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INVESTIGATION ON THE RELATIONSHIP BETWEEN PUPILS' EXPERIENCE IN SCIENCE ACTIVITIES AND SCIENCE ACHIEVEMENT

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ABSTRACT

This study investigated the relationship between pupils' experience in science activities and science achievement. The research design used was a cross-sectional survey. The target population was pupils in public day primary schools in Nakuru municipality Kenya, while the accessible population was the class seven pupils. A sample of 160 class seven pupils was used in the study. Two instruments were used for data collection, Science Achievement Test (SAT) and Pupils Questionnaire (PQ). The instruments were validated and pilot tested before use. The reliability Coefficient of PQ and SAT were 0.79 and 0.75 respectively. Statistical analysis of the quantitative data was done using Pearson Product Moment Correlation Coefficient (PPMCC) and t-test at alpha level of 0.05. The results of the study revealed that there was no relationship between pupils' experience in science activities and science achievement. There is need to have strategies to improve science activities and achievement in primary schools.

Keywords: Pupils' Experience, Science Activities, Science Achievement

INTRODUCTION

Science is an important part of a school curriculum and thereafter in the world of work. Science, technology and innovation are central to economic prosperity and to reaching the international development goals (UNESCO, 2006). Africa's common objectives and commitment to collective actions to development and use of science and technology for social-economic transformation aim at integrating the continent into the world economy. UNESCO acknowledges that science education is essential for human development, for creating scientific capacity and for having active and informed citizens. An improvement in science achievement at primary school level is of great importance as it lays a solid foundation for the pupils proceeding to secondary schools for further science learning. However the overall performance of both boys and girls at Kenya Primary Certificate Education (KCPE) is below a mean score of 50 in a scale of 1-100. Science is the second poorly performed subject after mathematics. Boys' science performance is slightly better than that of girls. Perhaps the boys are involved in activities that involve manipulative skills both at home and in school and they are able to relate and apply the skills during science classes arousing their interest and curiosity.

Table 1 shows results of KCPE Science performance by gender in Nakuru Municipality between years 2005-2012.

Table 1. KCPE Science Mean Scores by Gender in Nakuru Municipality 2008-2011

Year	*Raw Mean Mark*	
	Male	*Female*
2008	27.52	24.75
2009	30.89	27.32
2010	30.52	26.97
2011	33.79	30.30

Source: (KNEC KCPE 2009, 2010, 2011 and 2012 Reports)

Table 1 show that, over the years there is a steady improvement in science achievement except in the year 2010 which recorded a slight decline for both boy and girls. However the achievement is still poor for both boys and girls. Kithaka (2004) observes that there is a general feeling among learners that science is a difficult subject. This feeling according to him is a result of poor performance at national examinations, where anticipation of negative outcomes blocks or inhibits learning efforts. He further notes that too much theoretical teaching of science could also contribute to low achievement. Science education materials need to be redesigned to focus on the role of science and technology in societal development and more specifically on its usefulness and relevance in everyday life rather than on the capacity of man to master machines (Rathgeber, 1995).

Primary school science is important especially for those who do not continue with formal education. UNESCO (1999) notes that Egyptian schools foster creativity, critical thinking and problem solving skills as the basis for lifelong learning. Scholars and teachers have established gender sensitive classrooms where teacher-student interaction is mutually respectful and this encourages pupils to participate actively. Unfortunately, classrooms like these that apply the principles contained in the convention on the rights of a child are an exception in Africa (UNICEF, 1999). Gender sensitive classes should be composed of an equal number of girls and boys with equal participation. Science improves the conditions and quality of living, saves mankind from excessive toil and boredom, and it is a springboard for all the progress in the world (Mohanty, 2003).

Fewer girls than boys select and stay in sciences and their attrition rate is apparent at higher institution of learning as observed in a study involving university students at Penn State University (Amelink, (2009); Ng'ang'a, (2004). Social factors like implicit stereotypes right from birth, early childhood and schooling exposure exist and this might inhibit women from contributing to scientific and engineering advancement (Nosek, Smyth & Sriram, 2009; Rydell,Shiffrin,Boucher, Loo & Rydel, (2010).

Through socialization process at home and in the community, girls and boys acquire gender stereotypical roles, attitudes, values and norms (MOEST, 2006). Girls for instance internalise that girls and women are not good in science, maths and technology (SMT) subjects and thus develop negative attitudes about their ability in these subjects leading to their avoidance of, and poor performance in the subjects. Home factors such as traditions and pastoralist way affects science performance (Elimu Yetu Coalition (EYC), 2003). This is mostly felt by girls who are forced into early marriages. Female genital mutilation causes loss of interest in school work since girls are made to believe they are adult women ready for marriage. Some

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parents have negative attitude to girls' education and believe educating girls is like enriching her husband's family while educating a boy is enriching their own family. Often, boys are given preference by parents when it comes to purchasing core textbooks. EYC also explains that some families consider girls to belong to them only before marriage hence reluctant to spend so much on them on behalf of their future in-laws. More so marrying off girls provide the funds for financing the education of boys, or even for paying the bride wealth of their brothers. The pastoralist boys have to forego school during drought in such of pasture. This contributes negatively to science performance since time lost is never recovered.

STATEMENT OF THE PROBLEM

KCPE results analysis show poor science achievement among primary school pupils at national level. Gender stereotypes and low science experiences decrease self-esteem among many pupils and this leads to anxiety during examinations periods. These stereotypes are activated in the children's minds and are further enhanced by the scientific activities they are engaged with at home and in school. The results of this are that the pupils worry about confirming the stereotype affecting their achievement in science drops. It would therefore be necessary to investigate what effect regular activities with some scientific basis that pupils engage in both at home and in school have on pupil's science achievement. In addition it was also necessary to establish whether there was any gender difference in science achievement.

OBJECTIVES OF THE STUDY

The following was the specific objective of the study,

I. To establish if there is a relationship between pupils' experience in science activities and science achievement.

II. To establish if there is a gender difference between male and female pupils in science achievement.

HYPOTHESES OF THE STUDY

The following null hypothesis was tested:

H_O 2: There is no statistically significant relationship between pupils' experience in science activities and science achievement.

H_O 1: There is no statistically significant gender difference between male and female pupils in science achievement.

METHODOLOGY

A cross-sectional survey design which is a form of an analytical study that attempts to establish causes or risk factors for certain problems by comparing two or more groups was used in this study. Constructivist theory guided this study. Constructivist learning theory believes that the student must be able to build learning processes rather than just gain knowledge. Constructivists tend to be interested in teaching complex concepts. They also share the idea that knowledge must be applicable (EduTech Wiki, 2007). Constructivism demonstrate the importance of social interaction in teaching and learning and highlight the 'knowledge construction' processes of the learner and suggest that 'meaning making' develops through the social process of language use over time" (Ferdig & Trammell, 2004). The study adapted constructivist theory because science learning is a process and its products are for social consumption therefore social interaction is of paramount importance.

The research was carried out in Nakuru municipality, Nakuru County, Kenya. The target population was public day primary school pupils within Nakuru municipality. Public schools in Nakuru municipality draw pupils from urban centres and surrounding rural environs. The accessible population was the 4892 class seven pupils within the five zones in Nakuru municipality (Eastern, Western, Central, Southern and Northern zones). Class seven was purposively selected from each of the five randomly selected schools to be included in the study. Class seven was preferred because the pupils have tackled various science topics at primary school level including weather, human body, environment and energy. Class seven pupils are also relatively mature intellectually and have learnt science concepts sufficient to furnish the study with information required. Five schools were randomly selected to participate in the study. A total of 160 class seven pupils participated in this study. Through the assistance of the head teachers and science teachers of the sampled schools, SAT and PQ were administered to the pupils within a period of one week. The researchers scored the data and analysed it at alpha level of 0.05. Pearson Product Moment Correlation Coefficient (PPMCC) was used to establish where relationships existed between pupils' experience in scientific activities (SAS) and science achievement (SAT). T-test (for independent samples) that has superior powers to detect differences between two means was used to compare SAT mean scores of boys with that of girls.

RESULTS AND DISCUSSION

Relationship between Pupils' Experience in Science Activities and Science Achievement

To test the null hypothesis that there is no statistically significant relationship between pupils' experience in science activities and science achievement, the SAS and SAT scores were used. The SPSS version 11.5 was used to compute Pearson Product Moment Correlation Coefficient (PPMCC). The results are show in Table 2.

Table 2. Pearson Product Moment Correlation Coefficient for Pupils' Experience in Science Activities and Science Achievement

	N	SAT scores	P
SAS	157	0.057	0.482

An examination of Table 2 shows that there is no statistically significant relationship since r=0.057, p=0.482; p>0.05. This means that there is no relationship between pupils' experience in science activities and science achievement, and therefore null hypothesis Ho1 was retained

The study findings indicate that there is no relationship between pupils' experience in science activities in and out of school and science achievement indicates that primary school pupils do not relate the science activities they engage in everyday with the science learnt in class. This finding contradicts Tsuma (1998) who found out that, out of school co-curricular experiences do play such a strong role in the science interests and achievement of students. He concluded that attitudes towards science change with exposure to science but direction of change may be related to the quantity of that exposure.

In this study pupils were exposed to theoretical items only. Primary school pupils did not get exposed to practical science activities and hence cannot relate the science experienced outside class with the science that they learn during science lesson time. The results in this study are in line with conclusion made by Hodson and Hodson (1998) who found that everyday learning occurs simultaneously in the context of everyday experiences but learning of science

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has to be organized so that pupils can construct necessary understanding on their own. Marsh (2003) observes that science learning should be made more natural. Classroom "learning" is unnatural and something that does not occur in early years of life when a child learns a language, and something that adults avoid after they have escaped formal education. Marsh argues that unnatural classrooms do not take care of interests and dynamic functions and as such, the numerous science experiences pupils encounter in their daily life leaves no impact as far as achievement in science is concerned.

Science consist theories; learning science is learning theories which are the content. Actual examples and experiences are not the content but vehicles for learning the content (McClelland, 1982). McClelland however observes that direct interaction with real objects is central to learning process in science but successful instruction in science at primary level would be best achieved through relatively short bursts of individualized teaching materials concentrating on theory development, interspersed with normal classroom activities, both serving to exemplify and further elaborate the theories and giving opportunities for technological developments. Children solving technological problems can be little technologists. As such constant dialogue between teachers and pupils is essential if good intervention decisions are to be made. It is the nature of language used by the teachers during these exchanges that also establish the interpretive framework within which pupils are able to make scientific sense of whatever is being studied and enables them to make the crucial transition from simple descriptive observation to concept based statements.

The researchers agree with Rogoff (1990) who proposes a more formal, instruction-oriented apprenticeship where novices are systematically coached, guided and supported by expert practioneers which depend on communication and negotiation between teacher and learner. Teacher and learner negotiate on new knowledge or skill and how it can be made compatible with existing understanding and capability. This can assist learners relate the science experiences they encounter in and out of school with the science they learn in classroom and boost their achievement in science.

Gender Differences in Science Achievement

To test the second null hypothesis that there is no statistically significant gender difference between male and female pupils in science achievement. Analysis of independent sample t-test was done and the results are shown in Table 3.

Table 3. Independent Sample t-test of Pupils' Gender Difference in Science Achievement

Group	*N*	*Mean*	*Std. Deviation*	*Std Error*	*Df*	*t-value*	*p-value*
Male	80	46.84	15.72	1.82	155	2.80	0.006
Female	80	40.28	13.60	1.50			

Results in Table 3 show that the males had a SAT mean score of 46.84 and females SAT mean score was 40.28. df=155, t_{cri}=2.36, t_{cal}=2.80; $t_{cri} < t_{cal}$, p=0.006, p<0.01. Ho2 was therefore rejected implying that there was a significant gender difference in science achievement among primary school pupils.

DISCUSSION OF RESULTS

These findings strengthen the work of University of Virginia (2009) that arrived at the similar conclusion. In that study, it was found that males and females, at age 9, have quite similar

math and science scores. At age 13 the gender gap is quite apparent and at age 17 the gap is even wider. MOEST (2009) recommends class one pupil entry age of 7 years. Class seven pupils in Kenyan primary schools are therefore about 13 years old and they were the participants in this study. According to the study findings there is a gender difference in science achievement among the class seven pupils and this finding concurs with the findings of Bhanot and Jovanovic (2005). They *came up with similar conclusions that there is gender difference in science achievement among girls and boys of ages 13 to 17 years.* They found out that many factors undoubtedly contribute to the negative attitudes toward science and the lack of interest expressed by many female students. These factors include, but are not limited to, parental and societal attitudes, lack of adult role models, myths about female aptitudes, classroom patterns, stereotyping, and overt discrimination.

Parents also endorse the stereotype that math and science is a male domain and hence their daughters underestimate their math and science ability (Bhanot and Jovanovic, 2005). To boost girls' confidence in math and science it must be understood how girls perceive messages from parents and other adults about their abilities. Girls need help so that they can learn to interpret these messages to their advantage. Teachers can assist in reversing this situation by offering hands-on activities, and holding high expectations for all students. Some strategies include: structuring activities so girls play an active, rather than passive role in laboratory and field experiments, and showcasing female role models. Putting females in a situation where they're not preoccupied with negative gender stereotypes, they can significantly reduce the gender gap in standardized testing performance (McGlone, 2009).

CONCLUSIONS

Based on the findings, the study concluded that pupils do not associate science learnt in class with everyday events as well as applied science. Otherwise if they did relate science learnt in class with applied science around them, there would be a relationship between experience in science activities and science achievement. The study also concluded that there is a gender difference in science achievement among primary school pupils.

RECOMMENDATIONS

Science teachers emphasize the use of interactive approaches that require pupils' participation science lessons. They should also continually sensitize pupils on the importance of learning and achieving highly in science. This can be done for example by teachers encouraging more participation of science co-curricular activities like science symposiums and fares. It is also recommended that the curriculum, teaching and learning materials be engendered.

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