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Problems of Teaching Practical Biology in Senior Secondary Schools

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ABSTRACTS

Biology is taught and learned in Nigerian schools from nursery to secondary school and postsecondary institutions. Biology science education attempts to study and comprehend the live organism and how it functions, students must have first-hand experience with and observation of the relevant events. The purpose of this research is to look into the challenges of teaching practical biology in senior secondary school. The research was conducted using a descriptive research approach. Education district IV in Lagos State was chosen using a random selection process. Seventy-one Biology instructors were chosen at random from among the forty schools to take part in the study. The data for the study was collected using the Problems of Teaching Practical Biology Questionnaire (PTPBQ). The findings identified a number of difficulties, including a paucity of specimens for Biology practicals and insufficient or unsatisfactory equipment for Biology practicals. It was observed that improvising the specimen by the teacher, students, and principals, as well as aid from the Parent-Teacher Association and Non-Governmental Organizations in the acquisition of realistic materials and equipment, are viable solutions to these problems.

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1. INTRODUCTION

Biology is a science that teaches us how to describe and understand natural processes in our environment via observation and experimentation (Lewens, 2012; Hofstein & Lunetta, 1982; Kamarainen & Grotzer, 2019; Nesse *et al*., 2010). Biology knowledge is used to a wide range of human, material, and environmental challenges (Schwenk *et al*., 2009; Schwenk *et al*., 2009). A researcher stated it can also be divided into two key complementary modes: the gathering of information about their natural world through exploration and discovery endeavors, and the application of that knowledge for human and material development (Pye *et al*., 2017; Nsamenang, 2005). Because of its importance and relevance to life and society, science is given a lot of attention in schools. The achievement of this begins with the study and application of scientific disciplines such as biology, physics, basic science, and chemistry in secondary school, but biology alone focuses on human health and his environment (Tholey *et al.,* 2017; Marsland & Prince, 2012). Biology as a learning subject According to the Nigerian Education Research Council (NERC), the broad aims of the senior secondary school biology curriculum are to enable students to:

(i) Construct and apply knowledge of biology, understand the nature of science in biology-related contexts, and appreciate the relationship between biological science and other disciplines.
(ii) Acquire scientific inquiry skills, as well as the ability to think scientifically, critically, and creatively, and solve issues both independently and cooperatively in biology-related contexts.
(iii) Be able to articulate ideas and opinions on biology-related issues using scientific language; be aware of biology's social, ethical, economic, environmental, and technological ramifications, as well as the ability to make informed decisions and judgments on biology-related issues; and
(iv) Cultivate a sense of civic responsibility and a desire to improve personal and community health.

It is hoped, however, that no matter what profession students who have completed the curriculum end up in, their understanding of biology acquired in secondary school will be useful throughout their schooling and in their entire life.

Biology is taught in senior secondary schools in Nigeria with the following goals in mind:

(i) Appropriate laboratory and field biology skills,
(ii) The knowledge that is meaningful and relevant
(iii) The ability to apply scientific knowledge to everyday life in areas such as personal and communal health, agriculture, and the environment.
(iv) Scientific views that are reasonable and practical

Biology is taught as both a theory and a practical subject in senior secondary schools to attain these goals. In senior secondary schools, biology practical is required in the teaching and learning of biology (Hofstein & Lunetta, 2004; Torres, 2018).

Biology as a practical science provides students not just motivational and fun activities but with the opportunity to apply, investigate, and develop their knowledge and understanding of biology in investigative scenarios, which can help learning and recall, and drive curiosity (Stephens & Winterbotton, 2010; Hill *et al*., 2016).

The practical aspect of biology is very important in external examinations; it is written as an earmark examination to compute the grade for biology in the West African Examination Council (WAEC), which is an international examination body for Senior Secondary Schools Certificate Examinations (SSSCE), stated that the importance of biology practical in

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secondary school biology teaching and learning syllabus was created to help students develop their ability to:

(i) Acquire necessary scientific skills, such as observing and classifying;
(ii) Acquire adequate laboratory and field skills to carry out and evaluate experiments and projects in biology; and
(iii) Develop the ability to perform a simple experiment and draw inferences from the results obtained.
(iv) To improve one's capacity to conduct a simple experiment and make conclusions from the results.

Candidates should be aware of the practical application of what they are studying, according to WAEC. Students also learn by doing and having the opportunity to put what they have learned into practice.

However, the issues that affect biology teaching and learning also affect biology practical. This is owing to the current state of Nigeria's educational system, which allows for a variety of issues to arise in the teaching of practical biology. Teachers' variables, such as gender, can also have an impact on the issues. As a result, the research looked into the challenges of teaching biology practicals in Nigerian senior secondary schools.

2. METHODS

The research approach used in this study was descriptive survey research. A technique of random sampling was used. Educational district IV was chosen at random among six districts in Lagos State. Purposefully chosen schools included forty public senior high schools and seventy-one biology teachers. The data was collected using the Problems of Teaching Practical Biology Questionnaire (PTPBQ). There were two components to the instrument. The first component contains the participants' biography information, whereas section B seeks the respondent's perspective on the challenges of teaching practical biology. In a four-Likert scale format, Section B contains 19 items on problems in teaching biology and 12 items on possible solutions to problems in teaching biology practical. The mean and analysis of variance (ANOVA) were used to examine the data acquired in this study.

2.1. Statement

Biology should be taught and learned in a way that is simple, comprehensive, and concrete. Because of the materials that should be in the laboratory, biology practical as a component of teaching and learning biology makes it more learner-centered than teacher-centered, making it more exciting, stimulating, and understandable to instructors and learners. Biology students' academic success is greatly determined by the availability of and good teaching and learning of biology, where the practical complements the theoretical.

However, there are a variety of issues that arise when teaching biology in a practical setting. According to the WAEC chief examiner's report from 2010, student performance in Biological practical is reviewed in terms of poor spelling, poor observation, weak mathematics skills, poor deductive reasoning, misinterpretation of questions, and poor biology knowledge. Attendants also lack the technical expertise of how to operate, maintain, and repair accessible laboratory equipment. The issues of teaching Biology practical in senior secondary school were investigated based on the foregoing.

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3. RESULTS AND DISCUSSION

The result of this study is presented according to research questions.

3.1. Research Question 1: What are the Problems in Teaching Biology Practical's in Senior Secondary Schools?

Table 1 shows the problems of teaching biology practical. The results revealed that Biology students are too numerous to manage for practical ($\overline{X}$ =3.24), Some of the Biology practical specimens are not useable ($\overline{X}$ = 2.99), the biology practical does not have suitable equipment ($\overline{X}$ = 3.10). Also, the essential guide for conducting practical sessions is not provided to the teachers has the mean score of ($\overline{X}$ = 2.51), biology teachers need workshops, seminar, and conference mean ($\overline{X}$ = 3.69), laboratory assistants and technicians do not assist teachers in planning and executing practical exercises has the mean score of ($\overline{X}$ = 3.15). This implies that all these are problems of teaching practical biology in senior secondary school since it's greater than the benchmark of ($\overline{X}$ = 2.50). While some equipment is difficult to work with has a mean score of ($\overline{X}$ = 2.41), students who are not particularly interested in practical classes has a mean score of ($\overline{X}$ = 1.99) which implies that these are not problems of teaching practical biology in senior secondary school since is less than the benchmark of 2.50.

Table 1. Mean Responses of Biology Teachers on the Problems of Teaching Biology Practical.

S/N	Problems of Teaching Biology Practical	Mean
1	Biology students are too numerous to manage for practical	3.24
2	Some equipment is difficult to work with.	2.41
3	Some of the Biology practical specimens are not useable.	2.99
4	The Biology practical does not have suitable equipment.	3.10
5	Students are not particularly interested in practical classes.	1.99
6	The essential guide for conducting practical sessions is not provided to the teachers.	2.51
7	Laboratory assistants and technicians do not assist teachers in planning and executing practical exercises.	3.15
8	Workshops, seminars, and conferences are required for biology teachers.	3.69
9	Some essential materials are unavailable to teachers.	3.08
10	There isn't enough time set aside for practical work.	3.21
11	On the school timetable, there is no special time for biology practicals.	3.08
12	Inadequate records of biology laboratory materials	2.56
13	inexperienced laboratory assistants/technicians	3.04
14	A scarcity of skilled technicians	3.10
15	My school has a biology laboratory	3.46
16	Outdoor activities are better for teaching biology practical	3.00
17	Available resources outside the laboratory complement practical work better	3.30
	Grand Mean	2.91

Note: Decision Rule: Below 2.5 is disagreed, above 2.5 is Agreed.

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3.2. Research Question 2: Does Teachers' Gender Influence the Problems in Teaching Biology Practicals in Senior Secondary Schools.

Table 2 above shows the teachers' gender on the problems of teaching biology practicals. The results established that Biology practical work is tedious for female teachers ($\overline{X}$ = 2.28) and ecological instruments are very easy to manipulate by male biology teachers has a mean score ($\overline{X}$ = 2.58).

Table 2. Mean Score of Teachers' Gender on the Problems of Teaching Biology Practical.

S/N		Mean
1	Biology practical work is tedious for female teachers	2.28
2	Ecological instruments are very easy to manipulate by male biology teachers	2.58
	Grand mean	2.43

3.3. Research Question 3: What are the Possible Solutions to the Problems of Teaching Biology Practicals in Secondary School?

Table 3 above shows possible solutions to problems of teaching biology practicals in senior secondary school. The table established that laboratory assistants and attendants should be hired, and they should assist with practical with a mean of ($\overline{X}$ = 3.79), teachers should be supported to attend workshops, seminars, and conferences regularly to learn new teaching practices has a mean score of ($\overline{X}$ = 3.77). furthermore, the results indicate that teachers should engage students in practical tasks to pique their interest in the lecture with a mean ($\overline{X}$ = 3.63), enough time should be set aside has the mean score ($\overline{X}$ = 3.59), PTAs and non-profit organizations might be enlisted to help with the purchase of realistic materials and equipment has the mean score of ($\overline{X}$ = 3.30), could be called upon to give a specimen from their neighborhood has the mean score of ($\overline{X}$ = 3.27).

Table 3. Mean Responses of Possible Solutions to the Problems of Teaching Biology Practical in Secondary School.

S/N	Possible Solutions to Problems of Teaching Biology Practical	Mean
1	Laboratory assistants and attendants should be hired, and they should assist with practical.	3.79
2	Teachers should be supported to attend workshops, seminars, and conferences regularly to learn new teaching practices. for practical	3.77
3	Teachers should engage students in practical tasks to pique their interest in the lecture.	3.63
4	Enough time should be set aside for practical	3.59
5	PTAs and non-profit organizations might be enlisted to help with the purchase of realistic materials and equipment.	3.30
6	Students could be called upon to give a specimen from their neighborhood.	3.27
7	The principal should assist the teachers in obtaining some practical resources.	3.27
8	Biology teachers should make their biology teaching materials	3.32
9	Appropriately assessing the laboratory's human and material resources.	3.30
10	Laboratory materials that have been damaged must be replaced or repaired.	3.59
11	The teacher's prompt supervision of students during practical	3.39
12	Ensure the safety of laboratory materials	3.38
	Grand Mean	3.47

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Also, the principal should assist the teachers in obtaining some practical resources with a mean score of ($\overline{X}$ = 3.27), biology teachers should make their biology teaching materials has the mean score of ($\overline{X}$ = 3.32), appropriately assessing the laboratory's human and material resources has the mean score of ($\overline{X}$ = 3.30), laboratory materials that have been damaged must be replaced or repaired has the score of ($\overline{X}$ = 3.59), teacher's prompt supervision of students during practical has the mean score of ($\overline{X}$ = 3.39), ensure the safety of laboratory materials has the mean of ($\overline{X}$ = 3.38).

Therefore, an average mean of ($\overline{X}$ = 3.39) is computed for the entire items of 1-19. It can be deduced therefore the grand mean that all these are possible solutions to the problems of teaching Biology practical in secondary school since it's greater than the benchmark of 2.50.

3.4. Research Hypothesis

Ho_1: There is no significant difference in the problems in the biology practical in secondary schools based on gender. From **Table 4** above, analysis established that the t-value is .705, with a p-value of 0.483 >0.05 alpha level. This implies the null hypothesis, which states that there is no significant difference in the problems in the biology practical in secondary schools based on gender. Hence, the hypothesis was accepted. Therefore, there is no significant difference in the problems of teaching biology practicals in senior secondary schools based on gender.

Table 4. Significance Difference in the Problems in the Biology Practical in Secondary Schools Based on Gender.

Gender	N	Mean	SD	Df	T	Sig	Remark
Male	26	59.08	6.092				
				69	0.705	0.483	Accepted
Female	45	57.84	7.612				
Total	71						

4. CONCLUSION

The problems of teaching Biology practicals in senior secondary school were studied in this study, and some solutions to the problem were discovered. As a result, it is suggested that:

(i) Establishment of functional biology laboratories with a technologist on staff, as well as suitable equipment and chemicals for practical work.
(ii) Increase the amount of time allotted to biology teaching and learning so that students can engage in inquiry-based practical and activity work.
(iii) Students should have access to the use of modern facilities.
(iv) Faulty material resources should be rectified and replaced as soon as possible.
(v) Laboratory resources should be sufficiently given and documented, with no logistical stumbling blocks.
(vi) Workshops, seminars, and conferences for students, instructors, and laboratory assistants/technologists from the Ministry of Education and professional groups such as STAN should be arranged regularly to maximize their utilization potential.

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(vii) Constant observation and evaluation of biology laboratory resources are also used as basic methods to ensure adequacy in resource allocation and management in secondary school biology labs.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

6. REFERENCES

Hill, K. M., Fombelle, P. W., and Sirianni, N. J. (2016). Shopping under the influence of curiosity: How retailers use mystery to drive purchase motivation. *Journal of Business Research, 69*(3), 1028-1034.

Hofstein, A., and Lunetta, V. N. (1982). The role of the laboratory in science teaching: Neglected aspects of research. *Review of Educational Research*, *52*(2), 201-217.

Hofstein, A., and Lunetta, V. N. (2004). The laboratory in science education: Foundations for the twenty-first century. *Science education*, *88*(1), 28-54.

Kamarainen, A. M., and Grotzer, T. A. (2019). Constructing causal understanding in complex systems: Epistemic strategies used by ecosystem scientists. *BioScience*, *69*(7), 533-543.

Lewens, T. (2012). Human nature: the very idea. *Philosophy and Technology*, *25*(4), 459-474.

Marsland, R., and Prince, R. (2012). What Is Life Worth? Exploring Biomedicai Interventions, Survival, and the Politics of Life. *Medical Anthropology Quarterly, 26*(4), 453-469.

Nesse, R. M., Bergstrom, C. T., Ellison, P. T., Flier, J. S., Gluckman, P., Govindaraju, D. R., Niethammer, D., Omenn, G. S., Perlman, R. L., Schwartz, M. D.,and Valle, D. (2010). Making evolutionary biology a basic science for medicine. *Proceedings of the National Academy of Sciences, 107*(suppl 1), 1800-1807.

Nsamenang, A. B. (2005). Educational development and knowledge flow: Local and global forces in human development in Africa. *Higher Education Policy, 18*(3), 275-288.

Pye, C. R., Bertin, M. J., Lokey, R. S., Gerwick, W. H., and Linington, R. G. (2017). Retrospective analysis of natural products provides insights for future discovery trends. *Proceedings of the National Academy of Sciences*, *114*(22), 5601-5606.

Schwenk, K., Padilla, D. K., Bakken, G. S., and Full, R. J. (2009). Grand challenges in organismal biology. *Integrative and Comparative Biology*, *49*(1), 7-14.

Schwenk, K., Padilla, D. K., Bakken, G. S., and Full, R. J. (2009). Grand challenges in organismal biology. *Integrative and Comparative Biology, 49*(1), 7-14.

Stephens, K., and Winterbottom, M. (2010). Using a learning log to support students' learning in biology lessons. *Journal of Biological Education*, *44*(2), 72-80.

Tholey, A., Taylor, N. L., Heazlewood, J. L., and Bendixen, E. (2017). We are not alone: the iMOP initiative and its roles in a biology-and disease-driven human proteome project. *Journal of Proteome Research*, *16*(12), 4273-4280.

DOI: http://dx.doi.org/10.17509/xxxx.xxxx
p- ISSN 2775-6793 e- ISSN 2775-6815

Torres, L. (2018). Research skills in the first-year biology practical-are they there? *Journal of University Teaching and Learning Practice, 15*(4), 3.

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