

An Assessment of Effectiveness of the Secondary School Science Pedagogy and Curriculum Relevance to Students' Needs in Baringo Central, Kenya

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Abstract

There are particular distinct changes that students are supposed to portray as a result of science instruction. These changes can be identified in the development of the students as they progress with learning. The changes include among others: ability to develop investigative skills, to reason scientifically, learn about the complexity of the world and be informed citizens. The study aimed at finding out the effects of teaching and learning experiences of teachers and students on science education in secondary schools in Baringo Central District. This paper examines how the science curriculum and pedagogy affect the teaching and learning processes. An empirical study design was adopted for the study. The questionnaire, which was categorized into students' and teachers', was used to collect data. Respondents were divided into homogenous subgroups and stratified random sampling was used to identify three schools where three science teachers and a total of 36 students, 12 from each school were selected. The findings were analyzed using a descriptive approach for quantitative data while interpretative approach was employed for the qualitative data respectively. It was found out that practical teaching techniques are perceived by science learners to be the most effective method but its utilization by teachers falls short of expectations. The author recommends that effective teaching and learning methods be encouraged for use and should be implemented in science education to meet students' needs in life after school. The study is significant both to scholars and other readers as its findings may be a pointer in identifying deep-rooted issues that may require further investigation which will be used to inform future policy guidelines and quality assurance modes.

Keywords: assessment, relevance, secondary school science curriculum, students, Baringo Central Kenya.

INTRODUCTION

Since the inception of 8-4-4 system of education in Kenya, the teaching of science subjects has become a matter of debate due to poor performance in the national examinations by many candidates. This is an indication that the teaching and learning of these subjects in secondary schools has not been well. It is important that teachers identify the teaching and learning problems in sciences and seek solutions to this perennial problem. There is also need to establish a system of follow-up and monitoring to determine whether or not the resolutions arrived at in science seminars and workshops are actually used to improve the situation in the classroom. The science teachers should therefore make an effort to plan for what they are to teach well in advance. However, it is not usual to see a science teacher relying almost entirely on a textbook for his/her teaching with no schemes of work, lesson plans and only occasional reference to the syllabus. It should be remembered that a course largely succeeds or fails due to the way it is taught. On the other hand, it should be noted that science teaching is such a personal art that it should be wrong to suggest any single, rigid approach to science teaching and learning. The effectiveness of what is taught depends, to a large extent, on the amount and quality of planning put in before the class.

There are particular distinct changes that students are supposed to portray as a result of science instruction. These changes can be identified in the development of the students as they progress with learning. The changes include, among others: ability to develop investigative skills, to reason scientifically, learn about the complexity of the world and be informed citizens (Taraban *et al.*, 2007). This paper examines the relevance of the science curriculum to students' needs based on the findings of a study conducted by the author in Baringo Central District in Kenya.

Science Education in Kenya

Right from independence, the Government has consistently shown a keen interest in the promotion science education as a means to achieving the country's manpower requirement (Bogonko, 1992). That the Government has shown this kind of interest in Science education more than any other in the field of education is not to be disputed on the basis of the investments and commitment shown above. The presidential working party on the second university in Kenya noted that the National Council of Science had conducted research and found out that there was a shortage of trained manpower in the fields of Science and technology by the time the Mackay Commission

was constituted (Mackay, 1981). Following the findings, a second university (Moi University) was designed specially to offer courses in technology and related sciences (Bogonko, 1992, p 120). Another strategy that was also put in place to promote science education was the upgrading of nineteen secondary schools into Technical Training Universities in 1986 (Bogonko, 1992). The basic admission requirements to Science based faculties in the Universities were reduced to six points while the entry point for arts based courses remained at 10 points. All these efforts were consequential steps following what transpired in education at Secondary school level. The implication clearly suggests that Science subjects were neither popular nor were being performed well.

Following the situation, and the need to meet international standards, Science at Primary school level developed from generic Science curriculum which was merged with other social subjects under one umbrella subject identified as a General paper in the old system, to an independent Science subject. At this level, science is performed comparatively better than other subjects. In the secondary school sector, the generic science subject is divided into three: Physics, Chemistry and Biology. Prior to the introduction of 8-4-4 system of Education, three forms of Science Education were offered at Secondary school level: First was General Science which was an integration of all the three science subjects and emphasis was laid on theory and rote learning. The second was the Physical Science which was also integration of all the three subjects but with some element of practical approach. The final category was Pure Science where each of the Science subjects was done as an independent entity with a practical orientation and usually referred to as 'pure science'. Pure Science was largely a preserve for well endowed schools while General Science was for the schools without Science equipment. Physical science was an interface between the two.

Under the 8-4-4 system of education, General Science was removed. Emphasis was laid on Science subjects without any regard to the school's endowment in facilities. In reality, all schools did Pure Science. This might partly explain the continued general poor performance in the Sciences in Secondary schools in Kenya (Njeru, 2003). The stakeholders' pressure on the government following the performance in the sciences led to a series of revisions of the Science curriculum. In Chemistry, for example, some topics, e.g. colloidal Chemistry, gamogenesis, embryology, were removed on the grounds that they were above the level of the learners (KIE, 1992). The reintroduction of general Science and Alternative B Mathematics in the secondary school curriculum by 2009 has set a new paradigm shift in secondary science education in Kenya. To many, it is a reverse step towards the curriculum prior

to the introduction of 8-4-4 system of education. It is argued that because performance in science education has not been good compared to most of the other subjects done in secondary schools, there is need to simplify the content and give the students what they can understand. Several strategies that have been taken that were meant to counter the declining performance. All Science teachers were awarded better salaries through a Presidential decree in 1997 as a way of motivating and retaining them in the teaching service. This privilege remained in force until 2003 when it was lifted. The Government under the Kenya Education Sector Support Programme (KESSP) gives laboratory grants for equipment to ten schools per district in the country. For example, 700 schools received the grant from the government in 2004 alone (Kisangi, 2006). Another major strategy that the Kenya government has put in place to improve science education was the introduction of an in service course for all the science teachers under the 'Strengthening of Mathematics and Science in Secondary Education' (SMASSE) (Kisangi, 2006).

The Science Curriculum

Curriculum can be defined as the sum total of all learning programmes available to the learners (Kamunge, 1988). It is a fact that Science lessons have the highest proportion of specialist words (and concepts) compared to other subjects, making the content difficult to understand (Bennett, 2003). Science education curriculum has been reputed in many countries as not being relevant to the needs and experiences of the learners. The topics that are in science curriculum, especially in Africa, tend to reflect a western orientation. There are situations when scholars look down upon African science even when it has the credence to back it up (Tefera, 2003). Many scholars hold negative attitudes towards scientific activities from particular regions, especially from the developing world. Interestingly, some scholars from these disadvantaged regions have been reported to have ignored the scientific activities from their counterparts from the same regions (Tefera, 2003). In circumstances where the content is exotic, the language being used for instruction is not native; then science in such countries is bound to suffer greatly and its future being bleak unless efforts and strategies are put in place to indigenize both the curriculum content and the mode of instruction. Curriculum overload has also been reported (World Bank, 2007; Vespoor, 2008). For example, in Kenya, the Commission on the Inquiry into the Education System (Koech, 1999) has discovered that the curriculum is heavily loaded and needs to be downsized. In the context of this paper, science refers to discrete subjects (Ratcliffe, 1998). Each of these science subjects, in this case, Biology, Physics and Chemistry, vary in content, scope and relevance to the everyday life experiences of the learners. Kisangi (2006), citing the findings from the Strengthening of

Mathematics and Science in Secondary Education (SMASSE) project, states that the Biology syllabus contains topics that even the teachers find difficult to teach. Similarly, Chemistry is noted to contain topics that are too advanced for learners and have to be deleted from the syllabus (KIE, 1992).

Additionally, the science content taught in schools has been noted to be too academic and difficult for most learners (Vespoor, 2008) and has remained unchanged for many years (Cross, 2003). In some instances, it has been found irrelevant (World Bank, 2007). As a result, there are efforts to revamp the science curriculum by reducing its content and integrating the subjects (Vespoor, 2008). In the context of these circumstances, curriculum designers should work hand in hand with teachers in the selection of content and the choice of teaching methodologies that are relevant (Fensham, 2008). On the same note, the assessment procedures should be changed to enhance higher levels of learning and the achievement of intended outcomes in school science (Fensham, 2008). To be in tandem with the current prevailing conditions in the information age, science curriculum has to be taught through the modern modes such as ICT so that learning can be enhanced and more curiosity and create enthusiasm (World Bank, 2007).

Pedagogy

The role that teachers play in shaping the perception of students as elaborated in the preceding section cannot be overstated. Teaching approaches applied by teachers will necessarily differ according to the prevailing local factors (Howes *et al.*, 2008). Teaching methodologies differ from one individual to another, from one subject to another and from one environment to another. Many other factors also come to play, further complicating the process of establishing the most appropriate teaching methodology. In a nutshell, the classrooms where teaching and learning takes place are 'Complex systems' (Lampert *et al.*, 2008) and cannot be narrowed to particular circumstances. The learning set up is measured according to the prevailing circumstances. The fact remains that the actual outcomes in what students do will largely depend on what happens in classrooms (Taraban *et al.*, 2007).

It is, however, instructive to note that the teaching approaches applied by science teachers in particular to a greater extent would appear to determine the level of success enjoyed by learners in the learning environment. This is because teachers' roles both manipulate and influence classroom activities (Vespoor, 2008). What teachers do in class centres around four underlying beliefs: the transmission of knowledge, efficiency, preparing students to be successful in examinations and maintaining vigour in the curriculum (Roehrig *et al.*, 2007). Roehrig (2007)

identifies three beliefs that teachers hold which determine their approaches while teaching. These beliefs are: how students learn, teacher's role in the classroom and perceived ability of the students.

There are two main teaching approaches that are commonly identified by scholars; the first one is the teacher-centred approach, which gives prominence to the teacher during the teaching-learning process (Taraban *et al.*, 2007). The teacher does the major part of the work and the student is left with limited work. The second one is the student-centred approach, which promotes the student's participation during the learning process and the role of the teacher is to facilitate. If students are to construct meanings in science, they must be engaged regularly by being made to move away from their seats and get involved in activities (Fensham, 1985). Many policy documents advocate the pupil-centred approach, but the reality on the ground is often to the contrary (Bekalo & Wlford, 2000; Fensham, 2008). Roehrig *et al.* (2007) term student-centred method of teaching as something that exists in literature and (not in classrooms) than is expressed in practice.

The findings by Roehrig *et al.* (2007) from their study on factors that influence the implementation of an inquiry based Chemistry curriculum identify three types of teachers in a classroom situation. The first category are the traditional teachers, whose main activity is to present information to the students; then the mechanistic implementers whose main business is to follow the laid down procedures and subject content as prescribed. The third category is the inquiry teachers who discuss broadly with the students and encourage the students to question any findings between themselves and even with the teacher. Under normal circumstances, these different categories of teachers meet students in their classroom while guiding students on their areas of specialization. Each subject requires some attributes depending on context. For science subjects, the most recommended teaching method is 'inquiry' teaching. The majority of classes are hurried in a bid to finish a syllabus which is often said to be wide. As a result of such conditions, it has been found out that students in high school do not get enough opportunities to engage in inquiry based learning (Taraban *et al.*, 2007).

In a study carried out in Kenya by Muturi (2005) to ascertain the type of teacher-pupil classroom interaction patterns in sciences in high and low performing schools, it was discovered that the question and answer method was very popular and was used by the teachers often. It was also noted that most Biology teachers used a teacher-centred approach. This was further supported by the application of lecture method which was rated as the second most commonly used teaching method. Muturi (2005) gives further information on the lapses

of the 'right' pedagogical skills for Science Education. Muturi's investigated the causes of poor performance in Physics in Thika District in Kenya and found out that poor teaching methods were one of the causes of poor performance in Physics. The report did not however go into the details of what these poor teaching methods were and how were they were manifested in class?

Makgato (2007) went deeper into these details in search for factors that lead to poor performance of learners in Mathematics and physical science in secondary schools in Soshanguve, South Africa. The scholar focused on 11th grade. The findings gave, among other factors, poor teaching as the main cause of poor performance in the sciences. This poor teaching manifested itself in many ways: teachers were applying out dated teaching practices; some teachers were too fast in their teaching, while others were reported as not being serious with their work. Further, there were cases of teachers who were out rightly incompetent. Some gave examples of topics they could not tackle, e.g. linear programming. Few organized any practical lessons for the students, claiming that there were no facilities to do this (even in situations that improvising could be effective). As a result, everything remained theoretical, as the teachers, many of them lacking basic content knowledge to deliver the curriculum struggled in overcrowded, under equipped classrooms. Faced with such difficult conditions, students will have no choice but to surrender and seek alternative routes in other subjects. It is quite possible that the findings of Makgato are being replicated in many developing countries with little concern from the relevant government arms. Most policy papers regarding science in many countries are very impressive and advocate child-centred teaching. But the reality in classrooms is to the contrary (Vespoor, 2008).

Conversely, in some other countries, science has been designed to be student – friendly so that the learning process offers the students the opportunity to assert their knowledge. Kisangi (2006) has found out that the Japanese high school teaching and learning has graduated to a level where the students takes the major part of the lesson doing some activity. In a similar fashion, there is need to explore the possibility of adapting Biology learning styles from Japanese high schools in the Kenyan Context. The Japanese science classes, according to Kisangi (2006), are practical oriented. Learners are given series of tasks to accomplish practically during the lessons, the teacher's role is to ascertain the progress and offer assistance when the need arose. Kisangi notes that the classes are full of learning equipment and teachers show commitment on their work. Kisangi further observes that the Japanese teaching mode ideally is transferable to Kenya, but the serious challenge is on how to develop effective teaching.

Though the level of technology is high, compared to the Kenyan context, the issue of equipment does not rank high. This implies that if teachers can willingly accept to adopt methods that may not have been practiced before in a particular context, it can be applied successfully. Teachers therefore take a greater share in determining the success or failure of a particular teaching strategy.

It should be noted that the pupil-centred approach has been effectively applied in many places with a remarkable level of success and learners enjoy their learning experiences. Rennie *et al.* (2001), in their study of science teaching and learning in Australian schools, have found that teachers encourage learners to take ownership of their learning. As a result, many students opt to choose science in post-compulsory years. The use of a student-centred approach gives room to the student to construct meaning on what the teacher would like the student to learn. Most teachers tend to teach using the methods that their teachers used when they were in school, but the constructivist approach demands that teachers have to learn to teach in ways that are different from how they were taught themselves (Erdogan *et al.*, 2008).

Another reason often cited for ineffective transmission of information between students and teachers and eventual poor performance is the language being used for instruction (World Bank, 2007). Research has shown that many teachers use difficult terms and concepts that are often beyond the level of the learners (Bennett, 2003). Bennett (2003) observes that there is need to be careful with the use of conceptual words of science, e.g. power, energy and work because they are used in other contexts to mean different things. In Kenya (like in many African countries), the use of English language, which is a second language to most learners, for instruction can be identified as one of the main causes for consistent low performance among learners (Sifuna & Kaime, 2007). Learning is a dual process between the teacher and the learner.

Effective communication is the means by which this process is enabled. While teaching science, the language, especially terminologies, needs to be used with caution (Bennett, 2003). It has been noted that most teachers use unfamiliar terminology without explaining such concepts and this has been a big source of disadvantage to many learners in school (World Bank, 2007; Fensham, 2008). The language competence of both the teacher and the learners plays a crucial role in the realization of curriculum objectives. Consequently, Brown (2004) observes that if science is taught without paying attention to the language used, it may promote issues of social conflict among the students and will limit their understanding of concepts. In other words, success in the delivery of science content is realized if teachers

present scientific ideas in a way that avoids complex terminologies (Bennett, 2003). There is evidence that where learning is done using the learners' native language, there has been more understanding and quicker scientific growth. In countries where a second language is used for instruction, the challenge is two-fold, not only to the learners, but even the teachers themselves.

Abrahams and Miller (2008) have conducted a study in England to establish whether or not the practical in science teaching really worked. They argue that students found practical work useful and enjoyable compared to other forms of teaching and learning science activities. Ogunleye (1999), in a research in Nigeria, has found that the perception of teachers of their own teaching approaches, proficiency and the level of preparedness, determine to a great extent the success of the teaching process. Ogunleye has also found that most teachers had outdated content. Some teachers identified a number of topics, e.g. in Physics which they found hard to teach (Ogunleye, 1999). These findings bring to fore two important observations: that there is no effective mechanism within the education system to update teachers from time to time. Secondly, it creates an impression that teacher's who have are charged with the responsibility to set straight issues and concepts to learners in subject areas, do not always have the requisite competence to handle the subjects.

Science under the constructivist approach emphasizes the need to engage students in performing practical work. There is evidence that when students are assigned some practical work, they enjoy that task more than any other form of teaching (Abrahams & Miller, 2008). Abrahams *et al.* (2008) assert that practical sessions might not be as useful to the learners as it is usually taken. What goes on during practical contribute very little to their knowledge on what they learn. This is especially so when teachers give students cookbook experiments where all procedures and findings of the experiment are guided by the teacher (or textbook) without any opportunity being given to the student to discover and ask questions as the experiment progresses (Taraban *et al.*, 2007).

LIMITATIONS OF THE STUDY

The study was carried out within a span of two months, which duration was too short considering the level of the expected work taken on. Moreover, all the teachers who filled the questionnaire knew the author who is a deputy principal of a secondary school within the district. Most of the answers given could be partly biased as a result of this and if carried out by a neutral person, could gain access to more information. The sample could be further widened in similar studies to capture a bigger number of schools and respondents in order to improve on

generalization. The research instrument could be triangulated using other research methods like interview and observation in order to improve on validity of the information given.

MATERIALS AND METHODS

The study used an empirical mixed method research design. In this research, both qualitative and quantitative methods were utilized, thus necessitating the use of mixed methods. Baringo Central District is within the North Rift region of the Rift Valley Province and has 47 secondary schools and 120 primary schools (DEO's Office Statistics, 2007). Performance in Science education in the District has been below average. The marked contradiction between the performance in primary and secondary nationally is reflected, especially in national examinations.

The population that was targeted for the research was science students and teachers in secondary schools in the District. There were a total of 9,052 students and teachers in 47 secondary schools in the district. Out of these, a sample of three schools, thirty-six students and nine teachers were sampled for the study. A stratified random sampling technique was selected. This method was used to identify schools according to their categories. The Kenyan secondary schools are classified into three main categories: national schools, which are endowed with facilities and select the best performing students, provincial schools which are moderately equipped and which admit students of average and above abilities. The third category is the district schools; most of these are under-equipped and admit average students. In order to get fair distributions of respondents, using a purposive sampling technique; one school was selected to represent national schools. Because there was no national school within the District, the best performing school was selected using purposive sampling. The selected school was a boys' school. A second school, to represent the provincial category, was a girls' school and the third school to represent district school was also selected using the stratified random sampling technique. Other factors such as their geographical distribution across the three divisions in the District were also considered.

The normal secondary school establishment in Kenya is that there are four levels: Forms 1, 2, 3, and 4. In order to guarantee fair distribution of respondents, three chances were allocated to each level per school and the individual respondents were chosen through random sampling. The selection of teachers was done mainly through a purposive approach, that is, subject teachers majoring on science. It was only science teachers who were allowed to participate. In schools with many science teachers like in the boy's school, random sampling was employed. A total of 45

respondents participated in the research; 36 students, 12 per school, 9 teachers, 3 per school.

The tool that was used to collect data was a questionnaire. A coding scheme was devised which made it easy to compare, collate and contrast responses. Initially, pre-processing was done to iron out cases of unanswered questions, repetitions and any discrepancy that arose during the answering of the questionnaire which could in a way interfere with the process of analysis. Missing data was given its own code (D/A). Each school was given an initial: the boys' school became P, the provincial girls' school became Q and the district mixed school became R. All quantitative data were analysed through a descriptive method, put in frequency tables, converted into percentages and represented in tables and figures. The qualitative data was analysed using an interpretative approach, arranged according to themes, and classified in form of the most common themes in line with the research questions.

RESULTS AND DISCUSSION

Pedagogy

Important factors that Determined Students' Performance

The teacher and textbooks were rated by majority of the students as the most important variable in determining their success in science education. This was followed closely by factors such as good laboratory, group work and parental support, 28, 27 and 26 respectively as in Table 1. Others included personal effort (12.3%) regular tests (10.7%) and symposia (2.7%).

Table 1: Factors that Determined Students' Performance

Factors in performance	Boys' school	Girls' school	Mixed school	TOTAL	%
Teachers	11	10	8	29	15
Textbooks	10	10	9	29	15
Good Laboratory	12	10	6	28	15
Parental support	8	9	9	26	13.9
Group work	11	10	6	27	14.4
Regular tests	7	5	8	20	10.7
Symposia	0	5	0	5	2.7
Personal effort	7	9	7	23	12.3

Common Experiences in the Teaching and Learning of Science in Schools

Lack of exposure to perform practicals was identified as a common practice by 23(29.9%) of the respondents as shown in Table 2. This was followed by lack of time for private study by 17(16.1%), and then teacher's absenteeism, 16(15.2%). Poor teaching and shortage of textbooks were notably experienced in learning situations by the students as represented by 10 and 11 respondents respectively. Discouragement from teachers was the least

experienced challenge among the learners with only 4(3.8%).

Table 2: Common Experiences in the Teaching and Learning of Science in Schools

Experiences in Learning	CHEM	PHY	BIO	TOTAL	%
Lecture	8	9	7	24	22.9
Poor teaching	4	3	3	10	9.5
Discouragement from teachers	1	2	1	4	3.8
Teacher's absenteeism	6	5	5	16	15.2
Shortage of textbooks	3	5	3	11	10.5
Lack of time for private study	6	5	6	17	16.1
Lack of exposure to practicals	7	6	7	23	29.9

Commonly used Teaching Methods: Teacher's Perspective

According to teachers, practical approach was the most utilized method, 5(31.25%). This was followed by Questioning & answer, assignments and revision methods, both being 4(25%). Group work was the least utilized method with only one respondent equivalent to 6.25% of all the respondents.

Instructional Methods Perceived by Students as Appropriate for each Subject

In attempt to establish the most appropriate methods used by teachers in teaching science subjects, the students rated the various methods. According to the results, the students saw practical as the most effective way to learn science, 48(26.2%). This was followed closely by assignment, 47(25.6%), and questioning technique, 45(24.6%). Note taking, 19(10.4%), and lecture methods, 24(13.2%), were the most unpopular methods respectively according to the students.

Level of Understanding the Language used for Instruction

Table 3 shows that 30(83.3%) of the students confessed that the language used by teachers during science lessons was well understood, though some thought that students fairly understood. This is contrary to what Sifuna and Kaime (2007) conclude in their research. The general understanding has been that science has a lot of hard terminology which locks out learners from making progress.

Table 3: Level of Understanding the Language used for Instruction

Level of language used	Boys' school	Girls' school	Mixed school	TOTAL	%
Very well	11	10	9	30	83.4
Neutral	1	0	2	3	8.3
Does not understand	0	2	1	3	8.3
Total	12	12	12	36	100

According to the findings, a majority of the teachers, 4(66.6%), felt that the students understood the language fairly well.

The Science Curriculum

Relevance of Curriculum to day-to-day Life of Students by Individual Subjects

Physics and Biology were rated by the students to be the most relevant to their day-to-day life as they each constituted 31(35.2%) unlike chemistry with 26(29.6%). These results are as shown in Table 4.

Table 4: Relevance of Curriculum

Subjects	Boys' school	Girls' school	Mixed school	TOTAL	%
Physics	11	9	11	31	35.2
Biology	10	9	12	31	35.2
Chemistry	7	8	11	26	29.6

Topics that Students found Difficult to Understand

The following topics were commonly noted by students to be difficult:

- i) Physics - Turning effect of force; Reflection by Curved Surfaces; Electrostatics, Electricity II; Pressure and Moments.
- ii) Chemistry - The Mole Concept; Chemical Families; Structure and Bonding; Electrochemistry; Organic Chemistry and Titration.
- iii) Biology - Gaseous Exchange in Plants; Evolution; Cell and Cell Physiology; Homeostasis and Excretion.

According to teachers, the students found science topics difficult as follows:

- i) Physics - Magnetic Effect of an Electric Current; Floating and Sinking; Waves; Electronics and Farm Power and Machinery.
- ii) Chemistry - The Mole Concept; Organic Chemistry; Electro Chemistry, and Periodic Table.
- iii) Biology - Cell Division; Classification; Evolution and Genetics.

Students concurred with teachers on which topics are perceived as hard by the students especially in chemistry. The *mole concept*, *electro chemistry* and *organic chemistry* ranked at the top. Interestingly, teachers had a discrepancy on the understanding on which topics are taken by students to be hard. In Biology, there was a fair agreement between the students and teachers especially on *evolution* and the *cell*.

Some of the reasons given by students for finding the topics difficult were as follows:

- i) Physics – attitude-related reasons, a lot of calculations, hard formulae, shallow teaching, poor teaching approach and confusing basic concepts.

- ii) Biology - poor teaching, confusing terminologies, wide curriculum, many confusing sub-topics, teacher too strict.
- iii) Chemistry - poor teaching, balancing of equations, calculations especially in the mole concept, lack of exposure to practicals, difficult concepts and terms used by the teachers were received by students.

According to the teachers' students found some topics difficult because of reasons such as:

- i) Poor mathematical background
- ii) Terms used in science too abstract to most learners
- iii) The content of the curriculum is too wide on some topics
- iv) Some practical work is too advanced for the learners for example magnetic effect of an electric current

Biology and Physics were taken by students as subjects relevant to their day-to-day life. Chemistry had more topics that were consistently seen by students to be hard. These included: the mole concept, organic chemistry II, electrochemistry, structure and bonding and titration. Physics had only three: reflection by curved surfaces, electrostatics and electricity II. Biology had three topics perceived by learners as hard: evolution, cell and cell physiology and homeostasis. These topics varied with those given by the teachers except in chemistry, where three topics were similar to those given by students: The mole concept, organic chemistry and electrochemistry. Teachers added the 'periodic table' topic to their list. In Biology, one topic was similar: evolution; teachers added 'genetics' to the list.

The fact that there were some clear topics that teachers and students agreed that they were difficult means that those topics have not been getting enough attention from the teachers due to the perception. It may also infer that these topics are above the level of the learners. If these topics have been in the syllabus for quite some time, it means the communication between the teachers, as the curriculum implementers, and the curriculum developer is not effective. Evaluation of the curriculum for most countries is done through the performance in examinations. Considering the fact that the teacher and the students agreed that some topics are difficult, yet these topics will still be examined, then the indicator provided in examinations may not be conclusive. The reasons given for this situation vary from one subject to another and no single common factor was identified. This scenario denotes that the curriculum in Chemistry should be looked at to reduce the content that is not to the level of the learners.

CONCLUSION AND RECOMMENDATIONS

From the study findings and the discussion in this paper on teaching and learning practices, learner-centred approach is applied by most science teachers. It is worth noting that more often than not, this form of teaching is found more in literature than in classroom situations. This type of classroom instruction has some positive effect on the attitude of the learners towards that subject. The science curriculum has been continuously considered for review and developed so that it is able to recognize the abilities and the conceptual world view of the students.

The curriculum should be designed based on the needs of learners. The process of implementation of the curriculum should be harmonized to provide for consistency and validity of the teaching and learning process. In addition, teachers should encourage and recognize more students' views during science lessons. Science requires a practical approach which allows students the opportunity to regularly perform experiments. Teacher training colleges should also emphasize the pedagogical skills that will be applicable in the classroom situation. The process and not content should be emphasized in every effort and delineate between appropriate academia and teaching preparation of teachers.

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