# Enhancing Students' Non-Traditional Classroom Experience in Nigeria through Science Process Skill Based Learning

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***Abstract***

*An effective science education programme should help learners develop process skills which serve as ways to horn their inquiry and problem solving abilities. How far this is done depends much on science teachers and the teaching methods used in the classroom. This paper therefore advocates for a shift from the age long use of traditional teaching methods which now dominates science classrooms in Nigeria to a more student friendly, non-traditional method that enhance the development of process skills and other functional skills such as writing, reading, reasoning, creativity and other cognitive skills. The paper also considered some of the hindrances to the use of process based approach and concludes with some recommendations as a way forward.*

***Key words:*** *Process Skills, Traditional and non-traditional science teaching*

## Introduction

There is a growing concern among the enlightened public and members of the science education profession that the traditional teaching methods still persists in our classrooms despite the fact that age long theories of learning emphasize the necessity for learners to construct their own knowledge. It is therefore most frustrating to note that while the English speaking western countries have since the beginning of late 1960s and early 1970's opted for the inquiry and student centred learning methods which has helped them achieve scientific breakthrough, not only in improving their standards of living but in putting their flags on the moon, Nigeria after 5 decades of independence and huge financial investments in educational and curricula reforms still have didactic methods: chalk and talk, rote learning and memorization as dominant methods of instruction in her science classrooms.

For instance, Okebukola (1997) depicts this scenario aptly when he remarked that the average Nigerian science class begins with a brief chat as an introduction by the teacher and is followed by the reading of notes to the students and ends with the teacher leaving some notes behind for the class captain to copy for his mates during any available free period. Also, Abdullahi (1976) notes that traditional teaching methods permeates the fabrics of most Nigerian schools and has served the purpose of mechanical preparation of students for scaling through requirements of the examiners in West School Certificate Examinations. According to him, this method does not encourage scientific processes but lack flexibility and is didactic in nature.

The prevalence of use of traditional teaching is very common everywhere in Nigeria and has been labelled as one of the reasons for students' poor performance and low enrolment in the School Certificate Science Examinations (Ugwu, 1989; Okebukola, 1997; Ogunmade, 2005, ). This is also responsible for students' poor perception and understanding of the nature of science, since students

are only passive receivers of information and not actively engaged in cognitive process of learning (Gaskell, 1992). The use of obsolete and traditional methods of instruction has therefore not only resulted in students' poor performance, low motivation and an aversion for science, but has given the common impression that science is hard, dull and very boring to learn.

There is no iota of doubt that science education in Nigeria is in crises. While this is sad to note, it is however not totally bad, since the scientific revolution proposed by Kuln (1970) presupposes that crises could be viewed with much optimism as an essential element of a change process. The fact therefore remains that our science education has not functioned adequately in view of the multifaceted problems bedevilling the system and the poor performance of students in science examinations being recorded locally and internationally (STAN, 1992). The way forward therefore is that concerned educationist and the government ought to at this time begin to re-examine and re-conceptualise news ways of teaching science that are both pragmatic and student centred. This rethinking should call for a paradigm shift from science education based on learning of facts and technical vocabularies to one that emphasizes and encourages approaches that help learners formulate and test hypotheses as a means of constructing new understanding. This will be done by moving from traditional to non traditional teaching strategies and according to Aderelegba and Oyelakan (2010) could be the transformative education required at this time to bring Nigerian science education out of the woods and help transform the nation from a developing to a developed and advanced country. Teaching strategies that emphasize the development of science process skills must be encouraged as they have been found to be expedient for quality science education (Adeyemi, 1991 & Roth 2004). Students should through this learn to find and integrate multiple converging sources of learning that arise when the full spectrum of the senses are stimulated in learning and thereby help learners gain appreciation of how science actually works; its achievements, its imperfections and the scepticisms concerning the finality of scientific truth.

**The Traditional Versus Non traditional Teaching and Learning of Science**

Traditional teaching of science is both dogmatic and teacher centred and follows the cook book recipe procedure in its activities and demonstrations. The various teaching methods included under this umbrella are; use of lectures, questioning, demonstrations and even the mechanistic laboratory science teaching in our schools, which researchers: ( Akano, 1998; Hergarty, 1990 ; Hodson, 1990) have described as mindless exercises. Though the traditional teaching of science has for a long time tried to incorporate laboratory work to the science curriculum, one still doubts if this has helped students in being confident in applying scientific knowledge or in strengthening their problem solving abilities, due to the recipe nature of laboratory instructions and emphasis being on students confirming end results of experiments that are often predetermined (Akano, 1998; Opara, 2001). In the traditional science classroom students learn by absorbing and soaking information being given by the teacher who stands as the source of knowledge. The continued use of these methods in teaching is against the spirit of scientific inquiry and even the philosophy of Nigerian science education in the secondary schools as subsumed in the National Policy of Education (N.P.E., 2014), and this has not in any way enriched the classroom experience of students. Brooks & Brooks (1999), and the Wikipedia (2015) have summarized the classroom experience under traditional teaching and learning as centring on the following;

- Curriculum that concentrates in the development of the basic skills.
- Strict adherence to and value of a fixed curriculum.
- Curricular activities highly dependent on textbooks and worksheets.
- Classroom periods involve lectures and note taking, using either the chalk or white board.
- Students are seen as empty vessels and the teacher is to fill them up with information and so has to sit silently and soak information passed to them.
- The teacher is dogmatic and behaves in a didactic manner as he disseminates information to students and is looked upon as a role model.

- Assessment is seen as a detached entity from teaching procedure and is done entirely through examination.
- Students are encouraged to work alone.

The need to modify and adapt to student centred approaches in science teaching cannot be over-emphasized at this time when current research advocates for a shift in the cognitive structure of the classroom environment. According to Domin (1999) since knowledge cannot be transferred from one person to another, students need to have firsthand experience to internalise knowledge. This is the constructive view of the classroom experience: students are to have a realistic view of the nature of scientific enterprise itself and to acquire valuable skills through quality teaching using non traditional methods, which are innovative and interactive in nature. According to Harris and Johnson (2002) the use of non traditional methods will enable students experience the following:

- Acquire enhanced problem solving skills
- Develop self directed learning skills
- Develop the ability to find and use appropriate resources
- Develop critical thinking skills
- Demonstrate increasing performance.
- Develop measurable knowledge base
- Become more self directed
- Develop oral and written communication skills etc.

Again, science teaching in our classrooms should according to Barbules and Linn (1991) help prepare our students for multiple roles and responsibilities and this should affect not only how much science they learn but the forms of enquire appropriate to their needs. Barbules and Linn (1991) have spelt out the approach which acknowledges different goals while recognising set of objectives underlying all science learning. These include that science education should help students:

- Acquire basic knowledge and understanding of ordinary scientific phenomenon
- Develop the ability to generate fruitful and relevant question and frame them in an effective way for investigation.
- Learn to select and apply appropriate methods from a range of options in answering these questions.
- Evaluate and synthesize the scientific information gained as a result.

**Science Process Skills and the importance of process based learning in science classrooms**

Science according to Sund and Trowbridge (1973) is described as both a body of knowledge and a process. As a body of Knowledge, it is organised within various schemes as theories and laws and as a process, includes skills such as hypothesising, manipulation of the physical world and deductive reasoning from data. Process skills as seen by Nwosu (1991) are specific intellectual skills used by the scientists for the understanding of a situation and according to Gagne (1965) serves as the foundation of all scientific inquiry. The Science - A Process Approach (SAPA) apart from popularising science process skills have defined it as a set of broadly transferable abilities appropriate to all science disciplines and reflective of the behaviour of scientists and can be learned by students (Padilla,1999).

Process skills are therefore grouped into basic and integrated skills. The basic skills include; measuring, classifying, inferring, communicating and predicting etc all which serve as a foundation for the integrated skills. The integrated process skills include skills such as formulating hypothesis, controlling variables, and experimenting, formulating models, interpreting data and defining operationally. These skills according to Finely (1983) are applicable for the understanding of any phenomenon and contributes to the rational thinking in any problem. Finely (1983) also notes that

science process skills have the following characteristics;

- Each process is specific intellectual skill used by all scientists and are applicable to the understanding any phenomenon.
- Each process is identifiable behaviour of scientists that can be learned by students.
- The process skills are generalisable and transferable across content domains and contribute to rational thinking in everyday affair (Nnachi, 1988; 21)

The importance of science process skills as tools for problem solving is shown in the relative permanency of the process tools of scientific investigation as compared to the scientific knowledge itself, which is bound to change as knowledge explodes. Knowledge is not absolute because of its changing nature; the science process used in the discovery of new knowledge remains unchanged. For example a scientist today uses exactly the same intellectual skills as Newton or Aristotle. Ndukwe (1986) therefore notes that the National policy on science education and the curriculum material developed in the recent time are now shifting from concept oriented schemes to stress processes. So while the concept and content change, the mental skill of the scientist will still remain. Nwosu (1991; 30) states that;

> "We are faced with an entirely new situation in education
>
> where the goals of education if we are to survive is the facilitation
>
> of change and learning. The only man who is educated is the man
>
> who has learned to adapt and change. The man who has realised
>
> that no knowledge is secure: that only the process of seeking
>
> knowledge gives a basis for security and unchangingness."

Students could by the use of process skill based learning, where students directly manipulate materials gain a variety of experiences that can facilitate the development of other skills such as language, mathematical and logical abilities. For example, research indicates a strong relationship between hands on manipulative experiences science provides to students and the translation from one level of cognitive development to the next and an improvement in problem solving ability ( Afolabi and Akingbola, 2012). It is also true that the processes; concepts and methods found in science processes are useful in other disciplines such as reading and writing. CORD (1999) highlights that understanding about the learning process shows the following;

- Most people learn best in concrete manner that involves personal participation, physical hands on activities and opportunities for learning.
- Learning is greatly enhanced when concepts are presented in the context of relationships that are familiar to the students.
- Majority of learners relate better to concrete, tangible examples and experiences than to abstract conceptual models.
- Rote memorization of isolated fragments of knowledge is relatively inefficient and ineffective learning strategy for most learners

**Obstacles to acquisition of Science Process Skills**

There are a number of issues that tend to hinder students acquisition of process skills in schools.

These are as follows;

1. **Assessment**: There is a lack of valid and reliable instruments for assessing science process skills and assigning meaningful grades in Nigeria. The case is however different for the assessment of factual Knowledge where there are lots of well tested and standardized instruments for assessment. This dearth of process skill assessment tools may be due to the difficulty involved in both their design and use. The curriculum of secondary school education stipulates the acquisition of process skill, but the fact remains that not much has been done in the area of construction, validation and actual use of the instruments in measuring specific skills.

2. **The demands for external certificate examinations:**

   The demands of external certificate examinations seem to be at variance with the true nature of science and scientific inquiry. These examination bodies such as WAEC and NECO demand that students memorize and regurgitate facts at the expense of the development of science skills and attitudes of inquiry and investigations. Again the examination questions of these bodies are often skewed towards eliciting the mastery of content and do not enable teachers to expose the students to the rigor of science skill acquisition.

3. **Shortage of Science Teachers and overcrowded classrooms:**

   There is a dearth of science teachers in our schools to cope with the overcrowded classroom resulting from the increasing students' enrolment. Studies conducted by Eze (2000) revealed low percentage of qualified science teachers in Anambra and Enugu states of Nigeria and very high student- teacher ratios of 1:115 for biology, 1:133 for Physics and 1:122 for chemistry and that there is an average distribution of one science teacher to a school and three science teachers to a school in the rural and urban areas respectively. This scenario could be said to apply to all other states of the country and hence shows why the traditional methods of teaching science seems not go away. Overcrowded classrooms make it difficult for teacher to use the enquiry method but rely on the didactic and teacher centred methods that make coverage of over loaded syllabus easy at the expense of developing process skills.

   4. **Poorly Equipped Laboratories:**

   Most science laboratories are poorly equipped and others often lack maintenance. Science teachers and their students need to work with standard laboratory materials in order to develop their skills although; emphasis of late has been on the improvisation of science equipments but to what extent can the use of improvised science equipment support students acquisition of science process skills? The situation where students and teachers are forced to study science using just textbooks and the chalkboard for lack of equipment and consumables will continue to work against the spirit of scientific enquiry which science plans to inculcate.

**Conclusion**

The paper has looked at the continued use of didactic methods in science classrooms in Nigeria and stresses the need for a shift to the use of science process approach that will make science friendlier to students in terms of understanding and interest. A number of benefits of this approached is highlighted as well as the hindrances to their use.

**Recommendations;**

- Training and retraining of science teachers; the training and retraining of science teachers should be given greater emphasis so as to prepare enough science teachers who are in tune with the procedures of teaching science for process skill acquisition. This kind of

training is expected to expose the teachers to the inquiry and guided discovery methods of science teaching.

- Workshops and seminars should be mounted for practising science teachers so as to acquaint them with innovative non traditional methods of teaching science in the 21st century.
- Examination bodies must recognize the fact to achieve the objectives of the scientific inquiry in the students, the style of their questions have to change from theory to process assessment base.
- The Government should take bold step to recruit well qualified science teachers into our schools to at least reduce the student – teacher ratio.
- Curriculum planners should strive to emphasis the use of science process based approach in the teaching of science in all levels of education in Nigeria.
- Lastly science laboratories should be equipped in all secondary schools with standard laboratory equipment that will enable students have hands on experience with physical materials for learning.

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