TEACHING – LEARNING ENVIRONMENT, LITERACY LEVEL, ATTITUDE AND ACHIEVEMENT IN SCIENCE FOR SUSTAINABLE DEVELOPMENT AND HUMAN CAPACITY BUILDING IN THE THIRD WORLD NATION: A CASE STUDY OF SECONDARY SCHOOLS IN AKWA IBOM STATE, NIGERIA

Dr. (Mrs.) Udeme Akaninyene Umo and Dr. (Mrs.) Mary Ekong, Offong
Department of Educational Foundations,
Guidance and Counseling, University of Calabar,
P.M.B 1115 (UPO). Calabar, Nigeria.

Corresponding Author: Dr. (Mrs.) Udeme Akaninyene Umo

Abstract
This study is carried out to intimate us that the current development in science has greatly affected the lives of every individual in the third world countries. To be ignorant of the basic knowledge of this development is to live an unrealistic life. Therefore, the study analysis that, a nation without a scientifically educated citizenry cannot be expected to make any reasonable technically-based political decisions in issues such as; crime detections, nuclear energy, population explosion, atmospheric pollution etc. because of the lack of rudimentary tools to grasp the various arguments. One of the objective of science education in the 3rd world countries is to produce scientific and technological literacy, which will lead to the key for development of the third world countries so as to meet up with developed countries of the world. This study is to ginger the pupils and students especially in the primary and secondary schools where the foundation is laid to develop their interest in the science subjects through developing interests and positive attitude to science. Since science and technology are the major factors in developing any nation, for the third world and Nigeria as a nation, to be developed, the Nigerian populace has to be scientifically literate. This study will go a long way to achieve this purpose. The statistics used in the study is a three way ANOVA, mean, and standard deviation. These are used to study how the teaching learning environments of the students affect their attitude to learning and achievement level in science. From the analysis it is concluded that, the more positive the attitude of students and their interest in science, the greater their achievement in science, thus for the third world human capacity development in science, much interest should be developed in the students to study science for sustainable development of the third world nations.

Keywords: teaching, learning, literacy, attitude, achievement

INTRODUCTION

The valuable role of science and technology in the development of a nation is never in dispute and cannot be over-emphasized. Jegede (1983) observed that the current developments in science have greatly affected the lives of every human being and that the ignorance of the basic knowledge of this development is to live an unrealistic life. Therefore a nation without a scientifically educated citizenry cannot be expected to make any reasonable technically based political decisions in such issues as nuclear energy, population explosion atmospheric pollution and other science based projects because of lack of rudimentary tools to the various arguments. Ignorance or fear of science and technology can turn Nigerians into techno-peasants who according to Prewit (1983) are people bewildered or interdicted by the new techniques and languages of science and technology.

One of the objectives of science education is the production of science and technologically literate citizens. If the people are to be future creative citizens, then they must be given a training that will ensure scientific literacy. Scientifically literate persons are those who know how the environment works, understand how science and technology impinge upon public life and are able to make thoughtful decisions by bringing their pertinent knowledge into focus with values that guide decisions. It is a well-known fact that no economic, social, political issues that a citizen and the government must deal with can be well articulated or debated without science and technology playing vital roles. There is need for recognizing and responding to this by laying more emphasis on science and technology.

Science and technology is a major factor in the development of any nation. For Nigeria as a nation to be properly developed, the Nigerian populace has to be scientifically literate and to feel the impact of science in the society, scientific literacy is an important aspect that should be emphasized. For the secondary school student to be responsible citizens in the future, then they must be given a training that will ensure scientific literacy. This can only be possible if they are exposed to scientific concepts, seminars and even excursions to industries working under scientific principles, science conferences, educational scientific magazines and journals and well-developed science curriculum describing what should be taught. The essentials items in teaching often include good equipments, laboratory facilities, modern curriculum materials, teaching aids and limited student loads.

Attitude can be defined as a personal response to a stimulus developed through experience and can be favorable or unfavourable (Schibeci and Riley, 1986). Lewey (1997) pointed out that attitude towards science is known to decrease as students progress though their years in school, as a result considerable attention has been directed towards the identification
of variables which may be related to attitude towards science. Such studies have focused on endogenous and exogenous variables. Endogenous variables are those directly under the influence of the schooling process, for example, teaching behaviour, while exogenous variables are those located outside the influence of the institution, for example, gender of the students. Lewey (1997) observes the endogenous and exogenous variables as variables that offer most potential for improving attitudes. Such improvements can be obtained through new curriculum, better teaching and practical experience. Developing a positive attitude in the students go a long way to improve their academic performance in science.

Addey (1991) posited that the teaching learning environment is seen to be related to the attitudes that students have towards science and science classes. Addey further maintained that the learning experiences a student has in class with his or her classmates are powerful influences on the attitude a student carries away from the class. The teaching-learning environment of a school such as school location (whether it is urban or rural), type of school (single sexed or mixed), facilities available and principal's leadership style has a lot to play in influencing the students’ achievement in science (Effiong, 2002).

The ways students are exposed to science conferences/seminars, science quiz/exhibition and other science related activities increase their awareness to science and improve their literacy level in science (Nvagbo, 1997).

Scientific literacy should hold a rank equal to that of reading and numerical literacy (Martins, 1990). Students will need to operate in a world that will have much of its base in science and technology. The school holds the key to this literacy. One major purpose of an educational system is to prepare young people for future employment. In many developed nations of the world, it has become common in the last two decades or more for employers to blame the educational system for not equipping the students with the necessary and specific scientific and mathematical competencies they require for productive employment in their adult years (Wilson, 1981). The societies in which we live and work have undergone some dramatic changes arising from rapid scientific and technological growth. The need arises for every student and adult to be positioned to understand the present changes and those of unimaginable future. The work in future will increasingly be dependent on new technological tools of operations both in industry and commerce (Keeves and Aikenhead, 1995). This is to say that developing scientific and technological literacy has become imperative for survival, self-fulfilment and productive work in the third millennium (UNESCO, 1994).

The implication of this is that no nation can compete in the world economy without a technically skilled workforce (Champagne and Kloper, 1982). The national need therefore is clear especially for developing nations like Nigeria. Science education should be given its rightful place in the scheme of things in the interest of national economy, development and democratization process. Science education in Nigeria must be seen to be for all especially for its economic consequences (Chrisma, 1984). The overall aim, therefore, is to find ways and means of properly linking knowledge and skills gained from school science with their utility in the world of works. A question that comes to mind is, why has it been difficult for our Nigerian engineers to keep at least our refineries working? Why must we continue to spend huge amount on foreign exchange for turnaround maintenance of the refineries and other technological-based industries? Scientific literacy should be acquired by all as this is an available means of guaranteeing continuous learning even after leaving school (Hudgins, Shaw, Gary and Ames, 1983).

Teachers should attempt to indoctrinate students with certain values about science and scientific concept but instead, should help them to learn a process for solving science values and dilemmas by themselves (Gagne, 1977).

Attitudes are not inherited; they are learned, through some sort of experience. For example, if a teacher always encourages and praises a student on his performance in the science subjects, the student will develop a positive attitude towards the subject and perform better. If on the other hand, the teacher does not encourage the student, he will lose confidence both in the teacher and the subject and develop a negative attitude towards it and perform poorly in the subject.

Attitudes are linked to behaviour through a complex set of beliefs, values and expectances. Attitudes have intuitive appeal as explanation for behaviour. When students refuse to offer science subjects, it is easy to conclude that they have negative attitudes toward the subject or when they score low grades, it means that they do not like the subjects. Specific behaviour are not easily predicted from attitudes as Fishbein and Ajzen, (1995) have noted. An attitude, is a "general" disposition that does not predispose the person to perform any 'specific behaviour' as student move through this educational sequence they become less interested in academics by developing a negative and non-chalant attitude towards it and become more interested in social and extra-curricular activities.

Successful implementation of attitude and value learned depends on the teachers, whose own attitudes and values directly affect the instructional process. Teacher's expectances about the positive or negative consequences of interaction with particular students can affect students’ performances and behaviours both positively and negatively. As a result, teachers should base their expectances of students on complete first-hand information, try to form positive attitudes and communicate them to students. This will go a long way to help in the improvement of students’ achievement in science.

From the literature reviewed on students' attitudes and their achievement in science, it has been observed that students' achievement in science greatly depend on their attitude, whether positive or negative. There is no doubt about the statement that science education is one of the most important things that affect our lives and that science and technology has strong impact on many aspects of our lives. As science and technology is present in every part of our everyday life, it is also more and more present in our various ways of education. The popularity of science pervades all aspects of human life and with this dynamic age of science and technology, there is increased need for students to be highly proficient in science in order to function effectively in the modern day society. Secondary school education plays a prominent role in stage between elementary and university education.

Attitudes can be described as a state of the readiness, a tendency for all to react in a certain way. In general, it refers to a learned disposition or tendency on the part of the individual to respond positively or negatively to situation or another person. Bolayi (1996) opines that attitude influences how well students adjust and how they behave. Attitudes towards science have been studied with regards to achievement and gender differences for quite some time now. The very notable ones include Aksu (1991), Fennema and Sherman, (1976) Max and Kishor (1977). German (1994) using path analytic model hypothesized that attitude toward biology in school, directly or indirectly would influence student's performance in biology. He pointed out that students with positive attitude toward biology are expected to be interested in doing biology and science like activities.

As indicated in the National Policy on Education (1998), the Federal Government of Nigeria has made the teaching of science compulsory at all levels of the new educational system. According to Fayiga (1972), many Nigerian educators have pointed out the need for effective science teaching in order to bridge the gap between technologically advanced nations and the developing nations such as Nigeria. One of the most pressing questions asked in science education, the answer to which is crucial in bridging the gap, is which type(s) of science teaching should be given emphasis in our schools in order to produce students which are scientifically literate with the right orientation to solve problems and steer the nation towards technological development.

When our science students are scientifically literate their achievement in science will also be affected positively as they achieve better in science. Thus the need for increased literacy in the sciences being stressed by many science educators (Agin, 1994, Pella, 1986, Ogunniyi,1986, Moos, 1998) so as to enhance our scientific and technological development. The Federal Government and Ministry of Education (1997) lists as a major programme objective: to improve science education to meet the needs of a broader range of students and to increase substantially the number of persons who make effective use of the processes and results of science in their work and personal lives, whether or not they are engaged in scientific or technical occupation and understand public issues involving science and technology.

CONCEPTUAL FRAMEWORK
Albert Bandura (1977) social learning theory maintains that attitude are learned by observing the attitudes that are verbally expressed or acted out by others. This observed information, is internally represented in some manner (Visual images, verbal codes) and can be expressed at a later time. Children are known to learn a great deal simply by observing the behaviour of adults.

In non-classic study based on the principles of observational learning, or modeling Bandura (1977) had four-year-old children observe a film in which an adult behaved aggressively toward an inflated plastic Bobo doll being rewarded; with threats for behaving aggressively (aggression associated with positive consequences), a second group observed the adult getting punished (aggression associated with negative consequences), and a third group observed the adult receiving neither rewards nor punishment for aggressive behaviour. When the children were then placed in a room with the Bobo doll and other toys, those children who had seen the aggressive behaviour rewarded behaved more aggressively toward the doll than children in either of the other two groups. Those who had seen the adults punished exhibited the fewest aggressive behaviours, but when the children were offered incentives to reproduce as many responses as they could remember, even they modelled the aggressive behaviour of the adult. Thus observing the adult being punished only temporary suppressed their own aggressiveness, it did not interfere with the learning and recall of the aggressive behaviour.

Students who repeatedly see others come out of the principals' office looking troubled, may react negatively to even passing by the office, though they never have been called in. One characteristics of the observer which has been found to encourage modelling is past experience with being reinforced for imitating others. Observational learning is ongoing and continuous. Students pick up new behaviour, consciously or unconsciously, almost everyday by watching parents, teachers, peers and others. They may adopt both the desirable and undesired habits of others they regard as models. Almost every action of a teacher or parent in the presence of children, therefore has the potential of being modelled. Teachers can capitalize on this continuous modelling process by making every effort to be desirable models. They can channel the powerful influence of peers by having students volunteer to demonstrate various desirable behaviours. The support of others in the school community, including parents, other teachers and administrators, should also be enlisted in the modelling process.

The theory of achievement motivation which has become exceptionally influential was originally formulated by David C. Mclelland et al (1953) in the achievement motive. The achievement motive has
been used to predict such diverse events as a students’ academic performance and a country's economic growth, and it has been applied to such controversial areas as sex and social differences in motivation.

There are two basic motives at the heart of achievement theory, a motive or need for success (symbolized Ms) and a motive or desire to avoid failure (symbolized Nf). These are competing motives in that one pushes the individuals to undertake an achievement task and the other pulls the person in the opposite direction. If the motive to achieve success is greater than the motive to avoid failure, this person will likely succeed, but if the motives are equal in strength or if the motive to avoid failure is stronger, the person is not likely to succeed. The strength of these motives is considered relatively stable over time, but most people would experience both motives to some extent. The theory of achievement motivation had its origin in needs theories, which did not specify how to measure the existence and strength of a basic need.

THEORETICAL BACKGROUND

Research Design: Expo-facto
Research Area: Akwa Ibom State
Sample Size: 1,200
Instrumentation: Questionnaire

DATA ANALYSIS

The data were analyzed using the following statistical techniques which included the mean, standard deviation, population t-test, multiple regression, correlation, and 3-way analysis of variance (ANOVA).

This study was on teaching-learning environment, literacy level, attitude and achievement in science in secondary schools in Akwa Ibom State, Nigeria. The major variables in the study were teaching-learning environment, science literacy level, attitude to science and achievement in science. The teaching-learning environment was considered under physical and psychosocial learning environment. Data and all the variables were subjected to distribution statistics. In the achievement in science, students were scored using a 48 objective options comprising of 16 Physics items, 16 Biology items and 16 Chemistry items. After the scoring, their scores were converted to percentages to determine their performance in science by multiplying their scores by 100%.

The results on the analysis have been presented in Table 1.

Table 1: Means and standard deviations for all variables in the study

<table>
<thead>
<tr>
<th>SNO</th>
<th>VARIABLE</th>
<th>N</th>
<th>X</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Quality of laboratory</td>
<td>1000</td>
<td>28.48</td>
<td>28.38</td>
</tr>
<tr>
<td>2</td>
<td>Classroom climate</td>
<td>1000</td>
<td>51.76</td>
<td>32.60</td>
</tr>
<tr>
<td>3</td>
<td>Science literacy level</td>
<td>1000</td>
<td>13.83</td>
<td>2.04</td>
</tr>
<tr>
<td>4</td>
<td>Attitude to science</td>
<td>1000</td>
<td>28.30</td>
<td>4.11</td>
</tr>
<tr>
<td>5</td>
<td>Achievement in Physics</td>
<td>1000</td>
<td>53.64</td>
<td>19.49</td>
</tr>
<tr>
<td>6</td>
<td>Achievement in Chemistry</td>
<td>1000</td>
<td>46.38</td>
<td>20.75</td>
</tr>
<tr>
<td>7</td>
<td>Achievement in Biology</td>
<td>1000</td>
<td>54.94</td>
<td>19.75</td>
</tr>
<tr>
<td>8</td>
<td>Overall science achievement</td>
<td>1000</td>
<td>51.70</td>
<td>16.47</td>
</tr>
</tbody>
</table>

Table 2: Three—way analysis of variance of the influence of class size, school location and school type on students’ science achievement

<table>
<thead>
<tr>
<th>Source of Variation</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Between Class Size</td>
<td>305937.19</td>
<td>2</td>
<td>305937.19</td>
<td>4.195*</td>
</tr>
<tr>
<td>Location</td>
<td>317046</td>
<td>1</td>
<td>317046</td>
<td>12.727*</td>
</tr>
<tr>
<td>School type</td>
<td>1469.77</td>
<td>2</td>
<td>734.88</td>
<td>2.950</td>
</tr>
<tr>
<td>Class size &amp; location</td>
<td>1454.19</td>
<td>2</td>
<td>727.10</td>
<td>0.597</td>
</tr>
<tr>
<td>Class size &amp; School type</td>
<td>595.32</td>
<td>4</td>
<td>148.83</td>
<td>0.191</td>
</tr>
<tr>
<td>Location &amp; School type</td>
<td>952.09</td>
<td>2</td>
<td>476.05</td>
<td>1.291</td>
</tr>
<tr>
<td>Class size location &amp; school type</td>
<td>643.38</td>
<td>2</td>
<td>321.69</td>
<td>0.550</td>
</tr>
<tr>
<td>Within</td>
<td>245127.31</td>
<td>999</td>
<td>245.127</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>2711271.9</td>
<td>999</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

DISCUSSION OF FINDINGS

Table 2 shows the test of significance for the influence of class size on students' achievement show that the calculated F-ratio of 4.195 was greater than the critical F-ratio of 3.00 at .05 level of significance with 2 and 984 degrees of freedom. This implies that there was a significant influence of class size on students' achievement in science. The test of significance for the influence of location on students achievement also proved significant as the calculated F-ratio of 12.727 was greater than the critical F-ratio of 3.85 at .05 level of significance with 1 and 984 degrees of freedom.

The case was different for the test of significance of the influence of school type on students' achievement. The calculated F-ratio of 2.950 was less than the critical F-ratio of 3.00 at .05 level of significance with 2 and 984 degrees of freedom. This result indicates that there was no significant influence of school type on students' science achievement.

All the interactions carried out in the analysis proved no significance. The calculated F-ratio for interaction between class size and location (2.919), class size and school type (0.597), location and school type (1.911) and class size,
location and school type (1.291) were all less than the critical F-ratios of 3.00, 3.00, 2.61 and 3.00 respectively at .05 level of significance with 2 and 984, 2 and 984, 4 and 984, and 2 and 984 degrees of freedom respectively.

In summary, the results show that there were no interactive effect of class size, location and school type on students' science achievement.

CONCLUSION
From the results of the findings, it was concluded that the science literacy level amongst secondary schools in Akwa Ibom State, the attitude to science and their achievement in science is significantly high. The above facts can be proven from the recent performances of Akwa Ibom State secondary school students during their JETS and Mobil oil producing, Nigeria science quizzes in which they had outstanding performances; and also their achievement in science is improving from year to year. This development entails a high achievement in science which will help in the sustainable development and human capacity building in the African countries with special reference to Nigeria as a developing nation.

RECOMMENDATIONS
On the basis of the findings made in this study, the following recommendations are made:-

All post primary institutions in Akwa Ibom State should be provided with well-furnished laboratories. This will make the students to be exposed to scientific practical and science concepts to make them more literate in science.

Science curriculum should be revised to incorporate more of practical work than theory. This will help the secondary school students to relate what they learn in school to their practical day to day experience and this is the real literacy, to apply your knowledge to your daily living.

Schools should provide a good teaching-learning environments for the students by providing well-furnished laboratories, well qualified science teachers and other facilities that aid the teaching and learning of science. The school should educate the students on the usefulness of science and the implication it has on science and technology and also their future goals in life through scientific talks and seminars. This will increase the science literacy level of the students.

The parents should bring up the children in such a way as to make them know the usefulness of science in the society by exposing them to scientific gadgets such as the computer, television and the internet.

REFERENCES


Max & Kishor, N. (1977). Assessing the relationship between attitude towards mathematics and achievement in mathematics: A meta-


Pella, M. O. (1986). The place or function of science for literate citizenry. Science Education 60,97-110.

