ASSESSMENT OF THE IMPLEMENTATION OF THE PRACTICAL ASPECT OF BIOLOGY CURRICULUM IN SENIOR SECONDARY SCHOOLS IN OSUN STATE

Temitope Oluwafemi AKINBAYO
Obafemi Awolowo University,
Ile-Ife, Nigeria
E-mail: akinbayooluwafemi@oauife.edu.ng

Emmanuel Folorunsho BAMIDELE
Obafemi Awolowo University,
Ile-Ife, Nigeria
E-mail: bamdeleef@yahoo.com

Oyeniyi Sunday ARIYO
Curriculum and Educational Instructions Department
Federal College of Education,
Ilawe Ekiti, Ekiti State, Nigeria
E-mail: adufeniyi24@gmail.com

Abstract
The study assessed the implementation of the practical aspect of the Biology curriculum in senior secondary schools in Osun state. The population for the study consisted of all Biology teachers in Osun state. The study sample consisted of 66 Biology teachers. The study employed the descriptive survey design, the multistage sampling procedure was used to select 48 senior secondary schools in the state. A research instrument was used to collect data for the study tilted; Biology Practical Resources Checklist (BPIRC). Frequency counts and percentages were used to analyse the data collected. The findings indicated that laboratory resources for practical Biology in the study area are fairly available (41.3%) and they are largely inadequate (86.6%). Furthermore, the result showed that Biology practical activities hold regularly per term with a total number that ranges between 5 to 15 times. The study recommended that unavailable resources should be improvised to achieve the best

in the teaching and learning of biology in secondary schools, as this will boost students' active participation and improve their creativity skills.

Keywords: Curriculum, Curriculum Implementation, Laboratory equipment, Biology practical, Availability of laboratory equipment, Adequacy of laboratory equipment, practical periods

Introduction

Science is an area of learning that is absolutely necessary for the development of a nation because of its linkage to technology and industry (Marginson, 2022). Scientific development is essential for better quality of life, the sustainable development of the planet, and peaceful coexistence among people. From the immediate basic essentials of life such as access to water, food and shelter, to other issues such as management of agricultural production, water resources, health, energy resources, biodiversity, conservation, environment, transport, communication and so on. Science provides the basis for action at local, regional, national and transnational levels (Almasri,2024). Science and technology have been identified as the key drivers for growth and sustainable social development and transformation of nations, which could lead to industrialization (Tseng, Chai, Tan, & Park, 2022; Ogundare & Yohanna, 2023). Science education aims at helping learner to gain a functional understanding of scientific concepts and principles linked with real life situations and acquire scientific skills, attitudes and values necessary to analyse and solve day-to-day problems (Liu, Zowghi, Kearney & Bano, 2021). This portends the reason why basic sciences are core subjects in the elementary and secondary schools all over the world. It emphasises the fact that all citizens should achieve some degree of scientific literacy to enable them participate effectively as citizens in the modern and changing society.

Quality science education is successful science teaching that takes place when students learn and meet numerous scientific objectives

and not only the ability to repeat scientific knowledge (Olatoun, 2017). In the process of effective learning, the studentlearn to advance conceptual knowledge and thinking abilities to alter their intuitive, daily, methods of explaining the world around them to incorporate scientific notions and thinking styles in their individual paradigms to improve their problem-solving capabilities. Science gives a body of knowledge that can be utilized in solving different types of humans, material and environmental issues. It is also perceivable to be composed of two large complementary modes namely: gathering of knowledge by exploration and discovery activities about the natural world and the application of the same to human and material advancements.Science is studied and practiced in all parts of the world, including Nigeria. Nigeria is a developing country that faces the growing level of demand of science-based skilled labor. This can be initiated by learning and practice of science subjects like Biology in secondary level schools becauseBiology stands out as a special place in science curriculum in the senior secondary school. It is a prelude to the study of other professional courses related to science, such as Medicine, Nursing, Pharmacy, Agriculture, Microbiology etc. (Ayanda, Olayinka & Adeoye, 2020).

Biology is a highly significant subject in science and one of the science subjects in senior secondary school level (FRN, 2014). Biology refers to the part of science that examines life that encompasses the structure, functioning as well as conduct of organisms. It involves the study of living things (animals and plants) in various forms and extent like their evolution, structures, growth, distribution, and taxonomy (Asuzu& Okoli, 2019). The study of Biology can result in a person becoming more conscious of the changing world around him or her, studying it in greater detail and adjusting to it. Currently, Biology has become an important subject in the majority of human activities such as solutions to food scarcity issues, pollution, population explosion, radiation, disease, health, hygiene, conservation of natural resources, family life and biotechnology and ethics due to recent advancements that recorded

to the field of Biochemistry, Physiology, Ecology and Genetics (Pat-anyaenji and Okeke, 2019).

The curriculum in biology is aimed at ensuring that the students develop skills of inquiry and gain deeper knowledge about the sciences of biology, yet over the decades, research studies were able to report that academic performance of students who wrote biology examinations was not satisfactory (Oluwanife& Folasade, 2022; Kinta & Philip, 2025). This situation can be easily attributed to many factors such as inadequately qualified Biology teachers, lack of hands-on equipment and non-availability of laboratory facilities (Adeyemi & Okonkwo, 2024; Adedoyin, Bello & Sulaiman, 2025). Biology is an applied science course that demands hands-on activities of students in its teaching and learning. Proper and standard Biology experiments, which are also regarded as an essential component of the national curriculum in Biology, are not mere motivational and fun, but they provide students with the abilityto apply and elaborating their insight and knowledge about the learnt concepts in classrooms, which consequently, may shape their critical thinking and strengthen their interest in learning biology (Bukoye, 2019; Zulfiqar, Khalid& Ali,2025).

Practical work is one of the contributing factors to the interest and enthusiasm of the student in such a way that it encourages the interest towards biology in a lasting manner.Practical work, which is 'hands-on' activities, is an essential component when it comes to the study of the natural sciences, such as Biology, Chemistry and Physics. It is premised on the fact that the best way of learning scientific skills is through learning by doing. The so-called hands-on approach can arouse the interests of the students in the topic of the study, instill the laboratory skills, contribute to the further knowledge acquisition, and provide the understanding of the process of developing the scientific attitudes and skills. Akinwumi and Falemu (2020) note that the interest that the students bring to school is not the sole determinant of the motivation to learn

biology. Although practical lessons are what the teachers should use to ensure their students can perform better in biology, it was regrettable that in majority of the schools the biology laboratories were employed in teaching theoretical lessons but not practical lessons, this may be due to the condition of the laboratories which are poorly equipped with resources and equipment needed in delivering practical lessons, which consequently may influence the successful and proper implementation of the Biology curriculum (Hamunyela, Makaye,& Cruz, 2022)

In the definition of Okeke (2023), curriculum simply refers to the premeditated experiences offered by the school to help the students achieve the intended learning outcomes in the various school subject choices offered to the students to pursue when they join the school. The other aspect of curriculum is that learning content does not necessarily lead to the accomplishment of an objective where the contents and the objectives are not linked. According to the Nigerian Educational Research and Development Council (NERDC, 2009), the objectives of Biology curriculum in secondary schools in Nigeria were as follows: Sufficient laboratory and field skills in Biology; meaningful and relevant knowledge in Biology; application of scientific knowledge to the real life on issues of personal and community health and agriculture and fair and functional scientific attitude. The most important guidelines as noted by Hamunyela et al. (2022) were meant to offer student-centered learning environment that addresses the needs of individual learners by applying differentiated instructional strategies, and also to offer high-quality pedagogical outcomes-based curriculum. The curriculum, requires instructional and human resources to make sure that there is complete transition between teacher-centred approach which is characterised with memorization to inquiry-based instruction approach to build the scientific knowledge and skills of the student. This is possible only in science classrooms like laboratories.

Laboratory resources includes both print and non-print media, as well as equipment and resources specifically designed to convey information to students during the educational process (Zulfiqar *et. al.*, 2025). These teaching tools and practical equipment can be considered a tangible basis and bricks of subject matter comprehension. They are visible, audible, touchable, and manipulable, and thus, form effective platforms to the spreading of scientific information, ideas, and knowledge. These resources have a significant role in teaching and learning process in that they improve the memory retention, the ability to recall and understand abstract concepts of students. They do this through the concretization of ideas and engaging imaginations of students.
Practical activities can be considered as a method that may be accepted to make the task of a teacher even more credible to the learners rather than abstract demonstration of subjects. Thus, there is a dire need to involve students in the practical activity in teaching biology especially in secondary schools. Introduction of science subject curriculum lacking practical activities are considered a short-term strategy that cannot yield a long-term impact (Hamunyela*et al.,*2022)

There are standards to teaching and learning of biology as a branch of science that should be adhered to by teachers for effective learning among. The Biology curriculum has placed much importance on the participation of the students in the secondary school in practical activities.Although there could be militating factors against the implementation of the practical aspect of Biology curriculum such as availability and adequacy of the laboratory equipment and time devoted to practical activities. But there is a dearth in such information as regards those factors. Hence; this study.

The theory of learning that guided this study was cognitive constructivism theory of learning that was developed by Jean Piaget (1967). Constructivists are of the view that classroom based instructional approaches that are learner centric will enhance the

commitment and engagement of self-motivated learners due to the high engagement rate. In adapting this theory, this research paper considers the teaching strategies such as; Inquiry-Based Teaching, Laboratory method, Discovery method, and so on, as ways of permitting Knowledge construction in the process of teaching and learning. These instructional strategies are not so much employed by teachers implementing the Biology curriculum in Osun State, thereby leading to unsatisfactory learning outcomes among secondary school students in the study area over time.

According to the constructivism learning theory, the learning environment should also supply and avail specific laboratory equipment or facilities in such a way that the students are able to easily manipulate and shape their own knowledge. With the reference to constructivist theory, the study aimed to discover whether laboratory equipment and facilities exist and are adequate in the implementation of the biology curriculum appropriately. According to cognitive constructivists, the learner constructs knowledge actively as is reflected in the teaching-learning activities in the learning environmental. The constructivist learning methods involves educators implementing curriculum using experiences of their learners who are active in the learning process.Therefore, cognitive constructivist theory was relevant guide to this study, since it stresses on the fact that instructional strategies and activities of learning need to be learner-centered for effective curriculum implementation. It emphasized on provision of instructional materials, facilities and equipment that leads to motivation to learn and an improvement in the learning outcomes of students hence effective implementation of curriculum in secondary schools.

The objectives of the study are to;

1. examine the availability and adequacy of laboratory resources for teaching Biology in Osun state secondary schools; and

2. determine the time allotted to practical activities in senior secondary schools in the study area

According to the primary objective of the present research, the following questions were formulated;

(a) Are the laboratory resources for biology practical activities available in Osun state secondary schools?
(b) Are the laboratory resources for biology practical activities adequate in the study area?
(c) What is the frequency of practical work in Biology in secondary schools in the study area?

Methodology

The research design used in the study was the descriptive survey research design. This study had a population of 205 Biology teachers in the Senior Secondary Schools in the Osun State. It includes a sample of 66 Biology teachers of secondary schools that were chosen through multi-stage random sampling procedure. From each of the three Senatorial districts within the state, four Local Government Areas (LGAs) were chosen randomly resulting into a total of twelve LGAs. Simple random sampling technique determined four senior secondary schools in each of the twelve LGAs selected and this resulted in forty-eight schools.

The Biology Practical Instructional Resources Checklist (BPIRC) was used in collecting data for this study. The questionnaire consisted of two sections A and B where section A asked the teachers to give demographic information like qualification, time spent on practical activities in a week and term whereas section B included the list of recommended items/materials that a class of 50 students would need. It was adopted from the Federal Ministry of Education recommendation (2004), which was employed to carry out an inventory of the availability and sufficiency of instructional

materials as applied to the teaching and learning biology. The BPIRC was subjected to re-validation by experts to ascertain its content relevance and applicability to the study All the items of the observation checklist were rated on two Likert-type rating scale of Available and Not Available; Adequate and Not Adequate. The intsFaculty of Education, Obafemi Awolowo University, Ile-Ife.

As part of collecting the data of the study the researcher approached the schools with a letter of introduction to the principals of the secondary schools who then gave the respondents permission to answer the instrument. The research assistants who were trained by the researcher helped in the administration of the instrument to the respondents. The questionnaires were gathered as soon as they were filled.Descriptive statistics in form of frequency counts and percentage were used to answer the questions raised. Easy and quick interpretation of results was also done using representations like bar charts.

Results

Research Question 1: Are the laboratory resources for biology practical activities available in Osun state secondary schools?

To answer this question, the Biology Practical Instructional Resources Checklist and Questionnaire (BPIRCQ) was used to check the resources available based on the recommendation of list of items from the Federal Ministry of Education. The listed items provided in the checklist for the resources needed for Biology laboratories were for 50 students. this was then adjusted to the average number of students found in each schools using simple ratio for each item. The number required as compared with number available was used to test the adequacy of the resources in the schools. Responses to the items on the checklist were subjected to descriptive statistics and the results are presented below.

Table 1: Biology Practical Instructional Resources Availability

S/N	ITEMS/EQUIPMENT	AVAILABLE FREQUENCY (%)	NOT AVAILABLE FREQUENCY (%)	REMARK
1	Beakers			
	a-100ml	48 (100.0)	00 (0.0)	Available
	b-250ml	42 (87.5)	6 (12.5)	Available
2	Bell jars	21 (43.8)	27 (56.3)	Available
3	Bunsen burners	48 (100.0)	00 (0.0)	Available
4	Boiling tubes	29 (62.5)	19 (39.5)	Available
5	Crucibles (porcelain with cover)	8 (16.7)	40 (83.3)	Not Available
6	Conical flasks			
	a-250ml	40 (83.3)	8 (16.7)	Available
	b-100ml	39 (81.3)	9 (18.8)	Available
7	Cylinders (measuring)			
	a-10ml	45 (93.7)	3 (6.25)	Available
	b-100ml	36 (75.0)	12 (25.0)	Available
8	Chemical balances	11 (22.9	37 (77.1)	Not Available
9	Corks (assorted)	3 (6.3)	45 (93.8)	Not Available
10	Cork borers machine	1 (2.1)	47 (97.9)	Not Available
11	Crucible tongs	4 (8.3)	44 (91.7)	Not Available
12	Clinostats (clock work)	2 (4.2)	46 (95.8)	Not Available
13	Clamps (for retort stand)	23 (47.9)	25 (52.1)	Available
14	Dissecting sets	30 (62.5)	18 (37.5)	Available
15	Dissecting boards	21 (43.8)	27 (56.3)	Not Available
16	Dissecting pans (wared bottom)	4 (8.3)	44 (91.7)	Not Available
17	Dropping pipettes with rubber bulb	13 (27.1)	35 (72.9)	Not Available
18	Evaporating dishes 100ml	15 (31.3)	33 (68.8)	Not Available
19	Filter funnels (2 sizes)	13 (27.1)	35 (72.9)	Not Available
20	Flasks (Distilling)	8 (16.7)	40 (83.3)	Not Available
21	Flasks:			
	Flat bottom-250ml	30 (62.5)	18 (37.5)	Available
	Round bottom-250ml	30 (62.5)	18 (37.5)	Available
22	Flask filtering with side tube	10 (20.8)	38 (79.2)	Not Available
23	Flasks-Vacuum	8 (16.7)	40 (83.3)	Not Available
24	Filter paper-12cm, 15cm, 50cm	36 (75.0)	12 (25.0)	Available
25	Glass rods (50cm)	6 (12.5)	42 (87.5)	Not Available
26	Glass sheets	3 (6.3)	45 (93.8)	Not Available
27	Glass tubings (assorted) 3kg	8 (16.7)	40 (83.3)	Not Available

S/N	ITEMS/EQUIPMENT	AVAILABLE FREQUENCY (%)	NOT AVAILABLE FREQUENCY (%)	REMARK
31	Insectnets	19 (39.6)	29 (60.4)	Not Availabl
32	Insect settings (spreadir	4 (8.3)	44 (91.7)	Not Availabl
	board)			
33	Insect pins	10 (20.8)	38 (79.2)	Not Availabl
34	Litmus paper	30 (62.5)	18 (37.5)	Available
35	Light meters	7 (14.6)	41 (85.4)	Not Availabl
36	Microscopes	38 (79.2)	10 (20.8)	Available
37	Microscope slide	34 (70.8)	14 (29.2)	Available
38	Microscope slide cov	41 (85.4)	7 (14.6)	Available
	slides			
39	Petri-dishes	43 (89.6)	5 (8.3)	Available
40	Pipe clay (triangular f	12 (25.0)	36 (75.0)	Not Availabl
	tripod stand)			
41	Photometers	7 (14.6)	41 (85.4)	Not Availabl
42	Photometer Ganongs	7 (14.6)	41 (85.4)	Not Availabl
43	Plant pots	6 (12.5)	42 (87.5)	Not Availabl
44	Plastic models			
	• Heart	11 (22.9)	37 (77.1)	Not Availabl
	• Eye	13 (27.1)	35 (72.9)	Not Availabl
	• Ear	15 (31.2)	33 (68.8)	Not Availabl
	• Skeleton	24 (50.0)	24 (50.0)	Available
45	Rain gauge	29 (60.4)	19 (39.6)	Available
46	Rubber tubings (assorted	14 (29.2)	34 (70.8)	Not Availabl
47	Retort stands	29 (60.4)	19 (39.5)	Available
48	Soil sieves (granded)	8 (16.7)	40 (83.3)	Not Availabl
49	Soil test kits	22 (45.8)	26 (54.2)	Not Availabl
50	Spatula/plastic spoons	36 (75.0)	12 (25.0)	Available
51	Stop clocks	35 (72.9)	13 (27.1)	Available
52	Specimen bottles	25 (52.1)	23 (47.9)	Available
53	Separating funnels	13 (27.1)	35 (72.9)	Not Availabl
54	Test tubes			
	150 x 15mm	35 (72.9)	12 (25.0)	Available
	125 x 16mm	35 (72.9)	13 (27.1)	Available
55	Test tube holders	43 (89.6)	5 (10.4)	Available
56	Test tube rack in 12 holes	41 (85.4)	7 (14.6)	Available
57	Thermometer (0°C – 100°C)	37 (77.1)	11 (22.9)	Available
58	Thistle funnels	20 (41.7)	28 (58.3)	Not Availabl
59	Tripod stands	44 (91.7)	4 (8.3)	Available
60	Wire gauze	41 (85.4)	7 (14.6)	Available
61	Watch glasses	2 (4.2)	46 (95.8)	Not Availabl

Reagents

S/N	ITEMS/EQUIPMENT	AVAILABLE FREQUENCY (%)	NOT AVAILABLE FREQUENCY (%)	REMARK
67	Acid hydrochloric pure	42 (87.5)	6 (12.5)	Available
68	Acid Nitric pure	43 (89.6)	5 (10.4)	Available
69	Acid sulphuric pure	40 (83.3)	8 (16.7)	Available
70	Agar powder	13 (27.1)	35 (72.9)	Not Available
71	Alcohol methylated spiri	27 (56.3)	21 (47.8)	Available
72	Alum (iron) pure	15 (31.3)	33 (68.8)	Not Available
73	Ammonium Hydroxide i liquid	36 (75.0)	12 (25.0)	Available
74	Calcium sulphate pure	29 (60.4)	19 (39.6)	Available
75	Calcium phosphate pure	18 (37.5)	30 (62.5)	Not Available
76	Camphor blocks	3 (6.3)	45 (93.8)	Not Available
77	Cellophane	8 (16.7)	40 (83.3)	Not Available
78	Canada Balsam in Xylen	1 (2.1)	47 (97.9)	Not Available
79	Charcoal powdepure	4 (8.3)	44 (91.7)	Not Available
80	Calcium hydroxide	24 (50.0)	24 (50.0)	Available
81	Chloroform	29 (60.4)	19 (39.6)	Available
82	Colbalt Chloride paper	10 (20.8)	38 (79.2)	Not Available
83	Culpric sulphate anhydrous	5 (10.4)	43 (89.6)	NotAvailable
84	Diastase	0 (0.0)	48 (100.0)	Not Available
85	D-fructose	3 (6.3)	45 (93.8)	Not Available
86	Ethanol	28 (58.3)	20 (41.7)	Available
87	Formaldehyde	28 (58.3)	20 (41.7)	Available
88	Glycogen crystals	6 (12.5)	42 (87.5)	Not Available
89	Glycerine pure	0 (00.0)	48 (100.0)	Not Available
90	Lead Acetate pure	07(14.6)	41 85.4)	Not Available
91	Magnesium Phosphate pure	4 (8.3)	44 (91.7)	Not Available
92	Magnesium sulphate pur	4 (8.3)	44 (91.7)	Not Available
93	Maltose	2 (4.2)	46 (95.8)	Not Available
94	Oil of cloves	1 (2.1)	47 (97.9)	Not Available
95	Paraffin wax/oil or vaseline	5 (10.4)	43 (89.6)	Not Available
96	Pepsin 'Powder B.P'	2 (4.2)	46 (95.8)	Not Available
97	Potassiubicarbonate powder	44 (91.7)	4 (8.3)	Available
98	Potassium chloride pellets	4 (8.3)	44 (91.7)	Not Available
99	Potassium dichromate pure	5 (10.4)	43 (89.6)	Not Available
100	Potassium phosphate pur	4 (8.3)	44 (91.7)	Not Available
101	Potassium permanganate	44 (91.7)	4 (8.3)	Available
102	Potassiumiodide pure	4 (8.3)	44 (91.7)	Not Available
103	Pyrogallol	16 (32.8)	32 (67.2)	Not Available
104	Sodium sulphate	37 (77.1)	11 (22.9)	Available
105	Sodium hydroxide	42 (87.5)	6 (12.5)	Available
106	Starch soluble	6 (12.5)	42 (87.5)	Not Available
107	Sucrose	2 (4.2)	46 (95.8)	Not Available
108	Trypsin	2 (4.2)	46 (95.8)	Not Available
109	Turpentine	2 (4.2)	46 (95.8)	Not Available
110	Commercial yeast	22(45.3)	26 (54.7)	Not Available
111	Xylene	0 (0.0)	48 (100.0)	Not Available
112	Zinc chloride	26(55.7)	22 (44.3)	Available

S/N	ITEMS/EQUIPMENT	AVAILABLE FREQUENCY (%)	NOT AVAILABLE FREQUENCY (%)	REMARK
113	Congo red	6 (10.8)	42 (89.2)	Not Available
114	Methyl blue	11 (22.9)	37 (77.1)	Not Available
115	Methylene blue	16 (33.3)	32 (66.7)	Not Available
116	Sudan III	37 (77.1)	10 (20.8)	Available
117	Fehlings solution A & B	40 (83.3)	8 (16.7)	Available
118	Millions reagent	45 (93.8)	3 (6.3)	Available
119	Lime	20 (41.7)	28 (58.3)	Not Available
120	Disinfectant	25 (52.1)	23 (47.9)	Available
121	Rennin powder	6 (12.5)	42 (87.5)	Not Available
Models				
122	Skeleton of man	32 (66.7)	16 (33.3)	Available
123	Human eye	25 (52.1)	23 (47.9)	Not Available
124	L.S/T.S of leaf	7 (14.6)	41 (85.4)	Not Available
125	L.S of Skin	10 (20.8)	38 (79.2)	Not Available
126	Human baby in uterus	13 (27.1)	35 (72.9)	Not Available
Charts				
127	Human	39 (81.2)	9 (18.8)	Available
128	Brain (Human)	39 (81.3)	9 (18.8)	Available
129	Lungs (Human)	39 (81.3)	8 (16.7)	Available
130	Excretory Organ	37 (77.1)	11 (22.9)	Available
PREPARED SLIDES FOR USE WITH BIOVIEWERS				
131	Plant cell	14 (29.2)	34 (70.8)	Not Available
132	Animal cell	8 (16.7)	40 (83.3)	Not Available
133	Euglena	5 (10.4)	43 (89.6)	Not Available
134	Spirogyra	5 (10.4)	43 (89.6)	Not Available
135	Paramecium	2 (4.2)	46 (98.8)	Not Available
136	Amoeba	3 (6.3)	45 (93.8)	Not Available
137	T.S of monocotyledonous stem	0 (0.0)	48 (100.0)	Not Available
138	T.S of dicotyledon stem	0 (0.0)	48 (100.0)	Not Available
139	T.S of dicotyledon root	0 (0.0)	48 (100.0)	Not Available
Specimens				
140	Ascaris lumbricoides	7 (14.6)	41 (85.4)	Not Available
141	Tapeworm	36 (75.0)	12 (25.0)	Available
142	Fish	41 (85.5)	7 (14.6)	Available

CHARTS OR PLASTIC MODEL

S/N	ITEMS/EQUIPMENT	AVAILABLE FREQUENCY (%)	NOT AVAILABLE FREQUENCY (%)	REMARK
143	Dentition- Teeth type	34 (70.8)	14 (29.2)	Available
144	Blood circulatory system in man	42 (87.5)	6 (12.5)	Available
145	Different types of mammalian bones			
	-Arm	44 (91.7)	4 (8.3)	Available
	-Scapula	41 (85.4)	7 (14.6)	Available
	-Leg	41 (85.4)	7 (14.6)	Available
	-Pelvic girdle	40 (83.3)	8 (16.7)	Available
146	Different types of vertebrae			
	-Atlas	40 (83.3)	6 (12.5)	Available
	-Axis	38 (79.2)	10 (20.8)	Available
	-Cervical	38 (79.2)	9 (18.8)	Available
	-Thoracic	39 (81.3)	8 (16.7)	Available
	-lumbar	40 (83.3)	8 (16.7)	Available
	-Sacral	36 (76.5)	11(22.9)	Available
147	Different types of joints	15 (31.3)	33 (68.8)	Not Available
148	Reproductive system			
	-in man	41 (85.4)	7 (14.6)	Available
	-in woman	37 (77.1)	11 (22.9)	Available
149	Stages of development in toad, mosquito and cockroach	13 (27.1)	35 (72.9)	Not Available
150	Stages of human development	13 (27.1)	35 (72.9)	Not Available
151	Flower structure	28 (58.3)	20 (41.7)	Available
152	Stages of germination	14 (29.2)	34 (70.8)	Not Available
153	Parts of lower plants	7 (10.0)	41 (85.4)	Not Available
154	Parts of flower Flamboyant/Hibiscus	25 (52.1)	23 (47.9)	Available
155	Fruits dispersal types	8 (16.7)	40 (83.3)	Not Available
156	Vegetative propagation	2 (4.2)	46 (95.8)	Not Available
157	Bacteria	10 (20.8)	38 (79.2)	Not Available
158	Leaf types	2 (4.2)	46 (95.8)	Not Available
159	Mucor structure and reproduction	5 (10.4)	43 (89.6)	Not Available

Source: Research Survey, 2025

Table 1 presented the biology practical instructional resources availability in secondary schools in Osun State. The equipment and reagents from 50% and above are said to be available. On the Table, items with high availability include Beakers (100ml: 100.0%, 250ml: 87.5%), Bunsen Burners (100.0%)Measuring Cylinders (10ml: 93.7%, 100ml: 75.0%),Filter Paper (75.0%), Graduated Pipettes (77.1%), Hand lenses (83.3%), Microscopes (79.2%), Microscope Slides (70.8%), Microscope Slide cover Slides (85.4%), Spatula (75%), Stop Clocks (72.9), Petri Dishes (89.6%), Microscopes (79.2%), Test Tubes (72.9% for both 150mm and 125mm), Test Tube Holders (89.6%), Test tube Rack (85.4%), Thermometer (77.1%) and Tripod Stands (91.7%), Litmus Paper (62.5%), Reagents and Chemicals such as Hydrochloric Acid (87.5%), Nitric Acid (89.5%), Sulphuric Acid (83.3%), Ammonium Hydroxide, Pottasium Bicarbonate Powder (91.7%), Pottasium Permanganate (91.7%), Sodium Sulphate (77%), Sodium Hydroxide, (87.5%), Sudan III Solution (77.1%), Fehlings Solution A & B (83.3%), Millon's Reagent (95.8%), Some anatomical charts and models like Human Body (81.2%), Human Brain (81.3%), Human Excretory Organ (77.1%), Reproduction Systems in Man and Woman (85.4% and 77.1% respectively), Specimens such as Tapeworm (75.0%), Fish (85.5%), Plastic Models such as human Arm (91.7%), Scapula (85.4%), Leg (85.4%), Pelvic Girdle (83.3%), Atlas Vertebra (83.3%), Axis Vertebra (79.2%), Cervical Vertebra (79.2%), Thoracic Vertebra (81.3%), Lumbar Vertebra (83.3%) and Sacral Vertebra (76.5%). Moderately available Laboratory Resources include: Dissecting Sets (62.5%), Flat and Round Bottom Flasks (62.5%), Litmus paper (62.5%), Rain gauge (60.4%), retort stands (60.4%), Specimen bottles (52.1%), Reagents and Chemicals such as; Methylated spirit (56.3%), Calcium Sulphate (60.4%), calcium Hydroxide (50%), Chlorofoam (60.4%), Ethanol (58.3%), Formaldehyde (58.3%), Zinc Chloride (55.7%), Disinfectant (52.1%), Models and Charts such as; Human Skeleton (66.7%), Human eye (52.1%), Flower Structure (58.3%) and Parts of Flower (52.1%).

In addition, some items with low availability include Cork Borer Machines (2.1%), Crucible (6.7%), Corks (6.3%), Crucible tongs (8.3%), Clinostats (4.2%), Dissecting pans (8.3%), dropping Pipettes with rubber bulb (27.1%), Evaporating Dish (3.1%), Distilling flasks (16.7%), Glass rods (12.5%), Glass Sheets (6.3%), Hygrometers (10.4%), Insect nets (39.6%), Light meter (14.6%), Photometers (14.6%), Plant pots (12.5%), Soil sieves (16.7%), Watch Glasses (4.2%), Barometers (8.3%), Plastic Models such as; Heart (22.9%), Eye (27.1%), Ear (31.2%), L.S/T.S of leaf (14.6%), L.S. of the Skin (20.8%), Human baby in Uterus (27.1%), Reagents and Chemicals such as; Camphor Blocks (6.3%), Cellophane (16.7%), Canada Balsam in Xylene (2.1%), D-Fructose (6.3%), Glycogen crystals (12.5%), Magnesium Phosphate Pure (8.3%), Maltose (4.2%), Pepsin (4.2%), Potassium Dichromate pure (8.3%), Starch solution (12.5%), Sucrose (4.2%), trypsin (4.2%), renin powder (4.2%), Prepared slides (Plant Cell: 29.2%, Animal Cell: 16.7%), Euglena (10.4%), Spirogyra (10.4%), Paramecium (4.2%), Amoeba (6.3%), Specimen such as Ascaris lumbricoides (14.6%), Different part of Joints (31.3%), Stages of Development in Toads, Mosquitoes and Cockroaches (27.1%), Stages of Development in Human (27.1%), Stages if Germination (29.2%), Parts of lower plants (10%), Fruit dispersal types (16.7%), vegetative propagation (4.2%), Leaf types (4.2%) and Mucor Structure and Reproduction (10.4%).

On the whole, it can be deduced that basic laboratory equipment and reagents for common experiments are available, while core teaching models and charts for human anatomy are moderately available. Also, there's a significant lack of specialized equipment (e.g., cork borers, clinostats, Blotting paper) and reagents such as Diastase, Glycerine pure and Xylene. Prepared slides critical for advanced biological studies such as Transverse and Longitudinal Sections for Monocot and Dicot roots and stems for bio viewers are largely unavailable.

Table 2: Availability of Laboratory Resources/Equipment Based on Decision Rule

The distribution of the responses on the availability of laboratory resources/equipmentin secondary schools using the adopted decision rule of greater than 50% are presented in Table 2 below

DECISION	FREQUENCY	PERCENTAGE (%)
Greater than 50%	75	41.3
Lesser than 50%	105	58.7

Source: Research Survey, 2024

From Table 4.3 above, following the decision of 50% and above for availability of laboratory resources, it can be deduced that 41.3% of laboratory resources are available for biology practical in secondary schools while 58.7% of the laboratory resources are not available in secondary schools. This implies that laboratory resources for practical activities in biology are fairly available in the study area

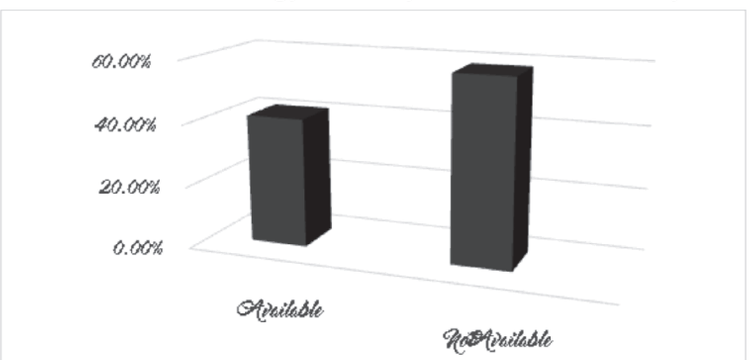

Figure 1: Biology Practical Instructional Resources Availability in Secondary Schools

Research Question 2: Are the laboratory resources for biology practical activities adequate in the study area?

To answer this question, responses to the items on the checklist were subjected to descriptive statistics and the results are presented below;

Table 3.Biology Practical Instructional Resources Adequacy

S/N	ITEMS/EQUIPMENT	ADEQUATE FREQUENCY (%)	NOT ADEQUATE FREQUENCY (%)	REMARK
1	Beakers			
	a-100ml	13 (27.1)	35 (72.9)	Not Adequate
	b-250ml	10 (20.8)	38 (79.2)	Not Adequate
2	Bell jars	06 (12.5)	42 (87.5)	Not Adequate
3	Bunsen burners	09 (18.8)	39 (81.3)	Not Adequate
4	Boiling tubes	9 (18.8)	39 (81.3)	Not Adequate
5	Crucibles (porcelain with cover)	5 (10.4)	43 (89.6)	Not Adequate
6	Conical flasks			
	a-250ml	27 (56.3)	21 (43.7)	Adequate
	b-100ml	19 (39.6)	29 (60.4)	Not Adequate
7	Cylinders (measuring)			
	a-10ml	13(27.1)	35 (72.9)	Not Adequate
	b-100ml	29 (60.4)	19 (39.6)	Adequate
8	Chemical balances	3 (6.3)	45 (93.8)	Not Adequate
9	Corks (assorted)	3 (6.3)	45 (93.7)	Not Adequate
10	Cork borers machine	1 (2.1)	47 (97.9)	Not Adequate
11	Crucible tongs	03 (6.3)	45 (93.8)	Not Adequate
12	Clinostats (clock work)	01 (2.1)	47 (97.9)	Not Adequate
13	Clamps (for retort stand)	22 (45.8)	26 (54.2)	Not Adequate
14	Dissecting sets	10 (20.8)	38 (79.2)	Not Adequate
15	Dissecting boards	12 (25)	36 (75)	Not Adequate
16	Dissecting pans (wared bottom)	02 (4.12)	46 (95.8)	Not Adequate
17	Dropping pipettes with rubber bulb	09 (18.7)	39 (81.3)	Not Adequate
18	Evaporating dishes 100ml	10 (20.8)	38 (79.2)	Not Adequate
19	Filter funnels (2 sizes)	02 (4.2)	46 (95.8)	Not Adequate
20	Flasks (Distilling)	04 (8.3)	44 (91.7)	Not Adequate
21	Flasks:			
	Flat bottom -250ml	25 (52.1)	23 (47.9)	Adequate
	Round bottom -250ml	28 (58.3)	20 (41.7)	Adequate
22	Flask filtering with side tube	0 (0.0)	48 (100.0)	Not Adequate
23	Flasks -Vacuum	04 (8.3)	44 (91.7)	Not Adequate
24	Filter paper -12cm, 15cm, 50cm	18 (37.5)	30 (62.5)	Not Adequate
25	Glass rods (50cm)	02 (4.2)	46 (95.8)	Not Adequate
26	Glass sheets	01 (2.1)	47 (97.9)	Not Adequate
27	Glass tubings (assorted) 3kg	05 10.4)	43 (89.6)	Not Adequate
28	Graduated pipettes	17(35.4)	31 (64.6)	Not Adequate
29	Hand lenses	26 (54.2)	22 (45.8)	Adequate
30	Hygrometers (Net and dry bulb)	01 (2.1)	47 (97.9)	Not Adequate

S/N	ITEMS/EQUIPMENT	ADEQUATE FREQUENCY (%)	NOT ADEQUATE FREQUENCY (%)	REMARK
31	Insect nets	36 (75.0)	12 (25.0)	Adequate
32	Insect settings (spreading board)	02 (4.2)	46 (95.8)	Not Adequate
33	Insect pins	08 (16.7)	40 (83.3)	Not Adequate
34	Litmus paper	29 (60.4)	19 (31.3)	Adequate
35	Light meters	03 (6.25)	45 (93.8)	Not Adequate
36	Microscopes	16 (33.3)	32 (66.7)	Not Adequate
37	Microscope slide	16 (33.3)	32 (66.7)	Not Adequate
38	Microscope slide cover slides	17 (35.4)	31 (64.6)	Not Adequate
39	Petri-dishes	22 (45.8)	26 (54.2)	Not Adequate
40	Pipe clay (triangular for tripod stand)	0 (0.0)	48 (100.0)	Not Adequate
41	Photometers	0 (0.0)	48 (100.0)	Not Adequate
42	Photometer Ganongs	0 (0.0)	48 (100.0)	Not Adequate
43	Plant pots	02 (4.17)	46 (95.8)	Not Adequate
44	Plastic models			
	• Heart	8 (16.7)	40 (83.3)	Not Adequate
	• Eye	11 (22.9)	37 (77.1)	Not Adequate
	• Ear	10 (20.8)	38 (79.2)	Not Adequate
	• Skeleton	20 (41.7)	28 (58.3)	Not Adequate
45	Rain gauge	19 (39.7)	39 (81.3)	Not Adequate
46	Rubber tubings (assorted)	10 (20.8)	38 (79.2)	Not Adequate
47	Retort stands	11 (22.9)	37 (77.1)	Not Adequate
48	Soil sieves (granded)	6 (12.5)	42 (87.5)	Not Adequate
49	Soil test kits	19 (39.6)	29 (60.4)	Not Adequate
50	Spatula/plastic spoons	33 (68.8)	15 (31.3)	Adequate
51	Stop clocks	20 (41.7)	28 (58.3)	Not Adequate
52	Specimen bottles	12 (25.0)	36 (75.0)	Not Adequate
53	Separating funnels	8 (16.7)	40 (83.3)	Not Adequate
54	Test tubes			
	150 x 15mm	21 (43.8)	27 (56.3)	Not Adequate
	125 x 16mm	17 (35.4)	31 (64.6)	Not Adequate
55	Test tube holders	38 (79.2)	10 (20.8)	Not Adequate
56	Test tube rack in 12 holes	26 (54.2)	22 (45.8)	Adequate
57	Thermometer ($10^{o}C$ – $100^{o}C$)	12 (25.0)	36 (75.0)	Not Adequate
58	Thistle funnels	12 (25.0)	36 (75.0)	Not Adequate
59	Tripod stands	16 (33.3)	32 (65.7)	Not Adequate
60	Wire gauze	14 (29.2)	34 (70.8)	Not Adequate
61	Watch glasses	01 (2.08)	47 (97.9)	Not Adequate
62	White tiles	12 (25.0)	36 (75.0)	Not Adequate

S/N	ITEMS/EQUIPMENT	AVAILABLE FREQUENCY (%)	NOT AVAILABLE FREQUENCY (%)	REMARK
63	Wind vane	32 (66.7)	16 (33.3)	Available
64	Aspirator 500ml	7 (14.6)	41 (85.4)	Not Available
65	Blotting paper	00 (0.0)	48 (100.0)	Not Available
66	Barometers	4 (8.3)	44 (91.7)	Not Available
Reagents				
67	Acid hydrochloric pure	42 (87.5)	6 (12.5)	Available
68	Acid Nitric pure	43 (89.6)	5 (10.4)	Available
69	Acid sulphuric pure	40 (83.3)	8 (16.7)	Available
70	Agar powder	13 (27.1)	35 (72.9)	Not Available
71	Alcohol methylated spirit	27 (56.3)	21 (47.8)	Available
72	Alum (iron) pure	15 (31.3)	33 (68.8)	Not Available
73	Ammonium Hydroxide in liquid	36 (75.0)	12 (25.0)	Available
74	Calcium sulphate pure	29 (60.4)	19 (39.6)	Available
75	Calcium phosphate pure	18 (37.5)	30 (62.5)	Not Available
76	Camphor blocks	3 (6.3)	45 (93.8)	Not Available
77	Cellophane	8 (16.7)	40 (83.3)	Not Available
78	Canada Balsam in Xylene	1 (2.1)	47 (97.9)	Not Available
79	Charcoal powder pure	4 (8.3)	44 (91.7)	Not Available
80	Calcium hydroxide	24 (50.0)	24 (50.0)	Available
81	Chloroform	29 (60.4)	19 (39.6)	Available
82	Colbalt Chloride paper	10 (20.8)	38 (79.2)	Not Available
83	Culpric sulphate anhydrous	5 (10.4)	43 (89.6)	Not Available
84	Diastase	0 (0.0)	48 (100.0)	Not Available
85	D-fructose	3 (6.3)	45 (93.8)	Not Available
86	Ethanol	28 (58.3)	20 (41.7)	Available
87	Formaldehyde	28 (58.3)	20 (41.7)	Available
88	Glycogen crystals	6 (12.5)	42 (87.5)	Not Available
89	Glycerine pure	0 (00.0)	48 (100.0)	Not Available
90	Lead Acetate pure	07(14.6)	41 85.4)	Not Available
91	Magnesium Phosphate pure	4 (8.3)	44 (91.7)	Not Available
92	Magnesium sulphate pure	4 (8.3)	44 (91.7)	Not Available
93	Maltose	2 (4.2)	46 (95.8)	Not Available
94	Oil of cloves	1 (2.1)	47 (97.9)	Not Available
95	Paraffin wax/oil or vaseline	5 (10.4)	43 (89.6)	Not Available
96	Pepsin ‘Powder B.P’	2 (4.2)	46 (95.8)	Not Available
97	Potassiubicarbonate powder	44 (91.7)	4 (8.3)	Available
98	Potassium chloride pellets	4 (8.3)	44 (91.7)	Not Available
99	Potassium dichromate pure	5 (10.4)	43 (89.6)	Not Available
100	Potassium phosphate pure	4 (8.3)	44 (91.7)	Not Available

S/N	ITEMS/EQUIPMENT	AVAILABLE FREQUENCY (%)	NOT AVAILABLE FREQUENCY (%)	REMARK
101	Potassium permanganat	44 (91.7)	4 (8.3)	Available
102	Potassium iodide pure	4 (8.3)	44 (91.7)	Not Availabl
103	Pyrogallol	16 (32.8)	32 (67.2)	Not Availa le
104	Sodium sulphate	37 (77.1)	11 (22.9)	Available
105	Sodium hydroxide	42 (87.5)	6 (12.5)	Available
106	Starch soluble	6 (12.5)	42 (87.5)	Not Availabl
107	Sucrose	2 (4.2)	46 (95.8)	Not Availabl
108	Trypsin	2 (4.2)	46 (95.8)	Not Availabl
109	Turpentine	2 (4.2)	46 (95.8)	Not Availabl
110	Commercial yeast	22(45.3)	26 (54.7)	Not Availabl
111	Xylene	0 (0.0)	48 (100.0)	Not Availabl
112	Zinc chloride	26(55.7)	22 (44.3)	Available
113	Congo red	6 (10.8)	42 (89.2)	Not Availabl
114	Methyl bla	11 (22.9)	37 (77.1)	Not Availabl
115	Methylene blue	16 (33.3)	32 (66.7)	Not Availabl
116	Sudan III	37 (77.1)	10 (20.8)	Available
117	Fehlings solution A & B	40 (83.3)	8 (16.7)	Available
118	Millions reagent	45 (93.8)	3 (6.3)	Available
119	Lime	20(41.7)	28 (58.3)	Not Availabl
120	Disinfectant	25 (52.1)	23 (47.9)	Available
121	Rennin powder	6 (12.5)	42 (87.5)	Not Availabl
Models				
122	Skeleton of man	32 (66.7)	16 (33.3)	Available
123	Human eye	25 (52.1)	23 (47.9)	Not Availabl
124	L.S/TS of leaf	7 (14.6)	41 (85.4)	Not Availabl
125	L.S of Skin	10 (20.8)	38 (79.2)	Not Availabl
126	Human baby in uterus	13 (27.1)	35 (72.9)	Not Availabl
Charts				
127	Human	39 (81.2)	9 (18.8)	Available
128	Brain (Human)	39 (81.3)	9 (18.8)	Available
129	Lungs (Human)	39 (81.3)	8 (16.7)	Available
130	Excretory Organ	37 (77.1)	11 (22.9)	Available
PREPARED SLIDES FOR USE WITH BIOVIEWERS				
131	Plant cell	14 (29.2)	34 (70.8)	Not Availabl
132	Animal cell	8 (16.7)	40 (83.3)	Not Availabl
133	Euglena	5 (10.4)	43 (89.6)	Not Availabl
134	Spirogyra	5 (10.4)	43 (89.6)	Not Availabl
135	Paramecium	2 (4.2)	46 (98.8)	Not Availabl
136	Amoeba	3 (6.3)	45 (93.8)	Not Availabl
137	T.S of monocotyledono stem	0 (0.0)	48 (100.0)	Not Availabl
138	T.S of dicotyledon stem	0 (0.0)	48 (100.0)	Not Availabl
139	T.S of dicotyledon root	0 (0.0)	48 (100.0)	Not Availabl
Specimens				
140	Ascaris lumbricoides	7 (14.6)	41 (85.4)	Not Availabl
141	Tapeworm	36 (75.0)	12 (25.0)	Available
142	Fish	41 (85.5)	7 (14.6)	Available

S/N	ITEMS/EQUIPMENT	AVAILABLE FREQUENCY (%)	NOT AVAILABLE FREQUENCY (%)	REMARK
CHARTS OR PLASTIC MODEL				
143	Dentition- Teeth type	34 (70.8)	14 (29.2)	Available
144	Blood circulatory system in man	42 (87.5)	6 (12.5)	Available
145	Different types of mammalian bones			
	-Arm	44 (91.7)	4 (8.3)	Available
	-Scapula	41 (85.4)	7 (14.6)	Available
	-Leg	41 (85.4)	7 (14.6)	Available
	-Pelvic girdle	40 (83.3)	8 (16.7)	Available
146	Different types of vertebrae			
	-Atlas	40 (83.3)	6 (12.5)	Available
	-Axis	38 (79.2)	10 (20.8)	Available
	-Cervical	38 (79.2)	9 (18.8)	Available
	-Thoracic	39 (81.3)	8 (16.7)	Available
	-lumbar	40 (83.3)	8 (16.7)	Available
	-Sacral	36 (76.5)	11(22.9)	Available
147	Different types of joints	15 (31.3)	33 (68.8)	Not Available
148	Reproductive system			
	-in man	41 (85.4)	7 (14.6)	Available
	-in woman	37 (77.1)	11 (22.9)	Available
149	Stages of development in toad, mosquito and cockroach	13 (27.1)	35 (72.9)	Not Available
150	Stages of human development	13 (27.1)	35 (72.9)	Not Available
151	Flower structure	28 (58.3)	20 (41.7)	Available
152	Stages of germination	14 (29.2)	34 (70.8)	Not Available
153	Parts of lower plants	7 (10.0)	41 (85.4)	Not Available
154	Parts of flower Flamboyant/Hibiscus	25 (52.1)	23 (47.9)	Available
155	Fruits dispersal types	8 (16.7)	40 (83.3)	Not Available
156	Vegetative propagation	2 (4.2)	46 (95.8)	Not Available
157	Bacteria	10 (20.8)	38 (79.2)	Not Available
158	Leaf types	2 (4.2)	46 (95.8)	Not Available
159	Mucor structure and reproduction	5 (10.4)	43 (89.6)	Not Available

Source: Research Survey, 2025

Table 1 presented the biology practical instructional resources availability in secondary schools in Osun State. The equipment and reagents from 50% and above are said to be available. On the Table, items with high availability include Beakers (100ml: 100.0%, 250ml: 87.5%), Bunsen Burners (100.0%)Measuring Cylinders (10ml: 93.7%, 100ml: 75.0%),Filter Paper (75.0%), Graduated Pipettes (77.1%), Hand lenses (83.3%), Microscopes (79.2%), Microscope Slides (70.8%), Microscope Slide cover Slides (85.4%), Spatula (75%), Stop Clocks (72.9), Petri Dishes (89.6%), Microscopes (79.2%), Test Tubes (72.9% for both 150mm and 125mm), Test Tube Holders (89.6%), Test tube Rack (85.4%), Thermometer (77.1%) and Tripod Stands (91.7%), Litmus Paper (62.5%), Reagents and Chemicals such as Hydrochloric Acid (87.5%), Nitric Acid (89.5%), Sulphuric Acid (83.3%), Ammonium Hydroxide, Pottasium Bicarbonate Powder (91.7%), Pottasium Permanganate (91.7%), Sodium Sulphate (77%), Sodium Hydroxide, (87.5%), Sudan III Solution (77.1%), Fehlings Solution A & B (83.3%), Millon's Reagent (95.8%), Some anatomical charts and models like Human Body (81.2%), Human Brain (81.3%), Human Excretory Organ (77.1%), Reproduction Systems in Man and Woman (85.4% and 77.1% respectively), Specimens such as Tapeworm (75.0%), Fish (85.5%), Plastic Models such as human Arm (91.7%), Scapula (85.4%), Leg (85.4%), Pelvic Girdle (83.3%), Atlas Vertebra (83.3%), Axis Vertebra (79.2%), Cervical Vertebra (79.2%), Thoracic Vertebra (81.3%), Lumbar Vertebra (83.3%) and Sacral Vertebra (76.5%). Moderately available Laboratory Resources include: Dissecting Sets (62.5%), Flat and Round Bottom Flasks (62.5%), Litmus paper (62.5%), Rain gauge (60.4%), retort stands (60.4%), Specimen bottles (52.1%), Reagents and Chemicals such as; Methylated spirit (56.3%), Calcium Sulphate (60.4%), calcium Hydroxide (50%), Chlorofoam (60.4%), Ethanol (58.3%), Formaldehyde (58.3%), Zinc Chloride (55.7%), Disinfectant (52.1%), Models and Charts such as; Human Skeleton (66.7%), Human eye (52.1%), Flower Structure (58.3%) and Parts of Flower (52.1%).

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On the whole, it can be deduced that basic laboratory equipment and reagents for common experiments are available, while core teaching models and charts for human anatomy are moderately available. Also, there's a significant lack of specialized equipment (e.g., cork borers, clinostats, Blotting paper) and reagents such as Diastase, Glycerine pure and Xylene. Prepared slides critical for advanced biological studies such as Transverse and Longitudinal Sections for Monocot and Dicot roots and stems for bio viewers are largely unavailable.

Table 2: Availability of Laboratory Resources/Equipment Based on Decision Rule

The distribution of the responses on the availability of laboratory resources/equipmentin secondary schools using the adopted decision rule of greater than 50% are presented in Table 2 below

DECISION	FREQUENCY	PERCENTAGE (%)
Greater than 50%	75	41.3
Lesser than 50%	105	58.7

Source: Research Survey, 2024

From Table 4.3 above, following the decision of 50% and above for availability of laboratory resources, it can be deduced that 41.3% of laboratory resources are available for biology practical in secondary schools while 58.7% of the laboratory resources are not available in secondary schools. This implies that laboratory resources for practical activities in biology are fairly available in the study area

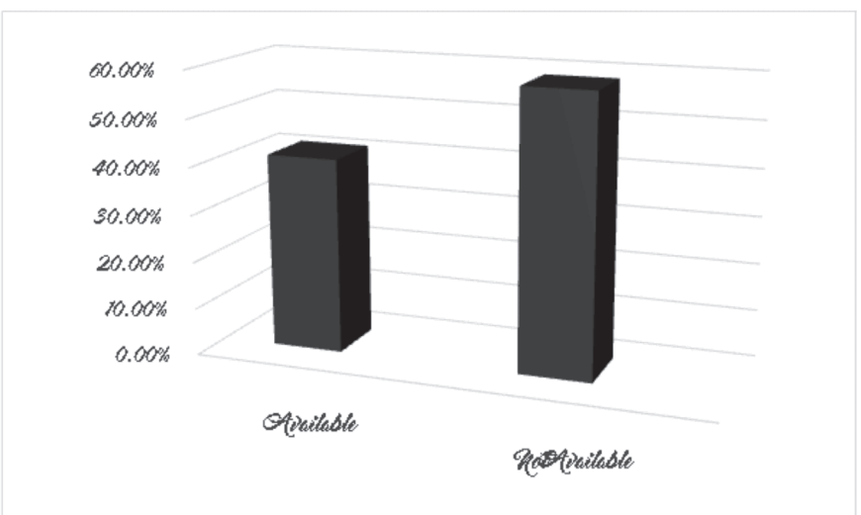

Figure 1: Availability of Biology Laboratory Resources in Senior Secondary Schools in Osun state

The summary of the available laboratory resources in senior secondary schools in Osun State is presented in Figure 1 above.

S/N	ITEMS/EQUIPMENT	ADEQUATE FREQUENCY (%)	NOT ADEQUATE FREQUENCY (%)	REMARK
1	Beakers			
	a-100ml	13 (27.1)	35 (72.9)	Not Adequate
	b-250ml	10 (20.8)	38 (79.2)	Not Adequate
2	Bell jars	06 (12.5)	42 (87.5)	Not Adequate
3	Bunsen burners	09 (18.8)	39 (81.3)	Not Adequate
4	Boiling tubes	9 (18.8)	39 (81.3)	Not Adequate
5	Crucibles (porcelain wit cover)	5 (10.4)	43 (89.6)	Not Adequate
6	Conical flasks			
	a-250ml	27 (56.3)	21 (43.7)	Adequate
	b-100ml	19 (39.6)	29 (60.4)	Not Adequate
7	Cylinders (measuring)			
	a-10ml	13 (27.1)	35 (72.9)	Not Adequate
	b-100ml	29 (60.4)	19 (39.6)	Adequate
8	Chemical balances	3 (6.3)	45 (93.8)	Not Adequate
9	Corks (assorted)	3 (6.3)	45 (93.7)	Not Adequate
10	Cork borers machine	1 (2.1)	47 (97.9)	Not Adequate
11	Crucible tongs	03 (6.3)	45 (93.8)	Not Adequate
12	Clinostats (clock work)	01 (2.1)	47 (97.9)	Not Adequate
13	Clamps (for retort stand	22 (45.8)	26 (54.2)	Not Adequate
14	Dissecting sets	10 (20.8)	38 (79.2)	Not Adequate
15	Dissecting boards	12 (25)	36 (75)	Not Adequate
16	Dissecting pans (wared bottom)	02 (4.12)	46 (95.8)	Not Adequate
17	Dropping pipettes with rubber bulb	09 (18.7)	39 (81.3)	Not Adequate
18	Evaporating dishes 100r	10 (20.8)	38 (79.2)	Not Adequate
19	Filter funnels (2 sizes)	02 (4.2)	46 (95.8)	Not Adequate
20	Flasks (Distilling)	04 (8.3)	44 (91.7)	Not Adequate
21	Flasks:			
	Flat bottom-250ml	25 (52.1)	23 (47.9)	Adequate
	Round bottom-250ml	28 (58.3)	20 (41.7)	Adequate
22	Flask filtering with side tube	0 (0.0)	48 (100.0)	NotAdequate
23	Flasks-Vacuum	04 (8.3)	44 (91.7)	Not Adequate
24	Filter paper-12cm, 15cm, 50cm	18 (37.5)	30 (62.5)	Not Adequate
25	Glass rods (50cm)	02 (4.2)	46 (95.8)	Not Adequate
26	Glass sheets	01 (2.1)	47 (97.9)	Not Adequate
27	Glass tubings (assorted) 3kg	05 10.4)	43 (89.6)	Not Adequate
28	Graduated pipettes	17(35.4)	31 (64.6)	Not Adequate
29	Hand lenses	26 (54.2)	22 (45.8)	Adequate
30	Hygrometers (Net and d bulb)	01 (2.1)	47 (97.9)	Not Adequate

S/N	ITEMS/EQUIPMENT	ADEQUATE FREQUENCY (%)	NOT ADEQUATE FREQUENCY (%)	REMARK
31	Insect nets	36 (75.0)	12 (25.0)	Adequate
32	Insect settings (spreading board)	02 (4.2)	46 (95.8)	Not Adequate
33	Insect pins	08 (16.7)	40 (83.3)	Not Adequate
34	Litmuspaper	29 (60.4)	19 (31.3)	Adequate
35	Light meters	03 (6.25)	45 (93.8)	Not Adequate
36	Microscopes	16 (33.3)	32 (66.7)	Not Adequate
37	Microscope slide	16 (33.3)	32 (66.7)	Not Adequate
38	Microscope slide cover slides	17 (35.4)	31 (64.6)	Not Adequate
39	Petri-dishes	22 (45.8)	26 (54.2)	Not Adequate
40	Pipe clay (triangular for tripod stand)	0 (0.0)	48 (100.0)	Not Adequate
41	Photometers	0 (0.0)	48 (100.0)	Not Adequate
42	Photometer Ganongs	0 (0.0)	48 (100.0)	Not Adequate
43	Plant pots	02 (4.17)	46 (95.8)	Not Adequate
44	Plastic models			
	• Heart	8 (16.7)	40 (83.3)	Not Adequate
	• Eye	11 (22.9)	37 (77.1)	Not Adequate
	• Ear	10 (20.8)	38 (79.2)	Not Adequate
	• Skeleton	20 (41.7)	28 (58.3)	Not Adequate
45	Rain gauge	19 (39.7)	39 (81.3)	Not Adequate
46	Rubbertubings (assorted)	10 (20.8)	38 (79.2)	Not Adequate
47	Retort stands	11 (22.9)	37 (77.1)	Not Adequate
48	Soil sieves (granded)	6 (12.5)	42 (87.5)	Not Adequate
49	Soil test kits	19 (39.6)	29 (60.4)	Not Adequate
50	Spatula/plastic spoons	33 (68.8)	15 (31.3)	Adequate
51	Stop clocks	20 (41.7)	28 (58.3)	Not Adequate
52	Specimen bottles	12 (25.0)	36 (75.0)	Not Adequate
53	Separating funnels	8 (16.7)	40 (83.3)	Not Adequate
54	Test tubes			
	150 x 15mm	21 (43.8)	27 (56.3)	Not Adequate
	125 x 16mm	17 (35.4)	31 (64.6)	Not Adequate
55	Test tube holders	38 (79.2)	10 (20.8)	Not Adequate
56	Test tube rack in 12 holes	26 (54.2)	22 (45.8)	Adequate
57	Thermometer (1°C – 100°C)	12 (25.0)	36 (75.0)	Not Adequate
58	Thistle funnels	12 (25.0)	36 (75.0)	Not Adequate
59	Tripod stands	16 (33.3)	32 (65.7)	Not Adequate
60	Wire gauze	14 (29.2)	34 (70.8)	Not Adequate
61	Watch glasses	01 (2.08)	47 (97.9)	Not Adequate
62	White tiles	12 (25.0)	36 (75.0)	Not Adequate
63	Wind vane	23 (47.9)	25 (52.1)	Not Adequate
64	Aspirator 500ml	07 (14.6)	41 (85.4)	Not Adequate
65	Blotting paper	00(0.0)	48 (100)	Not Adequate
66	Barometers	02 (4.17)	46 (95.8)	Not Adequate

S/N	ITEMS/EQUIPMENT	ADEQUATE FREQUENCY (%)	NOT ADEQUATE FREQUENCY (%)	REMARK
Reagents				
67	Acid hydrochloric pure	35 (72.9)	13 (27.1)	Adequate
68	Acid Nitric pure	30 (62.5)	18 (37.5)	Adequate
69	Acid sulphuric pure	25 (52.1)	23 (47.9)	Adequate
70	Agar powder	10 (20.8)	38 (79.2)	Not Adequate
71	Alcohol methylated spirit	18 (37.5)	30 (63.5)	Not Adequate
72	Alum (iron) pure	9 (18.8)	39 (81.2)	Not Adequate
73	Ammonium Hydroxide in liquid	30 (62.5)	18 (37.5)	Adequate
74	Calcium sulphate pure	10 (20.8)	38 (79.2)	Not Adequate
75	Calcium phosphate pure	10 (20.8)	38 (79.2)	Not Adequate
76	Camphor blocks	5 (10.4)	43 (89.6)	Not Adequate
77	Cellophane	4 (8.3)	44 (91.7)	Not Adequate
78	Canada Balsam in Xylene	1 (2.08)	47 (97.9)	Not Adequate
79	Charcoalpowder pure	1 (2.08)	47 (97.9)	Not Adequate
80	Calcium hydroxide	20 (41.7)	28 (58.3)	Not Adequate
81	Chloroform	18 (37.5)	30 (62.5)	Not Adequate
82	Colbalt Chloride paper	9 (18.8)	39 (81.3)	Not Adequate
83	Culpric sulphate anhydrous	2 (14.7)	46 (95.8)	Not Adequate
84	Diastase	00(0.0)	48 (100)	Not Adequate
85	D-fructose	1 (2.08)	47 (97.9)	Not Adequate
86	Ethanol	25 (52.1)	23 (47.9)	Adequate
87	Formaldehyde	16 (33.3)	32 (66.7)	Not Adequate
88	Glycogen crystals	3 (6.25)	45 (93.75)	Not Adequate
89	Glycerine pure	00(0.0)	48 (100)	Not Adequate
90	Lead Acetate pure	7 (14.6)	41 (85.4)	Not Adequate
91	Magnesium Phosphate pure	4 (8.3)	44 (91.7)	Not Adequate
92	Magnesium sulphate pure	4 (8.3)	44 (91.7)	Not Adequate
93	Maltose	1 (2.08)	47 (97.92)	Not Adequate
94	Oil of cloves	1 (12.5)	47 (87.5)	Not Adequate
95	Paraffin wax/oil or vaseline	4 (8.3)	44 (91.7)	Not Adequate
96	Pepsin ‘Powder B.P’	1 (2.08)	47 (97.92)	Not Adequate
97	Potassium bicarbonate powder	26 (54.2)	22 (45.8)	Adequate
98	Potassiumchloride pellets	4 (8.3)	44 (91.7)	Not Adequate
99	Potassium dichromate pure	5 (10.4)	43 (89.6)	Not Adequate
100	Potassium phosphate pure	4 (52.1)	44 (47.9)	Not Adequate
101	Potassium permanganate	29 (60.4)	19 (39.6)	Adequate
102	Potassium iodide pure	3 (6.25)	45 (93.75)	Not Adequate
103	Pyrogallol	6 (12.5)	42 (87.5)	Not Adequate
104	Sodium sulphate	36 (75.0)	12 (25.0)	Adequate

S/N	ITEMS/EQUIPMENT	ADEQUATE FREQUENCY (%)	NOT ADEQUATE FREQUENCY (%)	REMARK
117	Fehlings solution A & B	38 (79.2)	12 (20.8)	Adequate
118	Millions reagent	31 (64.6)	17 (35.4)	Adequate
119	Lime	9 (18.8)	39 (81.3)	Not Adequate
120	Disinfectant	21 (43.8)	27 (56.3)	Not Adequate
121	Rennin powder	3 (6.25)	45 (93.75)	Not Adequate
Models				
122	Skeleton of man	26 (54.2)	22 (45.8)	Adequate
123	Human eye	13 (27.1)	35 (72.9)	Not Adequate
124	L.S/T.S of leaf	6 (12.5)	42 (87.5)	Not Adequate
125	L.S of Skin	9 (18.8)	39 (81.3)	Not Adequate
126	Human baby in uterus	10 (20.8)	38 (79.2)	Not Adequate
Charts				
127	Human	31 (64.6)	17 (35.4)	Adequate
128	Brain (Human)	22 (45.8)	26 (54.2)	Not Adequate
129	Lungs (Human)	21 (43.8)	27 (56.3)	Not Adequate
130	Excretory Organ	12 (25.0)	36 (75.0)	Not Adequate
PREPARED SLIDES FOR USE WITH BIOVIEWERS				
131	Plant cell	2 (4.2)	46 (95.8)	Not Adequate
132	Animal cell	0 (0.0)	48 (100.0)	Not Adequate
133	Euglena	0 (0.0)	48 (100.0)	Not Adequate
134	Spirogyra	0 (0.0)	48 (100.0)	Not Adequate
135	Paramecium	0 (0.0)	48 (100.0)	Not Adequate
136	Amoeba	0 (0.0)	48 (100.0)	Not Adequate
137	T.S of monocotyledonous stem	0 (0.0)	48 (100.0)	Not Adequate
138	T.S of dicotyledon stem	0 (0.0)	48 (100.0)	Not Adequate
139	T.S of dicotyledon root	1 (2.1)	47 (97.9)	Not Adequate
Specimens				
140	Ascaris lumbricoides	2 (4.2)	46 (95.8)	Not Adequate
141	Tapeworm	13 (27.1)	35 (72.9)	Not Adequate
142	Fish	13 (27.1)	35 (72.9)	Not Adequate
CHARTS OR PLASTIC MODEL				
143	Dentition- Teeth type	29 (60.4)	19 (39.6)	Adequate
144	Blood circulatory system in man	22 (48.5)	26 (54.2)	Not Adequate
145	Different types of mammalian bones			
	-Arm	11 (22.9)	37 (77.1)	Not Adequate
	-Scapula	12 (25.0)	36 (75.0)	Not Adequate
	-Leg	11 (22.9)	37 (77.1)	Not Adequate
	-Pelvic girdle	14 (29.2)	34 (70.8)	Not Adequate

S/N	ITEMS/EQUIPMENT	ADEQUATE FREQUENCY (%)	NOT ADEQUATE FREQUENCY (%)	REMARK
146	Different types of vertebrae	17 (35.4)	31 (64.6)	Not Adequate
	-Atlas	17 (35.4)	31 (64.6)	Not Adequate
	-Axis	17 (35.4	31 (64.6)	Not Adequate
	-Cervical	16 (33.3)	32 (68.8)	Not Adequate
	-Thoracic	18 (16.7)	30 (83.3)	Not Adequate
	-lumbar	12 (25.0)	36 (75.0)	Not Adequate
	-Sacral			
147	Different types of joints	6 (12.5)	42 (87.5)	Not Adequate
148	Reproductive system			
	-in man	30 (62.5)	18 (37.5)	Adequate
	-in woman	18 (37.5)	30 (62.5)	Not Adequate
149	Stages of development in toad, mosquito and cockroach	4(8.3)	44 (91.7)	Not Adequate
150	Stages of human development	10 (20.8)	38 (79.2)	Not Adequate
151	Flower structure	18 (16.7)	30 (83.3)	Not Adequate
152	Stages of germination	10 (20.8)	38 (79.2)	Not Adequate
153	Parts of lower plants	5 (10.4)	43 (89.6)	Not Adequate
154	Parts of flower Flamboyant/Hibiscus	17 (35.4)	31 (65.6)	Not Adequate
155	Fruits dispersal types	2 (4.2)	46 (95.8)	Not Adequate
156	Vegetative propagation	2 (4.2)	46 (95.8)	Not Adequate
157	Bacteria	4 (8.3)	42 (91.7)	Not Adequate
158	Leaf types	1 (2.1)	47 (97.9)	Not Adequate
159	Mucor structure and reproduction	1 (2.1)	47 (97.9)	Not Adequate

Source: Research Survey, 2025

Table 4 provided the results of the adequacy of the laboratory resources biology practical in the study area. Laboratory resources that are 50% and above are tagged adequate, while those that are between 0-49% are tagged inadequate. From the Table, equipment such as Conical flasks (250ml), Measuring Cylinder (100ml), Flat and Round bottom flasks, Hand lenses, Litmus papers, spatula, Reagents and chemicals such as HCL, No_3, Sulphuric Acid, Ammonium Hydroxide, Sodium Sulphate, Sodium Hydroxide, Sudan III solution, Fehling's Solution, Milon's Reagent, Models and

Charts such as Human Skeleton, Human body, Dentition-teeth type and reproductive system in man are observed to be adequate. Many critical laboratory items, such as beakers 100ml, test tubes, cork borers, Bunsen burners, Boiling tubes, Chemical Balances, Dissecting sets and pans, Filter funnels, Graduated pipettes, distilling flasks, Litmus papers, Microscopes, Petri dishes, Photometers, Plastic models, Rain gauge, Retort stands, Soil sieves, Test tubes, Tripod stands, Wind vane, Wire gauze, Barometers are observed to be largely inadequate. Specialized items and reagents such as clinostats, diastase reagents, Agar powder, Methylated spirit, calcium sulphate, calcium phosphate, camphor blocks, chlorofoam, formaldehyde, Magnesium sulphate, magnesium phosphate, potassium iodide, pyrogallol, zinc chloride, methyl blue, methylene blue, renin powder, and prepared slides for bio viewers such as plant and animal cell, euglena, paramecium, amoeba, longitudinal and transverse sections of monocot and dicot roots and stems have relatively higher adequacy levels. Models like the human skeleton and tools like dissecting pans also show moderate adequacy. Educational Charts, Models such as Human eye, Longitudinal section of leaf, Longitudinal section of stems, Human baby in the uterus, Excretory organ of human, Different types of joints, Stages of Development in human, stages of development in insects, parts of lower plants, vegetative propagation, leaf types, Mucor structure and reproduction, stages of germination and Specimens such as Fish, Tapeworm and Ascaris lumbricoides are overwhelmingly inadequate. From these, it was deduced that majority of the equipment, reagents/chemicals, specimens, charts and plastic models are largely inadequate.

Table 4. Biology Laboratory Resources Adequacy Based on Decision Rule

The distribution of the responses on the availability of laboratory

resources/equipmentin secondary schools using the adopted decision rule of greater than 50% are presented in Table 4 below.

DECISION	FREQUENCY	PERCENTAGE (%)
Greater than 50%	24	13.4
Lesser than 50%	155	86.6

Source: Research Survey, 2025

From Table 4 above, following the decision of 50% and above for adequacy of laboratory resources, it can be deduced that only 13.4% of the laboratory resources are adequate for biology practical in secondary schools while 86.6% of the laboratory resources are not adequate for biology practical in secondary schools. This implies that there exists a poor level of adequacy of laboratory resources for biology practicals in the study area.

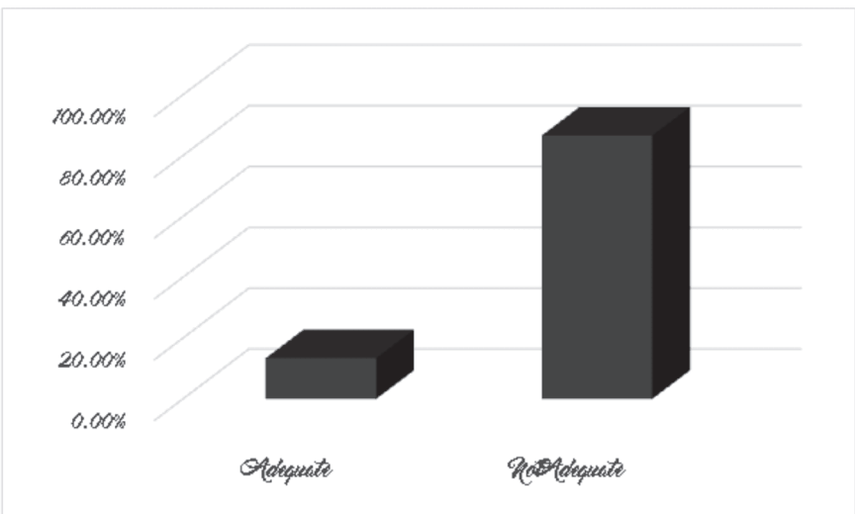

Figure 2. Biology Laboratory Resources Adequacy in Secondary Schools in Osun state

Research Question 3: What is the frequency of practical work in Biology in secondary schools in Osun?

Data collected from the section A in the BPIRC which addressed total number of practical classes per term were subjected to descriptive analysis and results are presented in Table 5 below;

Table 5: Number of Practical Class(es) per Term

	Frequency	Percentage (%)
Less than 5	10	15.15
5 - 10	25	37.88
10 - 15	19	28.79
15 - 20	07	10.60
More than 20	04	6.06
No Response	01	1.52
Total	**66**	**100.0**

Source: Research Survey, 2025

From the Table5 above, 37.88% of the teachers indicated a total of 5-10 number of practical classes per term, followed by 28.79% who indicated a total of 10-15 number of practical classes per term, 15.15% indicated less than 5 practical classes per term, 10.60% indicated 15-20 practical classes per term, while 6.06 indicated that they conducted practical classes for students more than 20 times. It was observed that the total number of practical classes per term is around 5 to 15. From the ongoing, it can be deduced that biology practical activities hold regularly per term in Osun.

Discussion of Findings

The result showed that laboratory resources were fairly available in secondary school in the study area. This is a clear indication that there are fewer resources in the study area, thus creating a picture of scarcity of resources. This observation is in line with a mass of literature that has reported such difficulties within the classroom. This outcome agrees with the findings of John, Sani, Kogi, Uche, and Mjagandi (2019) who concluded a general shortage of instructional resources and the lack of necessary facilities such as bio-gardens where live activities could be held. It is also confirmed by the results of Kamar and Danjuma (2015), who have found a massive deficiency

in biology resources in their investigation. This uniformity implies that lack of resources is a chronic and general problem in some learning environments.This finding however disagrees with the findings of other studies carried out in other levels of education or geographical areas. It was contrary to the findings of Oladipupo and Kareem (2023) who discovered that there were high supply levels of laboratory facilities in Colleges of Education. This difference illustrates the possible gap between the level of resources in the secondary and tertiary institutions. Moreover, it also disagress with the results of Rimamasomte, Bason, and Anderiben (2021), who have established that the vast majority of biology laboratory facilities were available. This comparison highlights the locality of the educational resource issues implying that whereas some schools might have been sufficiently providing laboratory resources, others, such as the study area, remain challenged.

Also, the research also found out that laboratory facilities were inadequate to support biology practicals appropriately. This does not only address the availability or unavailability of items, but also, the number and the capacity of fulfilling the needs of the student population. The definition given by Ofeimu and Asemhe (2022) is informative in this case, when they define adequacy as a condition when there is enough laboratory equipment to facilitate the appropriate use in teaching and learning. This is obviously what is lacking in the present state of affairs. The implication of this inadequacy on pedagogy is far-reaching. Dike and Salisu (2015) observed that the lack of equipment makes it challenging to organize the practical work, and, as a consequence, the acquisition of the necessary skills is not facilitated. Students are being denied a chance to acquire fundamental skills of scientific process and critical thinking, which form the most fundamental elements of scientific investigation. The result was supported by the findings Edeh and Nnabuife (2023) who posited inadequacy of laboratory facilities in the context of biology practicals in their selected high schools. This result is also in congruence with the findings of Sani, Mustapha, and Mohammed (2024), who ensured that in these setups, not all students

have access to availed equipment during practical classes, which creates a situation where students might be forced to share the available resources too much or be observers.This observation contrasts the results of Amoah, Emenah, Ngman-Wara, and Azure (2023), who claimed that Biology resources for teaching and learning were adequate in each of the secondary schools they explored. This contradiction is especially noticeable and may be explained by differences in teachers' creativity skills, educational policies or funding models, or geographical and economic environment of the studies. It supports the idea that generalizations about resources availability are false and that specific assessments of resources are important.

Furthermore, the study showed that even with the insufficient and unavailable resources, biology practical activities occur regularly and frequently in the surveyed secondary schools. This indicates that there is a good degree of resourcefulness and dedication among teachers, who are struggling to give their students practical experiences in spite of the high material limitations.It supports the results of Falemu and Akinwumi (2021), who underlined that the frequent use of practical experiments leads to better understanding of biological concepts by students due to the link between theory and practice, and promotion of creativity, curiosity, and critical thinking. It is also aligned with the study of Achor and Agambar (2016), which revealed a beneficial effect of the high frequency of practical activity on the academic results and the level of skills development among the learners. Additional evidence is given by Olayinka, Awelewa, and Musa (2024), who associated the frequency of practical activities with academic success. This is however contrary to the same study conducted by Amoah, Emenah, Ngman-Wara and Azure (2023). They indicated that they had adequate resources, but ironically, they discovered that most teachers did not plan the practical activities on a regular basis, and this adversely affected the curriculum objectives. This contrast provides an interesting juxtaposition, that the schools analysed that schools in Osun state, though resource-strapped, are still trying to carry out hands-on activities. However, the findings

disagree with the findings of Amoah, Eminah, Ngman-Wara, and Azure (2023), which revealed that many teachers did not regularly organise practical activities, which negatively impacted the development of certain profile dimensions outlined in the teaching curriculum.This brings out the fact that resource availability and adequacy as much as it is a requirement, is not the only predictor of good Science instruction. Teachers' creativity, motivation, self-efficacy their and support offered by school administrators are likely critical factors that influence the actual implementation of practical activities in Biology classrooms.

Conclusion and Recommendation

As a result of this research, it could be inferred that the practical aspect of Biology curriculum was not thoroughlyimplemented in secondary schools in Osun, though there are regular periods for practical activities, unavailability of and inadequate provision of laboratory resources as observed in the study can hinder the proper execution of practical lessons by teachers in the nearest future. Unavailable resources should be improvised to achieve the best in the teaching and learning of biology in secondary schools. This will boost students' active participation during and after biology practicals and also improve their creativity and critical thinking skills. Also, secondary schools should be adequately funded so that needed biology laboratory resources could be procured.

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