Republic of Nigeria (2014). For the students to gain education for useful living in the society they must have utter knowledge in ICT learning and practices so as to enable them compete with the global world in fighting global challenges.

### **Concept of Science**

Science is variously defined. However the most acceptable definition sees science as an organized body of knowledge gotten from systematic process. Science may be defined as activities culminating into testable, falsifiable and verifiable facts, principles and knowledge. Hornby, (2005) defines science as knowledge about the structure and behavior of the natural and physical world. According to Igwe, (2003) Science is knowledge attained through the study of the operation of general laws on nature especially that knowledge which is obtained, tested, approved and accepted through a scientific method. Ogbuagu, (2005) sees science as a systematic study of natural knowledge obtained by observation and testing of facts and are arranged in an orderly manner. From his view, scientific method, makes science a peculiar subject and distinguishes it from other types of study. Science comprises of the disciplines such as chemistry, physics, biology and mathematics. Science is a systematic knowledge of physical or material world gained through observation and experimentation, an integral part of human society. Importance of science is evident in agriculture, medicine, genetic engineering, cloning and many others and this is confirmed by Kola (2013) who noted that science is very vital, that its impact is felt in every sphere. Science involves both process and products. Processes of science are those activities/process skills of science. Examples are: observing, measuring, classifying, sorting, predicting, and communicating among others. The products of science are conclusions of science. Examples are: facts, concepts, definitions, laws, principles, assumptions and theories. Teaching and learning of science is an exciting intellectual adventure that contributes to the technological advancements and improves the quality of life. Unfortunately, students have persistent poor achievement in sciences.



This may be as a result of poor mentoring by the teacher during content delivery. There is an urgent need to improve the quality of science education to prevent the issue of poor achievement in sciences as well as reducing /bridging the gap between developed and developing countries/nations. Proper mentoring is considered as a necessary tool for this purpose.

### **Aims of science education in Nigeria**

The aim of science education in Nigeria are:

- a. To produce scientifically literate citizenry
- b. To produce a potentially scientific and technology manpower (Igwe, 2003).

### **Concept of technology**

Technology is a process of practically applying knowledge and using the resources of matter, energy and natural phenomenon to solve human problems and making life easier. Hornby 2005 defines technology as scientific knowledge used in practical ways in industry, example in designing new machines. Science and technology have long been recognized as the instrument per excellence for nation building and every countries today craves for their advancement, (Opera 2004 and Ajewole 2005). Each time science is mentioned, the next word that follows is technology. This is because, the word science consists of body of knowledge that is gotten through scientific processes, while technology is the act of practicalizing scientific knowledge. According to Chinwoke (2011), technology is science in action.

### **Concept of technology**

Technology is the practical application of knowledge especially in a particular area to achieve some results. Quite often the term technology is mostly used in three different contexts when referring to a tool or machine, a technique, a cultural artifact, or a combination of the three. Technology could simply be referred to as things people device to accomplish particular ends. It also refers to different categories of human productive effort and the processes people use to change various aspects of their world. Technology therefore has economic social, ethical and aesthetic dimensions which depend on the use to which it is put, where it is used and the circumstances that prevail at the time it is used Feenberg (2007). Philosophy of technology seeks to clarify the objectives of technology and the methods used by technologists. It is concerned with creativity, and hands on activities. It also

emphasizes that the training environment should be a replica of the actual environment where the knowledge acquired can be utilized.

The history of technology is at least as old as mankind. For instance, archaeologists have uncovered tools made more than a million years ago. The discovery and utilization of fire, a simple energy source with many uses was a turning point in the technological evolution. In our local communities, we can see evidence of technology all round us as we work to better our environment. For instance, women use the grinding stone in the kitchen; pupils construct the see-saw which they use to play. Pot moulding which is a common technology is very common in Nigeria. These are simple and common examples of technological products. We also build our houses in different forms and shapes, using different materials. Technology is not only the modern machines like cars, generators, aeroplanes, ships, and also things we do and use in our environment to make work easy. As pupils manipulate their toys, examine objects, things and events in the environment, design, draw and manipulate simple tools and machines they acquire technological skills that can be used in making their environment better and work easier. Technology is dynamic not static, it is always improving. Pupils and students manipulate objects in their environment as well as in the school where the teacher facilitates and guides as a mentor. By so doing, they acquire technological skills and this encourages critical thinking and creativity under their mentor – the teacher.

### **Reasons for mentoring in technology**

There are many reasons for teaching technology as a component of basic science and technology which are as follows:

I It helps pupils and students to apply scientific knowledge and concepts to better their environment.

Ii To make work easy.

Iii To help pupils / students to use their brain and hands.

IV To encourages critical thinking

V helps pupils and students to develop positive attitude towards work and productivity.

### **Safety during science and technology mentoring in secondary schools**

The method and strategies of teaching and learning science and technology in secondary schools is activity based and very interactive. There is the possibility that accidents may occur which could bring about health problems. There is also the need for teacher to take adequate precautions to prevent such accidents. Accidents which may occur during science and

technology lessons may include: pupils cutting themselves with sharp objects, swallowing and inhaling dangerous objects and chemicals, exposure to radiations, drowning in water, falling into pits or falling down to sustain injuries, sustaining burns during heating, bites by insects, reptiles like snakes and other animals. Accidents and injuries do occur because of student's exposure to potential dangers and lack of knowledge of proper procedures, and techniques. Experiences have shown that most accidents are caused by unsafe acts and unsafe environment.

As a dedicated science and technology teacher you should take proper precautions to avoid accidents during mentoring in science and technology activities especially as you are likely to be held responsible in the event of accidents. Pupils learn more in an environment that is free of accident. They are more confident to explore and carry out activities. Safe environment makes the mentor and mentee to be confident and perform their duties optimally.

Safety measures include:

- Prepare your lesson well in advance and tryout all activities before exposing your pupils / students to them.
- Provide, enforce and educate students on the correct use of personal protective clothing.
- They should always wear their laboratory coat/ good working apparel during activities / practical.
- Use the correct procedures, examples, illustrations and demonstrations.
- Give clear instruction to the students / give safety education and training to students.
- Alert students of hazards likely to occur during practical lessons.
- Always remove possible sources of accidents from the reach of students. / Materials and tools not in use are kept at the proper place.
- Always provide safety rules and ensure they are obeyed.
- Provide a first aid box for use in case of accidents.
- Create safe working environment. Safe environment makes the teacher to be confident and perform his/ her duties very well.

## **Conclusion**

Teachers should be a mentor, a guide, a facilitator and a motivator to the learners. The teachers seeing themselves as mentors during content delivery is vital for effective teaching and learning in the secondary school science and technology. The teacher must be able to select and combine the most appropriate teaching methods for effective teaching and learning. He /

she should not mislead the less experienced learners. He/she should use resource materials effectively. He/she should be ready at all times to produce resource materials. Students should also be used in generating resource materials from their local environment. The government should do their best by providing secondary school resource materials to all secondary schools in the country.

### **Recommendations:**

The researchers recommend the followings:

- Workshops and seminars should be organized by the head of school to tackle the need for teachers to use adequate and appropriate strategies and methods to teach science and technology in secondary schools to help tackle global challenges.
- Teachers should be specially trained and retrained on improvisation of instructional materials in the absence of the original materials.
- In view of the importance of pedagogical competence and skills of teachers in enhancing instruction, through proper mentoring, regular seminars and workshops should be organized for science and technology teachers by federal government to improve their pedagogical skills. This will equip them with knowledge of modern instructional methods.
- Only competent and qualified teachers should be allowed to teach science and technology in secondary schools. The teachers are also required to attend conferences and refresher courses on science and technology as a way of updating their knowledge.
- Provision should be made by school authorities for adequate and relevant instructional materials needed for teaching and learning of science and technology issues. This includes provision of modern technologies such as the internet, GIS software and CAI package.

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