International Journal of Development and Sustainability
ISSN: 2186-8662 – www.isdsnet.com/ijds
Volume 3 Number 9 (2014): Pages 1909-1918
ISDS Article ID: IJDS14051901

Creating science within and beyond the classroom: Strategies for African learners

Nsikak-Abasi Udofia *

Department of Educational Foundations, Guidance and Counselling University of Uyo, Uyo

Abstract

The paper creating science within and beyond the classroom: strategies for African learners cover the following: basic issues and strategies. The basic issues treated are science and the African learner, science language, students' interest and science, and loving science. The strategies are: raise a strong argument against a belief, make your science real, challenge the learner, follow curricula specification, customized or indigenized classroom interaction. Others are management of cognitive crises; let the child own up the science class, provocative science lesson, pre-emptive teaching, Transcendence teaching, innovation, listening skills, and Appeal to stakeholders. Some recommendations are made such as Stakeholders in education should create an enabling environment to ginger creation in science.

Keywords: Science education; Science language; Strategies for science instruction; Science creations; Science classroom

Cite this article as: Udofia, N.A. (2014), "Creating science within and beyond the classroom: Strategies for African learners", *International Journal of Development and Sustainability*, Vol. 3 No. 9, pp. 1909-1918.

* Corresponding author. *E-mail address:* nsisong99@yahoo.com

1. Introduction

Science refers to a cumulative body of knowledge which has undergone empirical validation over the ages and has assisted human beings overcome environmental challenges. Various school of thought look at science differently; some philosophically, others economically, some politically, democratically, in terms of process, in terms of skills, in terms of ability, in terms of culture, in terms of technology etc. The constructivist view science as the way of life of the people. In order words, the ability of humans to structure life and overcome hindrances in the environment reflect the science of that era. Science has its theoretical framework from nature, environment, societal variable, social structure, scientific activities, scientific processes, scientific products, scientific skills and human experiences over the ages. Science derives its potency from serving the people faithfully over the years. Science has the overcoming power on environmental challenges and can carve out routes and solutions over any environmental variation and seemingly obstacle.

Science is therefore that people's culture which enables sustainability and preservations of the specie. The difference between any two nations is in terms of technological and economic development. These two concepts are consequence on the nature and status of science in the immediate environment. And if that is the case, science is the tool, language and skills used by man to solve environmental mysteries. If this is so, then science is not wasted in the classroom. Rather science in the classroom is a preparation of the youth on the demand of the environment. It should be observed that most learning are not from the classroom rather they come from man's experience outside to affect the science in the classroom. Science as science, or as technology or in any subject matter controls the skills and sustainability of the subject.

In other words, science in the classroom must be seen as a driving force of civilization. Unless science is regarded as the driver of the future, the tendency is to distance science from human existence and regard science as an abstraction of ideas of man and at times far from reality. This is the problem of science teaching as both the teacher and student see science as an abstract subject. This introduces the concept of Learning, Loving, Living and Creating Educational Science Culture within and beyond the classroom. That is to make science part of the life of the learner otherwise to make science the way of life of the learner.

In other words, science should be made functional, the democratically principles must be upheld. Yet any science curriculum must align with the demand of the time. Hence, there is need for freedom where it is possible but with control where it is not possible. The prospect of a science teacher impacting knowledge should be replaced with the teacher not only facilitating learning but causing learning to occur and the student leaving beyond boarders.

Most scientific inventions and even discoveries either sprout out of a fertile environment of science or grow out of inspiration in a science rich environment. Technology is a product of scientific activities. Even creative arts, music, language, and acting are the reflection of the science of that era. Science reveals the creative power of nature. It is when a science teacher realizes that no world can grow beyond its science that the need is seen to begin scientific exploration and share experience with the learner. Not someone with only scientific skills but one who has passed through the various levels of cognitive, psychomotor and affective domains in the class. This is the foundation of creating science.

Nature remains an enigma but has man as a treasured tenant. Nature and man must live in harmony. Actually, interactively and the medium of communication is science. A science learner should be one who sees science, hears science, reads science, talks science, touches science and perceives science both in the realm of consciousness and in the subconscious realm. This paper covers the following: Basic Issues, the strategies and recommendations.

2. Basic issues

2.1. Science and the African learner

African proffers solution to all problems. This has caused the teachers to demarcate Africa Science from Western Science. One thing is sure, and that is that, the common denominator there is science. One cannot even look at the totality of man's experience without factoring in scientific experience. What science teachers should be aware of is the fact that African students come to class with what they call misconception, alternative conception or cognitive dissonance, which should be counter before teaching the new concept (Bajah, 1999). These extraneous scientific concepts are landlord concepts and cannot be removed by mere threats.

Misconceptions are more cognitive friendly than the much cherished classroom concepts. Misconception is like science outside the classroom which looks responsible for the survival of the race, while science in the classroom look like mere conceptualization.

Science is the language of explaining nature and phenomenon and it is therefore the efficacy of the science of the environment which determines the sustainability of science in the environment. If that is the case, it means that the power of science is its efficiency and effectiveness vis-à-vis its usability in tackling environmental challenges.

Where there seems to be no science, there is indigenous science there. A scientist once observed that nature abhors a vacuum. Nature abhors a vacuum of scientific ideas. Indigenous science is used for survival and solving challenges and task posed by society and space. This is because it has been ingested into the cognitive process. It regenerates and occupies the total mental and cognitive process of the individual. It has been the basic defect of science. Even when science is ominous it remains viable for the society.

A graphical example is in the African science which is predominate in the village and the western science which is taught in the classroom, most African researchers see African Science as alternative conception and western science as the real science. The error in this is that it fails to address the fundamental which is that the mind of the African child is choked up with scientific explanations which have helped in solving the societal problems over time. In effect, to the child, the African Science is the real science while the western science is the alternative conception. This is unacceptable but is the case.

It is only when a teacher consciously knows that he is operating from a defensive position that science could be successfully taught in the class. This means that, the western science teacher comes to the class with

strange concepts which are only useful for the student to learn by rote and pass examinations; only for the child to return to the comfort of the African Science conception in practice. The western science teacher therefore has a serious task. That is, to delete the African science concepts in the mind of the child before the Western science can be assimilated. The science teacher will have to be a gardener to remove weeds from which to plant the right seed if not the weeds will choke up the seed.

2.2. Science language

Science/mathematical language is a unique language which is made up of vocabularies consisting of principles, laws, signs symbols, terminologies, numbers and special expressions. Numbers are used to quantify things in science and mathematics (Ogunniyi, 1982). Incidentally, each branch of science has its specific terminology which is responsible for the classification of science. It is actually the use of this signs and symbols that is responsible for the compartmentalization of science and the seemingly abstract nature of science. This creates an unaccepted third language structure: the indigenous language, teaching language and science language in the classroom.

2.3. Students' interest and science

In his report, Olaloye (2001) found that students' interest towards science has significant direct effect on student achievement in the subject area. Adesoji (2008) asserted that despite recognition given to science subjects; it is evident that student still show low level of interest towards the science subjects thereby leading to poor performance and low enrolment.

According to Hallandyna and Shaughnessy (1982), interest towards science is in general, highly favoured for science learning and achievement. Igwe (1985) in their findings revealed that in countries where there was an emergent or thirst for industrial and technological development there were very favourable interest towards science. However, in countries where a high level of technology and industrial development had been achieved, the findings showed that interest towards science were more neutral. Generally, boys held more favourable interest towards science, the findings concluded. Okpalla and Onacha (1988) asserted that interest towards science is known to decrease as students' progress through their schooling years. He further submitted that attributes such as enthusiasm, respect for students and personality traits have been shown to influence students interest towards science as well as in other subjects, The implication of this findings is that attention should be given to science teaching early so as to enable students have favourable disposition towards science later in life.

Gibbons, Kimmel and O'shea (1988) examined six altitudinal dimensions and their effects on students' achievement. The dimensions were: social implications of science, attitude towards scientific inquiry, normality of scientists, enjoyment of science lesson, leisure interest in science and career interest in science, the result of the study revealed that students have positive interest towards science, mathematics inclusive. Odunsi (1988) in assessing the interest of some science students towards modern orientation in science found that students' interest to science was negative. Popoola (2008) differs in her report of two separate

studies carried out by Yara (2009) when she linked higher achievement in science to positive interest on the part of the students.

Despite these diverse views, and reports on interest towards science and student achievement, attempts have been made to improve students' interest and achievements. Researchers including (Aiken, 1979; Gibbons, Kimmel & O'shea,1997; & Trumper, 2006) opined that students interest about the value of learning science many be considered as both an input and outcome variable because their interest towards the subject can be related to educational achievement in ways that reinforce higher or lower performance. This means that those students who do well in a subject generally have high level of interest towards that subject and those who have high level of interest towards a subject tend to perform better in that subject (Salt & Tzougraki, 2004).

2.4. Loving science

It is difficult to talk about science without talking about the science of loving. Loving here refers to the warmth or attachment which causes hormonal changes in the body such that one begins to feel like having a permanent attachment with another. The loving in this case is psychological and has been classified into three stages by Helen Fisher of Rutgers University namely: lust, attraction and attachment.

Lust is the first stage of love and is characterized by physical attention. It is usually full of desire and seeking for satisfaction. It is driven by the sex hormones testosterone and oestrogen – in both men and women. Attraction is the second stage. It is more expressive than contentment. It is the stage where love is blind, flaws are covered and the new lovers keep occupying one another's thoughts. It is an amazing time where one is distracted by another and can think of little else. It is controlled by three main neurotransmitters namely: adrenaline, dopamine and serotonin.

Attachment is the next stage and involves sustainability. It is like a bond that keeps lovers together long enough for them to plan their life. Scientists associate this with two hormones namely; oxytocin and vasopressin.

It is not common around here to hear one say I do not have interest in science or I do not have positive attitude towards science. What is common here to hear is "I do not like science?" This is interpreted by researchers to mean I am not interested in science. However, this may not be so as it is susceptible to the proper utilization of two concepts namely interest and attitude. Interest refers to the student's positive mind-set to the study of science in secondary schools. Attitude refers to the behavioural disposition of students toward the teaching of science. It actually reflects part of the African seeming deep and passionate attachment or detachment to activities and issues. The fact is that, Africans tend to love what they do and do what they love. In extension, they excel in doing what they love and love to do what they excel. This means that, what they actually love, they do. Hence, if you can get them to love any activity, they will do such. A teacher will have to get the student to love science first if they are to be fully scientific. When they are made to like or love they easily develop permanent attachment; hence skills on such activity.

3. The strategies

3.1. Raise a strong argument against a believe

Since the child in the class has an already competitive scientific cognitive structure before coming into the class, the science teacher should interact with the child before and after the lessons, listen properly to the child and be able to recognize some local believe. The teacher should then take time to nullify them while with the child and also during the lesson. During playtime this should also be done both individually and in groups.

3.2. Make your science real

Mainstream the scientific concepts into real life situation. Take the science lesson home and to the home by citing scientific content of the lesson as part of home experience of the child and if possible the society in general. Describe links between natural phenomena and each lesson and take into considerations the cognitive nature of the child.

3.3. Challenge the learner

Always give the leaner such task as will be challenging to the child. It will help the child from boredom and procrastination. Learning topics should be made challenging to the child. Normally evaluation is designed using Bloom's Taxonomy of cognitive domain. The teacher should have in mind that the student will be assessed based on the several objectives of the cognitive domain therefore the teaching process should take the same mode.

3.4. Follow curricula specification

The curriculum usually makes provision for teachers and students activities. Also provided are curricula guidelines for evaluation by experts from diverse fields and authorities. What they suggest should be followed strictly. This will enable teachers meet the broad objectives of the curriculum. For the instructional objectives, the teacher should plan each lesson to reflect the environmental demand and the perceived cognitive structure of the leaner.

3.5. Customized or indigenized classroom interaction

If one wants to evoke the cultural essence of science lesson, the lesson should be indigenized. This can be done with illustrations and applications which portrays the immediate environment of the child. Where there are local names scientific names should be translated to such. Each conceptual framework should be explained as much as possible using local dialect, if not possible should be properly illustrated and domesticated.

3.6. Management of cognitive crises

According to Gagne when learning occurs there is cognitive transformation, during such cognitive transformation there is bound to be resistance which tends to offset it. This is because the cognitive process of the learner has been filled up with the alternative conceptions. The management of the crises involved is responsible for any form of learning which can ever take place. The teacher should consciously provoke crises and use the curricula science concept to implement the cognitive transformation positively.

3.7. Let the child own up the science class

If a child is to be part of any science class the child should be made to own up the science class. Unless the child sees the class as his own, the child is bound to see science as abstract. The science class should contain some form of familiar sceneries for the child not to be frightened or discouraged. The science class and the student home should be synchronized. The child should be directed to radio channel, websites and television station, where there is science station. The parent most also be science compliance.

3.8. Cloning of ideas

It is important to try and take some of the good ideas in the conception of the child and form new ideas in line with the lesson. Such concept may be alien to the science class but familiar to the child. They can come from the science class, the religious belief or the cultural belief. Grafting science concept into the local belief will make such ideas more fruitful. These ideas and strategies should be used to develop, trap, attract and adhere to some concept. It is useful in interdisciplinary multidisciplinary, integration and putting together fact in any teaching technique.

3.9. Provocative science lesson

Science lesson should be provocative. A science should provoke thought provoking images, fantasies, day dreams, visions, missions, goals, individual aims, personal objectives, self-driven attempts to create, and make science what it should be. It should motivated reinforced and provide ground to be innovative. No lesson should be taught without illustration and application outside the classroom.

3.10. Pre-emptive teaching

These are precautionary measures designed to forestall misconceptions attacking new concepts. The child usually goes home to meet other challenging concepts which are capable of erasing the newly acquired concepts. It makes the learning aloft or insignificance. A new concept when at home will meet with old concepts, which can immediately change the cognitive structure of the child. Hence, the teacher should take pre-emptive measures to nullifying what will likely affect and change the cognitive structure after lesson. Such anti-misconception should be based on being able to convince the child beyond any reasonable doubt. Teaching must be both individualistic and cooperative. The teacher, in other words, should attempt to

influence the child in the classroom outside the class, at home and beyond the classroom. Most especially, the teacher should make the child believe and have faith in the teacher and the science class.

3.11. Transcendence teaching

The mind of the African child is full of several spiritual concepts and imageries. This is because moral issues are taught along religious lines. This moulds the life of the child. The child sees the world from the eyes of extrasensory experiences. It is therefore necessary to emphasis science as transcendence but real and not abstract. The child habitually sees the real world, the perfect world and the world to come from the present world. Science teaching should be mainstream into such, where possible use science to checkmate extrasensory experiences. Science should be taught not only scientifically but with extra scientific or metaphysical applications. Some of the intervening concepts are part of the problems which resists cognitive transformation. The solution is to make science holistic in approach.

3.12. Innovation

Teaching must be that which could initiate innovation. Teaching should encourage innovation discovery and invention. It should ignite and stimulates creativity. The cognitive process should be made, strong; it should rehabilitate, reconstruct and re-structure the cognitive process. Enabling environment should be created for there to be discoveries and inventions.

3.13. Listening skills

Science listening skills needs special ability. Apart from the fact that it is the lesson language it is different from the local or indigenous language and dialect, science language is full with other languages and is full with signs and symbols. Hence, one has to listen carefully and communicate properly. This will make reference to both teachers and students. This will involve being careful in the language of communications.

3.14. Appeal to stakeholders

Various stakeholders should recognize the positive relationship between science and technology. This means that they should sponsor scientific and technological ventures. The government and people should embrace peaceful coexistence and harness resources for development instead of conflicts and war. People life should be upgraded in line with global best practice and global paradigm shift. The wide gap between the rich and the poor should be upgraded for the modern home found elsewhere. At present, the poor majority is at lost at some of the inventions available in modern homes which make the learning of science meaningful to the rich minority.

4. Conclusion

The children should be given sound foundation from homes as well as schools as partners in progress. Necessary modern textbooks should be provided to learners and teachers. Teachers should apply modern methods of teaching that will facilitate creation in science.

5. Recommendations

The following recommendations are made:

- The learner should not only be taught science they should be made to create science.
- Measures must be taken to improve the quality of science teachers. These include better recruitment, better substantive education of Science teachers in training institutions, retraining programme for young teachers with shallow experience, in-service and long vacation courses, improvement of teacher's salaries with special allowances for science teachers and upgrading of the teaching profession.
- Teachers should involve all students in practical work as it is known that learners learn fast what they can do things their own way. Teachers should assist in improving the interest of students towards the teaching and learning in order to enhance achievement in school certificate examinations.
- Teachers should be more committed to their duties.
- Teachers should establish a closer and warm relationship with their learners, parents and the community at large to be able to serve them properly.
- Stakeholders in education, Government and Parents teachers Association, should provide the necessary instructional materials and equipment in schools.
- The general public should create an enabling environment for science teaching to take place. Our Elders, Religious leaders, political leaders traditional heads, and everyone should shun superstition, crises, violence, war, terrorism, crime, corruption, political turmoil and think scientifically
- The gap between the poor and the rich is too wide. The very few privileged rich are science creation compliance, the rest cannot figure out what is going on in the classroom. There is need to carry everyone along for any progress to take place.

References

Adesoji, F.A. (2008), "Managing student's attitude towards science through problem-solving instructional strategy", *Anthropologist,* Vol. 10 No. 1, pp. 2-24.

Aiken, L.R. (1979), "Attribute towards mathematics and science", I*ranian middle schools, school sciences and mathematic,* Vol. 79 No. 3, pp. 229-234.

Bajah, S.T. (1999), "The Challenges of Science Technology and Teacher Education in Nigeria. Beyond the year 2000", *African Journal of Education,* Vol. 1 No. 9, pp. 43-49.

Fisher, H. (2013), *Why We Love: the Nature and Chemistry of Romantic Love*. ISBN 0-8050-6913-5. http://en.wikipedia.org/w/index.php?title=Love&oldid=524099514.

Gibbons, S., Kimmel, H. and O'shea (1988), "Staff development: Implies teacher behaviour and content standards", *Science and mathematics,* Vol. 97 No. 6, pp. 302-310.

Halladyna, T. and Shaughnessy, J. (1982), "Attitudes towards science: A qualitative synthesis", *Journal of Research in Science Teaching,* Vol. 66 No. 4, pp. 547-563.

Igwe, I.O. (1985), "Poor performance in chemistry I Technical College of education. Causes and implications", PGDEDissertation, Ahmadu Bello University, Zaria. *European Journal of Social Science,* Vol. 2 No. 3 (2009).

Odunsi, T.O. (1988), "A study of the attitude of some Nigeria teachers towards science and science teaching", *Journal of Research in Curriculum,* Vol. 692, pp. 200-211.

Ogunniyi, M.B. (1982), "An analysis of prospective science teachers' understanding of the name of science teaching", *Journal of Science Teachers' Association of Nigeria,* Vol. 19 No. 1, pp. 25-32.

Okpala, P. and Onacha, C. (1988), "Student factors as correlates of Achievement in physics", *Physics Education,* Vol. 23, pp. 361-363.

Olaloye, R.A. (2001), "A casual model of school factors as determinant of science achievement in Lagos State Secondary Schools." Unpublished PhD Thesis. University of Ibadan, Ibadan.

Popoola, M.A. (2008), "Factors affecting teaching and learning of agricultural science in secondary school (A case study of Akure South Local Government Area of Ondo State)", Unpublished PGDE Thesis, National Teachers Institute, Kaduna, Nigeria.

Saltak and Tzongraki, C. (2004), "Attitudes towards chemistry among 11th grade students in high school in Greece", *Science Education,* Vol. 88, pp. 535-547.

Trumper, R. (2006), "Factors affecting Junior High School students' interest in Biology", *Science Education International,* Vol. 17 No. 1, pp. 31-48.

Yara, P. (2009), "Student's attitude towards mathematics and academic achievement in some selected secondary school in South-western Nigeria", *European Journal of Scientific Research,* Vol. 36 No. 3, pp. 326-34.