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A Teachers Perspective on the Challenges in the Delivery of Content and Performance in Biology: A Case of Bungoma District, Kenya

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Abstract

Biology is a teaching and learning subject at secondary school level in Kenyan schools. Biology plays a key role in industrialization and other sectors of the economy. Biology is a practical subject, which equips students with concepts and skills that are useful in solving the day-to day problems of life. The study of biology aims at providing the learner with the necessary knowledge with which to control or change the environment for the benefit of an individual, family or community. However, the secondary school students' performance in biology as a learning subject in the Kenya Certificate of Secondary Education (KCSE) in Bungoma District has been quite low over the years. The public outcry and concern by parents, teachers, educationists and students about poor performance in science subjects and mathematics in national examinations is a clear indication that factors influencing student's performance in these subjects need urgent investigation. The aim of this study was to investigate the influence of teacher related factors on performance of secondary school students in biology. The Cross-sectional descriptive research design and the Ex post facto were employed in this study. Nine (9) secondary schools were randomly selected for study out of 139 schools in Bungoma district. Different categories of schools were used depending on the school set-up and these were (i) Single- gender boys boarding schools (ii) Single- gender girls boarding schools (iii) Single- gender girls day schools (iv) Co-educational boarding schools (v) Co-educational day schools (vi) Co-educational boarding / day schools. A total of three hundred and sixty (360) form three students were randomly selected for the study. A student questionnaire (SQ) and a teacher questionnaire (TQ) were used as the main instruments for data collection. Class mark lists were used as tracking records of performance in biology. Data collected were analyzed using descriptive statistics. The study established that boys perform better than girls in biology. Female teachers were found to have a higher level of science anxiety in the teaching of biology compared to the male teachers. It was established that most teachers still used the traditional lecture method in the teaching of biology and only a smaller percentage were using the new approaches. This study was expected to significantly contribute in the provision of information that could be used by teachers, parents, educationists and policy makers to improve on the teaching, learning and performance of students in biology.

Key words: Biology Education, Teachers Perspective, Challenges, Performance in Biology.

Introduction

The Government of Kenya spends over 30% of the annual budget on education (Republic of Kenya, 1989). Eshiwani (1993) observed that a large proportion of this money is channeled towards the improvement of science education. However there is no evidence that this increased expenditure has necessarily been associated with improved performance in science subjects on the part of the learners at the secondary school level (SMASE Project, 2000). Science education in Kenya has

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been in a lot of lime light, for example the project called Strengthening of Mathematics and Science Education (SMASE), which was initiated by the Ministry of Education to provide in-service refresher training for science and mathematics teachers. In the SMASE in-service training, teachers are given information that is integrated with hands-on activities and inquiry that assists teachers to have more interest and less anxiety when teaching (Nyongesa,
2011).

The Government of Kenya has particularly felt a need to improve the science education it offers so as to build up a knowledgeable manpower required for its industrial and technological transformation (SMASSE Project, 2000). In Kenya today, the most dominant feature of the education system is academic performance (Chepchieng, 1995); as such explanations for good and poor student academic performance have been exhaustive, yet controversy still exists among scholars as to what contributes singly or jointly towards students' poor performance. Orodho (1996) also gives us an insight into the reasons why learners perform poorly in science subjects; he suggests the following reasons: inadequate time allocated for learning science satisfactorily, inadequate instruction material, low level and inadequate training of teachers, and the nature of the science curriculum-it is highly abstract and seems irrelevant to the learners' immediate environment. The quality of teachers is dependent on the selection of top quality candidates for teacher training (Kang'ethe & Nafukho, 2000). A study by Kariuki and Kibera (1996) revealed that 57% of a second year Bachelor of Education cohort at a local university in Kenya did not like being teachers, even after having completed their teaching practice. They ended up in this programme after failing to get their first career choices. Such teachers would naturally go to school to 'work' rather than teach and would not really exert themselves in order to teach well.

Statement of the Problem

The performance of students in biology in the Kenya Certificate of Secondary Education (KCSE) has been unsatisfactory over the years in many secondary schools in the country. In Bungoma District, the performance has been lower than expected in this subject as indicated by records from the District Education Office. Studies focusing on the impact of different factors on performance in biology at secondary school level are not well conceptualized. This lack of sufficient knowledge regarding these factors and their influence would militate against the country's aspiration to achieve the 'Vision 2030' and the Millennium Development Goals (MDGs). This is because biology is one of the key science subjects that contribute towards industrialization, environmental conservation, medical research, food management and improved agricultural production. It is therefore important to study the influence of these factors on performance in biology.

Purpose and Objectives of the Study

The purpose of this study was to determine the influence of teacher related factors on performance in biology as a learning subject at the secondary school level in Bungoma District.

The specific objectives of this study were to:

(i) To investigate the influence of the teachers' expectations of students on performance in biology.

(ii) To investigate the influence of the teaching methods on students' performance in biology.

(iii) To investigate the influence of the teachers' science anxiety on students' performance in biology.

(iv) To investigate the influence of the teachers' gender on students' performance in biology.

(v) To investigate the influence of the teachers' work dissatisfaction and/or satisfaction on students 'performance in biology.

Research Questions

The study addressed the following research questions:

(i) What is the influence of teachers' expectations of students on performance in biology?
(ii) What is the influence of the teaching methods on students' performance in biology?
(iii) What is the influence of the teachers' science anxiety on students' performance in biology?
(iv) What is the influence of the teachers' gender on students' performance in biology?
(v) What is the influence of the teachers' work dissatisfaction and/or satisfaction on students' performance in biology?

Significance of the Study

The study is expected to contribute to the advancement of knowledge about science education and biology education in particular. The study may lead to improved strategies in teaching and learning of biology not only in Kenya but also in other parts of the world. The study may also be of immediate benefit to the Ministry of Education (MOE) and the National Council on Science and Technology (NCST) in the formulation of future science education policies aimed at enhancing students achievement in science subjects related to biology, which are chemistry, physics and agriculture. This study will assist teachers in helping students to develop positive attitudes towards the learning of biology.

Scope of the Study

Teacher factors that could influence performance of students in biology were focused. The teacher factors the study addressed were: gender, science anxiety, professional training, teaching experience, teaching methodologies, teacher expectations and teacher-pupil interactions in the classroom. The study also attempted to investigate the genesis of the positive and negative attitude towards the teaching of biology and the genesis of science anxiety in the teaching of biology. The population for the study consisted of biology teachers and biology students at the form three level in Bungoma District in the Western Province of the Republic of Kenya

Background to the study

Banu (1985), examined attitudes towards sciences held by secondary school students in Gongola State, in Nigeria. He concluded that the quality of science teachers and development of more relevant curriculum might improve students' attitude toward science subjects. Shumba (1993) surveyed the attitudes of students of form two and form four towards science subjects in Zimbabwe. It was noted that there was a significant difference between attitudes of the students at different levels. This suggests that variability in academic performance in sciences from one individual student to another can be attributed to other factors such teacher related factors. In this study, he cited the teachers' influence as a possible reason with the impoverished attitudes of students. It was also indicated that the secondary school science teachers in the Harare Region where the study was carried out reported lack of facilities and resource materials to support hands-on activities. He recommended that the pre-service teacher education should not rely on the convenient lecture method, as this could not inculcate positive attitude towards sciences by the prospective teacher. He observed that teachers may lack enthusiasm of making science subjects enjoyable to students due to lack of practical instrumentation and experimental techniques especially in cases of physics,

chemistry and biology. These skills are relevant in industrial practice and production. Galloway (1985) typically, found that teachers held stereotyped ideas about parents and children from different social groups. These leads to consequent teacher expectations of children' abilities (Persell, 1977). Most of the research involving learner attitudes has utilized the pupil gain on achievement tests as the sole or primary description of changed pupil behavior, to what Galloway (1985) called "academic problems". Actually this achievement tests explore only a small portion of the cognitive domain and disregard the affective and psychomotor domains. The reasons given for problems in science education include; inadequate facilities, lack of resources and money, lack of time for adequate science instruction, teachers lack of knowledge and the poor preparation of elementary teachers to teach science (Yager & Penick, 1985).

Research by Yager and Penick (1985) examined the relationship between pupils and school characteristics and pupils achievement in public examinations at "ordinary" (O-level) and "advanced" (A-level). The findings indicated that family influence of early childhood rearing were most effective in the early stages of education in relation to the child's readiness to learn. It was argued that by the time the 'O' levels were taken, most of the selective variables arising from family background and prior educational background will already have taken effect. The fundamental focus of education in Kenya has been preparing people for employment rather than training for education; an unwanted side effect of this over- emphasis on examinations is that teachers may focus only on the knowledge and skills that are testable by such examinations, to the exclusion of everything else (UNESCO, 2003). There is need for teachers to teach for understanding, this is the ability to take knowledge, concepts, skills and facts and apply them to appropriate new situations (Kiboss, 1997). Okere (1996) noted that science teaching and knowledge should not only be interpreted in terms of the effects on peoples' lives for example in technology, war and automation; it should also be considered in terms of its effects on peoples' ways of reasoning.

Numerous researchers have found gender differences in attitudes towards science, science anxiety and science achievement (Czerniak & Chiarelott, 1990; Czerniak, 1992). The Social Cognitive Theory according to Bandura (1997) suggests that the low levels of self-efficacy that many female teachers and students experience are related to gender expectations and beliefs. The findings indicated that females experience more science anxiety, have more negative attitudes towards learning science, and perform more poorly in science than males. Certain school subjects are viewed as gender related, many science subjects for example, are often viewed as "males" subjects. Research on gender biases in education seems to indicate that both the content of the curriculum and the delivery of the curriculum are equally important in addressing issues of efficacy and equity in science education (Carlson & Buskist, 1997). The authors observed that preponderance of women in elementary education given the high level of science anxiety among females, suggests that elementary students lack role models who can encourage positive attitudes towards science. Research on the impact of the role models on students' attitudes and performance suggest the need of career education including equity education. (Yager & Penick, 1985).

Raizen and Michelson (1994) suggested several strategies on which to increase equity in science and mathematics, including career education in science, providing female role models in science, and teaching spatial thinking to females. They also recommended inquiry, hands-on or manipulative materials for females. Bandura (1997) also reported that increased self-efficacy and decreased anxiety could be achieved through modeling, by watching other females succeed in science, being

exposed to females in science careers, or observing competent female teachers, girls may elect to take more science-related careers. Hong, Woo and Jeong (1995) reported that females favored the social-problems approach to teaching science more than did males. The authors observed that females might learn science more effectively if scientific, societal, and technological concepts were integrated into the curriculum and finally, instruction that places emphasis and lowers anxiety of science for females. Research by Enochs, Scharman and Riggs (1995) suggested that teachers need to be aware of the general classroom and school practices that encourage gender biases and point out to children gender stereotypes in texts, films, media, education materials and society as a whole. Science anxiety is a product of low self efficacy (Yager & Penick, 1985). Research on science anxiety involving over 2,000 students and 50 teachers supports the Social Cognitive Theory that low self-efficacy in science leads to high anxiety and reduced performance among many elementary students and their teachers (Czerniak, 1992). Students as early as the third grade, exhibit anxiety towards science (and students' interest in science starts declining between the third and seventh grade (Czerniak & Chiarelott, 1990).

Females, as early as the third grade, exhibit more anxiety than their male counterparts (Czerniak, 1992). This science anxiety may contribute to students, particularly females, low enrolments in science related careers at higher education (Westerback &Long, 1990). A high level of anxiety accompanies poor student performance in most academic areas. Spielberger and Syderman (1994) reported that highly anxious students tend to lack self confidence, curiosity and adventurousness. The Social Cognitive Theory according to Bandura (1997) suggests that anxiety is a result of feelings of inefficacy; anxiety then leads to avoidance of situations that arouse the feelings of inefficacy. Providing evidence of this relationship, some teachers reported in informal interview that they do not teach much science because they were not very good at it, they taught science only because they had to and hence they did it in a perfunctory manner, when possible they traded this responsibility with someone who was better prepared. The impression that these teachers felt powerless to affect in a positive way, their students' science learning was disturbing but not totally surprising (Horton & Hurtchinson, 1997). Viewed in the light of research concerns, education in general and related with self-efficacy among students and teachers in particular, these teachers' attitudes and behaviors are understandable. Thus, teachers' anxiety over teaching science is likely to have noticeable effects on both the quantity and quality of science instruction which may impact negatively on students' attitudes towards the subject (Nyongesa, 2011).

Teachers who provided clear expectations, opportunities for remediation and study support reduced anxiety towards science in the students. In teachers, anxiety about teaching science seems to be lowered after experiences with science content and science pedagogy (Westerback &Long, 1990) reported that a sequence of hands- on science content courses reduced prospective teachers' anxiety about teaching science. Similarly, Czerniak (1992) found that anxiety towards teaching science was significantly lowered after completing a science methods course. Science anxiety has been established to have a bearing on both the teaching and the learning in science subjects (Nyongesa, 2011). According to SMASE Project (2000), biology as a science subject requires an integration of both theoretical and practical work to make it easily understood by the students. This, therefore, calls for application of a myriad of teaching aids to enable learners to concretize biological principles, concepts and facts. Aiken and Aiken (1969) concluded that teachers of science generally recognized that teaching for development of favorable attitudes in the learners was an important part of their work. Newton and Tarrant (1992) observed that the attitudes and behaviors of teachers within classrooms may have a strong influence on the development of attitudes and

values towards science by students. In addition the teachers' attitude towards the curriculum influences the students' attitude towards the same curriculum (Nyongesa, 2011).

Kangoro (2007) observed that, failure of some students to do well in biology could be attributed to the teachers' atrocious attitude towards students who ask questions in between the lesson. The author observed that some teachers gave wrong answers to students, which the students discover and end up losing confidence in the teacher. Research on teaching behavior indicates that there are teaching methods that influence students' achievement more positively than others (Wenglinsky, 2000). The author further argues that there was a correlation between high academic achievements of students and classroom practices of the teachers. Lack of curiosity and innovativeness evident in many spheres of human endeavor all around us may be a reflection of the teaching methods that dulled curiosity rather than nurturing (Ndirangu, 2000). Instead of imparting factual information, the teacher should create situations where learners will ask questions, experiment and discover facts and relationships (Nyongesa, 2011). Kochlar (1992) argues that teaching methods should nurture an environment of students' creativity in learning. Teachers should use problem-posing teaching methods that create a challenge to experiment, explore and look for links between concepts. Gage (1963) noted that on the basis of efficiency as measured by percentile attainment, by lasting impression on the minds of learners, by persistence in memory (up to 56 days), by encouragement of independent thought and self reliance and by popularity among the students, the three methods rank;- experiment method, lecture method, book method. He asserted that carefully and neatly drawn diagrams do not increase the students' knowledge of science. He observed that work in elementary science must be based on daily experiences and observation by pupils. Elementary science in schools should be largely, if not entirely qualitative and not quantitative. Inquiry approaches to science instructions have a positive effect on students' attitude and achievement in science (Newton& Tarrant, 1992). The authors observed that the majority of elementary teachers rely heavily on the use of lecture and textbooks.

Cognitive psychologists ascribe a more active role for the learner in determining whether or not effective learning takes place (Heinrich, Molenda, Russel & Smaldino, 1995). Thus, the learners' previous knowledge and experiences, expectations, interests and beliefs have an impact on the way learning takes place (Ndirangu, 2000). Learners should be engaged in meaningful learning tasks in order to construct knowledge for themselves. Teacher-pupil interactions are greatly affected by class sizes. This is supported by the study of King and Wiseman (2001) who posits that learning in crowded classroom is less effective compared to one that is less crowded. Traditionally, it is believed that in school, a child tends to compensate for the failure of the home to provide the necessary educational background, and if home background is found to be more important than schooling, it can be held to be even more responsible for the inadequacy of children's education (Cullingford, 1985; Nyongesa, 2011). Teaching experience is always significant in the quality and quantity of instruction in the classroom (Wenglinsky, 2000). The author opines that long serving teachers are always more acquainted with the realities of classroom management. Teachers with a longer experience also display a high sense of confidence and self-efficacy in dealing with the learning problems of the learners (Bandura, 1997). The author asserts that long serving teachers also act as role models to influence pre-service teachers and most young teachers tend to copy more from the long serving teachers in terms of professional practice.Teacher expectations are affected by testing and tracking procedures which are biased against some learners (Persell, 1977). In addition, the author observes that; given the less powerful position of the lower class children in society, they appear to be more negatively influenced by teacher expectations.

Conceptual Framework

The conceptual framework used in this study is based on the Systems Theory presented by Joyce and Weil (1980). From the General Systems Theory is derived the systems concept (Mukasa – Simiyu, 2001). Organismic variables are a special class of variables that appear like independent variables but are not directly controlled by the researcher (Orodho, 2005). The author opines that these variables are special extraneous variables. Figure1 shows the conceptual framework.

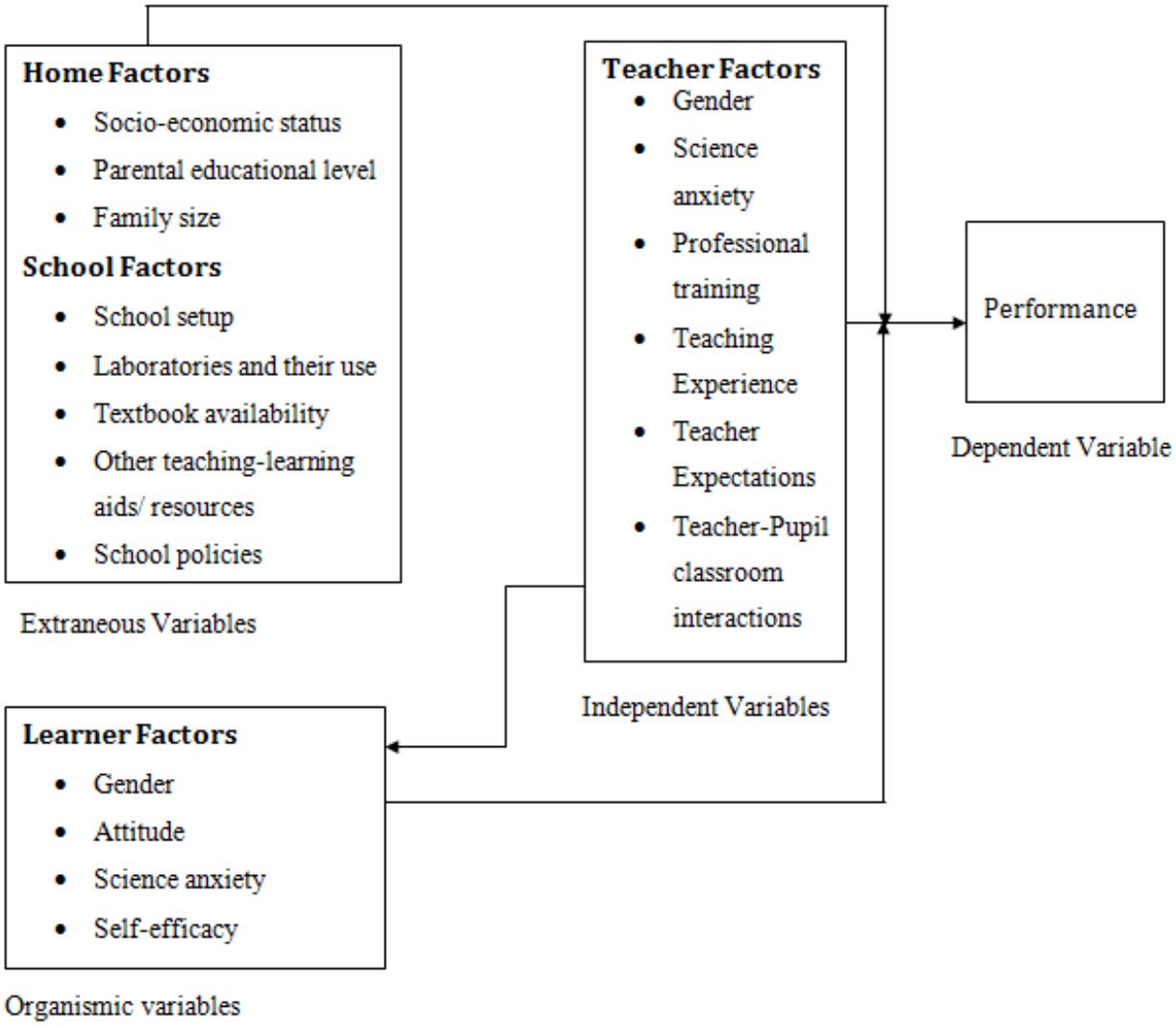

Figure 1: The Relationship between Home Factors, School Factors, Teacher Factors, Learner Factors with Performance. Source: Researcher

Methodology

The Cross-Sectional descriptive survey and the Ex Post facto designs were employed in this study in order to triangulate the information. According to Orodho (2005), the Cross-Sectional descriptive survey design involves collection of data at one and only one point in time from a random sample representing some target population. The Ex Post facto design was employed in use of class mark lists as tracking records for student performance.

Population, Sampling Procedures and Sample Size

There were 139 secondary schools in the district as reflected by the District Education. From the DEO's records, Bungoma district had a total of 264 biology teachers by the time of the study; out of this number 101 were female while 163 were male. From the same records the district had a total of 9,901 form three students by the time of the study, in this population 4871 were boys and 4030 were girls. The schools were selected using the stratified random sampling technique as advocated by Kathuri and Pals (1993). This ensured that all schools in the district had an equal chance of being selected for the study. Purposive sampling was used to select the teacher sample for the study as advocated by (Mugenda & Mugenda, 1999). A simple random sampling technique as advocated by Borg and Gall (1989) was applied to select the student sample. Three hundred and sixty (360) students from the schools were the sample size used; of which one hundred and sixty eight (168) making 46.7% were male and one hundred and ninety two (192) making 53.3% were female. Thirty five (35) teachers from the teacher population formed the teacher sample. Twenty one teachers (21) making 60% were male while fourteen teachers (14) making 40% were female. The three sample sizes can be justified from the formula of Kathuri and Pals (1993). This formula is as follows:

$$S = \frac{X^2 NP(1-P)}{d^2(N-1) + X^2 P(1-P)}$$

in which S= required sample size, N=the given population size

P= population proportion that has been assumed to be 0.5 as this magnitude yields maximum possible sample size required.

d= the degree of accuracy as reflected by the amount of error that can be tolerated – the value of d being 0.05

X^2= the table of value of chi square for one degree of freedom relative to the desired level of confidence, which is 3.841 for the 0.95 confidence level.

Instrumentation

Two categories of questionnaire were used; a Students Questionnaire (SQ) and a Teachers Questionnaire (TQ). Class Mark lists kept by the teachers as tracking records were used to find information on average performance of students up to the form three level. The Strait – Trait Anxiety Inventory (STAI) which was part of the questionnaire was used to collect data from the teachers related to science anxiety. This is a standardized test originally developed to study the relationship between anxiety and learning. Czerniak (1992) adopted the STAI to measure anxiety and self - efficacy about teaching science. The STAI was used to measure the levels of science anxiety of the teachers.

Data Analysis

The data were analyzed by use of descriptive statistics. The data were analyzed using the *Statistical Package for Social Sciences (*SPSS-11.5*)* on computer. Systematical content analysis technique (Orodho, 2005) was used where the responses were classified according to meaning. In this analysis both designation and attribution of characterizations and descriptors are used.

Results and Discussion

Teacher Expectations in terms of Students' Performance in Biology

Table 1 shows the distribution of the teachers' sample according to their general expectations of their students in terms of their achievement in biology at national examinations.

Table1: Teacher Expectations in Terms of Students' Performance in Biology

	f	%
General expectation of teachers		
Very low	0	0.0
Low	3	8.6
Average	22	62.9
High	6	17.1
Very high	4	11.4
Total	**35**	**100.0**

Teacher expectations have a bearing on the attitude and science anxiety levels of the learners particularly when the learners are aware of the level of expectation the teacher has of them (King&Wiseman, 2001)).

Factors that Determine Teacher Expectations of their Students' Performance

Table 2 shows the distribution of the teachers' sample according to the factors that determine their expectations of their students' achievement in biology at national examinations.

Table 2: Factors that Determine Teachers' Expectations of their Students' Performance in Biology

	f	%
Factors		
Teaching experience	4	11.4
Testing and tracking of students records	23	65.7
Family background of students	6	17.1
Race of students	1	2.9
Appearance and behavior of the students	1	2.9
Total	**35**	**100.0**

The largest proportion (65.7%) of teachers developed their general expectations of their students depending on the testing and tracking of students' records. Some teachers develop inappropriate expectations as to what the learners can achieve (UNESCO, 2006).

Teaching Methods most frequently used by Teachers in Biology

Table 3 carries information on the teaching methods most frequently used by the teachers while teaching biology.

Table 3: Teaching Methods most frequently used by Teachers in Biology

	f	%
Teaching methods		
Experiment method	7	20.0
Demonstration method	4	11.4
Project work	2	5.7
Lecture method	14	40.0
Field trips	0	0.0
SMASE(ASEI/PDSI) approach	8	22.9
Total	**35**	**100.0**

Information from Table 3 shows that the largest proportion of teachers (40%) still used the conventional lecture method while teaching biology. Certain teaching styles and methods tend to favor boys (Nyongesa, 2011). Children achieved higher levels of academic success where the teachers expressed higher expectations of them. It was noted that children are likely to work better if taught in an atmosphere of confidence that they can do well in tasks set for them The findings in this study indicated that most teachers of biology still use the traditional lecture method.

Factors that elicit Negative Attitude of Students towards Learning Biology

Table 4 carries information, which according to the teachers could be some factors that could elicit a negative attitude of the students towards teaching biology.

Table 4: Factors that elicit Negative Attitude of the Students towards Learning Biology.

	f	%
Factors		
Quality of teaching methodology frequently used	10	28.6
Authoritarian and impersonal teacher- student interaction in class	13	37.1
Large class size that minimize teacher- student interaction in class	12	34.3
Total	**35**	**100.0**

Most teachers (37.1%) observed that authoritarian and impersonal teacher- student interaction in class could be the major factor that contributes to negative attitude of the students towards learning

biology. Attitudes begin to develop on the first encounter between the teacher and the learner, once formed they play a key role in determining students' learning and performance in biology (Banu, 1985). Students of both genders who reported their dislike for biology cited the authoritarian and impersonal teacher – student interaction in class as the main causes for negative attitude towards the subject. Seli (2006) observed that teachers as role models were responsible for formation of positive attitudes towards a curriculum. Teachers' behavior and teaching practices have significant implications for female students' persistence, academic achievement and attainment (FAWE, 2004).

In a classroom setting, academic performance in biology varies from one student to another (Nyongesa, 2011).The author posits that this occurrence is usually observed despite the fact that the students are subjected under the same syllabus, curriculum and school facilities among other factors. In most co-educational schools, girls are usually the minority (UNESCO, 2003). This could have an influence on the attitude and science anxiety of the girls in the learning of biology, especially when the number of male biology teachers is more than that of the female biology teachers. The subject in such a school would appear to be male dominated. The educational attainment of girls has been associated with the type of educational institution one attends (UNESCO, 2006).

Factors that elicit Positive Attitude of the Students towards Learning Biology

Table 5 carries information that according to the teachers are some factors that could elicit a positive attitude of the students towards learning biology.

Table 5: Factors that Elicit Positive Attitude of the Students towards Learning Biology

	f	**%**
Factors		
Quality of teaching methodology frequently used.	10	28.6
Democratic and personal teacher-student interaction in class	13	37.1
Small or medium sized classes that maximize teacher-student interaction	12	34.3
Total	**35**	**100.0**

Information from Table 5 indicates that democratic and personal teacher-student interaction in class elicits positive attitude towards learning biology. This according to the teachers could be the major factor that contributes to positive attitude. The quality of teaching methodology frequently used, teacher-student interaction in class and class sizes could have an influence on the attitude and science anxiety of the learners towards biology (Nyongesa, 2011).

Factors that elicit Science Anxiety among Teachers in their Teaching of Biology

Table 6 carries information that shows the distribution of the teacher sample on the main causes of science anxiety in their teaching of biology. These findings are similar to those of Gorrell and Capron (1990). They suggested that without a belief in their ability to affect student performance,

teachers do not accept responsibility for motivating students' learning. High levels of self-efficacy have been associated with greater student achievement and greater teacher commitment to student achievement as well as higher expectations for children (Ashton, Webb & Doda 1983).

Table 6: Factors that elicit Anxiety among Teachers in their Teaching of Biology.

	f	**%**
Factors		
Lack of adequate teaching time	8	22.9
Lack of adequate content background	4	11.4
Lack of professional training.	1	2.9
Lack of sufficient laboratory equipment and apparatus	11	31.4
Long and congested syllabus.	11	31.4
Total	**35**	**100.0**

A large proportion of teachers (62.8%) observed that a long and congested biology syllabus and lack of sufficient laboratory equipment and apparatus were major causes of anxiety in their teaching of biology. The teaching approach, methodology and how the professional skills and practices of the teacher are displayed may be dependent on the level of science anxiety the biology teacher has (Nyongesa, 2011). This study found out that female teachers exhibit higher levels of science anxiety to towards the teaching of biology, as compared to the male counterparts. The authors assert that teachers with a high level of self-efficacy seemed to take personal responsibility for student's learning. They tended to feel that if a student was not learning, it was not the student's deficiency, but the inappropriateness of the teaching method.

Science Anxiety Levels Teachers of Biology

Table 7 shows the mean scores of the levels of science anxiety that biology teachers had as related to their gender.

Table 7: Science Anxiety Means Score Levels for Teachers of Biology.

Variable	**Gender**	**Mean**	**N**
Anxiety scale	M	2.1	21
At ease – anxious	F	2.6	14
1-2-3-4-5-6-7			
Confidence scale	M	2.2	21
Confident-fearful	F	2.4	14
1-2-3-4-5-6-7			
Interest scale	M	2.2	21
Curious – uninterested	F	2.4	14
1-2-3-4-5-6-7			
Total mean scores	M	**6.7**	
	F	**7.6**	

Mean scores for the anxiety scale, confidence scale and interest scale are higher for the female teachers than the male teachers. The total scores of the means are higher for the female teachers (7.6/21) as compared to the male teachers (6.7/21). This implies that female biology teachers have a

higher level of science anxiety in relation to the teaching of biology. This is likely to have noticeable effects on both the quantity and quality of science instruction which may impact negatively on the students' attitude towards the subject (Westerback&Long, 1990). Science anxiety has been related to the teachers' performance in science, highly anxious teachers tend to lack self-confidence, curiosity and creativity in their teaching approaches (Spielberger & Syderman, 1994). Results of studies on science anxiety have been consistent with studies of self-efficacy in general (Nyongesa, 2011). Poor self-efficacy may lead to science anxiety, thus providing a possible explanation for fewer entries into scientific careers (Guyton, Fox & Sisk, 1991). Many studies in education have determined that role models, especially in the field setting, greatly influence teachers. King and Wiseman (2001) summarized research in teacher education and concluded that role models such as co-operating teachers influence pre-service teacher's more than theoretical preparation on campuses.

Teachers' Perceptions of the Students' Attitude towards Biology of both Genders

Table 8 carries shows the distribution of the teacher sample on how they perceive the attitude of students towards biology in relation to the students' gender.

Table 8: Teachers' Perceptions of the Students' Attitude towards Learning Biology related to the Students' Gender.

	f	**%**
Teachers' Perceptions		
Boys have more positive attitude than girls.	16	45.7
Girls have more positive attitude than boys.	10	28.6
There is no difference in attitude of the boys and the girls	5	14.3
No response / NA	4	11.4
Total	**35**	**100.0**

Information in Table 8 indicates that a large proportion of the teachers (45.7%) opine that boys have more positive attitude than girls towards the learning of biology. Some teachers (28.6%) observed that girls had a more positive attitude than boys towards the learning of biology. Teachers always have first-hand information as regards their students (Ashton, Webb & Doda 1983). Most teachers have differential expectations for students' responses in activities like teacher-led class discussions, where boys are spoken to more frequently and asked higher order questions. This definitely discourages the girls and leads to a relatively lower attitude.

Teachers' Perceptions of the Students' Performance in Biology of both Genders

Table 9 carries information that shows the distribution of the teacher sample on how they compare the performance of their students in biology as related to the students' gender. From the findings of this study, boys generally perform better than girls in biology. This study found that teachers' perceptions and comparisons about the performance of their students in biology rated the boys higher than the girls. This finding is similar to that of Seli (2006).

Table 9: Teachers' Perceptions of the Students' Performance in Biology related to the Students' Gender.

	f	**%**
Teachers' Perceptions		
Boys perform better than girls.	18	51.4

Girls perform better than boys.	10	28.6
There is no significant difference in performance between boys and girls.	3	8.6
No response / NA	4	11.4
Total	**35**	**100.0**

Information from Table 9 indicates that a larger proportion of teachers (51.4%) opine that boys perform better than girls in biology. While (28.6%) of the teachers held a view that girls performed better than the boys. The negative societal perceptions regarding female involvement in science and technological fields are also transmitted within the educational system through books. According to a study carried out in Kenya by Obura (1991); it was found that textbooks in schools are a major socializing factor in the lives of children, first and foremost the text books present models of people; they present behavior and thought patterns which they imply are good to copy. The school as a social institution is authoritative and the textbooks used there carry authoritative messages on role models (Nyongesa, 2011).

Classroom observations in Kenya indicated that most teachers pay more attention to boys than girls or completely ignore the girls (UNESCO, 2006); and at times teachers reinforce the belief that girls lack spatial and analytical thinking. This is internalized and conclusively accepted thus justifying the self – fulfilling prophecy that there are certain subjects that are not for girls (Nyongesa, 2011); the potential for the self-fulfilling prophecy effects of the teacher expectations exists when these expectations are inaccurate and inflexible, this could have damaging consequences for the students' educational performance. Studies have shown that teachers tend to carry the societal expectations of girls into the school and therefore treat boys different from girls (Whyte, 1986); these differential expectations about the students in reference to their gender are a reflection of the broader societal biases about the role of women in society and the academic capacity of girls.

Teachers' Perceptions about Influence of the Teachers' Gender on Learning in Biology

Table 10 shows information regarding the perceptions of teachers on how the gender of the teacher influences the learning of students in biology.

Table 10: Teachers' Perceptions about the Influence of the Teachers' Gender on The Learning in Biology.

	f	**%**
Teachers comparison		
Male students prefer male teachers	3	8.6
Female students prefer male teachers	5	14.2
Male students prefer female teachers	2	5.7
Female students prefer female teachers	3	8.6
Teacher's gender has no influence on students' learning in biology	22	62.9
Total	**35**	**100.0**

From Table 10 the largest proportion of (62.9%) the teachers opine that teacher's gender has no influence on the learning of biology. Therefore the teaching and learning process according to these teachers is not influenced by the teacher's gender. Teachers need to be aware of the general classroom life, personality types and school practices that encourage gender biases (Obura, 1991).

The author asserts that teachers should be aware of and point out to the children gender stereotypes in texts, media, education materials and society as a whole.

Teachers' Reasons for Dissatisfaction in Relation to the Teaching of Biology

Table 11 shows the distribution of the teacher sample regarding the reasons the teachers had that could make them to have dissatisfaction with the teaching career as relates to the teaching of biology.

Table 11: Teachers' Reasons for Dissatisfaction in Relation to the Teaching of Biology.

	f	**%**
Reason for dissatisfaction		
Low salary scale	3	8.6
Teaching was a last option career choice	6	17.1
Low achieving students cause discouragement and burn- out	19	54.3
School administration never involves teachers in decision-making	3	8.6
Biology is not my main teaching subject	4	11.4
Total	**35**	**100.0**

Discouragement and burn-out caused by low achieving students was cited as a main cause of dissatisfaction in relation to the teaching of biology. Some teachers (17.1%) indicated that teaching was their last option career choice. Career or job satisfaction contributes a lot to achievement of the anticipated results (UNESCO, 2003). A teacher who suffers from career dissatisfaction is likely to contribute negatively in terms of performance of the learners; this is because the teacher will have lower self-efficacy and high levels of anxiety (King & Wiseman, 2001). However this could be issues of importance to all teachers or at least to most and not just to those who report a high satisfaction at work; a sense of job satisfaction may enhance the teachers' quality of teaching and motivation of students to learn. (Nyongesa, 2011). While job satisfaction will not necessary help a person become a better teacher, consistent lack of satisfaction at work may be associated with frustration and ultimately with the apathy associated with burn- out and this will influence the quality of instruction (Wenglinsky, 2000). Figure 2 shows the general performance of students in biology since joining form one in relation to their gender.

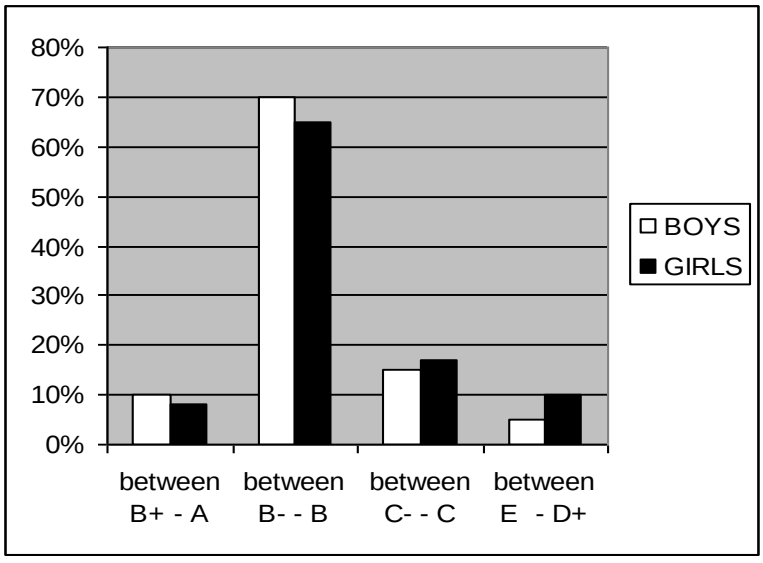

Figure 2: The General Mean Grade Performance in Biology of the Students.

Information in Figure 2 indicates that male students had an overall better performance than the female students in biology. The female students on the other hand had a higher representation in lower grades. For the higher grades between B+ and A the male students had (10%) representation while the female students had (8%) representation. This implies that biology is among the gender related science subjects.

Conclusions

Emerging trends according to the findings of this study indicated that the gender of the teacher and the teaching experience in years in this age of science education, were not the key factors that influenced delivery of content by the teachers and performance of secondary school students in biology directly but rather indirectly. Teacher perceptions, teaching methods applied the type of teacher –pupil classroom interactions, teacher expectations of students in terms of performance and science anxiety levels of the teachers- partly contributed by lack of job dissatisfaction or satisfaction were the key factors that influenced performance in biology. A basic question relates to the proper role of the teachers of biology in enhancing the learning. What criteria should guide us in determining what the teacher can try to do, much less what he or she can do? Where must the teacher begin? Can the biology teacher effect sufficient change of attitude and learning behavior in biology? There is no sufficient understanding of the effects that various teaching practices have on raising or lowering student attitude and science anxiety gender-wise. It can also be concluded that if we measure the cost in terms of unfulfilled human desires, underdeveloped capabilities and unexplored potential for improving the quality of biology education, any amount of money needed to do the job will be well worthy the expenditure. This is in consideration of the fact that, we are living in an age in human history of high technology and industrialization where biology education plays a key role. Therefore teachers of biology must consider the emotional, social and intellectual constructs if we are to examine the total educational goal of schools in a free society. The instructional materials should be free of gender biases and stereotypes. Figure 3 shows the conclusive working model of the inter-relationship between the genesis of teacher related factors, their outcomes and their influence on student performance in biology as envisaged by this study.

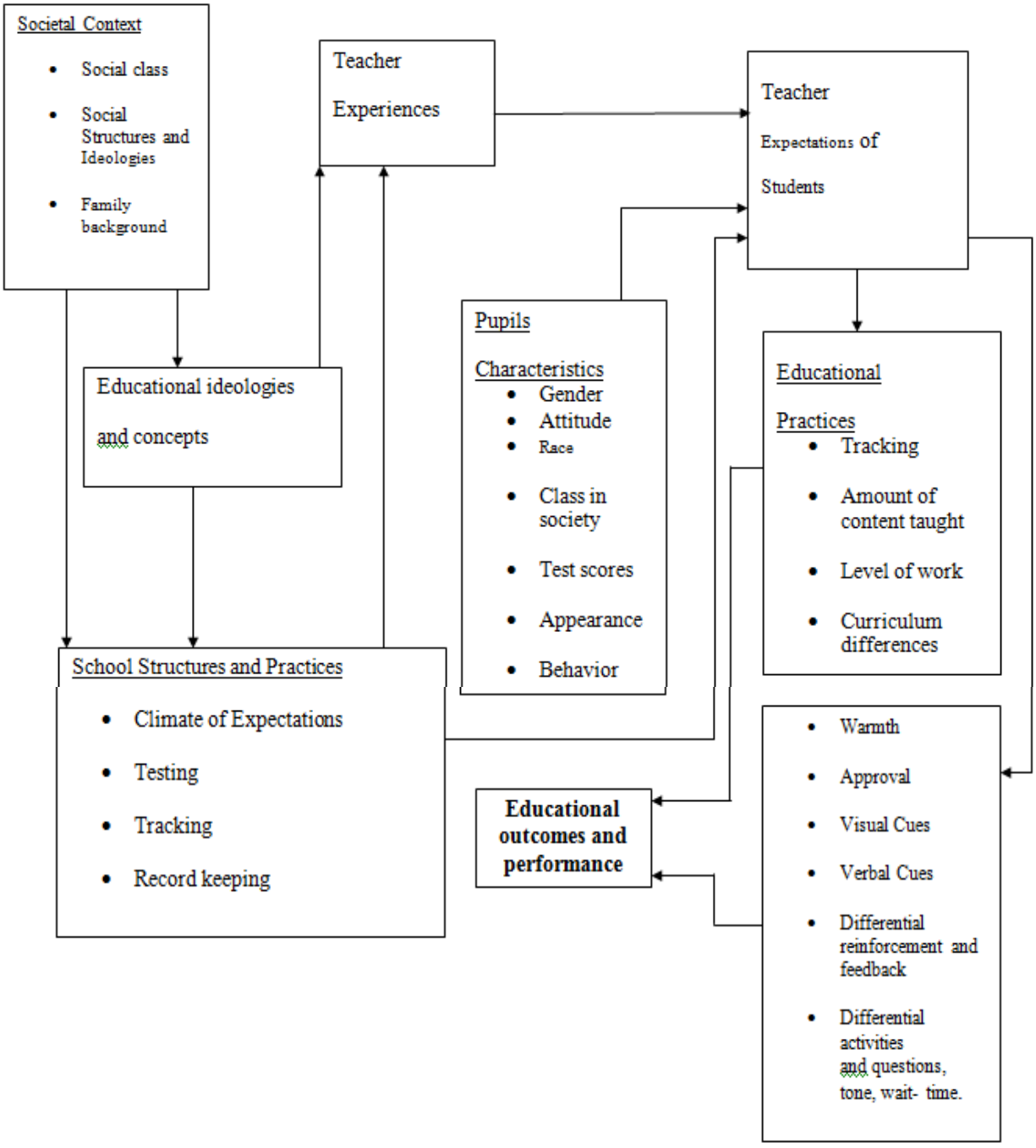

Fig3: Genesis of Teacher Related Factors and their outcomes.
Source: Researcher.

Recommendations

Most children have some difficulties. Teachers on the other hand are not perfect, and schools being institutions (however child centered) can not be ideal for every child all the time. Given normal attention, most problems can be dealt with. Some avenues are listed below without elaboration at this point.

(i) Teacher education programs need to prepare teachers for the realities of classroom

management, particularly in science, training from a life cycle approach. Such an approach in engendering the education system is likely to yield greater returns among generations of students.

(ii) Teachers of biology should provide opportunities for all children to participate in demonstrations and experiments. The students should be given recognition for their projects by having their exhibits displayed to other pupils as well as to their parents at periodically organized community science fairs. This helps to tap the creative skills and abilities of the children.

(iii) The Ministry of Education and policy makers should ensure that the instructional materials, the curriculum and examinations are gender sensitive. This call for the need to develop a criterion for evaluating gender – biases and stereotypes in instructional materials especially textbooks for all the National Curriculum Development Centers and Examination Council.

(iv) Teachers of biology should embrace the ASEI /PDSI approach as advanced by the SMASE Project which can improve on students' attitude and creativity much required in Industry, to bridge the gap in The Global Economy.

(v) Experiences with handling of science classes, which differ in some ways from other subject areas due to the laboratory, inquiry-based nature of science, should be an integral part of teacher education courses. Therefore, it is crucial that pre-service teachers have experiences with exemplary practicing science teachers.

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