Some Determinants of Students Performance in Biology in Kcse: A Case of Central Division of Machakos District

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Abstract: This article investigates some determinants of student's performance in Biology in Kenya Certificate of Secondary Education (KCSE) in schools in Central division of Machakos district. The study was conducted in twelve secondary schools in the division in the categories of national, county and district. Related literature on student's performance was reviewed from textbooks, thesis, government reports, and journals. A conceptual framework showing the relationship between the variables under investigation was developed. Data was collected from Form four Biology students, Biology teachers, heads of Science department and heads of secondary schools in the division through the use of a questionnaire and interviews. Pilot study in two secondary schools was conducted. The design of the study was descriptive survey and stratified sampling was used to select participants depending on the category of the school. Data analysis was done using both descriptive and inferential statistics using SPSS program. Data analysis revealed that the students' attitude towards Biology was generally neutral and this accounts for the dismal performance in the discipline. The research revealed that student's poor performance in Biology is caused by a number of inter-related factors and calls for more interaction and discussions among students. The study revealed that discussion methods and practical sessions were the major ingredients of good performance in Biology. The study recommends that the Ministry of Education should employ more Biology teachers in order to lessen the teaching workloads. The Kenyan government should intensify its efforts to train and retrain Biology teachers through conducting induction courses, seminars and refresher courses on teachers of Biology.

1. Introduction:

Globally, Science is recognized widely as being of great importance internationally both for economic well being of nations and because of the need for scientifically literate citizenry (Fraser & Walberg, 1995). According to Njuguna (2003) the major contributors to poor performance in Science subject include early childhood environment, family expectations, classroom management and instructional practices.

In Africa, the situation is even worse. Odanga (1995) observed that in many countries in Sub-Saharan Africa, the participation of girls in Science subjects compared to that of

boys is low. According to the Ministry of Education; Kenya (2005), performance in Biology at KCSE has been poor (MOE, 2005) despite its key role in industrialization and other sectors of the economy (Mwirigi, 2011). The teaching approach, methodology and how the professional skills and practices of the teacher displayed may be dependent on the level of science anxiety the Biology teacher has. A teacher who suffers from career dissatisfaction is likely to contribute negatively in terms of performance of the learners in Biology; this is because the teacher will have low self-efficacy and high levels of anxiety. Banu (1985) on the other hand examined attitude towards science held in secondary school students in Nigeria. Their attitude towards science and variables thought to affect the development of positive attitude towards science subjects were investigated. There was an indication that 69% of the students preferred science courses to other subjects. Quite a high percentage (70%) of the student also indicated that they could like to join science-related subjects. The result also showed that male students in general held a more positive attitude towards science as compared to the females. In another investigation Talton (1984) addressed the relationship of classroom environment and attitude towards science and achievement in science among the tenth grade Biology students. Subjects comprised of 150 students enrolled in 70 Biology classes. An attitude instrument was administered to obtain measure of student's attitude towards science. The teacher reported semester grade were used to provide measures of student's achievement. The findings of this study showed a weak positive relationship between attitude towards science and achievement in science. Further the research noted that the large number of interactions in the classrooms such as those occurring among students, teachers, peers and curriculum influenced both attitude and achievement of students in sciences.

A teacher's role in the life of a student is always indispensable; hence all teachers are expected to be highly trained so that they can handle students competently in various issues which arise in connection with learning. In relation to the teaching and learning of Biology, attitudes begin to develop on the first encounter between the teacher and the leaner and once formed they play a key role in determining students learning and performance in Biology. According to the same author, the teaching approach, methodology and how the professional skills and practise of the teacher may be dependent on the level of Science anxiety the Biology teacher has.

Mwirigi (2011) in his study says, a teacher who suffers from career dissatisfaction is likely to contribute negatively in terms of the learners in Biology. This is because the teacher has a low self-efficacy and high levels of anxiety. He concluded that this kind of a teacher would develop negative attitudes towards the students and in her/his interaction with the students would be negative and this may contribute to a negative attitude of the students towards Biology with the likelihood of the students developing high level of anxiety towards the subject.

Research results (Abijo 1981; Ivowi1997; Ajaja 2005) have shown that science teachers continue to teach science using the lecture method despite the recommended guided discovery/inquiry methods and the acceptance of these methods by teachers at organized training and orientation courses (Mochire 2010). The inability of science teachers to apply guided discovery/inquiry approaches in their teaching is hinged on some teething problems which include; lack of laboratories equipped with facilities in schools; large class sizes of science students with very few teachers and competency problems arising from the training of science teachers (Sifuna and Kaime 2007). This tends to suggest that poor science learning by students is traced to the teachers' fault-in the area of competences.

 Daily observation of science teachers in the classrooms indicate that most of the teaching skills science teachers acquired before certification are not put into practice. The deficiencies in science teaching range from; non coverage of contents in schemes of work, non giving and marking of assignments, non supervision of instruction, non-organization of practical lessons, non-organization of extra lessons to cover lost grounds, non-assessment of learning outcomes regularly, non-application of improvisation knowledge in instruction to non taking out of students to field experiences. Again all these tend to suggest that teachers are to be blamed

for the lack of proper exposure of the science students-which result in poor learning performance of science students (West Africa Examination Council (WAEC) 2006, 2007).

2. Statement Of The Problem:

Biology plays a key role in industrialization and other sectors of the economy (Mwirigi, 2011, Muraya and Githui 2011, Inyega 2005). It is a practical subject which equips students with concepts and skills that are useful in solving day to day problems of life. For many years, reports on analysis of the Kenya Certificate of Secondary Examinations (KCSE) results have indicated a general poor performance in Science subjects' country wide (Muraya and Githui 2011, Ministry of Education 2005). This study therefore investigated some determinants of poor performance in Biology in KCSE in selected secondary schools in Central division of Machakos district.

3. Objectives Of The Study:

The study was guided by the following objectives.

i.   To establish the extent to which Biology teaching methodologies influence students' performance.

ii.   To establish the influence of school related factors on secondary school students' performance in Biology in KCSE

4. Methodology:

This was a qualitative and quantitative study. The qualitative approach was chosen because it can yield intricate details reflecting insights of the problem being investigated. The research findings were both quantitatively and qualitatively analyzed. The quantitative data were processed with the help of the Statistical Package of Social Sciences (SPSS) software program and were summarized into tables of frequencies and percentages, while qualitative data were subjected to content analysis from which relevant information was extracted.

A variety of instruments was used to obtain data on different aspects from different people namely:

4.1. Questionnaire:

A self-administered questionnaire was used to collect data on secondary school students' performance in Biology. The questionnaire was administered to Biology teachers and Form four Biology students. The questionnaire was designed using closed and open ended questions in order to promote effective quantification and to enhance data analysis.

4.2. Interview Guide:

Interviews were conducted with the selected heads of science departments and principals of secondary schools. This method is very appropriate because of its flexibility. It permits issues to be probed and rejoinder questions to be added as the need arises. The researcher ascertained the respondents comfort by being warm and created a suitable environment where the interviewee responded to questions freely.

5. Results:

A total of 124 Biology students out of 127 respondents from the sampled secondary schools in Machakos district completed and returned the questionnaires. This represented 97.6%. All the Biology teachers in the sampled schools filled in the questionnaires. This represented 100% return rate. The findings are summarized in Table 1. This level of return was perhaps affected by several factors, among which were the type of questions and mood of the recipients.

Respondent	Number of Questionnaires	Number Returned	Response Rate (%)
Biology Teachers	12	12	100.0
Biology Students	127	124	97.6
Total	**139**	**126**	**90.6**

Source; (Field data, 2012)

Table 1: Survey responses rate

Factors	Descriptors	N (f)	%
Type of School	Boarding School	59	47.6
	Mixed day school	57	46.0
	Mixed boarding school	7	5.7
	Day school	1	0.8
Gender	Males	69	55.7
	Females	55	44.4
Age group	15 – 20 years	124	100
	Over 20 years	-	-
Live with whom at home	Father & Mother	90	72.6
	Mother	22	17.7
	Guardian	6	4.8
	Father	3	2.4
	Siblings	3	2.4
Religion	Christian	123	99.2
	Muslim	1	0.8
Parent level of Education	Secondary school level	60	48.4
	Graduate	48	38.7
	Primary school level	14	11.3
	Never went to school	2	1.6

Source: (Field data, 2012).

Table 2: Preliminary information of the sampled schools and respondents

As Table 2 indicates, 47.6% of the sampled schools were boarding school while 46.0 % were mixed day secondary schools. Mixed boarding schools were 5.7% while day schools made up of only one percent. These schools reflected the common pattern among Kenyan secondary schools whereby majority of schools are either in boarding or mixed day schools. In terms of gender for the participating students, 56% percent of the survey sample comprised of males while females made up 44.4 % of the sample. The largest percentage of respondents in the present sample was in the 15-20 year-old range, making up 100%. In fact, none were over 20 years-old.

The percentage of respondents with whom they live with showed that the majority of the participants (72.6%) reported living with both father and mother, while 17.7% of the respondents reported living with their mothers, 4.8% with guardians, and only 2.4% lived with either their fathers or siblings. The majority of the participants were Christians (99.2%) while (0.8%) were Muslims.

From the findings, the majority of respondent's parents had attained secondary level of eucation (48.8%), 38.7% graduates, 11.3% primary level of education while 1.6% never went to school. The findings seems to suggest that most parent were well educated and had attained secondary level of education and above. Perhaps this explains why most children were at school during field administration of the research tools.

6. Findings Based On Objective One: To Establish The Extent To Which Biology Teaching Methodologies Influence Students' Performance:

As Table 3 indicates, (37.7%) reported that lecture method was a good predictor of performance, (32.8%) disagreed while (29.5%) considered it least important. Across the age bracket (15-20 years), 87.7 % reported that demonstration method was crucial in promoting good performance in Biology, 7.4% were neutral with 4.9% disagreeing. Regarding discussion 78.9% agreed, 9.8 % were neutral while 11.4% disagreed. On narration 50% agreed, 11.0% were neutral with 39% disagreeing.52.1% of the respondents agreed that dramatization method influence performance in Biology, 21.8% were neutral with 26.1% disagreeing.

Others were as follows; role playing (59.6 agreed), 20.2% neutral while 20.2% disagreed and regarding field trip 67.7% agreed. 11.0% were neutral with 19.3% disagreeing. The findings of this research seem to suggest that demonstration/practical sessions, discussions, dramatizations, role playing and field trips were key methods in teaching of Biology across the sampled students. Similarly, the findings seem to suggest that there are no difference of opinions between age of students and teaching of Biology. The difference only lies in the frequency with which different methods are used to teach Biology.

Teaching Methodologies		Age (15 – 20) yrs	
	Descriptor	N	%
Lecture method	Agree	46	37.7
	Neutral	36	29.5
	Disagree	40	32.8
Demonstration / practical	Agree	107	87.7
	Neutral	9	7.4
	Disagree	6	4.9
Discussion	Agree	97	78.9
	Neutral	12	9.8
	Disagree	14	11.4
Narration	Agree	59	50.0
	Neutral	13	11.0
	Disagree	46	39.0
Dramatization	Agree	62	52.1
	Neutral	26	21.8
	Disagree	31	26.1
Role playing	Agree	62	59.6
	Neutral	21	20.2
	Disagree	21	20.2
Field trip	Agree	76	69.7
	Neutral	12	11.0
	Disagree	21	19.3

Source: (Field data, 2012).

Table 3: Influence of teaching methodologies on performance at KCSE as perceived by students

These findings are in agreement with Digolo (2005), who noted that the poor performance in Biology in Kenya was mostly due to poor teaching methods and an acute shortage of text books. If the students have access to the variety of resources they are able to progress smoothly and complete their homework on their own. Poor syllabus coverage is also due to unqualified teachers in overcrowded, non-equipped classrooms and science laboratories. The findings from interviews confirm the questionnaire results and revealed that inadequate text books and poor teaching methods were to blame for poor performance in Biology. If nothing is done to improve performance, many negative consequences will result, for example dropout rate will continue to rise

7. Findings Based On Objective Two: To Establish The Influence Of School Related Factors On Secondary School Students' Performance In Biology In KCSE:

The results of this study, as reported in Table 4 show 36.3% males and 21% females agreed that inadequate books was major cause of poor performance in Biology, 4.8% males and 4.0% females were neutral with 14.5% males and 19.4% disagreeing. Regarding poorly equipped laboratories 38.7% males and 23.4% females agreed, 5.6% males and 3.2% females were neutral while 11.3% males and 17.7% disagreed.

On the influence of administration styles on performance of Biology 23.6% males and 22.0% females agreed, 13.0% males and 5.7% females were neutral while 18.7% males and 17.1% females disagreed. On the relationship between the geographical location and performance in Biology 8.9% males and 5.6% females agreed, 8.1% males and 9.7% females were neutral while 38.7% males and 29% females disagreed. On parental support 26.4% males and 31.4 % females agreed. 10.7% males and 2.5% were neutral with 19.0% males and 9.9% females disagreeing.

The findings suggest that there are no significant differences of opinions across sexes regarding the influence of school related factors on performance in Biology. From this observation, it would seem that all students across sexes were in agreement that inadequate textbooks, ill-equipped laboratories and administration styles were key determinants of performance in Biology at KCSE level. However, it was noted that the distance between home and school was not a significant determinant of students' performance. Among the many studies which support the findings of this study, is Jane (1996) who investigated the extent to which inadequate teaching resources such as textbooks, laboratory and its related facilities affect students' performance in Biology. These responses demonstrate that the causes of poor performance in Biology at KCSE level are varied and require closer scrutiny by the stakeholders towards policy intervention measures.

School related factors	Descriptor	Males		Females		Total	
		N	%	N	%	%	N
Inadequate Biology text books is major cause of poor performance	Agree	45	36.3	26	21.0	71	57.3
	Neutral	6	4.8	5	4.0	11	8.9
	Disagree	18	14.5	24	19.4	42	33.9
Poorly equipped science laboratories influence performance	Agree	48	38.7	29	23.4	77	62.1
	Neutral	7	5.6	4	3.2	11	8.9
	Disagree	14	11.3	22	17.7	36	29.0
Administration styles in schools influence performance in Biology	Agree	29	23.6	27	22.0	56	45.5
	Neutral	16	13.0	7	5.7	23	18.7
	Disagree	23	18.7	21	17.1	44	35.8
The geographical location of school influences performance in Biology	Agree	11	8.9	7	5.6	18	14.5
	Neutral	10	8.1	12	9.7	22	17.7
	Disagree	48	38.7	36	29.0	84	67.7
Parental support influences school performance in Biology	Agree	32	26.4	38	31.4	70	57.9
	Neutral	13	10.7	3	2.5	16	13.2
	Disagree	23	19.0	12	9.9	35	28.9

Source: (Field data, 2012).

Table 4: Influence of school related factors on performance in Biology at KCSE as perceived by students by gender

8. Conclusions:

Student's performance in Biology at KCSE level seems to be affected by a combination of factors (Methodologies, teacher's related factors, school related and social-economic factors). This implies that the causes of poor performance in Biology are varied and complex. Teachers and parents, for example, contribute a lot to the student's performance in Biology. This is manifested in poor fee payment supported by weak economic base, teacher's attitudes and level of education. This to a larger extent affects psychological balance in the classroom which leads to low concentration by teachers and students, low esteem and emotional instability among students.

A total transformation approach focusing on changing parents, teachers and students perception of Science subjects is a principle asset in bringing the problem of poor performance in Biology at KCSE level to rest.

Poor equipped laboratories and poor teaching methodologies contribute to problems of teaching and learning. Therefore for poor performing schools the root cause should be traced

and appropriate strategies aimed at improving the performance be improved. Long distance to school caused lateness and fatigue which was an obstacle to good performance. Creation of boarding schools would solve the problem of long distance and would provide a conducive environment for learning.

9. Recommendations:

Based on the findings of the study, the following recommendations have been made.

The government through the Ministry of education should employ more Science teachers in order to lessen their workload. In addition to this, students should be sensitized on the importance of Science subjects in general and Biology in particular for both boys and girls.

The Kenyan government should intensify its efforts to train and retrain Biology teachers through conducting induction courses, seminars and refresher courses on teaching of Biology in order for them to teach efficiently and effectively. These programmes would improve teachers' pedagogical skills for work and provide the needed personal output in performance. Retraining of teachers would give them better orientation of what is expected of them.

The number of boarding schools should be increased in the division to solve the distance to school and isolate the learners from the daily influences. This will help retain students in schools and improve their performance. In addition school Board of Governors should look for ways of motivating teachers and students in order to promote good performance.

School-community partnership is fundamental in improving performance. This is because community involvement and support facilitates communication between school staff and parents who are experiencing academic difficulties. It is therefore recommended that the Government of Kenya should develop a code of conduct for students in consultation with the stakeholders of the school, concerning all aspects of the education policy with a view to promoting good performance in secondary schools.

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