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Surveying Aspects Of Biology Instructional Practices In Selected Schools In The Central Region Of Ghana

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Abstract: ***This study investigated the types of cognitive and process skills specified in the biology curriculum from selected schools in the Central Region of Ghana. A cross-sectional descriptive survey design was used for the study. The accessible population however consisted of 21 schools making up 36% of the target population. The schools were categorised based on Ghana Education Service standards into grades A, B and C. The schools were selected through stratified random sampling from nine districts and municipalities in the region. Factor analyses was used to perform inferential analysis and draw conclusions on the research question. Some teachers did not organise practical activities regularly and this was affecting some profile dimensions, suggested by the teaching curriculum specifically the scientific inquiry skills. Recommendations made were that schools should employ qualified laboratory technicians to assist biology teachers in organising regular practical activities. Also support and capacity enhancing activities should be organised regularly to augment teachers' cognitive and process skills.***

Keywords: Biology teaching and learning, biology curriculum, cognitive and process skills, science education

I. INTRODUCTION

A central aspect of the biology curriculum is the concept of profile dimensions that should be the basis for instruction and assessment. Learning may be divided into a number of classes. A student may acquire some knowledge through learning. The student may also learn to apply the knowledge acquired in some new context. The four learning behaviours, "knowledge", understanding", "application" and "process "are referred to as dimensions of knowledge (Ministry of Education, 2010). Knowledge is a dimension; application of knowledge is another dimension. More than one dimension forms a profile of dimensions.

The three profile dimensions that have been specified for teaching, learning and testing are in the biology curriculum:

Knowledge and Comprehension 30%,

Application of Knowledge 40%

Practical and Experimental Skills 30%.

Each of the dimensions has been given a percentage weight that should reflect in teaching learning and testing. The weights indicated, show the relative emphasis that the teacher should give in the teaching, learning and testing processes. The focus of this curriculum is to get students not only to acquire knowledge but also to be able to understand what they have learnt and apply them practically. Combining the three dimensions in teaching would ensure that biology is taught not only at the factual knowledge level but that student also acquire the ability to apply scientific knowledge to issues and problems, and will also acquire the capacity for practical and experimental skills that are needed for scientific problem solving (Ministry of Education, 2010).

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A set of broadly transferable abilities to many science disciplines and reflective of the behaviour of scientist is referred to as process skills. Process skills involve demonstration of practical manipulative skills using tools, machines and equipment for problem solving in science Process skills also involve 'the process of observation, classification, drawing, measurements, interpretation, recording, reporting and expected scientific conduct in the laboratory/field (Ministry of Education, Science and Sports (MOESS), 2007, p. xiii).

According to Wilke and Straits (2005), students with stronger foundations in science process skills will be able to use them in other more intensive scientific inquiries and were more likely to be successful in those inquiries. For this reason, instructors should lay emphasis on the teaching and reinforcing of science process skills. Dökme and Aydìnlì (2009) found out that the level of students' performance on basic science process skills was low and these findings were contrary to their expectations.

Effective teachers help students make these connections by scaffolding and dialogue. In fact, these are the essence of mediating. Teachers plan learning activities at points where students are challenged. Teachers plan activities and experiments that build on the language of students' everyday lives through familiar examples and behaviours, analogies and metaphors, and the use of commonly found materials. Teachers demonstrate, do parts of the task students cannot do, work collaboratively with students where they need help, and release responsibility to students when they can perform the task independently (Vygotsky, 1986).

Practical skills involve the demonstration of manipulative skills using tools, machines and equipment for practical problem solving. The teaching of practical skills should involve projects, case studies and field studies where students will be intensively involved in practical work and in search for practical solutions to problems and tasks (MOE, 2010).

Experimental skills involve the demonstration of the inquiry processes in science and refer to skills in planning and designing of experiments, observation, manipulation, classification, drawing, measurement, interpretation, recording, reporting and conduct in the laboratory/field. Practical and experimentation skills refer to the psychomotor domain of profile dimensions (MOE, 2010).

The significance of process skills in the teaching and studying of science is generally recognised by experts in the field (Al-Sadaawi, 2007). For the teaching and learning of science to be of considerable value, students must be able to apply their scientific concepts, procedures and attitudes to their wider life or use them in their day-to-day activities. A restricted and constricted understanding of science without expertise in the associated scientific skills is an understanding with very limited value. Therefore, students should be initiated into these skills early in their school experience since so much of their success in their subsequent guided studies requires a second understanding and appropriate use of these science process skills [observing, measuring, classifying, inferring, and communicating] (Ango, 2002). A summary of skills that are required for effective practical and experimental work is as follows: Equipment Handling, Planning and designing of experiments, Observation, Manipulation, Classification, Drawing, Measuring, Interpretation, Recording, Reporting, and Conduct in Laboratory/Field. This discussion led to the modification of the list of process skills in figure 1.

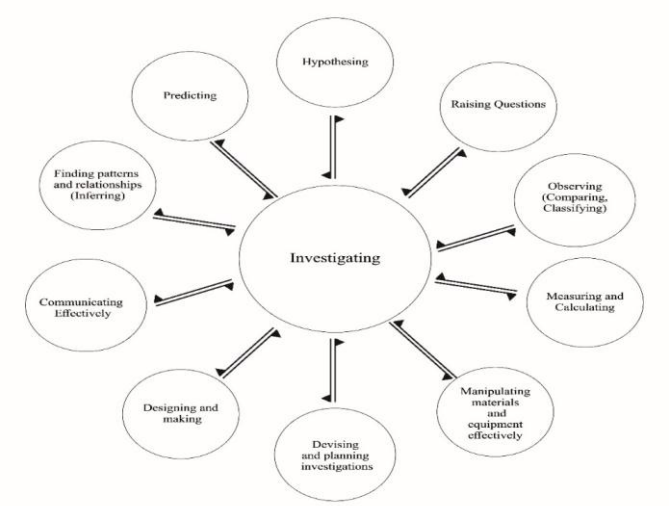

Figure 1: Modified process skills diagram

RESEARCH QUESTION

The main research question that directed this study was:

- ✓ What types of cognitive and process skills are reflected by senior high school biology teachers' instructional activities?

II. METHODOLOGY

The study employed a combination of qualitative and quantitative approaches such as surveys and in-depth interviews for data collection. The two methods of different methodological origin and nature were used to:

- ✓ Obtain a variety of information on biology teachers and how they implemented the curriculum in the classrooms
- ✓ Achieve a higher degree of validity and reliability of data
- ✓ Overcome the deficiencies of single method studies

POPULATION

The target population comprised all biology teachers and second year biology students in senior high schools in the Central Region of Ghana. The selection of an accessible population is that a smaller population gives an in-depth view of a research. One hundred and six (106) biology teachers and 354 biology students formed the accessible population. Twenty-one (21) Senior High Schools out of a total of 58 were used for the study making up 36% of the entire accessible population. Biology teachers and second year biology students formed this population since they would not be focussing on writing their final examination and also might have covered a substantial amount of the biology curriculum.

INSTRUMENTATION

The modified version of the Barbados workshop instrument used by Eminah (2007) was adapted. The

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instrument was categorised into three forms namely form 1, form 2 and form 3 respectively. Form 1 was used to code the behaviour of a group of students' activities throughout the lesson by the observer ticking in a box opposite the categorized behaviour within a time interval of two minutes. Form 2 was used to code the behaviour of the teacher (excluding his/her movements). Form 3 was blank and the researcher was to code the teachers' movements in class.

A questionnaire titled "Evaluating Classroom Implementation of Senior High School Elective Biology Curriculum Questionnaire" (ECISHSEBC), a structured interview and observation was the final technique to augment the data collection procedure. The questionnaire was specifically for teachers and students comprising of four sections (A, B, C and D), where sections A involves the demographics or bio data of the respondents. Sections B was made up of 7 and 8 items followed by a five-point Likert scale with the students and teachers' questionnaire respectively. Sections C was made up of 11 items distributed among a five-point Likert scale for the students' questionnaire whilst 6 questions were raised with mixed possible answers in the teachers' questionnaire. Sections D was made up of three questions with closed-ended and open-ended options in the students' questionnaire whilst two questions were raised in the teachers' questionnaire one-closed ended and the other open-ended.

Questions for the structured interview were predetermined and set by the researcher based on a strict procedure. All the questions were open-ended comprising 8 questions in both the students and teachers interview respectively.

DATA COLLECTION PROCEDURE

The researcher collected an introductory letter from the Department of Science Education, generated extra copies which were sent to the Regional, Metropolitan/ Municipal or District Directors of Education as well as Heads of senior high schools to enable the researcher undertake the study. Teachers' and students' consent were sought to participate in the study before the tools were administered.

In order to ensure reliability in an uncontrolled environment, the respondents were informed that the questionnaire and questions are not tests, more so, their responses were not going to be used to change their status or affect their promotion(s). The researcher by making appointment with some teachers who could not complete the questionnaires was carried out at later dates.

DATA ANALYSIS

Both descriptive and inferential statistics were used to analyse the data. Microsoft Excel and The Statistical Package for Social Sciences (SPSS version 22.0) were used by the researcher to analyse the data. The means, frequencies and standard deviations were calculated using the descriptive statistics function of the software and were presented as tables. The results were thoroughly explained with tables used to answer the research question.

III. RESULTS

Table 1, shows that 86.5% of the respondents were always allowed to ask questions to aid their understanding of concepts followed by 36.5% of the total respondents indicating that the teacher always involved them in practical activities. Also, 44.1% of the respondents showed that the students sometimes worked in groups with others on the various topics followed by 31.8% respondents indicating that they sometimes read biology textbooks/hand-outs and made their own notes. However, 74.1% respondents always copy the notes that the teacher dictated/wrote on the board whiles 75.9% of the total respondents indicated that their teacher always marked their quizzes and class exercise on time and gave them feedback accordingly.

	Never %	Rarely %	Sometimes %	Most of the time %	Always %
I am allowed to ask questions to aid my understanding of concepts	.6	.6	2.9	9.4	86.5
The teacher involves me in practical activities	3.5	7.1	34.1	18.8	36.5
I work in groups with other classmates	7.1	14.7	44.1	16.5	17.6
I hold discussions with others on the various topics	6.5	15.9	47.6	20.0	10.0
I read biology textbooks/hand outs and make my own notes	9.4	7.1	31.8	24.7	27.1
I copy the notes that the teacher dictates/writes on the board	1.8	4.7	6.5	12.9	74.1
Enough time is allocated on the school time table for the teaching and learning of biology	10.0	7.1	8.2	12.9	61.8
The teacher allows me to handle materials and equipment during practical lessons	7.6	8.8	21.2	15.3	47.1
The teacher uses various tools (quizzes, exercise, assignment, projects etc.) to assess my work	0.0	2.9	8.8	13.5	74.7
The teacher marks my quizzes and class exercises on time and gives me a feedback accordingly	1.2	1.8	6.5	14.7	75.9

Table 1: Students views on teachers' instructional activities

From Table 2, it could be seen that 99 (93.4%) of the respondents agreed that they had a good understanding of biology with an agreement mean level of 4.31 and standard deviation of 0.85. Also, 86 (81.13%) of the respondents agreed that during lesson delivery they introduced activities that promoted mutual learning among students as well as encouraging students to initiate collaborative inquiry-based learning with a mean agreement of 3.89 and standard deviation of 0.99. Again, 82 (77.36%) of the respondents agreed that there were some challenges in relation to their teaching functions. This also recorded a mean level of agreement of 3.87 with a standard deviation of 1.05. However, 77 (72.64%) of the respondents agreed that the school's curriculum is crowded with an agreement mean level of 4.09 and standard deviation of 1.12.

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	N Agreement	% Agreement	Mean	Standard Deviation
Does your school have adequate equipment, facilities, laboratories and general resources required for implementation of the biology programme?	65	61.32	3.17	1.27
There are some challenges in the course of teaching functions	82	77.36	3.87	1.05
There is enough support for teachers from within the school and outside, e.g., opportunities to receive ongoing curriculum professional support.	35	33.02	2.60	1.28
There is enough time available for preparing and delivering the requirements of the biology course, e.g., enough time to develop your own understanding of the subject you are required to teach	63	59.43	3.23	1.19
Have you ready access to science materials and resources in this school to enable you implement the biology programme as demanded by the objectives of the curriculum?	51	48.11	3.17	1.18
Is the school curriculum crowded? Does biology suffer because of this?	77	72.64	4.09	1.12
During lesson delivery do you introduce activities that promote mutual learning among students as well as encourage students to initiate collaborative inquiry-based learning?	86	81.13	3.89	0.99
Does the biology programme enable students to acquire the relevant manipulative skills that enable them to handle and operate science equipment and materials effectively at the end of the lessons?	42	39.62	2.94	1.09
You have a good understanding of biology. i.e., knowledge, skills and attitude needed to promote in teaching of SHS biology.	99	93.40	4.31	0.85
Do you have the opportunity to undertake professional development in biology to enhance your role in teaching biology?	53	50.00	3.10	1.20

Table 2: Opinions of teachers on the implementation of the biology curriculum

Table 3 contains the results of the observation of teachers in terms of verbal activities. For activities "asks question requiring recall of previous learning", "ask questions requiring students' ideas", answering student's questions", answers own questions", "explains meaning of words", "comments on students work or answers", "asks pupils to comment on each other's answer", "gives information" and "gives instruction", all the schools performed such activities throughout the lesson. For "ask for report/description of work" and "asks questions for supervision/control (not topic)", Grade A schools performed such activity throughout the lesson, Grade B performed such an activity but not throughout the lesson, but Grade C school did not perform such an activity throughout the lesson. For the activity "refers to worksheet", none of the schools performed such activity.

Activity	Grade of School	Average Number of Times for Activity: 1 - 10 mins	11 - 20 mins	21 - 30 mins	31 - 40 mins	41 - 50 mins
Asks question requiring recall of previous learning	A	1.40	1.20	0.60	0.20	0.00
	B	3.00	0.75	1.00	0.00	0.75
	C	1.50	0.50	1.00	0.50	0.50
	Total	**1.92**	**0.85**	**0.85**	**0.23**	**0.38**
Asks questions requiring students' ideas	A	3.60	2.00	1.00	0.00	0.20
	B	2.50	3.50	0.50	0.25	0.50
	C	8.50	7.00	4.75	1.25	0.25
	Total	**4.77**	**4.00**	**2.00**	**0.46**	**0.31**
Asks for report/description of work	A	0.40	0.40	0.20	0.20	0.00
	B	1.00	0.25	0.00	0.00	0.50
	C	0.00	0.00	0.00	0.00	0.00
	Total	**0.46**	**0.23**	**0.08**	**0.08**	**0.15**
Asks questions for supervision/control (not topic)	A	2.60	0.20	0.80	0.20	0.00
	B	0.75	0.75	0.00	0.00	0.25
	C	0.00	0.00	0.00	0.00	0.00
	Total	**1.23**	**0.31**	**0.31**	**0.08**	**0.08**
Answering student's questions	A	0.40	0.60	1.80	1.00	0.00
	B	0.25	0.25	0.50	2.00	0.50
	C	0.25	0.75	0.25	0.75	0.50
	Total	**0.31**	**0.54**	**0.92**	**1.23**	**0.31**
Answers own questions	A	1.40	0.20	1.00	0.60	0.00
	B	1.25	1.00	1.50	0.25	0.75
	C	1.00	0.25	0.00	0.25	0.00
	Total	**1.23**	**0.46**	**0.85**	**0.38**	**0.23**
Explains meaning of words	A	2.40	5.60	4.40	2.40	1.80
	B	4.00	6.50	5.00	1.75	1.50
	C	8.75	13.75	11.50	12.00	8.25
	Total	**4.85**	**8.38**	**6.77**	**5.15**	**3.69**
Comments on students work or answers	A	1.80	2.00	2.40	1.40	1.20
	B	2.75	2.50	2.25	3.25	0.50
	C	4.00	5.25	4.00	0.75	0.00
	Total	**2.77**	**3.15**	**2.85**	**1.77**	**0.62**
Asks pupils to comment on each other's answer	A	0.40	0.40	0.80	0.40	0.00
	B	0.00	0.25	0.00	0.00	3.25
	C	0.75	0.25	3.50	0.00	0.00
	Total	**0.38**	**0.31**	**1.38**	**0.15**	**1.00**
Gives information	A	8.00	5.60	5.60	3.00	1.60
	B	6.50	7.25	4.25	1.75	1.00
	C	12.75	13.50	12.00	12.25	9.00
	Total	**9.00**	**8.54**	**7.15**	**5.46**	**3.69**
Gives instruction	A	1.80	1.60	0.40	0.40	0.00
	B	0.75	0.00	0.50	0.25	0.00
	C	2.50	5.00	2.25	0.75	1.25
	Total	**1.69**	**2.15**	**1.00**	**0.46**	**0.38**
Refers to worksheet	A	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Other	A	0.00	0.00	0.00	0.00	0.00
	B	0.50	0.50	1.75	1.50	0.25
	C	0.00	0.25	0.00	0.00	0.00
	Total	**0.15**	**0.23**	**0.54**	**0.46**	**0.08**

Table 3: Observations of teachers in terms of verbal activities

Data presented in Table 4 were on observation of teachers in terms of non-verbal activities. For "uses black board to record student findings/ideas", "uses black board for other purpose", "demonstrate activity/what to do", "listens to students" and "observe students/not interacting", all the schools performed such activities throughout the lesson. For "helps with use of specific equipment (not activity)", Grade A and B schools performed such activities but not throughout the lesson, but none of the Grade C school performed such activity. For "organises/distributes equipment", none of the schools performed such activity.

Activity	Grade of School	Average Number of Times for Activity: 1 - 10 mins	11 - 20 mins	21 - 30 mins	31 - 40 mins	41 - 50 mins
Uses black board to record students' findings/ideas	A	5.60	2.00	3.40	1.00	0.60
	B	4.25	2.00	1.25	0.00	0.00
	C	1.75	0.50	1.50	0.00	0.00
	Total	**4.00**	**1.54**	**2.15**	**0.38**	**0.23**
Uses black board for other purpose	A	3.40	0.60	3.20	1.00	0.60
	B	3.50	3.00	1.50	0.00	0.00
	C	6.00	5.75	4.00	3.50	0.75
	Total	**4.23**	**2.92**	**2.92**	**1.46**	**0.46**
Organises/distributes	A	0.00	0.00	0.00	0.00	0.00

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equipment	B	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00
	Total	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Demonstrate activity/what to do	A	1.00	0.80	0.80	1.00	0.60
	B	1.25	0.75	0.25	0.50	0.00
	C	0.50	0.50	1.50	0.50	0.75
	Total	**0.92**	**0.69**	**0.85**	**0.69**	**0.46**
Helps with use of specific equipment (not activity)	A	0.00	0.20	0.00	0.40	0.00
	B	0.25	0.00	0.75	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00
	Total	**0.08**	**0.08**	**0.23**	**0.15**	**0.00**
Listens to students	A	3.00	2.60	4.00	2.00	3.60
	B	0.50	1.50	1.00	0.25	0.00
	C	2.50	3.50	1.75	0.50	0.25
	Total	**2.08**	**2.54**	**2.38**	**1.00**	**1.46**
Observe students/not interacting	A	3.60	2.00	2.00	0.00	0.00
	B	1.50	1.75	1.50	1.00	0.00
	C	5.00	5.00	5.00	4.00	3.00
	Total	**3.38**	**2.85**	**2.77**	**1.54**	**0.92**
Other	A	4.80	5.00	4.80	1.80	1.00
	B	5.00	5.00	5.00	3.75	0.75
	C	2.50	2.50	2.50	1.50	0.75
	Total	**4.15**	**4.23**	**4.15**	**2.31**	**0.85**

Table 4: Observation of teacher in terms of non-verbal activities

IV. DISCUSSION

Results from Table 1, revealed that 306 (86.5%) of the respondents were always allowed to ask questions to aid their understanding of concepts followed by 129 (36.5%) of the total respondents indicating that the teacher always involved them in practical activities. Also, 156 (44.1%) of the respondents' showed that the students sometimes worked in groups with others on the various topics followed by 112 (31.8%) respondents indicating that they sometimes read biology textbooks/hand-outs and make their own notes. However, 262 (74.1%) respondents always copied the notes that the teacher dictated/wrote on the board this results simply implies that students were not using any of the process skills. Finally, 269 (75.9%) of the total respondents indicated that their teachers always marked their quizzes and class exercises on time and gave them feedback accordingly.

From Table 2, it could be seen that 93.4% of the respondents agreed that they had a good understanding of biology with an agreement mean level of 4.31 and standard deviation of .85. Also, 81.13% of the respondents agreed that during lesson delivery they introduced activities that promote mutual learning among students as well as encouraging students to initiate collaborative inquiry-based learning with a mean agreement of 3.89 and standard deviation of 0.99. Again, 77.4% of the respondents agreed that there were some challenges in relation to their teaching functions. This also recorded a mean level of agreement of 3.87 with a standard deviation of 1.05. However, 72.6% of the respondents also agreed that the school's curriculum is crowded with an agreement mean level of 4.09 and standard deviation of 1.12.

Diabene (2012), stated that process skills that scientists used for practicing and understanding science could be categorised into two (namely basic process skills and integrated process skills). The basic (Simpler) process skills provide a foundation for learning the integrated (Complex) skills. The basic skills that students are more likely to develop according to the syllabus are planning (defining the problem and thinking of ways to solve it through experimentation or some structured investigation) and observing (use of the senses, the microscope and other tools to make accurate observations of phenomena) (Shaw, 1983). The rest are manipulating (skilful handling of objects and tools to accomplish a task) and measuring (accurate use of measuring instruments and equipment). The integrated process skills include creative problem solving (this is a process of analysing a problem and choosing a noble but relevant solution in order to remedy or alter a problem situation) [MOESS, 2007].

Equipping students with the necessary process skills during instruction would forestall the memorisation of facts and rather encourage practical and active participation of all the learning processes that lead to the discovery of new knowledge (Finley, Steward and Yaroch, 1982). According to Ossei-Anto (1996), once science process skills are acquired, they become very powerful means of mastering content. Lee, Hairston, Thames, Lawrence and Herron (2002), also stated that science process skills ensure that students have meaningful learning experiences. All these give a lifelong experience to the students and condition them favourably to develop interest and have an inclination towards science.

Table 3 presented results on observation of teachers in terms of verbal activities. For activities such as "asks question requiring recall of previous learning", "ask questions requiring student's ideas", answering student's questions", answers own questions", "explains meaning of words", "comments on students work or answers", "asks pupils to comment on each other's answer", "gives information" and "gives instruction", all the schools performed such activities throughout the lesson. For "ask for report/description of work" and "asks questions for supervision/control (not topic)", Grade A schools performed such activity throughout the lesson, Grade B performed such an activity but not throughout the lesson, interestingly Grade C school did not perform such an activity throughout the lesson. For the activity "refers to worksheet", none of the schools performed such activity.

According to Saribas and Bayran (2009), teachers who are not confident about their capability to foster student learning through cognitive and process skills specified in the curriculum may dwell on negative images about their classrooms. Thus, teachers with the right beliefs about their abilities and about practical work would look beyond the challenges and still teach effectively. For "organises/distributes equipment", none of the schools performed such activity. This was as a result of inadequate equipment in the selected Senior High Schools (Asare, 2010).

Table 4 presented results on observation of teacher in terms of non-verbal activities. For activities such as "uses black board to record pupil findings/ideas", "uses black board for other purpose", "demonstrate activity/what to do", "listens to pupils" and "observe pupils/not interacting", all the schools performed such activities throughout the lesson. For "helps with use of specific equipment (not activity)", Grade A and B schools performed such activities but not throughout their lessons, but none of the Grade C schools performed such an activity.

The results obtained in this study was also in agreement with the work of Webb and Glover (2004), who cautioned that if educators do not have an appropriate understanding of the processes of science, they cope in ways that impoverish

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students learning opportunities and hence affects their academic achievements.

In conclusion, Asiamah (2011), stated that the role of process skills in this development of understanding was crucial. If scientific skills were not well-developed and relevant evidence not collected, then the emerging concepts would not help in the understanding of the world around us. It was to be noted, that the inclusion of science process skills as part of the curriculum, constituted the main goal of science education.

V. CONCLUSION AND RECOMMENDATIONS

This study revealed that most of the teachers used the teacher-centred method of teaching and learning, where lecture and discussion were the most used methods of instruction instead of student-centred and activity-oriented approaches prescribed by the biology curriculum.

Another major finding from the study revealed that most of the senior high schools selected had science laboratories, which in most cases, were used for theory lessons rather than practical activities. This was because such laboratories were ill equipped with materials and equipment necessary for practical lessons.

Process skills, observed in this study included drawing, interpretation, measurements, recording, reporting, classification and observation. The cognitive skills on the part of the teachers were found to be standard in Grade A schools since most of the teachers were academically and professionally qualified. In some of the grade B and C schools; some teachers, although academically qualified seemed not to be professionally qualified. Their qualifications in methodology were inadequate, due to that they lacked confidence and their lesson delivery was poor.

Biology teachers should always use their immediate environment to teach as it contains a lot of material resources for effective teaching of the concepts in the subject. The functionality and duration of equipment should be taken into consideration so as to utilize it judiciously. There is need for Government, Parent Teacher Association, Voluntary Organizations and Philanthropists to join hands in procuring necessary biology materials and resources in senior high schools. Biology teachers should set up simple aquarium, vivarium and botanical gardens in schools as prescribed by the curriculum.

To facilitate the implementation of the curriculum, professional development programmes should be regularly organized for biology teachers. The Ministry of Education and Ghana Education Service should make appropriate plans to expose biology teachers to training workshops, improvisation seminars in order to update their techniques for improvising specific equipment. More female teachers in Science, Mathematics and Technology (SMT) must be trained to handle girls and act as role models. Biology teachers should be adequately motivated through enhanced salaries, allowances and incentives for them to improvise and use eclectic methods for teaching and learning.

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