

INSTRUCTIONAL PRACTICES IN BIOLOGY AND THEIR INFLUENCE ON STUDENT PERFORMANCE IN SECONDARY SCHOOLS IN KENYA

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ABSTRACT

Performance in Biology in the Kenya Certificate of Secondary Examinations (KCSE) has been below expectations, and has continued to cause concern to educators and the general public. In the past five years, performance of biology nationally has been below average. This performance has been attributed to many factors among which are the uses of predominantly teacher-centered approaches in teaching. Biology was recorded among the worst performed subjects nationally in the KCSE 2008. This prompted this study. The purpose of this study was to investigate the instructional practices that biology teachers employ when teaching. The objective of the study was to establish the instructional methods used by the teachers of biology. In order to achieve the objective of the study, research focused on the instructional methods in use in secondary schools. A descriptive survey design was used in the study. Stratified, simple random, and purposive sampling techniques were used in the sampling. District Quality Assurance and Standards Officers, school principals, biology teachers and form three students participated in the study. Three types of instruments were used to collect data: Classroom Event Observation Schedule, interview schedules, and questionnaires. The data obtained was analyzed using descriptive statistics. The findings showed that teacher-centered methods were dominant in the teaching learning process. Biology teachers had the necessary qualifications, training and experience. From the findings, there was a clear indication that instructional methods employed in the teaching affect performance in biology. Teachers used teacher-centered more than learner-centered approaches in teaching denying learners the opportunity for active involvement in the learning process and this had led to low understanding of biological concepts. Active participation of students in the learning process should be enhanced. The available resources though inadequate should be fully utilized to enhance practical work. Teachers and learners should be motivated to encourage a more positive attitude. There should be continuous and effective monitoring of the teaching practices.

INTRODUCTION

The secondary school curriculum in Kenya lays emphasis on science, technical and practical education. Biology is one of the science subjects which are offered in the secondary school curriculum in Kenya. The study of Biology aims at equipping the learner with knowledge, skills and attitudes necessary for controlling and preserving the environment. The subject enables the learners to enter into careers such as health, agriculture, environment and education. Biology is the precursor for biotechnology which is a tool for industrial and technological development. According to the secondary education syllabus volume two, 2006, the objectives of Biology are as follows: communication of biological information in a precise, clear and logical manner; application of the knowledge gained to improve and maintain the health of the individual and the community; observation and identification of features of familiar and unfamiliar organisms, recording of observations and making deductions about the functions of parts of organisms; developing positive attitudes and interests towards Biology and the relevant practical skills; demonstrating resourcefulness, relevant technical skills and scientific thinking necessary for economic development; and acquisition of a firm foundation of relevant knowledge, skills and attitudes for further education and for training in related scientific fields among other objectives.

Students learn Biology mainly through the experiences their teachers provide. The teaching they encounter in school shapes their understanding, their ability to use it to solve problems and their confidence in disposition towards Biology. The improvement of Biology learning for all students requires effective teaching in all classrooms. As students learn by connecting new ideas to prior knowledge, it is essential that teachers establish what students already know. Thus teachers should know how to ask questions and plan lessons that reveal students' prior knowledge. They can then design experiences and lessons that respond to and build on that knowledge. (Temba, 2009)

“Science is an active process, and learning science is something that learners must do and not something that is done for them. Therefore Biology must be “learned actively”. Teaching should be more practical than theoretical. To achieve this, the learners must be provided with appropriate “hands on” activities as well as “minds on” experiences (Trowbridge, et al, 2004). Mukachi (2005) in his study on the use of the science process skill of investigating supports Mestre, (1990) who notes that a scientist raises questions in his area of interest, decides on how to investigate the question and the apparatus or equipment to be used in the investigations, identifies variables to be investigated and data analysis procedures and analyses data in the context of existing theories. There are many teaching approaches that can be used to achieve these. These are approaches that actively involve the learners in the learning process resulting into better learning. They include the inquiry approach, problem-solving approach and the process-based approach. In all these approaches, several methods and strategies are employed. The methods include laboratory work, project work, question-answer methods, demonstration, class or small group discussions and informal lectures (Shiundu&Omulando, 1992).

The Kenya Institute of Education (KIE) advises Biology teachers to keenly supervise and guide individual learners and groups during Biology instruction, especially during practical sessions, so as to develop their scientific skills (K.I.E 2006). In spite of the elaborate guidelines for teachers on how to implement the Biology curriculum, performance in this subject has continued to be below average both in theory and practical papers.

2.7 Performance in Biology Examinations

The knowledge and skills in Biology traverse all spheres of life and helps in solving societal problems particularly in health and environment. This is because it prepares learners for studies in applied disciplines such as agriculture, medicine, biotechnology and the agro-chemical and food industries among other areas of application (Mukachi, 2005). Although the subject scores comparatively higher among sciences in national examinations, the mean score has been below average in the national examinations from 2004 to 2007 as shown in Table 1.1.

There was a marked drop in 2005 with a negative deviation of 7.48 in the mean score from 49.07 in 2004 to 41.59 in 2005. From the year 2006, the results reveal an upward trend in the mean score, but it is noted that from the year 2006, the Biology examination was offered under the revised KCSE curriculum where three examination papers were offered instead of the two in the preceding years. The previous curriculum offered two papers with a maximum score of 160, while the revised curriculum of three papers has a maximum score of 200. The result shows a mean score of 54.89 in 2006 and 83.90 in 2007 respectively. Although the results show some improvement, it has remained below average in all the years. The KCSE results of 2008 revealed a drop from the previous 83.90 causing an alarm to educators and the general public.

Attempts have been made to counter the problems of poor performance in sciences in schools. Interventions such as SMASSE , in-service training through workshops and seminars organized and run by the Ministry of Education are all aimed at disseminating and implementing the new innovations and inventions in schools, yet little improvement has been noted.

According to the KNEC reports (2005, 2007), it was noted that questions testing experimental design were poorly performed; indicating that practical approach to teaching was not practiced. The teachers are advised to teach using practical approach where learners should be exposed to more practical activities and trained more in accounting for the results observed. Teachers are also advised to take students to research centers and museums where difficult concepts such as “genetic engineering”, “hybrid vigor” and evolution can be learned. The trend in performance indicates some problem which needs to be addressed. Some researches done in the field of Biology in the country have dealt with the aspect of theory delivery and practical work. Wekesa (2003) and Kiboss (1997; 1998) concentrated on the issue of innovations in content delivery in terms of current technology and cognitive theories such as Computer Based Instruction, while Mukachi (2005) investigated science process skills in laboratory work, but did not assess the actual practice by teachers. Hence there is need to investigate the actual practice by teachers to establish what goes on in classrooms.

The Knowledge Gap

The problems associated with biology subject just like other science subjects include attitude and low understanding of concepts which translate into poor performance at national examinations. Ogunniyi (1996), as cited by Wekesa (2010) notes that poor performance in science subjects was due to many problems, ranging from low understanding of concepts to language and science versus cultural conflicts. Poor funding leads to insufficient provision of resources required for instruction. Inadequate qualified teachers, negative attitudes and poor motivation of both teachers and students are also contributing factors to poor performance in science, Das (cited in Wekesa, 2010). According to the KNEC reports (2005, 2007), it was noted that questions testing

experimental design were poorly performed. The trend in performance indicates some problem which needs to be addressed. Some researches done in the field of Biology in the country have dealt with the aspect of theory delivery and practical work. Wekesa (2003) and Kiboss (1997; 1998) concentrated on the issue of innovations in content delivery in terms of current technology and cognitive theories such as Computer Based Instruction, while Mukachi (2005) investigated science process skills in laboratory work. The instructional practices have a strong impact on the performance of both the theory and practical examinations. No systematic study has been done to focus on the practices of Biology teaching through direct observation of actual teaching in the classrooms. This study was aimed at filling this gap. Through direct observation, the actual practice by teachers, methods of content delivery were established.

THE PROBLEM

In Kenya, performance in Biology continues to be below expectations despite numerous research efforts to find a solution. Attempts have been made to counter the problem of poor performance in sciences in schools but no significant improvement has been recorded. For instance, interventions such as SMASSE project, a joint venture by the Government of Kenya (GoK) and Japan International Co-operation Agency (JICA), In-Service Education and Training (INSET) through seminars and workshops organized by the Ministry of Education are aimed at improving the performance. Unfortunately, statistics show that performance has continued to be poor. For example, Biology was recorded among the badly performed subjects in the 2008 KCSE. “Students did poorly in 15 of the 23 subjects offered in examinations. They performed particularly poorly in English, Kiswahili and Biology,” (The Minister of Education in the Wednesday Daily Nation, March 4 2009 p.1).The chronic poor performance necessitated a study to determine some causes of the poor performance.

THE PURPOSE OF THIS STUDY

The purpose of the study was to investigate the instructional practices which Biology teachers use and how they influence performance in Kenya.

OBJECTIVE OF THE STUDY

The objective of the study was to find out the instructional methods that Biology teachers used in the in the teaching/learning process.

RESEARCH DESIGN AND METHODOLOGY

The descriptive survey design was used in the study. This design enabled the researcher to collect the current information about the instructional methods used by the teachers of Biology. It enabled the researcher to explore and describe the prevailing situation at the time of study.

THE SAMPLE

A total of twelve schools were selected from Bungoma West District using stratified random sampling to ensure equal representation of provincial and district schools. One boys' school, three girls' schools, and eight mixed secondary schools were selected for the study as shown in the table 1 below.

Table 1: Categories of Schools by Classes and Gender

Category of school	Boys'	Girls'	Mixed	Total
Provincial	1	1	1	3
District	-	2	7	9
Total	1	3	8	12

Table 1, shows that three provincial schools were sampled for the study as follows. One boy's, one girl's, and one mixed school. Nine district schools were sampled of which two were girls' while seven were mixed schools.

3.5.2 Sample size

Purposive and simple random sampling techniques were used to get a sample of two Quality Assurance and Standards Officers, twelve school principals, eighteen teachers, and one hundred and five students as shown in the table 2.

Table 2: Sample Size

Respondents	Population (N)	Sample population(n)%	Type of sampling	
Students	675	105	15	Random
Teachers	60	18	30	Random
School Principals	12	12	100	Purposive
DQASOs	2	2	100	Purposive

The form three students were selected for the study because they had covered most of the Biology syllabus (more than half of the secondary Biology syllabus) and this makes them suitable for the study while the teachers were directly involved in the instructional process. The head teachers participated in the research because they are charged with the responsibility of supervising the implementation of the curriculum and facilitate the teaching /learning process by ensuring adequate provision of resources. The DQASO are responsible for ensuring quality and standards.

RESEARCH INSTRUMENTS AND DATA COLLECTION

Five instruments were used to collect data in this study; Classroom Event Observation Schedule (CEOS), DQASO's and Biology Teachers' Interview Schedules, Principal's Questionnaire (PQ), Teachers' Questionnaire (TQ), and Students' Questionnaire (SQ). The CEOS was a guide that contained a table with sections B, C and D. Section B consisted of the teaching methods, section C consisted of the resources while section D consisted of concept definition and explanation and use of examples against which the researcher was to evaluate the lesson by indicating the frequency of usage.

The questionnaires for students and teachers contained both open and closed ended items. The items were mainly testing on attitudes of Biology teachers and students towards the Biology subject. They also contained a table showing various teaching methods against which the respondents were to indicate the frequency of usage. The teachers' questionnaires had four sections. Section A, B, C, and D. Section A, had items that would help establish the usage of various teaching methods by the Biology teachers, while section B was to establish the use of resources. Section C sought information on the teachers' qualification, while section D sought information on the teacher's attitude.

The questionnaire for students sought to establish usage of various methods of teaching. This was on the assumption that the findings would help confirm the teachers' responses over the same aspects. Learners, being the focus of all instructional activities, are able to give their views, which are paramount in evaluating if the recommended teaching approaches are followed. The students indicated by ticking in the appropriate box on the frequency of usage of the various methods and resources.

The questionnaire for principals and Biology teachers' and Interview schedules for DQASOs contained open and closed items that were mainly inquiring about availability and use of resources, competence and attitude of Biology teachers. The DQASO's interview schedule also sought to establish the number of schools under his/her jurisdiction, state of science laboratories, use of available resources, in-service training of teachers through seminars, level of attendance of seminars, attitude of teachers towards the organized seminars, the impact of the seminars and performance of Biology in KCSE in relation to other science subjects.

RESULTS AND DISCUSSION

Instructional Methods

The objective of the study was to find out the instructional methods that Biology teachers used in their classrooms. All respondents were to answer questions asked under this objective. In the three instruments, a table was provided with various instructional methods. The methods included the inquiry, questioning, discussion, demonstration, lecture, field trip, problem solving, class practical, simulation and games, and computer based instruction. The Biology teachers and students were to indicate by ticking in the appropriate boxes the frequency of use of the instructional methods. These were then presented in the form of frequency tables 3, 4, and 5.

Table 3: Frequency of use of instructional methods by the Biology teachers

Method	Never	Less often	Sometimes	Used	Always used
Inquiry/discovery	0(0.0%)	1(5.9%)	4(23.5%)	7(41.2%)	5(29.4%)
Questioning	0(0.0%)	0(0.0%)	0(0.00%)	5(29.4%)	12(70.6%)
Discussion	0(0.0%)	0(0.0%)	5(29.4%)	3(17.6%)	9(52.9%)
Demonstration	0(0.0%)	1(5.9%)	6(35.3%)	8(47.1%)	2(11.8%)
Lecture	0(0.0%)	8(47.1%)	2(11.8%)	4(23.5%)	3(17.6%)
Field trip	2(1.8%)	9(52.9%)	4(23.5%)	2(11.8%)	0(0.00%)
Problem solving	0(0.0%)	1(5.9%)	5(29.4%)	6(35.3%)	5(29.4%)
Class practical	0(0.0%)	0(0.0%)	3(17.6%)	11(64.7%)	3(17.6%)
Simulation & Games	3(17.6%)	6(35.3%)	4(23.5%)	3(17.6%)	1(5.9%)
Computer based	14(82.4%)	1(5.9%)	1(5.9%)	1(5.9%)	0(0.00%)

The findings from the teachers presented in table 3, show that methods such as the inquiry approach, questioning, discussion, demonstration, lecture, problem solving, and class practical are used most of the times while the field trip, simulation and computer based instruction are rarely used. From the KNEC reports (2005,2007), teachers are advised to take students to research centers and museums where difficult concepts such as “genetic engineering”, “hybrid vigor” and evolution can be learned. Lack of field trips to such educational centers, deny learners exposure and an opportunity to learn through such avenues. The concepts targeted cannot be understood and internalized by learners translating into poor performance of questions testing such concepts.

To further determine the instructional methods in use, more information was sought from teachers and learners under section D. In the Biology teachers’ questionnaire, item 7(a) sought information on provision of lesson objectives to the learners prior to the lesson. The results are presented in figure 1.

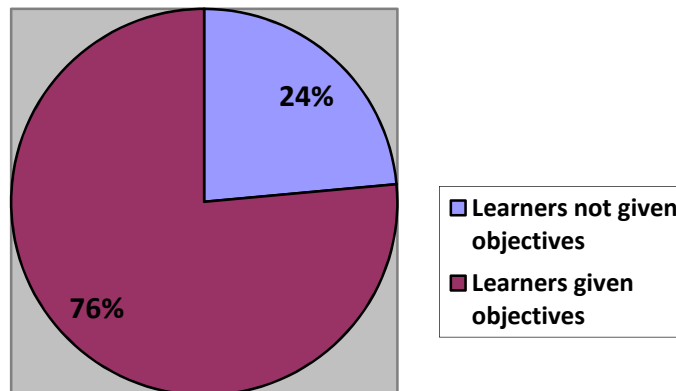


Figure 1: Provision of objectives

Results in figure 1, on provision of lesson objectives show that 13(76.5%) of the teachers gave learners objectives prior to the lesson, while 4(23.5%) never gave objectives to the students. A large percentage of the teachers give objectives to learners prior to the lesson enabling them to be involved in research activities translating into better understanding when subject matter is presented. Item 7(b) sought to find out if teachers prepared practical sessions of which all the 17 (100%) teachers did. Item 7(c) was meant to find out if the teachers involved the learners in practical preparations. Results are shown in figure 2.

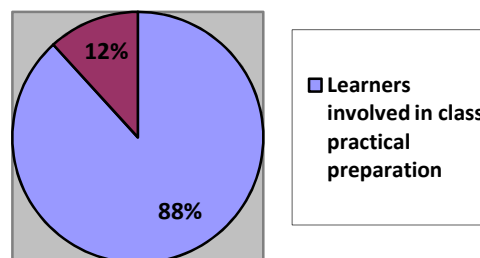


Figure 2: Involvement of learners in practical preparation

From the findings presented in figure 2, 2(11.8%) of the teachers did not involve students in practical preparations while 15(88.2%) of the teachers involved the students in practical preparation. A large percentage of the teachers involved learners in the preparation of class practicals. This is a positive attribute as learning is most effective when the learner is actively involved in the learning situation (Shiundu & Omulando, 1992).

Item 7(d) sought information on the ways in which learners were involved in practical activities. The following are ways in which teachers involved learners in practical preparations:

- i. Collection of materials/specimens.
- ii. Suggestion of time for outdoor experiments.
- iii. Preparation of flow charts.
- iv. Hands on activities during practical sessions.
- v. Reading and researching about the practical in advance
- vi. Arranging apparatus and specimens
- vii. Labeling specimens.
- ix. Discarding waste and clearing up after practical.
- x. Asking and answering questions.
- xi. Preservation of specimen.
- xii. Filling in of questionnaires during field trips
- xiii. Timing

In the students' questionnaire, information on instructional methods in use was covered under section B. The results are presented in table 4 and figure 3

Table 4: Frequency of usage of instructional methods by students

Method	Always used	Used	Sometimes	Less often	Never	Total
Inquiry	32(30.5%)	24(22.9%)	31(29.5%)	5(4.8%)	13(12.4%)	105(100%)
Questioning	77(73.3%)	16(15.2%)	11(10.5%)	1(1.0%)	0(0.0%)	105(100%)
Class discussion	42(40.0%)	30(28.6%)	20(19.0%)	7(6.7%)	6(5.7%)	105(100%)
Group discussion	26(24.8%)	26(24.8%)	31(29.5%)	8(7.6%)	14(13.3%)	105(100%)
Demonstration	41(39.0%)	30(28.6%)	24(22.9%)	5(4.8%)	5(4.8%)	105(100%)
Lecture	35(33.0%)	16(15.2%)	23(21.9%)	12(11.8%)	19(18.1%)	105(100%)
Field trip	14(13.3%)	10(9.5%)	37(35.2%)	27(25.7%)	17(16.2%)	105(100%)
Problem solving	49(46.7%)	24(22.9%)	22(21.0%)	7(6.7%)	3(2.9%)	105(100%)
Class practical	37(35.2%)	24(22.9%)	28(26.7%)	8(7.6%)	8(7.6%)	105(100%)
Simulation & games	75(71.4%)	15(14.3%)	5(4.8%)	5(4.8%)	5(4.8%)	105(100%)

From the results in table 4, a variety of methods which range from teacher-centered to learner-centered are used during instruction. According to the students, questioning, simulation and games are most frequently used, followed by problem solving, class discussion, demonstration, class practical, lecture, inquiry, and group discussion in that order. The field trip is rarely used, and in some schools, it has never been used. These findings agree with the KNEC reports of 2005, 2007 which indicated that most students failed in questions testing experimental design revealing that practical approach to teaching was not practiced. Lack of field trips meant that learners are not taken to research stations and museums as recommended in the syllabus and in the reports. This definitely denies the learners the opportunity to learn some abstract content such as found in the topics of genetics and evolution. This translates into poor performance of questions examining concepts in these topics.

In the students' questionnaire, information on provision of lesson objectives to learners was sought under item three. Results are shown in the figure 3.

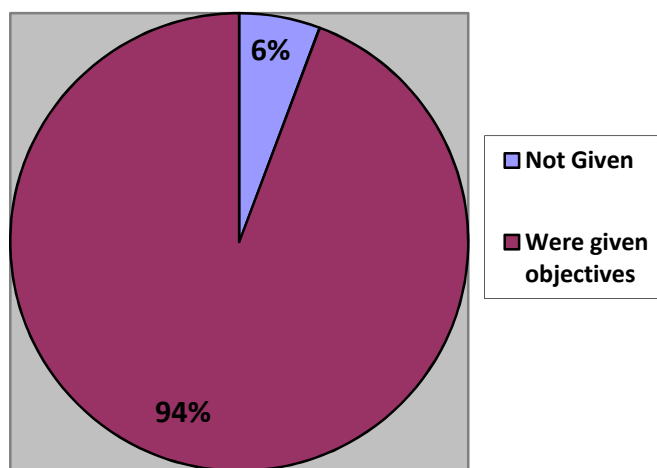


Figure 4.7: Provision of lesson objectives to learners prior to the lesson

The results indicated that out of the 105 students who participated in the study, 99(94.3%) were usually given objectives while 6(5.7%) were never given objectives. A large percentage of students were given objectives. This is important because it enables learners to read ahead of the teachers enhancing learning during the lesson.

In the classroom observation schedule, a table with various methods was provided against which the researcher indicated the frequency of usage of the methods. The results are shown in table 5

Table 5: Frequency of usage of instructional methods, as observed in the classrooms

Method	Not at all	Fairly Adequately	Adequately	Cumulative
Inquiry approach	2(28.6%)	4(57.1%)	1(14.3%)	7(100%)
Question & Answer	0(0.00%)	3(42.9%)	4(57.1%)	7(100%)
Class Discussion	2(28.6%)	4(57.1%)	1(14.3%)	7(100%)
Group discussion	4(57.1%)	2(28.6%)	1(14.3%)	7(100%)
Demonstration	4(57.1%)	1(14.3%)	2(28.6%)	7(100%)
Lecture	1(14.3%)	1(14.3%)	5(71.4%)	7(100%)
Problem solving	3(42.9%)	2(28.6%)	2(28.6%)	7(100%)
Class practical	3(42.9%)	1(14.3%)	3(42.9%)	7(100%)
Simulation & games	7(100%)	0(0.00%)	0(0.00%)	7(100%)
Computer based instruction	7(100%)	0(0.00%)	0(0.00%)	7(100%)

Table 5 shows the summary of frequency of use/percentage of various methods of teaching observed in form three classes of seven schools. From the observation of the form three classes, it was noted that there was very little variation in the methods in use. The lecture method dominated the teaching with a few concept definitions and explanations. The information collected shows that the frequency of use of transmission methods outweighs the use of heuristic methods. The blackboard use dominates the subject matter presentation making the teachers' work tedious. Teachers rarely use charts, diagrams which could conventionally be drawn on charts are drawn on the blackboard hence consuming a lot of time and disabling some slow students from completing their work during the lessons. This in turn translates into the development of negative attitudes as learners are unable to accomplish the set goals.

Information on instructional methods in use in the principals' questionnaire was captured under section B. The principal had to indicate the number of Biology teachers on the staff and the average workload for the Biology teacher. The workload could be used as a pointer into what instructional methods could be in use. Results are presented in table 6.

Table 6: Number of Biology Teachers per School

No. of teachers	Frequency	Percentage
0	1	9.1%
1	5	45.5%
2	3	27.3%
4	1	9.1%
6	1	9.1%
Total	11	100%

The results in table 6 show that one school had no TSC employed Biology teacher, five schools had one each, three schools had two each, one had four while one, had six teachers of Biology.

Item 3b on the principals' questionnaire sought to find out the average workload for teachers and the results are shown in table 7

Table 7: The average work load for teachers

Average workload	Frequency	Percentage
32 and above	3	27.3%
Between 27-31	5	45.5%
Between 22-36	2	18.2%
Between 17-21	1	9.1%
Total	11	100%

The results presented in table 4.11 shows that the workload for teachers varies. In three schools teachers had 32 lessons and above. In five schools, between, 27 and 31, in two schools between 22 and 26. It was only in one school where the workload was between 17 and 21. From these findings, it was revealed that teachers had a heavy workload making it almost impossible to prepare for practical lessons and paving way for transmission methods of teaching which arise with heavy workloads as teachers cannot prepare adequately for lessons.

The principal was also supposed to indicate if at all learners had time to work in groups, and as to whether the Biology teachers involved learners in out of class activities. Item four sought information on group work by students. The results are presented in figure 4.8.

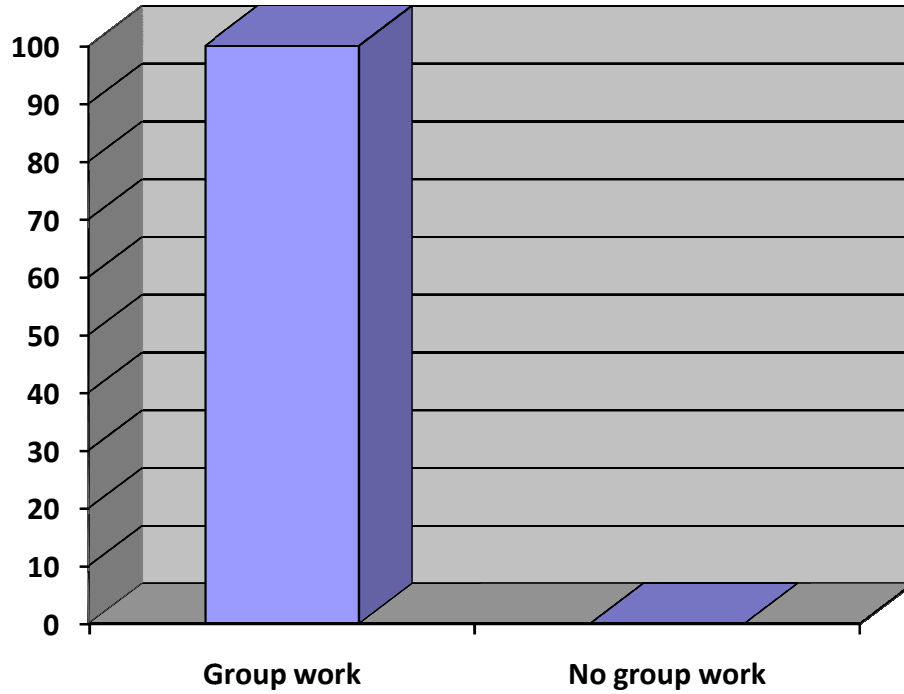


Figure 4: Group work by students

From the results presented in figure 4, all the principals reported that the students were allowed time to discuss in groups.

Item five sought information on learner involvement in out of class activities. The results are presented in figure 5.

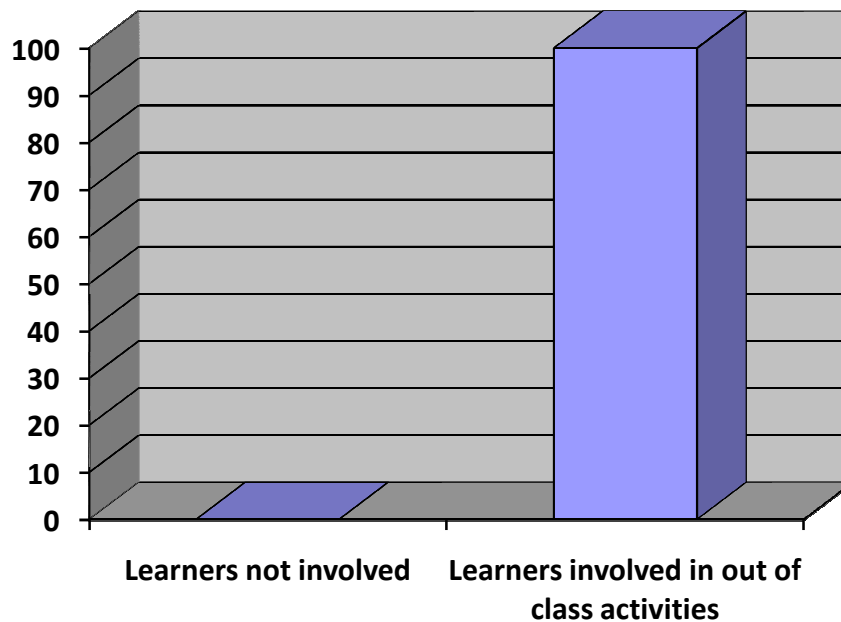


Figure 5: Learner involvement in out of class activities

From the results presented in figure 5 above, all principals reported that teachers involved learners in out of class activities which included:

- i. Science congress and contests
- ii. Symposia
- iii. Biology cultural days
- iv. Fieldwork

The findings from teachers' and students' questionnaire, teachers' interview and classroom observation reveal that most Biology teachers use the theoretical approach to teaching. The instruction is more teacher-centered than learner centered. This agrees with the baseline survey conducted in Kenya Secondary Schools in 1998 and the report of the SMASSE Curriculum Review Committee (SCRC) of 2001, which revealed the use of predominantly teacher-centered approaches in teaching. Learners are not actively involved in the learning process as their participation is mainly through note taking in addition to answering few questions that the teachers pose during the lessons. From the classroom observation and teachers' interview, the results show that teacher centered approaches dominate the instructional process and these include demonstration, direct instruction, lecture and lecture discussions. Little group discussion was observed. Teachers attribute the usage of the teacher-centered approaches to a number of factors which range from large class sizes, heavy workloads, to inadequate facilities and materials.

Learner-centered approaches which involve instruction where the teacher facilitates the learners to construct their own understanding is low in most of the sampled schools. Such methods include class and group discussions, discovery learning, problem-based learning, simulation and games, field trips, class practical, and questioning. The methods promote active participation of the learners in the learning process. For learner centered approaches to be effective, there is need for resources use. This is hampered by inadequacy of resources which seems to result from underfunding as revealed by the teachers' interview. This agrees with the findings of Mukachi (2005) who established that inadequate resources were due to underfunding. Inadequate resources affect the practice of science laboratory work whereby a number of schools lack science laboratories; and instead have science rooms with inadequate materials and equipment. Where science laboratories are available, most are poorly equipped making it difficult for learners to involve in Biology practically.

Suggestions for improvement

Other than the main objective of the study, the researcher also sought information from the respondents on how best to improve the performance of Biology in national examinations. Such information was collected from the Biology teachers, the school principals, and the DQASOs. This came as the last question in the data collection instruments of the three groups of respondents. The following suggestions were given:

The DQASO from the two districts suggested that teachers should implement the recommendations by KIE and KNEC reports. In addition, they suggested that practical approach to teaching should be emphasized and teaching should be more learner-centered where instructional methods such as group discussion, project work, and inquiry approach should be enhanced. Learners should also be encouraged to participate actively in the learning process. They also proposed that the governments should increase funding of education and increase the

tuition fund to enable purchase of more instructional materials to enhance practical lessons. The BOG/PTA/principals should address issues on equipping the science laboratories. There is also the need to solicit funds from well-wishers, NGOs/CBOs in order to improve the infrastructure in schools and equip science laboratories. This will enable provision of adequate teaching/ learning resources. The DQASO also proposed the need for curriculum supervision by heads of subjects to ensure correct practices. They also proposed the enhancement of friendly teacher-learner relationships and the motivation of students by rewarding those who do well.

The school principals proposed the need for the government to employ more teachers who should be well trained. They should also be exposed to regular in-service training through which new innovations such as ICT should be addressed to enable its integration in the teaching and learning of Biology. Teacher trainees at college levels (Diploma/Degree) should be introduced to SMASSE strategies of handling science subjects. They also proposed the need to review the syllabus with an aim of reducing the content to enable proper coverage.

Biology teachers proposed the need for the specification of topics for papers 1, 2 & 3 as a way of improving performance in the subject. They also suggested the need for publishers to provide more photographs and photomicrographs in the text books to enable learners familiarize and acquire the skill of interpreting them.

Conclusions

On the basis of the findings, the following are the conclusions arising from the study.

The instructional methods in use vary from teacher –centered to learner centered. The results show that teacher-centered methods dominate the instructional process. Majority of the teachers predominantly make use of the lecture method and demonstration. Instructional methods employed in the teaching of biology, affects performance in the subject. Teacher-centered approaches do not promote active participation of learners in the learning process translating into low understanding of biological concepts that lead to low performance in national examinations.

Biology teachers have the necessary qualifications, training and experience to make the teaching of the subject effective. The teachers are also exposed to in-service training courses that improve their teaching and update them on any new developments. This is through seminars, workshops and SMASSE INSETs. The qualification, experience, and capacity building through seminars, workshops, and SMASSE INSETs have not had a big impact on performance because of other factors which include heavy workloads, overcrowded classes, inadequate resources, and lack of motivation.

5.5 Recommendations

This study recommends the following measures to be taken.

- i. There is need to employ an adequate number of qualified Biology teachers and laboratory technicians to ease the work of laboratory preparation and heavy workloads on teachers and enhance "hands on" activities which involve learners enabling multi-sensory learning. There is need for Biology teachers to vary the teaching methodologies to enable concretization of the concepts taught, these can be through continuous in-service training for practicing teachers and participation in workshops and seminars to update on new innovations in science education. Such forums enable participants to share experiences with colleagues. The teachers should also be trained in setting, answering and marking of examinations.
- ii. There is need to intensify curriculum monitoring i.e. there should be continuous monitoring of school practices by the quality and standards department of the Ministry of Education to ensure that the recommended syllabus guidelines are implemented and anticipated objectives achieved in schools. Internal quality assessment should also be intensified by Directors of Studies, Heads of Departments, and Heads of subjects, to enhance the correct practices as recommended by the K.I.E.
- iii. Schools should source for funds from the Ministry of Education, and other funding organizations to enable putting up of laboratories and purchase of equipments and instructional materials to enhance practical work by learners. Science departments should be allocated their own funds to facilitate purchase of instructional resources for science subjects. This is because some schools lack laboratories and laboratory equipment despite the government's effort to provide funds to the schools towards their provision. All schools should have at least three laboratories to enable practical approach to learners in all science subjects.

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