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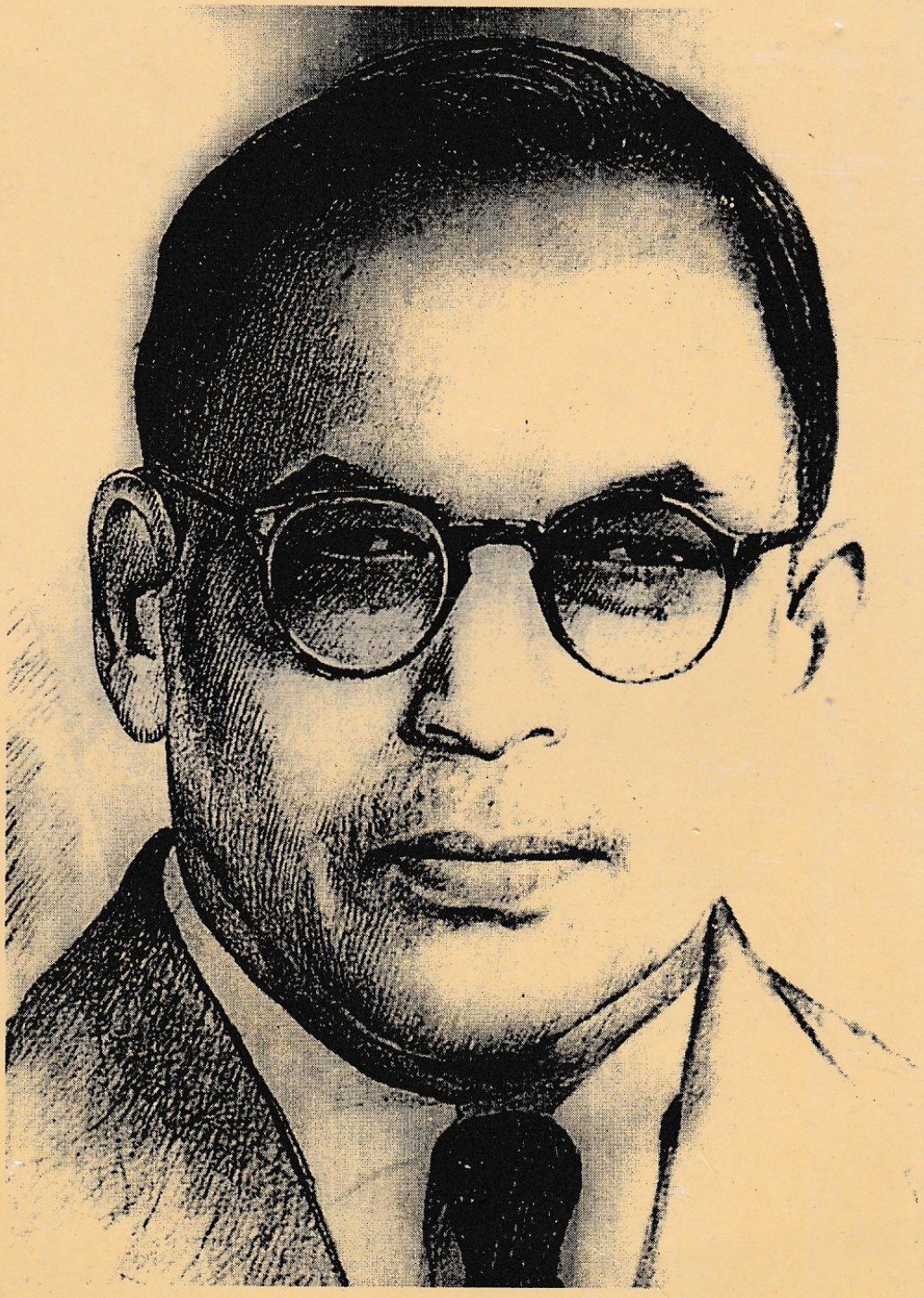

Science Teaching-Learning Modes in Senior Secondary Schools of Akwa Ibom State

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WITH the introduction of the 6-3-3-4 system of education, there has been a revolution in science teaching-learning processes in our secondary schools. The National Policy on Education (1981) upon which the current system of education is founded favours "self-learning", "development of skills in certain basic fields," and "people who can apply their scientific knowledge for the improvement and solution of environmental problems" (CESAC National Curricular for Biology, Chemistry and Physics, 1985). In line with this development, there has been increasing emphases on learning modes which were hitherto neglected. In recent times, shifts have occurred from:

- Teacher demonstration to student experimentation
- Memorization of facts to their understanding
- Learning solutions to problem solving
- Teacher domination to teacher direction etc. (Banu, 1992).

Science teachers and educators, curriculum designers, science education departments of tertiary institutions have over the past two or three decades engaged in designing and reviewing secondary school science curriculum, in an attempt to make students learn science through "hands-on" experiences. This indicates a shift from the traditional "talk-chalk" approach to the "hands-on" method of learning. With the use of this new approach, greater emphasis is now laid on the learning of school science using the discovery approach whereby students are continuously encouraged to find solutions to problems by themselves, through proposing their own methods of investigations; making their own observations and drawing their own conclusions (Blough and Schwartz, 1964; Okeke and Okpara, 1991).

The new science curricula for biology, chemistry and physics are organized around the learner with student "activity-centred" orientation. Ivowi (1979) observed that active students participation through experimentation and discussion with the teacher playing the role of a leader, is encouraged in the transaction of curricula. He further noted that student activity-oriented nature of project provides a unique chance of students "doing" science instead of "reading" science at school. Ivowi (1982) points out that, the CESAC's science curricula lay a lot

of emphases on discovering facts, explaining them and applying them. The approach discourages rote learning and the usual lecture method with separate practicals in secondary school science teaching.

Those claims are buttressed by abstracts from the three science curricula for the Senior Secondary Schools. "CESAC Chemistry curriculum (1985) shall, resting on the activity of the students, be used in teaching; while in the Physics Curriculum (1985) teachers are strongly encouraged to employ the student-activity-based, inquiry-oriented mode of teaching". The contents and contexts of the Biology syllabus place "emphasis on field studies, guided discovery, laboratory techniques and skills coupled with conceptual thinking" (CESAC Biology Curriculum, 1985).

Abdullahi (1982) defines discovery method as involving an unstructured exploration in the laboratory in which a student, through his mental process such as observing, measuring and classifying draws general conclusions from data which he has gathered. Learning by discovery allows more room for individual experience and involvement during study. In totality, discovery learning is self-sequenced, goal-directed and the pace is self-determined (Abdullahi 1982).

As claimed by Olarinoye (1982), Nigeria needs creative and well trained individuals in science to take charge of her industries and technical establishments. To realise this goal, he proposed an inquiry-discovery approach to the teaching-learning of science. This approach according to Grambs et al (1979) leaves much responsibility on the students, the pivot around which the teaching of science should evolve. To adopt this teaching-learning strategy, the teacher acts as a "catalyst" rather than a "dispenser" of information. He introduces the problem to the student, and then provides encouragement for inquiring into the nature of the problems and adequate guidance to seek solutions (Bruner, 1960). Here the teacher decides on concepts to be taught provides instructional resources and guides students through innovative strategies with laboratory motivations for effective learning of the science concepts and skills (Igwebuike, 1991).

According to Eze (1980), guided discovery method is a technique that incorporated many other methods. It can start with a demonstration or lecture method from where the problem arises, through a project or an approach where findings by individuals or groups are shared. Other teaching methods that are often co-opted during the use of this technique include, the discussion, project, independent and laboratory methods of teaching.

The inquiry-discovery teaching-learning approach to scientific lessons have various advantages. As observed by Lindgren (1976), this teaching-learning method produces superior results in terms of students' ability to apply the principles that they had learned in one problem situation to a similar situation. He also cited that this procedure to the learning of scientific facts facilitates the development of the ability to make intelligent guesses as the necessary data are provided by the

students. Other advantages of this method of science teaching as perceived by Bruner (1962) include;

- Increase in intellectual potency
- Increase in intrinsic motivation
- Increase in ability to recall assimilated facts
- Conservation of memory (Olarinoye, 1982).

Purpose of Study

This study is aimed at appraising the different modes of instruction used in teaching-learning of science in our secondary schools. Efforts are also made to assess the modes of self-involved methods of learning employed by students to complement the science teaching process. With this regard, the following research questions are addressed:

- What are the other prevalent modes of instruction used in science teaching despite the present emphases on inquiry-discovery and other related techniques by science educators?
- How often are these modes of instruction used?
- What are the different procedures employed by students in the learning of science?

Methodology

The research data were collected from thirty-three Senior Secondary Schools (SSS) selected through the use of the table of random numbers. These schools formed a representation of Senior Secondary Schools in Akwa Ibom State. Forty-three science teachers responded to the questionnaire. Thirteen respondents were from 11 urban schools which represents 33% of the total sample; while 30(67%) respondents were from 22 rural schools. From the total sample of 43 teachers, 6 were females while 37 of the teachers were males.

Instrument

The questionnaire used for the study was designed to meet the criteria for appraising secondary schools science teaching-learning process in Nigeria and was adapted from "A suggested Checklist for Assessing a Science Programme" (Victor and Lerner, 1975); and "A Survey of Teaching Faculty Opinions about Teaching in Institutions of Higher Learning" (Goolsby, 1986). These instruments were modified to suit the Nigerian situation. The questionnaire was designed in two parts, viz:

- Part I: Demographic information about the teaching staff (the respondents)
- Part II: Information on the teaching/learning modes.

The instrument was validated through the help of the senior academic staff members of the Department of Science Education of the University of Uyo.

Analysis and Interpretation of Data

Each item of the questionnaire was scored according to an empirically determined key with each item response having three Likert-type scale options of 'always' = 3.0; 'occasionally' = 2.0; and 'never' = 1.0.

The cut-off value for each questionnaire item was determined after care-

TABLE 1

Science Instructional Modes in Secondary Schools

Modes of Instruction	*Likert Scale*	*Responses Frequency*	*Percentage*	*Weighted Mean Score*	*Remarks*
Lecture Mainly	3	16	37		
	2	16	37	2.1	Occasionally
	1	11	26		
Lecture	3	21	49		
Demonstration	2	21	49	2.5	Occasionally
	1	1	2		
Demonstration	3	6	14		
	2	32	74	2.0	Occasionally
	1	5	12		
Lecture	3	15	35		
Discussion	2	23	53	2.2	Occasionally
	1	5	12		
Lecture	3	6	14		
Laboratory	2	26	60	1.9	Occasionally
	1	11	26		
Programmed	3	5	12		
Learning	2	19	44	1.7	Occasionally
	1	19	44		
Inquiry/Discovery	3	7	16		
	2	22	51	1.8	Occasionally
	1	14	33		
Laboratory Method	3	12	38		
	2	24	56	2.1	Occasionally
	1	7	16		
Project Method	3	0	0		
	2	30	70	1.7	Occasionally
	1	15	30		
Individualised	3	14	33		
Learning	2	18	42	2.1	Occasionally
	1	11	26		
Field Trips	3	0	0		
	2	23	53	1.5	Never
	1	20	47		
Team Teaching	3	4	9		
	2	25	58	1.8	Occasionally
	1	14	33		
Guest Speaker	3	0	0		
	2	20	47	1.5	Never
	1	23	53		

fully noting the good and weak item response scores. The impressions gained were translated into "weighted mean score" on a one-to-three rating scale for each item. The weighted item mean response scores between 2.6 and 3.0 were regarded as highly positive responses to modes "always" practised. Weighted item mean response scores between 1.6 and 2.5 were regarded as being "occasionally" practised; while the weighted mean response scores between 1.0 and 1.5 were considered as "never" practised modes.

Table I shows a high frequency of occasional use of lecture method of teaching with the other combinations. This is indicated by the weighted mean score for lecture demonstration (2.5); lecture-discussion (2.2); lecture only (2.1); and lecture-laboratory (1.9). The demonstration technique, which is principally teacher-centred is also put into such use as it records the weighted mean score of 2.0.

Science being a laboratory based course records 2.1 weighted mean score for the use of laboratory mode of instruction. On further inspection of Table 1, student-centred modes of instruction were found to record very low weighted mean scores. For example programmed learning (1.7); inquiry/discovery (1.8); while field trips and the use of guest speakers which could have accorded the students the opportunities of having a 'first-hand" information and/or experiences were not adequately utilized. This is shown by a record of 1.5 weighted mean score for both modes of teaching.

As shown in Table 1, the predominantly used mode of instruction is the lecture method; this, thus lends credence to the observed high frequency in the use of lecture notes as a major learning strategy adopted by science students in Table 2. Independent reading approach (2.3) and the reading of assignments in textbooks (1.9) have also been highly used. The laboratory and the discussion approach to learning have occasionally been utilized. These are shown by the 2.2 weighted mean score for laboratory exercises; while discussions with the teacher by the students have been noted with a weighted mean score of 2.1.

Seventy-nine percentage of the sampled schools have never used the media supported learning method. This is further affirmed by a 1.3 weighted mean score. Although the media have not been put into much use, other self-learning material have been occasionally used by the students to enhance their learning of science. This is shown by the weighted mean score of 1.8.

Significance of Study

Some of the prevalent modes of instruction used in science teaching and the different procedures employed by students in the learning of science help them develop the concept of science as a human enterprise. In science teaching-learning process the question is not, "what methods and materials are best for teaching and/or learning of science?" Rather, the question should be: "What methods and materials are best to achieve a particular objective at a particular time with a particular group of young people?" By assessing the modes of self-involved learning methods employed by students to

TABLE 2

Learning Modes Adopted by Science Students

Students' Learning Modes	*Likert Scale*	*Response Frequency*	*Percentage*	*Weighted Mean Score*	*Remarks*
Studying	3	24	56		
Lecture Notes	2	15	35	2.5	Occasionally
	1	4	9		
Reading	3	4	9		
Assignments	2	32	75	1.9	Occasionally
in Textbooks	1	7	16		
Working	3	16	37		
Regularly	2	21	49	2.2	Occasionally
Assigned	1	6	14		
Problems or					
Lab Exercises					
Discussing	3	11	26		
Topics with	2	26	60	2.1	Occasionally
Teacher	1	6	14		
Independent	3	20	47		
Reading	2	18	42	2.3	Occasionally
	1	5	11		
Media Supported	3	2	5		
Learning	2	7	16	1.3	Never
	1	34	79		
Working on	3	2	5		
Special	2	24	56	1.7	Occasionally
Projects	1	17	39		
Tutorial	3	6	14		
Support	2	30	70	2.0	Occasionally
	1	7	16		
Self	3	5	11		
Instructional	2	23	54	1.8	Occasionally
Material	1	15	35		

complement the science teaching process data becomes available to determine ways by which students' learning can be gauged (Busari, 1991).

Discussion

The different curriculum for the three science subjects of biology, chemistry, and physics have consistently proposed direct students involvement in the teaching and learning of science. Despite this persistent call, the use of the lecture method of teaching and the study of lecture notes by students have not yet left out science classrooms. This situation, the researchers believe, have persisted because of the age long problem of inadequate textbooks, laboratory equipment and other relevant instructional materials that could aid learning. This stance has been confirmed by Nwoko (1984) and Banu (1992) who opined that inquiry-discovery method of instruction has not been adequately put to use due to inadequate apparatus, ill-equipped laboratories and the lack of adequate background for scientific discovery in the early years of the SSS students.

On a general inspection of the two tables, the teacher centred teaching approach is gradually paving way for the student-centred learning. The use of discussion method, laboratory technique, inquiry-discovery approach, and individualized learning methods tend to give rays of hope for better teaching-learning situations for future science students.

In the previous years, science learning was characteristically rote, here, the students were expected to memorize most of the laws taught; understanding these concepts were more or less taboos. But in recent times as shown by the data gathered, science students now have the opportunity to discuss "science" with their teachers. Students use instructional materials for improved learning and work on individual projects with the help of tutorials from their teachers.

Conclusion and Recommendations

Based on the findings of the study, the following observations and conclusions have been arrived at by the researchers:

- An undesirable high use of the lecture method is still in use in the teaching and learning of science. Thus most science students depend much on the teacher's lecture notes.
- Media supported learning, field trips and the use of guest speakers have never been used in most schools surveyed for the teaching and learning of science.
- After more than ten years of using the new science curricula, the recommended method (inquiry-discovery) has only been occasionally put to use.
- Some student-centred modes of instruction such as the discussion method, laboratory method, individualised learning have been in use.

With this unbalanced picture in the teaching-learning situations of science, there is still room for improvement. As advocated by the curricula of these science subjects, there is the need to make the student the centre-piece dur-

ing learning. Students should be accorded the opportunity of "doing science" rather than "reading it". This seems to be advocated at present. Below are listed some recommendations for the improvement of the lot of science teaching and learning:

(i) More science equipment should be made available to schools, in order that the students will have the chance of using these equipment individually. The methods of science instruction in our schools depend on the availability of the equipment and apparatus.

(ii) Some of the virtues in the Nigerian Science Projects should be incorporated into the lecture-laboratory system to take care of both the less capable and the brighter students at the same time, provided the teacher takes personal interest in the students apart from the material being taught.

(iii) Seminars and workshops should be organised for science teachers, so as to introduce them into the use of the inquiry-discovery teaching technique.

(iv) Further studies should be conducted to ascertain the actual limitations of the use of the inquiry-discovery method of teaching science in our schools.

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