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Original Research Article

Factors Affecting the Teaching and Learning of Biology in Kolokuma/Opokuma Local Government Area, Bayelsa State, Nigeria

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Abstract	Keywords
<p>This study investigated and described the status and quality of biology teaching and learning in Kolokuma/Opokuma Local Government Area of Bayelsa State, Nigeria. Research questionnaires were used for gathering data from 10 public secondary schools involving 21 biology teachers and 200 students in Senior Secondary (SS1), Senior Secondary (SS2) and Senior Secondary (SS3). The study hypothesised the following: (a) HO₁: Teacher's competence has no significant relationship with the performance of secondary school students in biology examinations. HO₂: The absence of educational facilities has no significant relationship with the performance of students in biology examinations. Data obtained were analyzed and the stated hypotheses were tested using the chi-square analysis. The null hypothesis (HO₁) was accepted ($\chi^2_{(cal)}(18.06) < \chi^2_{(tab)}(31.3_{0.995})$) while the null hypothesis (HO₂) was rejected ($\chi^2_{(cal)}(39.82) > \chi^2_{(tab)}(37.2_{0.995})$). Findings from the study indicated a gap between the actual (observed) biology teaching and learning and the ideal school biology teaching with regards to curriculum, pedagogy and learning, and resource allocation, teacher knowledge and skills, attitude and professional development and community support. A major factor responsible for these gaps is the poor facilities for teaching and learning. Recommendations were made on closing the gap between the idea and real teaching and learning to improve the teaching and learning of biology in schools.</p>	<p>Bayelsa State Biology Learning Quality teaching</p>

Introduction

Over the years, science education in Nigeria has faced various challenges. The school curriculum offers a child-centered teaching-learning approach as students

are encouraged to take up the science related subjects including biology, which occupies a unique position in the school curriculum and is central to many science

related courses (Yusuf and Afolabi, 2010). In Nigeria, the inclusion of science subjects in the school curriculum is to promote national development as the nation adopts more science oriented policies and programmes in education (Oriahi et al., 2010).

Poor performance of students is mainly due to lack of motivation for teachers; poor infrastructural facilities; attitude of students to learning; lack of teaching skills and competence by science teachers; and lack of opportunities for professional development of science teachers (Brimoh and Okadeyi, 2001; Olaleye, 2002). Other factors include syllabus, teacher's qualifications, workload, experience and disposition, general lack of teaching skills and ineffective style of delivery of subject matter are also identified as some of the causes (Adepoju, 1991; Salau, 1996).

Scientific issues involve the teaching of biological concepts through technology so as to develop science through interesting contexts. The inclusion of science-technology-society (S-T-S) issues in the school curriculum (Osborne and Collins, 2000) will achieve the engagement of students in problem solving activities.

Ideal teaching refers to the teaching and learning process as it is expected to take place in a classroom in an ideal situation. Actual teaching is the teaching and learning process that actually takes place in the classroom in relation to the prevailing academic and environmental conditions. Quality teaching is the process of continuously improving teaching and learning in order to bring desirable education goals in the school system. It is the principal measure of the effectiveness of education and the most attribute to suffer. Teaching and learning are improved continuously and maintained to bring the desired goals (Aminu, 1995).

Quality teaching in biology is crucial for developing scientifically literate citizens and improving economic productivity for sustainable development. It enhances students achievement and strengthens public confidence in schools. Quality teaching helps students to attain a deep conceptual understanding (AAAS, 1989). Quality teaching is characterized by an adequate knowledge of subject matter; encouraging inquiry and hands-on approach to learning for students; and recognizing individual students as learners as the teacher builds on learner's strengths rather than trying to stamp out their weaknesses.

Quality teaching helps teachers to focus on the educational improvement of learners through the integration of adequate knowledge of the curriculum content areas, functional pedagogic skills, critical reflective teaching, empathy and commitment to the educational process and the acquisition of managerial competencies within and outside the school context. Quality teachers of biology are knowledgeable about biology, learning and science teaching and they create an environment in which students are regarded and treated as active learners. Teaching and learning of biology involves teachers' knowledge of subject matter and teaching pedagogy (Ball and McDiarmids, 1990).

Intelligence, cognitive styles and personality are individual characteristics that play important role in teaching and learning (Tella, 2007). Other variables such as motivational orientation, self-esteem and learning approaches are important factors that influence academic achievements. Motivation has gained more popularity amongst educational psychologists in leading other variables that could be manipulated to improve academic gains. Lack of interest by students in biology affects their listening to the teacher.

Hypotheses

HO₁: Teacher's competence has no significant relationship with the performance of secondary school students in biology.

HO₂: The absence of educational facilities has no significant relationship with the performance of students in biology.

Materials and methods

Questionnaires were used to survey both teachers and students. Teachers' survey helped in the identification of typical practice in curriculum delivery, teaching and assessment in biology. The student survey assisted in the gathering of students view on interest in biology, their perception of the relevance of biology, their competency and work attitude toward biology. The quantitative methods helped to identify and assess the bounds of knowledge of the respondents' attitudes, values, beliefs or opinions (Berg, 1989; Bouma, 2000). Ten state governments owned secondary schools were selected at random and used for the study. All the biology teachers in the respective schools were

surveyed. In each of the classes (SS1, SS2 and SS3), 10 students were surveyed. The random stratified sampling approach was used to select students from the schools. A total of 200 students and 21 teachers were sampled for the study. The questionnaires were administered to the respondents by the researcher. Teachers completed the teacher questionnaires themselves while the students were guided in the completion of the student questionnaires by the researcher.

Data was analysed using qualitative (descriptive) and quantitative methods (measurements of frequencies, percentages, means, standard deviation). Descriptive statistical methods involving percentages, means and standard deviations were used for analysis. Responses to open-ended questions were coded into categories and the frequency of teachers and students responses in each category was determined. Responses on scale items were also coded in relation to the items. The

chi-square statistical analysis was used to test the null hypothesis.

Results and discussion

The data revealed that 76.2% of the respondents believe students should do more hands-on group activities and 57.2% indicates there should be regular interaction between learners and the teacher. A percentage of 61.9 indicate that the class size must be manageable with adequate material resources and 28.6% believe that there must be sufficient laboratories, textbooks and equipment and a school environment free from distractions. More than one third (42.9%) indicated teachers must have a sound knowledge of the subject matter and 23.8% believe that teachers that must have relevant skills and approaches to cater for students of different learning abilities.

Table 1. Rating of pedagogy, curriculum, teacher knowledge and community support in ideal and actual circumstances (n=21).

Activity	Ideal		Actual		
	SA+A	A/D	D+SD	SA+A	A/D
Pedagogy					
Discussion between students discouraged	24.3	6.4	69.3	36.4	13.0
Students existing knowledge assessed	75.6	10.3	14.3	79.5	3.8
Curriculum					
Focused on preparing students for life	82.3	3.8	13.9	83.4	10.3
Focused on preparing students for higher school	67.6	9.1	23.4	71.8	11.5
Teacher					
Sound content knowledge	86.8	9.2	3.9	79.3	10.3
Required teaching skills	73.1	128	14.1	72.0	9.3
Community support					
Supported by school administration	58.5	20.8	20.8	47.4	21.8
Opportunities for improvement	50.0	33.3	16.7	33.8	19.5
key: SA-strongly agree; A- agree; A/D- agree/disagree; D-disagree; SD- strongly disagree					

Senior secondary students have typically 120 minutes of biology instruction per week as one 40-minute lesson and one 80-minute lesson. Eighty-minute lessons provide opportunities for student practical work. In actual 40-minute lessons, average of 68% of lesson time is devoted to teacher-centered activities while only 32% is devoted to student-centred activities. In ideal lessons, the teachers believe that the proportion of student-centred activity would be increased to 40%.

In the actual biology lessons, only 26% of the respondents believe that students do hands-on practical work every week all or most of the time, 51% of the

respondents believe that practical work is used to illustrate the concepts that have been introduced all or most of the time, 90% believe that students must carefully follow the teacher's instructions for experiments to reach correct conclusions all or most of the time. In ideal circumstances, only 36% of the respondents believe that students do hands-on practical work every week all or most of the time, and 99% indicate that students would carefully follow teacher's instructions for experiments to reach the correct conclusions all or most of the time and 64% indicate there would be practical work to illustrate concepts that have been introduced all or most of the time.

More than three quarters of respondents strongly agree or agree that students' existing knowledge was assessed to guide lesson planning (Table 1). Majority (83%) strongly agree or agree that the curriculum was focused on preparing students for life and almost three-quarters (72%) believe that the curriculum was focused on preparing students for study of biology at higher school. More than 79.3% strongly agree or agree that teachers must have a sound content knowledge and have the knowledge and skills required for teaching by inquiry (72%).

In ideal circumstances, teachers believe that there would be more student discussion. They also agree that under ideal circumstances, they would have more support from the school administration than under actual circumstances.

Almost half of the total time devoted to teaching and learning in 40 minute lessons is allocated to teacher explanations and demonstrations and note copying by the students. About 20% of the time is used to engage students in whole class discussion with the teacher while only 16% of the lesson time is used for students taking part in group practical activities.

The data indicates that the majority of students believe that for them to do well in biology, they need to think and ask questions (96%), understand and explain biology ideas (85%) remember lots of facts (85%) and apply biology to understand things in their lives (83%) as shown in Table 2. Thus, learning science involves more than just remembering facts; it requires a search for understanding and applying ideas to their own lives. More than half of the respondents believe that schools have poor laboratory facilities (58%); poor state of repair of the school laboratory facilities (66%), inadequate supply of chemical reagents (71%); poor amount of equipment for experiments (65%); and poor state of repair of laboratory equipment (64%) (Table 3).

The six most important factors inhibiting effective teaching and learning of biology mentioned by the respondents include insufficient teaching and learning resources, lack of well-equipped laboratories, students' poor communication skills, poor students' attitude to biology, non-conducive classroom environment and overloaded biology curriculum (Table 4). Teachers' lack of subject matter knowledge and inadequate motivation were also mentioned as factors that inhibit effective science teaching and learning.

Table 2. Response to items on learning biology (n=200).

Activity	N	Percentage of respondents	
		SA+A	D+SD
Think and ask questions	198	96.4	0.8
Remember lots of facts	199	84.6	7.6
Understand and explain biology ideas	198	84.6	5.2
Apply biology to understand life	196	82.5	9.2
Key: SA- strongly agree; A- agree; D- disagree; SD- strongly disagree.			

Table 3. Resources and facilities for teaching biology in schools (n=21).

Resources/facilities	Good	Satisfactory	Poor
Sufficient laboratory facilities	19.2	23.1	57.7
State of repair of facilities	6.5	27.3	66.2
Supply of chemical reagents	10.3	19.2	70.5
Amount of equipment for experiments	18.2	16.9	64.9
State of repair of equipment	15.4	20.5	64.1
Quality of student textbooks	21.1	43.4	35.5

Nearly one-third of students believe studying science will help to: understand the world around them including their environment; and to build up their future careers; and enable them to be curious, creative and inquisitive. Only 15% mentioned that biology would enable them to understand their health. Ten per cent of the students believe the study of biology would enable them gain societal respect (5%) or to be a good

citizen (5%) while only about one per cent indicated it would enable them overcome superstitions.

The stated hypotheses were tested using the formula for the chi-square analysis:

$$\chi^2 = \Sigma(O - E)^2/E$$

HO₁: the chi-square calculated (18.06_{0.995}) is less than the chi-square tabulated (31.09_{0.995}) leading to the

decision of accepting the null hypothesis that teachers' competence have no significant relationship with the performance of students.

HO₂: the chi-square calculated (39.82_{0.995}) is higher than the chi-square tabulated (37.20_{0.995}) resulting in a decision to reject the null hypothesis which states that the absence of educational facilities have no significant relationship with the performance of students and accepting the alternative.

The major factors identified include the lack of well-equipped biology laboratories; poor students' attitude to biology; non-conducive classroom environment; overloaded biology curriculum and students poor communication skills. Teachers' lack of subject matter knowledge and inadequate motivation were also mentioned as factors that inhibit effective science teaching and learning. The low status of the teaching profession equally militates against quality teaching and learning.

Table 4. Weight rank of factors inhibiting effective teaching (n=21).

Limiting factors	Number of Teacher			*Total weighted rank
	1st (X3)	2nd (X2)	3rd (X1)	
Resources				
Insufficient teaching resources	9	7	6	47
Lack of well-equipped laboratory	8	8	7	47
Non-conducive classroom environment	9	5	7	44
Lack of laboratory support staff	3	7	9	32
Teachers				
Teachers' lack of subject matter knowledge	6	4	3	29
Inadequate teachers' motivation	7	5	7	28
Lack of professional development	7	6	8	41
Curriculum and pedagogy				
Over loaded curriculum	8	7	7	45
Poor teaching skills	6	5	6	34
Poor students' attitude to biology	8	6	9	45
Students' poor communication skills	7	8	9	46

*Total weighted rank obtained by multiplying number of teachers mentioning factor with the weighting and summing.

The following recommendations are made:

- Provision of functional biology laboratories with laboratory assistants and adequate supplies of equipment and reagents for practical work.
- Increase in time allocated to teaching and learning biology to enable students participates in inquiry-based practical and activity work.
- Streamline biology curriculum to include only aspects of instructional content knowledge that would enhance learners' conceptual understandings.
- Equipping graduating biology teachers with strategies for conducting inquiry-based teaching and formative assessment practices during their training to improve teaching and learning.

Provision of modern facilities and access to modern texts for students' use.

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