Prior Knowledge as Correlate of Students Learning Outcome in Biology

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Abstract:- **Improving educational outcomes especially in science education will require efforts on many fronts, but a central premise of this monograph is that one part of a solution involves helping students to better regulate their learning through the use the prior knowledge. Biology as a science of life occupies an important position in the secondary school curriculum. It is designed, ultimately to educate individuals who may or may not pursue biology related careers, but at least acquire the knowledge of the basic essentials for the proper functioning of the body system. It is disciplines that seem to be synergic with other disciplines, this study therefore accessed Prior knowledge as correlate of students' learning outcome in Biology in secondary school in Akinyele local government. Oyo state.This study adopted descriptive survey design and correlation. Data were collected from Five hundred public secondary schools biology students' in SS2 from Akinyele local government area of Ibadan, Oyo state.**

The instruments used were validated and each reliability tested; Student Attitude to Biology Questionnaire (r=0.63), Student Prior knowledge Assessment Probe (r=0.65) and Student Achievement Test in Biology (r=0.75). Data collected were analyzed using descriptive statistic of frequency counts and percentages; Pearson moment correlation was also used. The study revealed that there was a positive, low significant relationship between students' prior knowledge (r = 0.362; p<0.05) and students' achievement in Biology.It also revealed that a positive, weak non-significant relationship between students' prior knowledge (r = 0.040; p>0.05) and students' attitude to Biology.It was recommended that Teacher should plan their lesson plan in such a manner that it will build on student previous knowledge and experience, since Biology has to do with nature and life which entail what you can see, Teacher should help the learner to outgrow from a declarative prior knowledge to the level of procedural knowledge which engage them to have better learning outcome in Biology and Teacher should develop means of allowing student to be engaged in practical activities that can affect both their affective, psychomotor and cognitive domain for better learning outcome. Students should be exposed to things that around that will enhance to cultivate a much more batter attitude to Biology

I. INTRODUCTION

Integrating student knowledge of nature around them and using their prior knowledge to form the bases of new knowledge has been discover to be one the best way to promote learning and teaching in this part of the world. The purpose of exposing children to science instruction right from primary school level is not necessarily to turn them into scientist per se but to enable them acquire favourable scientific attitudes of 'finding out' and carrying out 'hands-on' activities and to enable them raise questions about things that intrigue them. Science therefore is receiving much emphasis in education because of its significance and relevance to life and society. Nzewi (2008). being a science of life occupies an important position in the secondary school curriculum. It is a discipline that seems to be synergic with other disciplines such as physics, chemistry, medicine, pharmacy, geography and geology. Despite the importance of the knowledge of Biology to human beings, it appears students' achievement in this subject at the secondary school level is poor. One of the chief examiners report of the West Africa Examination council (2015) states the fact that students performance and academic achievement has being fluctuating as a result of many factors such as poor spelling, inability to draw proper diagrams in Biology.

Students' attitudes toward science significantly affect their achievement in science. According to Prokop (2007), Understanding of students' attitudes is important in supporting their achievement and interest towards a particular discipline. Students' attitudes toward science have been extensively studied. Dhindsa and Chung (2003), Osborne, Simon, and Collins, (2003) revealed that research has initially focused greatly on science in general and less attention was addressed to particular disciplines like biology, physics or chemistry. This will not give the true pictures of students' attitudes because science is not viewed as a homogeneous subject (Spall, 2003**).**

Prior knowledge has long been considered the most important factor influencing learning and student achievement. The amount and quality of prior knowledge positively influence both knowledge acquisition and the capacity to apply higher-order cognitive problem-solving skills, (Hailikari, Nevgi and Lindblom-Ylänne, 2007). Preece, (1984) noted that previous ideas cannot have another source than the everyday experience that students accumulate in the course of their evolutionary development, which involves cognitive skills, but also, and above all, procedural

and affective abilities. Prior knowledge learned from social roles can both support and conflict with students' learning in schools. For example, Heath found that everyday family habits can be ignored or reinforced in schools by teachers, which in turn, affects how students learn. To connect new learning with prior knowledge, teachers need to be able to take account of the social and cultural prior knowledge with which students enter schools. Nevada department of education (2014) learners construct knowledge by connecting new concepts and information to prior knowledge. As Shuell states, "Learning is cumulative in nature; nothing is learned in isolation"

An essential factor in developing an integrated knowledge framework is to create a learning environment in which learning means actively constructing knowledge and skills on the basis of prior knowledge. Inadequate or fragmented prior knowledge is an important issue to consider because if there is a mismatch between the instructors' expectations of student knowledge and the students' actual knowledge base, learning may be hampered from the start of the studies. Trying to learn something without having adequate prior knowledge or, worse, having misconceptions, may result in rote memorization. Hailikari, Nevgi and Lindblom-Ylänne (2007) noted that this type of surface learning may occur if students cannot relate the new knowledge to their existing knowledge frameworks.

TelleHailikari (2007) notes that at the lowest level, prior knowledge may consist of declarative knowledge, which is the knowledge of facts and meanings that a student is able to remember or reproduce. This type of declarative knowledge is often referred to as "knowing about" or surface learning. Declarative knowledge can also be described as rote learning or "knowledge-telling" which may include many facts and details that do not form an integrated whole. Students who have declarative knowledge are able to answer fairly simple reproduction tasks that do not require an ability to integrate or apply knowledge. Procedural knowledge, on the other hand, is characterized by an ability to integrate knowledge and understand relations between concepts and, at the highest level, apply this knowledge to problem-solving. It is often referred to as "knowing how" and is closely related to higher-order cognitive skills.

From this above finding, it is evident that student can learn science meaningfully and record an impressive achievement and positive attitude in biology when positive learning strategies such as exposure to natural world this foster student positive prior knowledge towards learning of Biology which will in turn result students better learning outcome in Biology and other science subject.

A. Statement of the problem
Learning outcome over the years and student attitude has not been encouraging due to many factors. Few of the factors that different researcher have pointed out ranges from poor funding of practical activities, low interest of student towards Biology due to monopoly of teaching and learning method, inadequate use of student previous knowledge to explain new concept, wrong usage of some learning techniques, and inadequate use of instructional material, despite this fact, different instructional strategies have been suggested for improving student learning outcome in Biology, building on student prior knowledge as a teacher, influence student positive performances and attitude to biology which will in turn affect their achievement in Biology. Therefore this study will investigate prior knowledge as correlate of student learning outcome in Biology in secondary schools of Akinyele local Government Area of Oyo.

B. Research Questions
➢ What is the nature of prior knowledge that students have in Biology?
➢ What is the level of students' achievement in biology?
➢ What are students' attitudes to Biology?
➢ Is there a relationship between student prior knowledge and
- students' achievement in biology
- students' attitude towards biology

II. METHODOLOGY

This study adopted survey research design of correlational type. This is because all the variables have already existed and no variable was manipulated. The study also use correlational in order to determine the extent to which the factor could predict the dependent variable.

A. Variables

➢ *Independent Variables:*
Prior knowledge which involve declarative and procedural prior knowledge.

➢ *Dependent Variable:*
Involve student attitude to biology and student achievement in biology

B. Population, sampling technique and sample
The population of the study comprises of Five hundred secondary schools' II biology students' randomly selected from Akinyele local government area of Ibadan, Oyo state. Six public secondary school were selected to carry out this assignment with the permission of the school principal.

C. Instrument
The instruments used were; Student Attitude to Biology Questionnaire (STBQ) was adapted and modify by the researcher from the work of James Rusell (1975) to suit the content of this work and to measure student's attitude towards Biology. It consist of twenty item on a four ikert

scale ranging from Strongly Agree(SA), Agree(A), Disagree(D) and Strongly Disagree(SD). For positively structure question the score ranges from SA=4, A=3, D=2 and SD=1 and vice-versa for the negative structure question. r=0.83, Student Prior knowledge Assessment Probe (SPKAP) which checkmate the declarative prior knowledge and procedural knowledge at three different stage which are pictorial match as category A, objective to checkmate category A and category c to check their procedural knowledge. r = 0.63 and Student Achievement Test in Biology (SATB) was designed by the researcher to measure students' achievement in Biology. This is made up of two sections. It consists of twenty multiple choice question from (A-D) from which the participant were to choose the correct alternative. r=0.76.

D. Data Analysis

Data collected were analyzed using frequency counts, percentages and Pearson product moment correlation.

III. RESULT

Research question 1: What is the profile of students' prior knowledge?

Data collected to answer this question was based on students' prior knowledge assessment probe (SPKAP) which has three categories. Category A on pictorial match word with eighteen questions on skeletal system of man, category B has 20 objective questions on skeletal system, nutrition and classification of plants and animals and category C which contain 17 short answer questions. The results will be presented according to students' performance the SPKAP for the three categories. The tables 1, 2, 3 and 4 shows the data analysis

Level	Categorical Score	Frequency	Percentage
1	0 – 25	209	43.4
2	26 – 50	67	13.9
3	51 – 75	119	24.7
4	76 – 100	87	18.0
Total	100	482	100.0
Weighted mean = 2.17			

Table 1:- Profile of students' prior knowledge in Biology (categorical A)
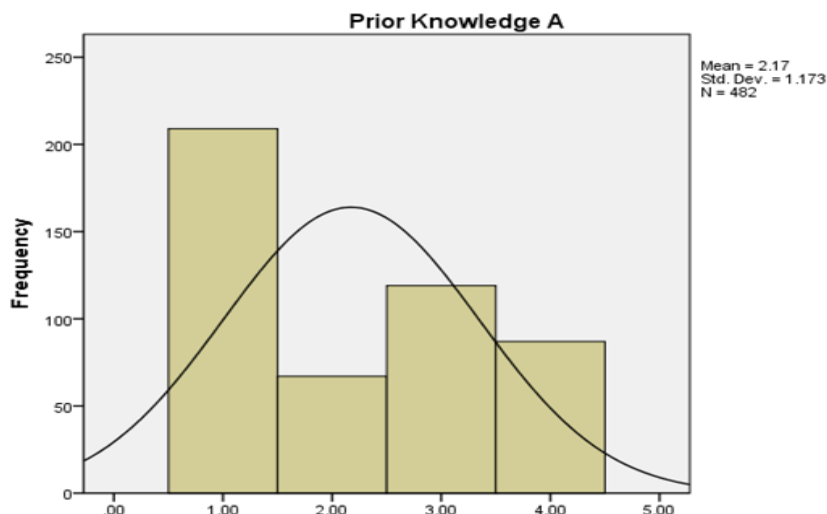

Fig 1:- Distribution of students' prior knowledge score (category A) in Biology

Table 1 revealed that secondary school students' prior knowledge in category A. 209 (43.4%) of the students scored 0 – 25%, 67 (13.9%) of the students scored 26 – 50%, 119 (24.7%) of the students scored 51 – 75% while the remaining 87 (18.0%) of the students scored 76 – 100% respectively. Table 1 indicated a weighted mean of 2.17 which is below the standard mean of 5.0. This implies that students have poor prior knowledge of previously learnt topic in category A on skeleton of man.

Level	Categorical Score	Frequency	Percentage
1	0 – 5	288	59.8
2	6 – 10	182	37.8
3	11 – 15	10	2.1
4	16 – 20	2	0.4
Total	100	482	100.0
Weighted mean = 1.43			

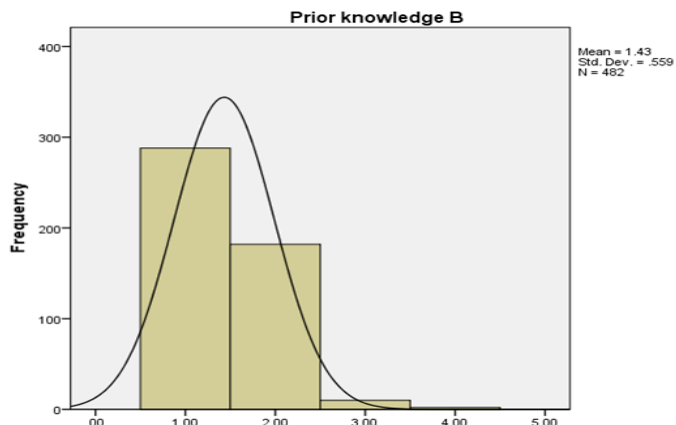Table 2:- Profile of students' prior knowledge in Biology (category B)

Fig 2:- Distribution of students' prior knowledge score
(category B) in Biology

Table 2 revealed that secondary school students' prior knowledge in category B. 288 (59.8%) of the students scored between 0 – 5 marks, 182 (37.8%) scored between 6 – 10 marks, 10 (2.1%) scored between 11 – 15 marks, while the remaining 2 (0.4%) scored between 16 – 20 marks respectively. Table 3 indicated a weighted mean of 14.3 which is below the standard mean of 5.0. This implies that students have poor prior knowledge of previously learnt topics in category B.

Level	Categorical Score	Frequency	Percentage
1	0 – 5	334	69.3
2	6 – 10	101	21.0
3	11 – 15	45	9.3
4	16 – 20	2	0.4
Total	100	482	100.0
Weighted mean = 1.41			

Table 3:- Profile of students' prior knowledge in Biology
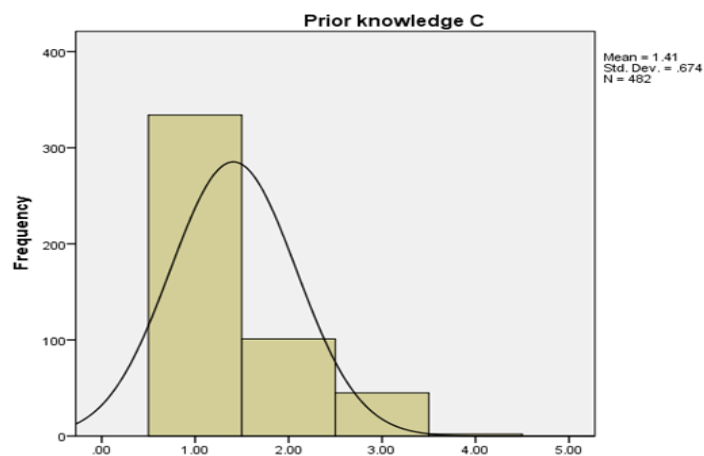(category C)

Fig 3:- Categorical distribution of students' prior knowledge
(category C) in Biology

Table 3 revealed that secondary school students' prior knowledge in question C. 334 (69.3%) of the students scored between 0 – 5 marks, 101 (21.0%) scored between 6 – 10 marks, 45 (9.3%) scored between 11 – 15 marks, while the remaining 2 (0.4%) scored between 16 – 20 marks respectively. Table 3 indicated a weighted mean of 14.1 which is below the standard mean of 5.0. This implies that students have poor recall of previously learnt topic in category C.

Level	Categorical Score	Frequency	Percentage
1	0 – 5	329	68.3
2	6 – 10	140	29.0
3	11 – 15	13	2.7
4	16 – 20	0	100.0
Weighted mean = 13.4			

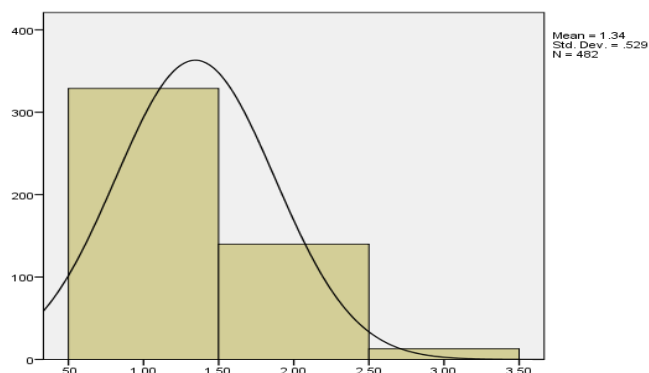Table 4:- Profile of Students' Achievement in Biology

Fig 4:- Distribution of Students' Achievement Test in
Biology

Table 2 that secondary school students performed below average of 15 marks. This implies that majority of the students fell within 11 – 15 marks.

The result shown above shows that students level of performances is below average, from twenty questions, 68% of the students perform well in question 1-5, 29% perform well in 6-10, 2.7% scored in questions 11-15 while 0% perform well in question 16-20, this indicates that students are not good at answering question on evaluation base and application base due to their nature of procedural knowledge which is declarative instead of both procedural and declarative.

Research question 4: What are Students' Attitudes to Biology?

S/N	Items	SA	A	D	SD	Mean	STD.D
1	Biology is very interesting to me.	190 39.4%	224 46.5%	43 8.9%	25 5.2%	3.20	0.807
2	I don't like biology, and it scares me to have to take it.	46 9.6%	58 12.1%	224 46.6%	153 31.8%	3.01	0.907
3	In general, I have a good feeling toward biology	137 28.4%	263 54.6%	56 11.6%	25 5.2%	3.09	0.924
4	When I hear the word biology, I have a feeling of dislike	32 6.7%	83 17.3%	214 44.5%	153 31.6%	3.01	0.880
5	I really like biology	175 36.4%	197 41.0%	69 14.3%	40 8.3%	3.05	0.916
6	I have always enjoyed studying biology in school	157 32.6%	219 45.4%	74 15.4%	32 6.6%	3.04	0.863
7	I feel at ease in biology and like it very much	129 26.8%	225 46.7%	92 19.1%	36 7.5%	2.93	0.868
8	I feel a definite positive reaction to biology; it's enjoyable	139 28.8%	215 44.6%	87 18.0%	41 8.5%	2.94	0.898
9	My teacher is the reason why I like Biology	112 23.2%	188 39.0%	132 27.4%	50 10.4%	2.75	0.928
10	Biology makes me feel uncomfortable, restless, irritable, and impatient	48 10.0%	82 17.0%	175 36.3%	177 36.7%	3.00	0.968
11	I find Biology as a simple subject	121 25.1%	216 44.8%	94 19.5%	51 10.6%	2.84	0.920
12	I have better understanding of practical physics	101 21.0%	184 38.2%	130 27.0%	67 13.9%	2.67	0.964
13	I hate my physics lecturer's attitude	133 27.6%	183 38.0%	110 22.8%	56 11.6%	2.82	0.968
14	I have enough material on Biology	87 18.0%	201 41.7%	139 28.8%	55 11.4%	2.66	0.902
15	I read my Biology material every time	89 18.5%	215 44.6%	130 27.0%	48 10.0%	2.72	0.880
16	I don't see Biology relevance to everyday life and society	50 10.4%	85 17.6%	102 41.9	145 30.1%	2.92	0.942
17	It is difficult to ask our lecturers questions based on the topics taught	62 12.9%	63 13.1%	185 38.4%	172 35.7%	2.99	1.002
18	My Biology lecturers lack innovation, encouragement and resourcefulness	44 9.1%	80 16.6%	181 37.6%	177 36.7%	3.02	0.949
19	Biology is fascinating and fun	143 29.7%	212 44.0%	78 16.2%	49 10.2%	2.93	0.929
20	Biology questions are too difficult to answer	43 8.9%	75 15.6%	214 44.5%	149 31.0%	2.96	0.908
Weighted mean = 2.93							

Table 4:- Students' Attitude to Biology

Table 4 shows the level of students' attitude in the learning of Biology. The rating is as follows: Biology is very interesting to me (mean 3.20), I don't like biology (mean 3.09), In general, I have a good feeling toward biology (mean3.01), when I hear the word biology, I have a feeling of dislike (mean3.05), I really like biology (mean3.04), I have always enjoyed studying biology in school(mean2.93), I feel at ease in biology and like it very much (mean2.94), I feel a definite positive reaction to biology; it's enjoyable(mean2.75), My teacher is the reason while likes Biology(mean3.00), Biology makes me feel uncomfortable, restless, irritable, and impatient(mean2.84),I find Biology as a simple subject(mean2.67), I have better understanding of practical physics (mean2.82), I hate my physics lecturer's attitude (mean2.66), I have enough material on Biology (mean2.72), I read my Biology material every time(mean2.92),I don't see Biology relevance to everyday life and society (mean2.99), It is difficult to ask our lecturers questions based on the topics taught(mean3.02), My Biology lecturers lack innovation, encouragement and resourcefulness (mean2.93), Biology is fascinating and fun (mean2.93), Biology questions are too difficult to answer (mean2.96)

Table 1 further revealed a weighted mean of 2.93 out of the maximum obtainable score of 4.00, which is higher than the standard mean of 2.50. This implies that the students had positive attitude to Biology.

Variables	Achievement	Prior knowledge
Achievement	1	
Prior knowledge	0.362* 0.000	1
Mean	3.85	8.42
STD.D	3.165	6.869

Table 5:- Correlation Matrix Showing the Relationship between Independent Variable and Students' Achievement in Biology

* denotes significant at p<0.05

Table 5 showed that there was a positive, low significant relationship between students' prior knowledge (r = 0.362; p<0.05) and students' achievement in Biology. This implies that prior knowledge is positively related to students' achievement in Biology.

Research question 6. Is there a relationship between students' prior knowledge on students' attitude towards biology?

Variables	Attitude	Prior knowledge
Attitude	1	
Prior knowledge	0.040 0.379	1
Mean	58.52	8.42
STD.D	10.375	6.869

Table 6:- Correlation Matrix Showing the Relationship between Independent Variable and Students' Attitude to Biology

* denotes significant at p<0.05

Table 6 showed that there was a positive, weak non-significant relationship between students' prior knowledge (r = 0.040; p>0.05) and students' attitude to Biology. This implies that prior knowledge is not related to students' attitude to Biology.

Model	Under standardized Coefficients	Standardized Coefficient		Rank	T	Sig.
	Beta	Std. Error	Beta (β)			
(Constant) prior knowledge	3.431 0.183	1.313 0.019	0.397		2.613 9.464	0.009 0.000*

Table 7:- Summary of Multiple Regression Showing Relative Effects of Independent variables on Students' Achievement in Biology

Table 7 revealed that the relative effect of prior knowledge (β = 0.397; t = 9.464; p<0.05), to students' achievement in Biology was significant.. Prior knowledge was the independent variable that strongly predicts students' achievement in Biology.

The prediction equation is given by $Y = 3.431 + 0.183X_1$

Where Y = Students' achievement in Biology
3.431 = Constant
X_1 = Prior knowledge

IV. DISCUSSION

A. Students' Prior knowledge and their Achievement in Biology

The finding of the results showed that there was a positive, low significant relationship between students' prior knowledge and students' achievement in Biology. This implies that prior knowledge is positively related to students' achievement in Biology. This is in line with the view of Halilikari, (2008), that previous knowledge significantly influenced student achievement and also that student who possessed relevant and deeper-level of prior knowledge will

perform well in achievement test; it also supported the view of Craker (2006) which suggested that prior knowledge has a great effect on students' knowledge of scientific concepts. Although the rate at which prior knowledge affected the achievement of the students is very minimal which might be due to inadequate skill on the part of the student and the teacher to connect the prior knowledge of the student to the new lesson introduces or inability of the students to transfer knowledge had to new experience.

B. Students' Prior Knowledge and Students' Attitude to Biology

The results revealed that there was a positive, weak non-significant relationship between students' prior knowledge and students' attitude to Biology. This implies that prior knowledge is not related to students' attitude to Biology. It explains George (2000) that agreed with the assertion that attitude is comprised of two component parts which are affective in dealing with mental process (ability to recollect and behave in the right way due to exposure). Positive attitude cultivates students' ambitions and morale of what they want to be in future hence and not from what they have learnt in the past or their previous knowledge of a particular subject. This also explained the view of Steven D

Verhey (2005) that prior knowledge has a very weak impact on student attitude, since the rate and level which each learner can reason varied with different factors such as home factor, environmental factor and individual ability.

C. Relative Effects of Independent variables on Students' Achievement in Biology

The results indicated that the relative effect of prior knowledge to students' achievement in Biology was significant. This explain that prior knowledge on the part of the student is enough to affect student achievement in biology, this support the findings of Telle Hailikari (2008) that Prior knowledge from previous courses significantly influenced student achievement. Procedural knowledge was especially related to student achievement. Instructors and students had mainly positive reactions towards the prior-knowledge tests.

D. Relative Effects of Independent variables on Students' Attitude to Biology

The findings revealed that the relative effect of prior knowledge to students' attitude to Biology was not significant, which means previous knowledge has no influence on student attitude. This result agreed with the findings of that attitude is a critical factor in learning. It also agreed with the assertion of and that students' positive attitude to science correlate high with their science achievement. Moreover, also reported that learners bring the attitude they acquired into the classroom and this has the capacity to facilitate or hinder learning rate. Furthermore, the findings also in line with that students' positive attitude in science correlate highly with their science achievement

V. CONCLUSION

It could be concluded from the findings that if prior knowledge which involve procedural prior knowledge and declarative prior knowledge can jointly have positive effect on student attitude to biology and achievement in Biology. Also teacher should bring student closer to the knowledge by avoiding making topic that are being taught to look abstract to student but it will be better if student are expose to nature. Hence, students' related variables are very important and so should be put into consideration in the teaching and learning of Biology. It must also be noted that the teacher have to help student to graduate from the level of declarative prior knowledge to procedural knowledge which is meaningful learning to enhance better learning outcome in Biology and other science subjects. More should be done in the curriculum to enhance the effectiveness of the usage of prior knowledge to facilitate positive attitude from the student and effective reaction toward their achievement in Biology and others science subject.

➢ *Educational Implications*

Prior Knowledge is highly a means of getting better side of the student's in Biology learning outcome. This implies that teachers need to employ teaching methods/strategies that suits the way learners learn, catches their attention and makes them actively involved in classroom activities, out-of-school-science experience as this will enhance effective teaching and learning of the subject. It is also very essential for Biology teachers to create good and favourable learning environment where learners are given the opportunities to learn in more practical and interactive ways. This study therefore revealed the need for educational bodies to organize conferences and workshops regularly where teachers can gain first-hand information on the latest development in the teaching of Biology to fit the needs of the learners and also biology curriculum should be structured to support time for student exposure to nature with budget supporting it.

RECOMMENDATIONS

Based on the findings, this study therefore recommends that;
➢ Teacher should plan their lesson plan in such a manner that will bring student closer to nature, since Biology has to do with nature
➢ Teacher should help the learner to outgrow from a declarative prior knowledge to the level of procedural knowledge which engage them to have better learning outcome in Biology
➢ Teacher should develop means of allowing student to be engaged in practical activities that can affect both their affective, psychomotor and cognitive domain for better learning outcome

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