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SCIENCE EDUCATION IN NIGERIA:
DROWNING BUT WAVING

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61ST INAUGURAL LECTURE
OLABISI ONABANJO UNIVERSITY
AGO-IWOYE

Tuesday, 11th December, 2012.

Dedication

To my Children - Lola, Lade, Lara & Lolu.

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SCIENCE EDUCATION IN NIGERIA: DROWNING BUT WAVING

The Vice-Chancellor,
Deputy Vice-Chancellor,
Other Principal Officers of the University,
Provosts of Post Graduate School and Colleges,
Fellow Deans of Faculties,
Distinguished Professors,
Heads of Department,
Distinguished Colleagues and Friends from Sister Universities and other Institutions,
Your Excellencies and Royal Highnesses here present,
My Lords Spiritual and Temporal,
Gentlemen of the Press,
Great OOUITES!
Ladies and Gentlemen

Preamble

Mr. Vice-Chancellor Sir, my distinguished audience, it is with great pleasure and a heart full of gratitude to the Almighty God that I stand before you to give an account of my stewardship in the business of science education. This Inaugural Lecture which is being delivered on behalf of the Department of Curriculum Studies and Instructional Technology (CSIT), is the 61st in the general series of Inaugural Lectures delivered in the University, the 12th from the Faculty of Education and the 4th from the Department of CSIT. This lecture is unique, and it is a landmark in the history of the University for the following reasons: First, the presenter is an Alumnus of this great citadel of knowledge; Second, the presenter is presenting as the first Female Alumnus Dean of this great University. Third, the presenter

is the only female among the current Deans and Provosts of this University.

When we were asked to choose a date for presentation, I specifically chose December to commemorate my 50th birthday. So, this is a double joy for me. I bless the name of the Lord for giving me the opportunity to attain the golden age of 50 and getting to the peak of my career. I started my academic career in the then Ogun State University (now Olabisi Onabanjo University) as a Graduate Assistant on 19th December 1990, and rose through the ranks to the exalted position of Professor of Science Education on the 1st of October, 2007.

My being a Professor of Science Education is a divine design. When I sought admission into the then Ogun State College of Education in 1979, I was to study English/Yoruba. However, the then Deputy Provost, Dr. Eniola Sogbesan of blessed memory looked at my Secondary School Certificate result (as it was the custom then to go before him before the final clearance for full registration) and just changed my course from English/Yoruba to Biology/Geography.

He said the Government had given them a mandate to admit more students into the Sciences and since I had passed those subjects equally well, I should just go ahead with Biology/Geography or forfeit the admission. I cried, and asked "but why"? Is it a crime to pass all subjects offered? A lecturer that saw me crying intervened on my behalf, but that worsened the case as Dr. Sogbesan maintained that if I was not ready for the course, I would forfeit the admission. After two (2) weeks of passionate but fruitless appeal, I resolved to forge ahead. To the glory of God, today, I thank Dr. Eniola Sogbesan for that firm stance.

Mr. Vice-Chancellor Sir, my distinguished audience, in 1987, I was encouraged by my late husband – Prince Solomon Ademola Bilesanmi, to seek a full-time admission into the then Ogun State University, which I did after much persuasion because I preferred the part-time mode for I knew full time was not going to be easy, with me off job and our girls in school, but he insisted and subsequently, supported and took care of us wholeheartedly.

The encouragement and commitment he showed spurred me into action and from the first semester examination, it was a success story. Then, we planned that I would be a University lecturer, have a Ph.D. and eventually become a Professor. I kept faith with the plan and graduated in 1990 as the best student in the Department of Curriculum Studies and Instructional Technology and the best in the Faculty of Education. Since it was customary for Ogun State University to retain the best graduating student of each Faculty, I was given an automatic employment as a Graduate Assistant that year.

Unfortunately, on 21st September 1990, barely three months after the completion of my programme, my husband died. It was a very harrowing experience. On the hospital bed, as if he knew he was going to die, he made me promise him that I would not derail from the path we charted together. His sudden departure was most devastating but I was determined to fulfil my pledge, so with perseverance, strong-will and hope to the glory of God, I plunged on. At trying times, when it seemed I could no longer muster enough strength to continue, I would remember my vow and somehow, I mean somehow, Mr. Vice-Chancellor, there would be a way out. He motivated me even in death.

Mr. Vice-Chancellor Sir, distinguished audience, may I humbly crave your indulgence to kindly rise for one minute in honour of my late

husband – Prince Solomon Ademola Bilesanmi. (May his gentle soul continue to rest in perfect peace, Amen).

Now to the business of the day.

1.0 Introduction

Mr. Vice-Chancellor Sir, my distinguished audience, I am here today as a Professor of Science Education to give a synopsis of what I have been professing. Sir, there is scarcely anyone here who can debate the assertion that a country's level of scientific and technological advancement is an index of her level of development. It therefore follows that if any nation must be in the league of developed countries, she must take the issue of science education seriously, and with a burning passion.

Perhaps, in appreciation of its facilitative potentials, the National Policy on Education has as one of its objectives for secondary school education the desire "to equip students to live effectively in our modern age of science and technology" (FGN, 2004). This, to my mind, suggests that the Federal Government realizes the fact that science is not only a school subject, but also a way of life.

Then, the big question is "Can science in Nigeria as it is today meet the challenges of development in the 21st Century?" The answer is glaringly evident in the state of science education in Nigeria. Without mincing words, the science teaching and learning processes in Nigeria are bedeviled with a lot of challenges. It is therefore pertinent to ask, what is the situation of Science Education in Nigeria? Hence, this Inaugural Lecture is titled:

Science Education in Nigeria: Drowning but Waving.

Science Education in Nigeria: Drowning but Waving.

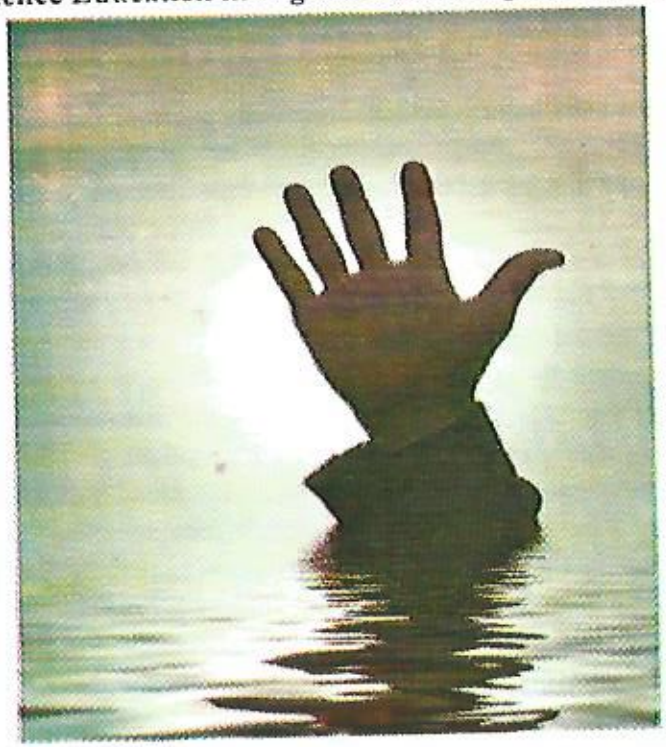

Figure 1

To do justice to the topic, I shall run through the following outlines:

- Conceptual Clarification of Teaching, Learning and Science Education.
- The Teacher and Teaching Effectiveness.
- Achievement in Science Education.
- Gender, Achievement and Science Education.
- Indicators of "Drowning".
- Response to the "Waving"/ Suggested Rescue Actions.
- Conclusion.

1.1 Conceptual Clarification of Teaching

Teaching can be defined as a purposeful activity carried out by someone with a specialized knowledge in a skillful way to enhance the cognitive, affective and psycho-motor development of a person or a group of persons (Ogunyemi, 2000). To Das (2006), teaching is an interaction between the teacher and the taught and the result of the interaction is expected to bring about the desirable changes in the behaviour of the learners.

According to Clark and Starr (2006) and Bilesanmi-Awoderu (2010), teaching is an attempt to assist students in acquiring or changing some skills, knowledge, ideas, attitudes or appreciation. Moore (1972) concluded that teaching is not just a matter of teachers talking and students listening. He opined that effective teaching involves interactive communication patterns that are skillfully directed. Therefore, before anyone can be adjudged to be teaching, he or she must have acquired the necessary knowledge to be shared and possessed the wherewithal for its effective delivery.

Ogunyemi (2000), while quoting Ehman, et. al. (1974), stated the goals of effective teaching to include:

- enabling the learner develop his or her potentials;
- contributing to thinking in the subject;
- sustaining students' interest;
- suiting the circumstances of teaching language; and
- suiting the individual teacher's activity and interest.

The aims of teaching science, following Das (2006) would include:

1.1.1 **Acquisition of Knowledge and Information**: The students studying science should acquire knowledge of scientific facts, principles and events of nature, living and non-living, rules of health, and sanitation and other kinds of knowledge of science that will help the learner to live an intelligent and efficient life in a modern society.

1.1.2 **Development of Interest and Appreciation**: Teachers are expected to conduct their teachings in such a way as to stimulate the interest of learners so that what they eventually learn will be meaningful and permanent. Such teachings should make students develop interest to pursue scientific activities within and outside the school, read scientific news and literature, organize science clubs and science exhibitions, science competitions and try to apply scientific knowledge in everyday acts. In addition, studying science should make students appreciate the contributions of science for the well being and comfort of mankind and how the ideas and achievement of science have helped the progress of human activities.

1.1.3 **Development of Favourable Habits:** Science is a pursuit of truth and its pursuit demands intellectual honesty, diligence, perseverance, tenacity, patience, concentration of mind, unbiased judgment, and objective observation. These qualities also help the learners to become self-confident. The study of science should develop such healthy habits. Students should imbibe habits of taking care of personal health and preventing common diseases.

1.1.4 **Training in Scientific Method**: Through the study of science, the students should be trained in scientific method of procedure for solving problems. This is infact the problem-solving method that involves applications of critical thinking and systematic procedure.

1.1.5 **Development of Scientific Attitude:** Scientific attitude refers to critical observations, inquisitiveness, broad-mindedness and open-mindedness, objectivity in approach, non-belief in superstition and hearsay, belief in proof, trust in correct evidence, respect for others' opinion, faith in scientific methods, unprejudiced judgment, belief in cause and effect relationship. Such attitudes are needed not only in study of science but also in solving problems at home and in the society. For instance, through development of scientific attitude, you accept that Albinos are not products of mating in the afternoon but that of gene mutation, having children that are of sickle cell is not a function of some unseen powers but as a result of the parents having AS or SS genotypes. These qualities when developed in the minds of the students and instilled in the behavioural pattern of the learners, solve many problems of individual and social living. Hence, science attitude is considered an important constituent of the aims of teaching science.

1.1.6 **Development of Skills and Objectives**: Teaching of science should aim at developing in the learners various skills involved in studies of science, such as skills in drawing diagrams and sketches of specimen and

apparatus, constructual skills, experimental skills for arranging and organizing experiments in science as well as for handling instruments and apparatus, skill of observations, and the skill for solving problems. Studying science should develop in the learners the ability to identify a problem and formulate hypotheses, experiment, collect and interprete data, discuss results, ability to improvise equipment and apparatus where necessary.

1.1.7 **Science Studies as a Basis for Future Career**: In the scientific and technological world of today, there are innumerable avenues where science finds its application. Science, in addition to being a part of general education, prepares students for future vocations and careers in science.

1.2 Conceptual Clarification of Learning

Teaching is not meaningful without learning. For teaching to be completely done, students taught must have learnt. However, learning is a personal thing. According to Odejobi (2010), learning is a change in behaviour as a result of past experience. One could say that the general aim of educational activities is that people will learn from them. But, that doesn't make education synonymous with learning; it simply says that learning is the intended outcome of educational processes and practices (Biesta, 2009).

Learning can be in different forms/types. However, Bloom, Mesia and Krathwohl (1964) identified three domains of educational activities as:

1.Cognitive;
2.Affective; and
3.Psychomotor domains.

1.2.1 *Cognitive Domain*: This has to do mainly with cognition. It emphasizes knowledge, mental abilities, recall of information and development of intellectual skills. Here, students are expected to acquire scientific knowledge and learn scientific concepts, facts, principles, theories, laws, and generalizations.

1.2.2 *Affective Domain*: This is mainly concerned with feelings, attitudes, emotions, etc. Students are expected to imbibe scientific attitudes, ethics of science like objectivity, curiosity, open-mindedness, honesty, skepticism, etc.

1.2.3 *Psychomotor Domain*: This is mainly concerned with the coordination of the brain with the hands. It emphasizes the use of motor areas. Here, students are expected to draw, build, mould, manipulate equipment, perform experiments, etc.

1.3 Conceptual Clarification of Science Education

Science education is an integrated field of study which considers both the subject matter of science disciplines such as Biology, Chemistry, Physics, Agriculture, etc, as well as the processes involved in the learning and teaching of science. In other words, science education implies exposing learners, usually prospective teachers of science, to scientific and technological knowledge, to the nature of science and scientific

processes, to scientific attitude as well as equipping them with professional skills. Thus, a thin line exists between science education and education in science where the latter refers primarily to understanding and application of scientific concepts and principles while the former involves the development and acquisition of processes/procedures required to help others acquire scientific and technological knowledge for ready application to everyday living (Okeke, 2007).

Let me quickly remind us that the importance of science and technology to life cannot be overemphasized. As a matter of fact, science and technology make life what it is today.

1.3.1 Values of Science in Everyday Life:

The knowledge of science has brought about significant changes in all spheres of life be it health, industry, agriculture, communication, transportation, engineering, power, etc. Science education is essential as it is of immense value in the student's individual life and his or her life in the society. Its values as opined by Joshi (2007) are:

1.3.1.1 **Intellectual Value**: Science is a method of acquiring knowledge. Such scientific knowledge helps to sharpen our intellect and promote intellectual honesty. It makes us systematic in our reasoning and helps to report an event or a thing without any prejudices. Science education helps one to develop positive attitudes like open-mindedness, rational reasoning, confidence and desire for the acquisition of correct knowledge and, such positive attitude helps an individual to solve social problems.

1.3.1.2 **Aesthetics Value**: Science is basically the process of unfolding the store of mysteries and beauties that nature possesses. Thus, science education is essential for developing an aesthetic sense in an individual. The scientists feel an intrinsic claim and happiness by enjoying the aesthetic aspects of his or her discoveries and inventions.

1.3.1.3 **Vocational Value**: There are a large number of vocations for which the study of science is a primary requirement. Examples are Medicines, Engineering, Computer Studies, Paramedics, Agriculture, Biotechnology, etc. In the contemporary time, there is hardly a vocation that does not need the knowledge of science. It thus becomes quite clear that to enter into any such vocational course, an individual must have knowledge of science.

1.3.1.4 **Practical Value**: Scientific principles and laws find a large application in everyday life. For proper utility of such applications, basic knowledge of science is necessary. The application of science is found in electricity, communication, electronics, transport, information technology, etc. One striking example of the practical utility of science is found in telephone and Internet through which one can reach people anywhere in the world in a matter of minutes. The practical value of science is felt in medicines and

health. The sources of entertainment like the television, radio, cinema, Internet, are all contributions of science which have tremendous utility in modern day life. Science has provided newer dimensions to the hobby of an individual, for example, a person whose hobby is gardening will enjoy and benefit from the knowledge of plant breeding, soil, science, fertilizer science, etc.

1.3.1.5 **Moral Value**: Truthfulness and reasoning are good qualities desirable in all human beings. These qualities make one's life worth living although there is currently erosion of moral values due to materialistic greed. However, Science still places emphasis on training in truthfulness.

1.3.1.6 **Psychological Value**: Teaching of science is essential for developing scientific attitudes and scientific temperament. Learning of science is based on the fundamental principles and mazims of learning. Science being an activity-oriented subject helps to satisfy basic human desire of knowing about wonders of nature and satisfies human instinct like creativeness, self-assertion, curiosity, etc.

1.3.1.7 **Cultural Value**: The knowledge of science develops in us a capacity to critically examine facts and arrive at logical conclusions. A study of the past and the discoveries give us an insight into the life, sacrifice and adventures

of great scientists, and also the cultural heritage of people.

1.3.1.8 **Adjustment Value:** Science helps us to develop scientific attitude and scientific method. Such a method prepares an individual to face problems of life and solve such problems systematically and successfully. A person possessing scientific attitude is open-minded and has a desire for accurate knowledge. He or she believes that the problems can be solved through proper efforts involving scientific observations and experimentation. Science attempts to provide us with systematic and organized information comprising scientific facts, concepts, generalizations, laws and theories which may prove helpful to all of us not only in enhancing the span of our knowledge but also in finding solutions to our problems.

2.1 The Teacher and Effective Teaching of Science

A teacher is simply somebody who imparts knowledge. Dada (1999) defined a teacher as "a person who imparts knowledge for a living". The success of any educational system or programme depends, to a large extent, on the quality and availability of qualified and committed teachers. This is true because the teacher formulates, designs, assembles, controls, supervises, selects, explores, facilitates, manipulates, assesses the teaching-learning materials, and evaluates all other factors in the teaching-learning process (Adetayo, 2011).

Stressing the importance of teachers to curriculum implementation, Alaba (2001) opined that no matter how well defined an educational system may be, the implementation cum the implementers will be responsible for its successes in the final analysis. He further opined that whatever happens to the implementers will eventually reflect in the output of the system.

Furthermore, Bajah (1999), while submitting on the importance of science teacher asserted that:

> *"No matter how well our thoughts about science have been developed and documented, no matter how realistic we think our objectives are, the success of our science programmes depends to a great extent on the classroom teacher. It is he/she in the final analysis who translates our thoughts into actions – pg. 43 – 49".*

The teacher therefore occupies a key role and he/she is central to the business of teaching in the schools. According to Joshi (2007), a school teacher may be provided with all possible facilities in terms of laboratory, apparatus and equipment, given an ideal syllabus and a sufficient time for teaching of science but unless he/she is enthusiastic about his/her work, knows the subject and really knows how to teach science; he/she is not likely to achieve success. On the other hand, a keen and well informed teacher who loves his/her subject and believes in its value will succeed in spite of difficulties and handicaps.

Of all the factors instrumental to effective teaching and learning in the school system, Bilesanmi (1999) alluded to the fact that the most important is the teacher factor. This is partly because the teacher is capable of turning a seemingly hopeless learning condition to a motivating or conducive one thereby influencing positively the effectiveness of the teaching-learning process. In line with this thinking is the axiom that "no education system may rise above the quality of its teachers" (FGN, 2004:26). Hence, this statement aptly and succinctly underscores the decisiveness of the teacher-factor in any educational system (Akhilomen, 1992).

Let us look at the analogy drawn between teaching and marketing or selling by Ehindero (2010). The teacher like the seller has a product (packaged knowledge) to "sell" to an active, critically minded "buyer", the students. To sell the knowledge or message; call it concepts, generalizations, principles or laws embedded in the different disciplines of the school curriculum, the teacher has to make the product "attractive" to the buyer. He/she has to know through reasoning and planning the 'taste' of the buyers in order to determine how to develop and package the product to sell. In developing such products, the teacher will be guided by the psychology of the learners, their levels of intellectual abilities, their preparedness or predisposition to learn, their learning styles, learning habits and the optimum atmosphere within which the learners can negotiate the meanings of the packaged knowledge with the teacher. The negotiation has to take place within the context of trust, commitment, willingness, understanding and professional ethics.

Bilesanmi (1999), in examining the causal model of teacher characteristics and students' achievement in some ecological concepts, sampled one hundred (100) secondary school biology teachers and one thousand (1000) students, the study provided a most meaningful causal model involving eleven (11) independent teacher variables and students' achievement in secondary school ecology. It also indicated the direction as well as the estimates of the strengths of the causal paths bringing out the direct and indirect effects of teacher characteristics on students' achievement as well as proportion of the total effect of the eleven (11) variables that are direct and indirect.

The Hypothesised Causal Model for X_1-X_{12} Showing Path and Zero Order Co-efficients.

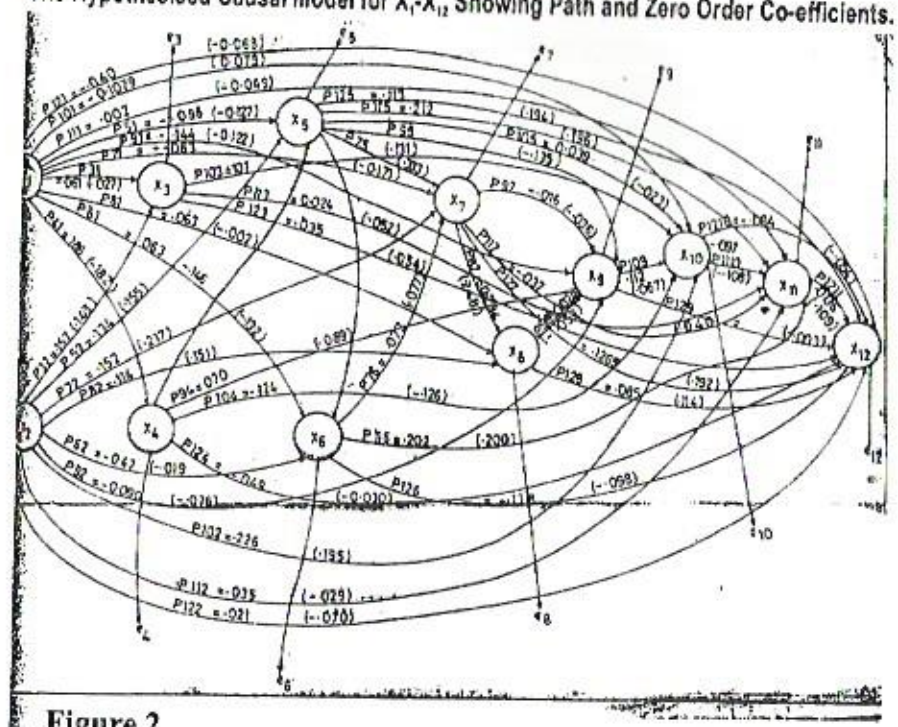

Figure 2

X_1 = Variable$_1$ = Gender
X_2 = Variable$_3$ = Scientific
X_4 = Variable$_5$ = Experience
X_7 = Variable$_7$ = Teachers' understanding of Science
X_9 = Variable$_9$ = Attitude to Teaching Profession
X_{11} = Variable$_{11}$ = Teaching Style
X_3 = Variable$_2$ = Qualification
X_5 = Variable$_4$ = Mode of Study
X_8 = Variable$_8$ = Cognitive Style
X_6 = Variable$_6$ = Self Concept
X_{10} = Variable$_{10}$ = Attitude to Biology Teaching
X_{12} = Variable$_{12}$ = Achievement

The study documented that the more parsimonious model is effective in determining students' achievement in ecology. As such, six (6) teacher variables; understanding of science, experience, self-concept, teaching style, attitude to biology teaching and cognitive style were reported to have direct causal effect on students' achievement in ecology. The study, therefore, concluded that the various linkages shown in the

more parsimonious model should be noted by curriculum developers and science educators since these could provide a strong basis for developing a more effective theory and technique for efficient nation-building through effective Science Education.

The New Model for X_1-X_{12}: A More Parsimonious Model

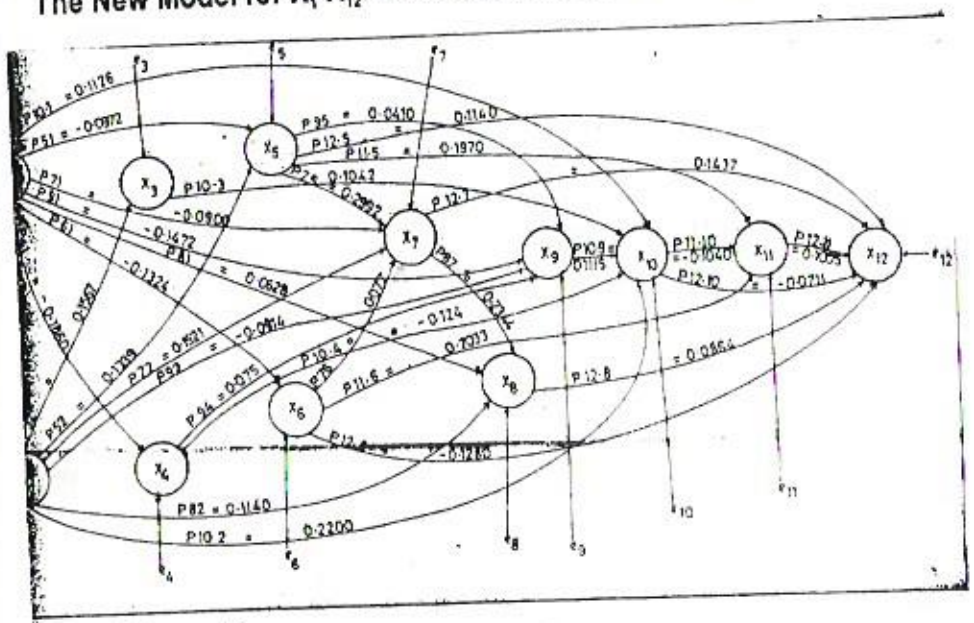

Figure 3:

X_1 = Variable$_1$ = Gender
X_2 = Variable$_3$ = Scientific
X_4 = Variable$_5$ = Experience
X_7 = Variable$_7$ = Teachers' understanding of Science
X_9 = Variable$_9$ = Attitude to Teaching Profession
X_{11} = Variable$_{11}$ = Teaching Style
X_3 = Variable$_2$ = Qualification
X_5 = Variable$_4$ = Mode of Study
X_8 = Variable$_8$ = Cognitive Style
X_6 = Variable$_6$ = Self Concept
X_{10} = Variable$_{10}$ = Attitude to Biology Teaching
X_{12} = Variable$_{12}$ = Achievement.

3.1 Achievement in Science Education

Despite the importance of Science as aforementioned, the individual and collective efforts of researchers to improve science teaching and learning, science students still underachieve (Soyinbo, 1982; Onocha, 1985; Okebukola, 1986; Balogun, 1992; Bilesanmi, 1994; Ogunniyi, 1996; Bilesanmi-Awoderu and Ogunkola, 2004; Bilesanmi-Awoderu, 2006a and Bilesanmi-Awoderu, 2007b). This is evident in Table 1.

Table 1
Students' Achievement in the May/June Pure Science Subjects between 2002 and 2011

Year	Subject	Total No. of Candidates	No. of Credit Pass	%
2002	Physics	254,188	120,768	47.51
	Chemistry	262,824	90,488	34.43
	Biology	882,119	278,122	31.53
2003	Physics	270,474	130,982	48.43
	Chemistry	273,906	143,839	52.51
	Biology	1,025,572	392,249	38.25
2004	Physics	265,262	135,359	51.03
	Chemistry	269,774	105,133	38.97
	Biology	832,689	287,484	34.52
2005	Physics	345,640	144,132	41.70
	Chemistry	351,378	179,153	50.398
	Biology	1,055,710	377,693	35.77
2006	Physics	379,823	221,450	58.30
	Chemistry	384,123	173,304	45.11
	Biology	1,149,400	568,202	49.43
2007	Physics	419,245	181,092	43.19
	Chemistry	423,335	194,729	45.99
	Biology	1,239,829	414,408	33.42
2008	Physics	405,913	195,922	48.26
	Chemistry	409,069	180,563	44.13
	Biology	1,244,242	420,923	33.82
2009	Physics	454,802	146,341	32.18
	Chemistry	460,933	161,534	35.05
	Biology	1,518,220	499,432	32.90
2010	Physics	487,963	159,264	32.64
	Chemistry	511,735	128,388	25.09
	Biology	1,995,223	531,564	26.64
2011	Physics	587,772	157,543	26.80
	Chemistry	622,453	130,345	20.94
	Biology	2,076,675	556,132	26.78

Source: *West African Examination Council, Research and Statistics Unit 2011*

Table 1 shows that students underachieved for the period of ten (10) years under consideration (2002 – 2011) in the May/June Senior Secondary Certificate Examination (SSCE). For instance, in 2002, only 47.51% of the students could obtain credit pass level (Grades 1 – 6) in Physics followed by 34.43% in Chemistry and 31.53% in Biology. In 2003, Chemistry students managed to obtain an average percentage credit pass of 52.51%, followed by Physics recording 48.43% with Biology taking the rear with 38.25%.

A quick summary of their performance shows that for Physics, in the ten (10) years under review, it was only in two (2) years i.e. 2004 and 2006 that over 50% of the candidates passed. The same can be said for Chemistry whose candidates had above 50% also only in 2003 and 2005. Surprisingly, Biology which students see as a very soft science subject did not record 50% pass in the ten (10) years. The nearest was 49.43% in 2006.

This implies that a few students would eventually be able to pursue science-related courses in higher institutions. This consequently has a great implication on manpower development, scientific advancement and technological attainment of the country. This dismal performance calls for serious concern and confirms that Science Education in Nigeria is indeed drowning.

Several factors have been identified in the literature as significant contributors to this deplorable situation, such include the teachers, the students, the school environment, the home environment, the nature of the subject, nature of examination, teaching strategies, the government and the society at large (Onocha 1985; Adeyegbe, 1993; Bilesanmi-

Awoderu, 1996a&c; Onafowokan, 1998; Bilesanmi-Awoderu, 2004a&b; Bilesanmi-Awoderu, 2006c; Bilesanmi-Awoderu & Oludipe, 2006; Bilesanmi-Awoderu, 2007b and Bilesanmi-Awoderu & Bamiro 2008).

4.1 Gender, Achievement and Science Education

Perhaps, gender issue is one of the most discussed topics in recent time. This is premised on the fact that female constitutes more than half of the world population (UNICEF, 1998; & UNIDO, 2001) and as such, no meaningful scientific and technological advancement can really take place if women are absent or under-represented in science and technology related courses.

There is a general consensus that students' performance does not follow a particular pattern as far as sex is concerned. This is evident in Table 2.

Table 2.
Statistics of Entries and Performance Results by Grade on Gender Basis

Year	Subject	Sat for Exam		Pass Grades 1-6			
		Boys	Girls	Boys	%	Girls	%
2002	Physics	130,904	123,284	62,067	47.42	33,573	27.23
	Chemistry	119,891	142,933	67,170	56.02	36,675	25.66
	Biology	486,700	395,419	128,807	26.47	101,680	25.72
2003	Physics	163,423	107,051	85,661	52.39	64,059	59.84
	Chemistry	165,432	108,474	83,100	50.23	63,353	58.40
	Biology	599,415	426,157	274,812	45.85	171,115	40.15
2004	Physics	182,456	82,806	92,868	50.89	44,512	53.75
	Chemistry	175,523	94,251	87,074	49.61	45,258	48.02
	Biology	572,134	260,555	132,917	23.24	100,729	38.65
2005	Physics	196,543	149,097	96,342	49.02	69,742	46.77
	Chemistry	198,987	152,391	96,208	48.35	74,222	48.70
	Biology	601,232	454,478	298,321	49.62	213,342	46.94
2006	Physics	256,619	123,204	82,067	31.98	33,573	27.25
	Chemistry	264,232	119,891	87,170	32.99	36,675	30.59
	Biology	586,700	562,700	118,807	20.25	101,680	18.07
2007	Physics	224,143	195,102	105,661	47.14	94,059	48.21
	Chemistry	226,246	197,089	113,100	49.99	103,353	52.44
	Biology	640,415	599,414	264,812	41.35	271,115	45.23
2008	Physics	223,457	182,456	112,868	50.51	94,512	51.80
	Chemistry	224,569	184,500	87,074	38.77	75,258	40.79
	Biology	672,134	572,108	202,917	30.19	180,729	31.59
2009	Physics	256,345	198,457	126,342	49.28	89,342	45.02
	Chemistry	260,953	199,980	116,208	44.53	104,222	52.12
	Biology	834,654	683,566	398,321	47.72	283,342	41.45
2010	Physics	291,540	196,423	124,342	42.65	95,453	48.60
	Chemistry	301,390	210,345	99,456	32.99	76,102	36.18
	Biology	1,050,006	945,217	345,564	32.91	192,231	20.34
2011	Physics	300,118	287,654	124,342	41.43	95,453	33.18
	Chemistry	332,108	290,345	109,456	32.96	76,102	26.21
	Biology	1,133,243	943,432	345,564	30.49	192,231	20.38

Source: West African Examination Council, Research and Statistics Unit 2011

A review of the ten (10) year (2002 – 2011) pure science students' performance based on sex revealed that no particular pattern could be ascertained. Also of note is that at no time did the students (male and female) record 60% credit pass. In 2002, in all the sciences, boys had higher percentage passes than their female counterparts. They recorded 47.47% in Physics as against 27.23% for the girls; in Chemistry, they had 56.02% as against 25.66% for the girls; and in Biology, they had 26.47% as against 25.72% for the girls. Also in 2006, the boys outperformed the girls by having 31.98% in Physics as against 27.25% for the girls; 32.99% for the boys as against 30.59% in Chemistry and 20.25% as against 18.07% for the girls in Biology. Also in 2011, the boys performed better than the girls in Physics by recording 41.43% as against 33.18%; while in Chemistry, the boys had 32.96% as against 26.21% for the girls and in Biology 30.49% as against 20.38%.

However, in 2007, girls outperformed the boys by recording 48.21% as against 47.14% in Physics, 52.44% as against 49.99% in Chemistry and in Biology, 45.23% as against 41.35%. Also, in 2008, the girls recorded 51.80% as against the boys' lower record of 50.51% in Physics, 40.79% as against 38.77% in Chemistry and 31.59% as against 30.19%.

This general picture of equal performance has support in other studies. For instance, studies such as Bilesanmi-Awoderu (2000f), Milbourne (2004) and Bilesanmi-Awoderu (2006a&c) found that male students performed better than their female counterparts. On the other hand, studies such as Duyilemi (1997), Bilesanmi-Awoderu (1998) and Bilesanmi-Awoderu (2007b) found that female students outperformed their male counterparts. However, no significant difference

was recorded by Bilesanmi-Awoderu (2001) and Bilesanmi-Awoderu (2002).

However, Bilesanmi (1998)'s study came up with the fact that sex is an important factor even in students' achievement of identified difficult concepts in Biology. For males, Ecology is the least difficult followed by Diffusion and Respiration. This could be explained against the background that boys are generally interested in Space, Environment and Aesthetics (Erinosho, 1994) and this positively affects their performance in Ecology which is an outdoor affair. Females, on the other hand, have been found to be interested in Home, Health and Hygiene (Erinosho, 1994), no wonder then that they found Respiration which deals directly with the functioning of the body least difficult followed by Diffusion and Ecology. In the study, it was documented that male achieved higher than their female counterparts.

This inconsistency will not allow researchers to put-paid to studies on sex and science achievement for now, particularly when students keep recording dismal performance in Sciences, thereby confirming that science is indeed drowning in Nigeria. Mr. Vice-Chancellor Sir, distinguished audience, it is expedient for us to examine the evidence.

5.1 Indicators of "Drowning"

5.1.1 **Overcrowded Nature of Science Classes**: In Nigeria, the demand for formal education with a concomitant increase in school enrolments, have resulted in a dramatic increase in class sizes, with attendant high teacher-pupil ratio (Onwu, 1998). Ajewole (1995)

disclosed that although the recommended teacher-pupil ratios are 1:30 for primary and 1:35 for secondary schools, but, observations in many states in Nigeria revealed between 1:50 and 1:85. Whereas, the National Policy on Education (FGN, 2004:13) stipulates that students should choose one subject out of the following: Biology, Chemistry, Physics or Health Science, it is observable that almost all the students offer Biology as there is an assumption that it is the softest of all the three (3) sciences.

This choice or singular act has placed a lot of stress on Biology teachers because all Biology classrooms are always overcrowded with students. In Ogun State, Bilesanmi-Awoderu (2000d) and Ogunkola, Olatoye & Erinosho (2004) found the teacher-student ratio to be 1:70 in Biology classes as against the stipulated 1:40 ratio (FGN, 2004:15). Onwu (1995) opined that despite the expansion of teacher-training programmes, teacher-pupil ratios still remain high between 1:50 and 1:85.

It must be noted that large classes do not encourage active interaction between the students and the teachers no matter how competent the teachers are, large class overstretches the inadequate instructional materials and places much problem on the teacher in case he/she considers improvisation (Ogunkola, et. al. 2004). In this context, the teacher is not in the best position to give his utmost best; therefore science education is left to drown.

An Overcrowded Biology Class

Figure 4

5.1.2 **Inappropriate teaching methods:** Teaching method is an integral part of the teacher-training programme. It essentially, in most cases, differentiates between trained and untrained teachers. The methods of teaching employed by a teacher, is fundamental to the extent of learning acquired by his/her students. If the general aim of science teaching includes assisting learners to develop certain attitudes, knowledge and skills regarding order in nature, then no single method should be stuck to by the teacher. Instead, the teaching methodology should accommodate a variety of methods to suit the concept to be taught.

But, what is the observed picture on the field?

Bilesanmi-Awoderu (1996b) found out that of the

twenty-five (25) teaching and learning approaches/methods/strategies presented to ninety-six (96) Biology teachers, only three (3) were indicated as mostly used and mostly confident with, while seven (7) were never used despite the nature of the existing Biology curriculum which emphasizes variety of teaching and learning approaches. One of the mostly employed strategies by the teachers was the demonstration method. This finding is in agreement with Laoye (1994) who pictures what operates at the secondary school level as mere science teaching with the aids of simple demonstrations. He further criticised the method (demonstration) as an activity centered around the teacher and meant only to verify facts and principles that have earlier been learnt without the students being actively involved.

Another major finding was the range of strategies that were rated as being "Never Used" in Biology lessons. These strategies included video-playing, using resource persons, "role-play", simulations, etc. One probable reason for the non-use of video-machine and television in teaching for instance, was the fact that the rural schools do not even have electricity. On the other hand, in the urban schools, where there is electricity, its supply is epileptic and the cost of buying and maintaining a generator is too prohibitive. Also, procurement of video-machine and television may be beyond the financial capability of some schools.

On interview, some of the teachers admitted that they knew those students' centered approaches and appreciated their potency in effective teaching and learning process, but argued, strongly too, that those strategies could not be employed due to shortage of time, scope of content and

problem of assessment. So, science education is left to drown.

Ogunniyi (1982) contended from an analysis of data on direct observation of interactions occurring in selected secondary school science lessons that science teaching is still a "talk and chalk affair". Science in most cases is taught for the students largely to satisfy examination conditions but not to gain useable knowledge and skills.

The conventional method of teaching science in the secondary schools is a method where little or no instructional materials are used in the teaching-learning process. Researchers such as Bajah (1984), Ogunniyi (1996) and Bilesanmi-Awoderu (2000d) have established that such method is typical of Nigerian Biology classes. Thus, students learn by rote and are unable to apply knowledge to new and unfamiliar situations. This method of instruction, no doubt, falls short of the principle of modern learning theory and goals of science education, which stresses students' active involvement in the teaching-learning process. It does not also accommodate individual differences.

Moreover, Bilesanmi-Awoderu (2000d) showed that 61% of the science teachers employed direct teaching while only 39% employed indirect teaching, at the secondary school level. This is in line with the findings of Odubunmi (1980), Okebukola (1982) and Osuafor (1999) who found that most science teachers engaged in direct mode of teaching. This is not good enough, as studies such as Joe, James and Russel (1981), Olagunju (1994) and Adeyegbe (2005) have indicated that the indirect mode of teaching is a profitable

strategy of enhancing students' achievements in Biology/Sciences than the direct teaching style. What accounted for this, according to Ogunbiyi (2004), is that teachers have not been given enough opportunity for re-training.

One can then conclude that science teaching is being done with inadequate and inappropriate teaching methods thereby leaving science education to drown.

5.1.3 **Inadequate Teachers in Quality and Quantity:** For science to be effectively taught in schools, teachers must be adequate in quality and quantity. In a study carried out by Ogunkola, et. al. (2004), it was found out that science teachers were not sufficient in number. Also documented was the fact that only 67.7% of the Biology teachers were professionally qualified while Chemistry had 90.0% and Physics was 34.5%. Integrated Science, the basis for all these separate sciences is the worst hit, having only 29.3% of its teachers as professionally qualified for the job. This is not good enough, when the foundation is weak, many would-be scientists would be lost and science education will be left to drown.

In a study titled "Evaluating Biology Teaching in Nigerian Secondary Schools as a Means of Effective Nation Building", Bilesanmi-Awoderu (2000d), found that the teacher-pupil ratio was at 1:71 as opposed to the 1:40 ratio recommended by the National Policy in Education (FGN, 2004:15). This finding is in congruence with Elegbede (1992) who found that professionally trained teachers are perennially in short

supply. It should be noted that two decades after, the situation has not improved for good. This result clearly shows that there is a disconnect between the intention of the curriculum planners and the actions of the curriculum implementers. This disparity, however, may go a long way in explaining the reasons for underachievement in Biology/Sciences.

Furthermore, the result indicated that only about 40% of the teachers were Biology education graduates. On the whole, teacher quality assumes a value of 40%, which can be described as being below average. This position buttressed the findings of Fajiola (1983) who evaluated the teaching of Biology in Oyo State and concluded that there was inadequate quality of Biology teachers in the State. This indicates further that the implementation of the Biology curriculum, which is at variance with its conceived goal, should be tackled at the national level if effective nation building is to be achieved using science as an indispensable tool. The alternative will be leaving science education to drown.

5.1.4 **Unavailability of Laboratories, Equipment and Instructional Materials**: In a study by Bilesanmi (1992) purposed to find out the problems confronting effective teaching and learning of science through the perception of the science teachers themselves. Result showed that problems related to instructional process, textbooks, students, teachers and examination were serious, facility problem was not serious and equipment, syllabus, instructional materials and home and society problems were very serious problems. One is tempted to

say that, then, most secondary schools sampled had classrooms, laboratories, and other facilities without the necessary equipment and instructional materials for science teaching. However, the story has since changed for worse with the present situation presenting inadequate classrooms, laboratories, equipments, etc. in the secondary schools (Bilesanmi-Awoderu, 2000d). On the issue of the type of laboratories available and whether they are well-equipped or not, Bilesanmi-Awoderu (2000d) reported that 54% of the understudied schools had separate Biology laboratories and only 46% of the schools had 50% of the examined resources. This situation is not good enough if we consider the importance of science resources from the standpoint of Balogun (1983)'s submission that science teaching equipment and resources are indispensable tools to good science teaching and learning. He went further to say that teachers need to bear in mind that at least some of the students may become Professional Scientists, Technologists, and Engineers, such students need the equipment to begin to develop the necessary science skills, attitudinal skills and practical skills right from secondary schools.

Judging from the acute shortage of laboratory equipment in our secondary schools as documented by Bilesanmi (1992), Bajah (1999) and Adeyegbe (2005) one can then argue that the teaching method engaged in by the teachers is not particularly the laboratory type but other methods ranging from discussion to lecture which may be sufficient for liberal arts but not relevant for effective teaching and learning of science. Within a science

course, the term "practical work" may be taken to include any activity involving students in real situations using genuine materials and properly working such equipment.

Some of the instructional operations of the laboratory method are:

1. Illustrating regulative principle of science, instances, development of laws, and developing in students' ability to write reports on laboratory exercises;

2. Providing opportunity for students to use laboratory tools and equipment;

3. Providing opportunity for repeating some of the classic experiences in science and of performing an original experiment in the laboratory based on students' project;

4. Making students familiar with such mental processes as observing, inferring, classifying, measuring, data interpretation, hypothesis, etc;

5. Leading to better retention of information and development of favourable attitude towards science (Abdullahi, 1982).

However, Bajah (1984) was of the opinion that teachers do not utilise the laboratory investigative approach for the following reasons:

1. Lack of adequate professional preparation during training;

2. Lack of confidence in handling science equipment and apparatus;

3. Lack of technical know-how on improvisation of science equipment.

Corroborating this view, Atoyebi (1990) opined that teachers neglect and defer practical work till the final qualifying examination. Akpomedaye (1992) said as a result of this, students eventually develop a negative tendency towards practical work, due to the inadequacies of equipment, chemicals and materials for effective practice.

It must be noted, that the findings of Atoyebi and Akpomedaye were of studies reported twenty (20) years ago! It is most disheartening that the situation has not positively improved. The question is how can laboratory method be effectively utilised in a situation that "alternative to practical" has become the norm?

A Multipurpose Laboratory

Figure 5

5.1.5 **Home Factor:** Bilesanmi-Awoderu (2004b) and Ogunkola & Bilesanmi-Awoderu (2004d) submitted that some parents and guardians over-labour their children and wards when they get home, thereby distracting their attention from effective study and completion of their home work. This may make the students lose concentration and perform poorly in science. Also, some parents are in the habit of forcing their children to study science, thereby, making them miserable and frustrated when they do not make enough progress.

5.1.6 **Difficult Concepts in Science:** Some concepts have been identified as difficult in the science curriculum. For instance, concepts such as ecology, evolution and respiration have been identified as difficult for students to conceptualise, consequently contributing to students' poor performance (WAEC Chief Examiner's Report, 1987; Bilesanmi, 1994; & Abimbola, 1998).

In a sample of two hundred and ten (210) senior secondary school students randomly selected from three (3) secondary schools in Ogun State, Bilesanmi (1994) found that some concepts (Respiration, Diffusion and Ecology) are actually difficult for students to conceptualise based on their poor performance in the Test of Concept Difficulty (TCD).

5.1.7 **Students' Language Proficiency:** English is the official language in Nigeria and as such science teaching at the senior secondary school is done in English. This, therefore presupposes that students need to have a good

understanding of English language to be able to understand what the teacher is teaching in science. Findings from Owolabi, Okebukola and Adegbuyi (2011) revealed that interference of first language (Yoruba) with the second language (English) occurs at the levels of syntax, phonology and morphology in the scripts of the science students analyzed. They opined that these levels of interference have a telling potent on students' thinking abilities.

Such interferences bring about restructuring of language during assimilation because of the differences in linguistic heritage. Hence, the proficiency of writing is distorted by interference in view of the mix-up that accompanied such. In effect, students form defective knowledge, pseudo-understanding and will eventually perform below their competence level.

5.1.8 **Teacher Morale:** Experiences in the University have documented reasons why undergraduates eventually found themselves in the Faculty of Education. Reasons range from low cutoff point, inability to get admitted into their Faculty of choice, as a last resort, just to study something in the University, not sure of the next JAMB result, have stayed home for some time, to the love of teaching which is rated least.

Ehindero (2010) documented that the first two major reasons that propelled students into the teaching profession are:

- lack of any other "thing" (apparently more lucrative);
- to make a living or a start using teaching as a stepping stone to other programmes.

He then concluded that the refusal or reluctance by young

men and women to enter the teaching profession is partly due to the low social esteem/status of teaching and the very poor public perception of the profession. Both of which are rested in the welfare and reward system in teaching. All these have affected teacher education and training. Bennel and Akyeampone (2007) in Azure (2011) opined that the professionalism and dedication of teachers particularly in Africa wane with time due to their unattractive working conditions and auxiliary benefits. They further opined that teachers become demoralized and fractured due to low pay, lack of motivation and absence of learning materials in schools. So, they watch as science education gets drown.

Mr Vice-Chancellor Sir, my distinguished audience, should we watch on as Science Education gets drown? My personal opinion is no. This then brings us to the rescue mission.

6.1 Response to the "Waving"/Suggested Rescue Actions

6.1.1 **Solution to Overcrowded Classes**: To arrest the problem of large classes, teachers should diversify their methods to include cooperative learning strategies (Theodora 2001, Samuel & John 2004, Burcin & Leman 2007 and Oludipe 2011), groupings during practicals (Okebukola, 1986, Ogunkola & Bilesanmi-Awoderu 2000 and Bilesanmi-Awoderu 2001), working together on assigned tasks (Lacombe, 1992, Bilesanmi-Awoderu 2006c, Bamiro 2011), etc.

A study by Bilesanmi-Awoderu and Ogunkola (2004)

titled "Teaching Large Classes in Biology: An Investigation into the Effectiveness of Instructor – Expressiveness Teaching Behaviour", found a significant main effect of treatment (instructor-expressiveness) on the students' academic performance in Biology. This result has established among other things the potency of the treatment in improving students' academic performance in large Biology classes. By implication, this strategy can assist in arresting students' declining and disturbing academic performance if effectively employed by practicing Biology teachers.

Instructor-expressiveness refers to a teaching behaviour that emphasizes how a teacher communicates what he or she intends to teach through words, gestures and looks (Ogunkola, 2000). Perry, Abrami and Leventhal (1979) submitted that instructor-expressiveness teaching behaviour is measured in terms of four (4) specific observable behaviours involving physical movements, voice inflection, eye contacts and humour. They further opined that the decreased and increased frequencies of these behaviours represent low and high expressive conditions.

6.1.2 **Inappropriate Teaching Methods**: Since the existing science curriculum emphasizes the processes of science rather than mere acquisition of knowledge, the current science classrooms should be activity-laden emphasizing the laboratory-based method of instruction. Furthermore, the finding of Ogunkola and Bilesanmi-Awoderu (2000) documented that laboratory-based method of instruction could significantly improve

academic achievement in Biology more than the conventional classroom method.

This result is explicable considering the view of Iroegbu and Okpala (1998) that when students are given some freedom in deciding how to proceed with their practical activities in the sciences, their level of performance rises above what is attainable when they work under strict teacher control as it is observed in conventional method of instruction. In addition, Bilesanmi-Awoderu (2002) found that concept-mapping is a versatile method of enhancing Biology students' academic performance.

Teachers must be more dynamic and diversify their teaching method, discarding the conventional method and adopting versatile, effective and innovative teaching and learning Methods/Strategies which are student-centred. These include Computer-Assisted-Instruction, Excursion, Team-teaching, Think-Pair-Share, Inquiry method, Instructor-effectiveness teaching behaviour, Cooperative teaching strategies (Jigsaw II, Learning Together), Concept-mapping, Games and Role-play, etc.

6.1.3 **Provision of Adequate Teachers in Quality and Quantity**: There is an urgent need for the government to recruit more professionally trained science teachers into the secondary schools. This is important to solve the problem of high teacher-student ratio. There is a limit to what a teacher can do in a situation of 1:100 ratio in four (4) arms of a class, in addition to teaching other classes and performing other functions in the school. Also, a deadline which must be adhered strictly to must be put in

place for academically qualified but professionally unqualified teachers to train as qualified teachers or vacate the schools.

6.1.4 **Provision of Laboratories, Equipment and Instructional Materials:** Governments should no longer politicize education. They should engage in adequate provision of useful instructional materials and equipment to schools. Laboratories, water and electricity should also be provided to schools where they are lacking. Governments should provide enough funds for purchasing science equipment for the schools.

I wish to suggest that with Tertiary Education Trust Fund (TETFUND) basically for financing the Tertiary Institutions and Universal Basic Education Commission overseeing all aspects of the Primary and Basic Education (Junior Secondary School, and adult & non-formal education), an Intervention Commission or Agency for Senior Secondary School Education Trust Fund (SSETFUND), should be instituted by the federal government to cater for the Senior Secondary School especially in financing Science Education. It will be the business of this Commission or Agency to provide among other things, adequate, relevant, appropriate and "state of the art", facilities, chemicals and equipment for effective teaching and learning of science. This kind of Commission or Agency should also exist in the states. The State Government can in addition to other means raise funds from the industrial tax which can be used to argument their expenditure in funding science education.

A related recommendation of the Bilesanmi and Onifade (1994) and Bilesanmi-Awoderu (2006c)'s studies is that modern educational technology equipment should be procured for Ogun State secondary schools to be compliant with the 21st century technological advancement and to solve the problems of classroom overcrowding. In all, government should provide schools with laboratories, relevant laboratory equipment and other allied instructional materials that could encourage science teachers to engage their students in scientific processes. Also of note is the fact that science teachers themselves are expected to be creative. They should get involved in the improvisation of science equipment and materials. In-service training to equip teachers with skills for production and improvisation of emerging technologies should be periodically organized.

6.1.5 **Home Factor**: Household chores and errands should be reduced to the minimum level so as to allow the students to concentrate on their studies. More importantly, chores and errands should be shared fairly between male and female children. (Bilesanmi-Awoderu 2004). As reported by Davidson and Kanyinka (1992) and Agu and Hamad (2000), after school hours, girls remain more engaged than the boys with household chores like preparing meals, caring for younger siblings and going to the market, so much that they hardly have time for their homework. The resultant effect is girls' poor performance in public examinations.

6.1.6 **Encouraging More Participation and Higher Achievement of Female Students:** In a study by

Bilesanmi-Awoderu (2000b) titled "A Survey of Women Professionals' Opinion on Strategies for Enhancing Female Participation in High School Science Technology and Mathematics (STM)", where the sample was two hundred and fifty (250) female professionals from across the world that attended an International Conference of the Association on Gender and Science Technology (GASAT) in Ghana 1999, the following recommendations were made; the Federal Government is enjoined to: provide free and qualitative education for girls, (as is being done in Bangladesh, Bhutan & Nepal) offer them scholarship, providing equal job opportunities for them after graduation and put in place slogans, propaganda and programmes to discourage teenage pregnancy because usually when girls drop out of school as a result of pregnancy, they hardly re-enter and the "culprits" that is, the young lover boys progress academically without any disturbance.

May be we should be thinking of passing a bill that when a girl drops out of school because of pregnancy, the "culprit" should also be chased out of school and both of them can re-enter at the same time. In addition, more female science teachers should be employed to serve as role models to the girls.

Science teachers are encouraged to make their lessons interesting and more practical-oriented. They should avoid passing negative or discouraging remarks on the girls. For instance, a teacher that says "I know you will not know it" for a girl and "I know you can still try more next time" for a boy has communicated a message that

can deter or discourage the girl-child from studying science. Also, teachers should learn to engage both boys and girls equally in science activities. Boys should not be given roles to perform while girls are passive. They should also use examples that are gender-neutral. Publishers too are advised to be gender-sensitive in their writing and picture presentation.

Moreover, parents, especially the mothers should serve as role models, discourage stereotypes in careers, provide toys that depict Science Technology and Mathematics (STM) for both boys and girls. The school authority has been advised to provide scholarship opportunities, give girls prizes and awards, frequently organize workshops, seminars and symposia anchored by Female Professionals, promote gender-neutral curriculum, educate Parents of the need to allow their girls to do Science Technology and Mathematics (STM).

Government should enact laws, and formulate policies and programmes that would incorporate these research findings in order to improve the study of science. Also, monitoring facilities should be provided to ascertain that the appropriate strategies when put in place are properly implemented. To encourage more female into science education and science related courses, successful Women Professionals in Science and Technology are called upon to serve as mentors to the young girls. (Bilesanmi-Awoderu 2006b, and Bilesanmi-Awoderu & Kalesanwo 2007). This is expected to motivate the girls and sustain their interest in science education and science related courses.

6.1.6 **Solving the Problems of Difficult Concepts in Science:** Identified difficult concepts should be taught with more seriousness. Teachers should not brush over them or teach at the abstract level, but rather, they should employ diverse teaching methods and strategies with the appropriate instructional materials and practical experiences so as to make the concepts concrete and easy for the students to understand.

Teacher educators should make more provisions for ways and means by which identified difficult concepts among others would be taught to the pre-service teachers in such a way that they would have an in-depth understanding of the concepts which would in turn assist in no small measure when they get to the field. This is because the teachers would only be able to teach what they themselves understand. Authors of science textbooks should take cognizance of the difficult nature of these concepts when they write their textbooks. Thus, they should make their language simple, explanatory and un-confusing to the students. More importantly, the Authors should endeavour to make use of local and practical examples that the students are familiar with or can readily have access to.

6.1.8 **Students' Language Proficiency:** Since the study of Owolabi, et. al. (2011) has established that the first language of the science learners imposes a linguistic handicap on their written expressions in English language, it is therefore important to find ways of redressing the issue. As such, in line with their opinion, it

is hereby recommended that students' competence in English language be enhanced through appropriate method such as grammar-translation which emphasizes forms of language along with the teaching of communicative use of the language.

6.1.9 **Teacher Morale:** The morale of teachers has to be improved upon by the government. Government at various levels are enjoined to further encourage experienced teachers to stay on the job by providing them with more incentives and fringe benefits. Salaries and allowances are to be paid promptly and as at when due. The establishment of the Teachers' Registration Council in 1993 and the official take-off in Abuja in 2000 is a welcome development. Teachers can register and get their certificates and license to practice. This, in addition to regulating the teaching profession, can boost the teachers' morale. As licensed Professionals, they will be cautious of the fact that the license can be withdrawn in case of any misconduct. Such a development will bring to consciousness the fact that teaching is not an "all comers affair" but the business of Professionals.

6.1.10 **Government Involvement:** Teaching is a dynamic profession. The government should constantly engage science teachers in in-service training, seminars, workshops and conferences where they can learn new and productive methods of teaching to enhance better learning. Dogru and Kalender (2007), noted that many teachers were educated in the classrooms where the role of the student was to memorize information, conduct well-regulated experiment and were then tested on their

ability to repeat these tasks or remember specific facts. (Agberugbeso). Government should therefore organize in-service courses for practicing teachers to re-orientate, refresh, remind, re-engineer and improve their knowledge in the science subjects they teach and also in the pedagogy including innovative methods such as instructor-expressiveness teaching behaviour. Also, this strategy should be made an integral part of the method courses in the Colleges and Faculties of Education in Nigeria. Adeyemi (2008) documented that in the interview with his respondents, they were of the opinion that the occasional inspection of schools by State Ministry of Education was not sufficient. Therefore, it is being suggested that practicing teachers should be observed occasionally by Inspectorate Teams, made up of experienced teachers at school level. An important function of this type of classroom observation is to assist teachers in recognizing both their strengths and weaknesses with a view to capitalizing upon the former and properly addressing the latter.

The Teaching Service Commission should engage Science teachers in computer literacy programmes that would enable them to source for current knowledge in their subject and effective delivery of the acquired knowledge. Since experience significantly affects teaching style, it is hereby recommended that teachers be encouraged with improved welfare packages to stay on their job in the best interest of their students. They should no longer be "birds of passages", which only use teaching as a stepping stone to get more lucrative jobs. Since professionalism significantly affects teaching

competence, it is recommended that those professionally unqualified teachers still practicing should, as a matter of urgency, proceed on professional training in order to acquire the necessary skills and techniques for efficient and effective performance.

In the case of prospective teachers, micro-teaching technique should be emphasized so as to develop in the trainees various teaching skills such as skills of writing objectives, introducing a lesson, fluency in questioning, explaining, illustrating with examples, stimulus variation, silence and non-verbal cues, reinforcement, increasing pupil participation, using the chalkboard, effective content delivery and recognizing attending behaviour which are the components of indirect teaching behaviour in line with the views of Joshi (1977), Lalithamma (1977), Passi (1977), Bilesanmi-Awoderu (1996), Bilesanmi-Awoderu (2000d), Bilesanmi-Awoderu (2002a), Bilesanmi-Awoderu (2004a) and Bilesanmi-Awoderu & Ogunkola (2004). Philanthropists, Old Students, Parents and other Stakeholders are called upon to pay more attention to science education. The government is also enjoined to enforce strict adherence to the 60:40 admission ratio in favour of the Science students (only natural science students and not inclusive of social science as is the case now) so as to encourage more participation in science education.

7.1 Conclusion

Mr. Vice-Chancellor Sir, distinguished audience, this lecture titled "Science Education in Nigeria: Drowning but Waving", has reviewed the Conceptual Clarifications of Teaching, Learning and Science Education. It further examined the Concepts of Teacher, Teaching Effectiveness and Students' Achievement in Science. Indicators of "Drowning" were extensively discussed and the suggested Rescue Actions elaborately presented.

It is my opinion that the recommendations of this lecture are worth trying by the concerned stakeholders in Nigeria. If teachers are adequate in quantity, if they are professionally qualified, if their salaries and allowances are paid promptly and as at when due, if they don't hop in and out of the teaching job, if they adopt appropriate teaching methods, if they have well-equipped laboratories with adequate and relevant instructional materials, if they have well-motivated students that are ready to learn and possess good understanding of the official language (English), these could help to rescue science from drowning. Invariably, we may begin to foresee a lasting solution to the problem of poor performance in secondary school science and consequently evolve an effective science education in Nigeria. This will eventually lead to advancement in scientific and technological development.

Acknowledgements

Mr. Vice-Chancellor Sir, distinguished audience, I am grateful to the Lord of Lords, the King of Kings; for making today a reality despite all odds. If not for Him, I will not be standing before you distinguished audience, today, in Olabisi Onabanjo University, Ago-Iwoye to give this Inaugural lecture. This lecture is a testimony to the fact that God has the final say. If God says yes, nobody can say no. This is the day that the Lord has made, I rejoice and I am glad in it. I thank God for preserving me despite the storms of life and for showering untold blessings on me.

I am very grateful to my Parents – Chief L. A. Ogunyinka (A retired School Principal) and Chief (Mrs.) M. I. Ogunyinka (A retired School Headmistress). I thank God for sparing their lives to witness today which is a landmark in their lifetime. I thank you Sir and Ma for providing me with sound foundation that has leveraged my advancement. God will continue to grant you good health. I acknowledge the presence of all my siblings – Dr. & Mrs. Rotimi Ogunyinka, Engr. & Mrs. Ikhane, Mr. & Mrs. Ogunbanwo, Engr. & Engr (Mrs.) Ogunyinka, Miss Folashade Ogunyinka and Mr. & Mrs. Ilusanmi.

I am grateful to my paternal Uncle – Pastor S.I.D. Bello of blessed memory who was there for me when it mattered most. In the midst of my storm, he listened and counselled. I also appreciate Mrs. Bose Eyituwi of blessed memory who provided succor when I was in great need of it. May your children be compensated for your good deeds. I am particularly grateful to my cousins, the Eyituwis – Toyin, Wunmi, Funke and Sola, for standing by me during my trying period. God bless you real good. I acknowledge with joy and sincerely appreciate the presence of my paternal and maternal relations here present; that

is; the Ogunyinkas, the Bellos, the Otuyigas and the Onanugas. God bless you all.

Mr. Vice-Chancellor Sir, distinguished audience, I acknowledge with great respect, the distinguished presence of all Alayeluwas in this hall. Kabiyesi O, Ade a pe lori, Bata a pe lese. Igba Odun, Odun kan ni. I specially acknowledge and appreciate with great respect and utmost joy the role played in my life by His Majesty – Alayeluwa Oba (Dr.) S. K. Adetona JP (CFR), the Awujale and Paramount Ruler of Ijebuland, Ogbagba, Agbotewole the II. Kabiyesi Baba, Esin Oba a je oko pe. Igba Odun, Odun kan ni. I appreciate the dignifying presence of my Spiritual Lords. I thank the Redeemed Family for my spiritual development. My gratitude goes to my Zonal and Parish Pastors – Pastors John Olatunbosun and Tobi-Ariyo. My Father in the Lord – Late Pastor Samuel Adebajo and my Mummy in the Lord – Pastor (Mrs.) Toyin Adebajo, for their prayers, encouragement and special interest in me and my children. God will continue to work with you Ma. My friends in the RCCG, El-Shaddai Parish are highly appreciated. I am grateful for the spiritual contributions of the following Pastors in my life – Pastors Deji Afuye (The Pastor in Charge of Ogun Province II), Adesanya, Adesina, Martins, Adegbein, Israel, Oladunjoye, Dehinbo, Bamiro, Iyunade, Dasaolu, Adekoya, etc.

I recognize the distinguished presence of a serving Senator of the Federal Republic of Nigeria and former Deputy Governor of the State – Distinguished Senator, Alhaji Adegbenga Kaka. In the same vein, I recognize the distinguished presence of a serving member of the House of Representatives, Abuja; in person of Hon. Kehinde Odeneye. I am glad to acknowledge the distinguished presence of a renowned Science Educator, the former Executive Secretary of NUC and the current Pro-Chancellor of Crawford University, Nigeria, in

person of Prof. Peter Okebukola (OFR). You are appreciated Sirs.

I express with joy my heartfelt gratitude to all my teachers at primary and secondary schools. I appreciate all my Lecturers at the undergraduate level in the Faculties of Education and Science in Olabisi Onabanjo University. Also, I appreciate most profoundly my Postgraduate Lecturers in the Department of Teacher Education, Faculty of Education, University of Ibadan where I had my Master and Ph.D. Degrees. More importantly, my deepest gratitude goes to my Academic Mentor and Ph.D. Supervisor – Prof. Charles Onocha, who had diligently developed my research skills and acumen. I am much honoured by his distinguished presence. He is a seasoned Science Educator, a Researcher per-excellence and a dedicated Administrator. He is currently the Acting Executive Secretary of Universal Basic Education Commission (UBEC). I welcome you Sir.

Mr. Vice-Chancellor Sir, distinguished audience, I extend my deep appreciation to the University Management, Provosts of Colleges, Fellow Deans of Faculties, Heads of Department and Directors present here today as well as the Academic Ceremonies Committee led by my Uncle and the Deputy Vice-Chancellor – Prof. A. O. Sule-Odu. I appreciate all teaching and non-teaching staff of the Faculty of Education. I am particularly happy and grateful to you all. I thank you most sincerely for the confidence reposed in me by electing me as the first female Alumnus Dean in the Faculty and the University as a whole. I thank everybody, both teaching and non-teaching staff for their cooperation, support and encouragement since I became the Dean. I also appreciate both the Undergraduate and Postgraduate students of the Faculty and all other students in the University.

I wish to thank Prof. Tola Osilesi, a former Vice-Chancellor of this

University for appointing me as the Deputy Director of CESAP in 2005. I am grateful for the support and cooperation I enjoyed from the staff of the Centre. I appreciate you all. In 2008, Prof. Osilesi also appointed me as the Head, Department of CSIT. I was particularly lucky with the staff, both teaching and non-teaching with whom we discharged our duties efficiently. However, in November 2009, "Tsunami" came and eight members of the Academic Staff including Professors were disengaged in my Department. It is my hope that very, very soon, these crop of staff along with others will be recalled. The University cannot afford to miss their qualitative services and experience. I strongly appreciate the Academic Staff Union of Universities (ASUU), OOU Chapter, under the able-leadership of Dr. Sola Nazir, and the Chief Scribe – Dr. Tayo Omoniyi, for protecting the interest of all members very adequately.

I acknowledge and appreciate Colleagues here present today from other Sister Universities like University of Ibadan, Lagos State University, University of Lagos, Obafemi Awolowo University, Tai-Solarin University of Education and Others. My sabbatical experience in O.A.U., was one I will not forget in a hurry. In that context, I thank the former Vice-Chancellor of O.A.U., Prof. Michael Faborode, (who is currently the Executive Secretary of the Committee of Vice-Chancellors in Nigeria), the former DVC (Admin), Prof. Funmi Togonu Bickersteth, the former DVC (Academics), Prof. Saburi Adesanya who incidentally is the Ag. Vice-Chancellor in Olabisi Onabanjo University and the Chairman of this occasion, the former Dean of the Faculty of Education – Prof. Kayode Alao and the former Director of the Institute – Prof. P. O. Jegede under whose tenure I was appointed a Visiting Professor into the Institute of Education. I am very grateful to everyone that made the period memorable. The staff provided good working relationship and made me feel at home even when I was many kilometers away

from home. It is in this high spirit that I acknowledge with joy the distinguished presence of my Colleagues and friends from O.A.U., Ile-Ife. You are a crop of great people. Great Ife!

I wish to express deep gratitude to the foundation Librarian of this University – Chief (Mrs.) Laide Soyinka and the late Librarian – Mr. O. K. Odusanya. Mr. Vice-Chancellor Sir, let me use this medium to strongly appreciate my Alumni friends, my other friends in the Department, Faculty and University at large both teaching and non-teaching. They are too numerous to mention. I say a very big thank you to you all. However, I wish to acknowledge and appreciate a very good friend and Classmate in person of Dr. Olufemi Kalesanwo of SSHE Department. We have been together for twenty-five (25) years. Thank you for being a good friend. I recognize the presence of members of Honey Ladies Club which I am the Matron under the able-leadership of Dr. B. O. Adekola of CSIT Department. I appreciate all my social friends. They have been very wonderful. I thank you all.

Mr. Vice-Chancellor, Sir, permit me to recognize and acknowledge all the distinguished members of the Ijebu State Movement of which I am the Secretary under the Chairmanship of Prof. Adebayo Adedeji (MFR).

The Ilusin Community is specially appreciated for encouraging me to achieve this academic feat. I am particularly grateful to the Onisin of Ilusin – Alayeluwa Oba (Alhaji) Taiwo Adesanya, who installed me as the First Iyalode of Ilusin-land. Kabiyesi O. Esin Oba a joko pe. I am grateful to the Oba-in-Council and all other Traditional and Titled Chiefs here present. Ayo o ni tan nile wa o (Amin). My appreciation goes to my Egbons in Ilusin who are here present. Prominent among whom are Prof. Segun Awonusi, the Vice-

Chancellor of TASUED, Otunba (Alhaji) Ojonla Mafe, Otunba Segun Ogunye, Otunba Dapo Awobotu, Mr. Juwon Otuyiga, Otunba Laitan Ogundile, Otunba Odutan, Otunba Ladi Odukoya, etc. I remember with sadness today one of my Egbons, a very close brother – Late Otunba Dele Ajayi, fondly called Pele, who always provided the shoulder for me to lean on. He gave succor when I most needed it. I know the role you would have played today, if you were alive. May your kind soul continue to rest in perfect peace (Amen).

I appreciate the Landlords and Landladies of Imoru Community here present. I thank you for your love, support and friendship. I am grateful to Arch Gabriel Obajuluwa for always being ready to support and encourage me. I profoundly thank the members of the National Council of Women Society (Ijebu-Ode Chapter) of which I am their Matron.

I appreciate all the members of the Awoderu's family who are here present and those who are unavoidably absent – starting with the Patriarch of the family – Pa Samuel Awoderu, Prof. V. A. Awoderu, Oba J. B. Awoderu, the Alakaka of Akaka-Remo, Kabiyesi, Igba Odun, Odun kan ni, Engr. Bola Awoderu, Mrs. C. O. Adara, Mrs. Dupe Olojede, Miss Yemisi Adara and all other members of the Awoderu family.

Finally, my joy knows no bound in appreciating my children, the source of my joy. The reason for my stability in the storm of life. I appreciate God Almighty for giving me well-behaved children. I appreciate my first child, a Pharmacist – Mrs. Omolola Adeyinka (Nee Bilesanmi) and her husband Mr. Adeoye Adeyinka. The second, Omolade, a final year Medical student in OOU and my prospective Son-in-law – Barrister Kola Oyekan. The third, Omolara, a final year Microbiology student in OOU, and my boy –

Omololu Victor Ayoola, a 200 level Computer Science student in Babcock University. I love you all wholeheartedly and I am very, very, proud of you. I also appreciate my other sons – Segun, Tunde, Babalola and Babajide. You have been very wonderful. I love you with all my heart.

It is wonderful to be a Grandma. In this context, I want to appreciate the good Lord for the gift of two grandsons whom I have named Oluwanifemi and Oluwadarasimi. I am always thrilled by these wonderful gifts and I gladly acknowledge their presence in this hall. Indeed, I am fulfilled.

Mr. Vice-Chancellor Sir, Distinguished Audience, may I crave your indulgence to end this lecture with a song which I request you to please join me in singing:

O Lord, I am very very grateful,
For all you have done for me.

O Lord, I am very very grateful,
I say thank you Jesus.

Mr. Vice-Chancellor, Sir, Principal Officers of the University, Distinguished Ladies and Gentlemen. This is my story and that is my song.

Thank you most sincerely for your attention. God bless.

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