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Research Article

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ABSTRACT

Although knowledge of biology is important for the survival of humans, performance in the subject, both in pre-Kenya Certificate of Secondary Education (pre-KCSE) assessment and national examinations in Vihiga county has always been below average. Several interventions have been put in place to rectify the situation but in vain. However, the effect of the general computer use has not been investigated. This study investigated the effect of the general computer use on secondary school students' performance in biology. This study used descriptive survey research design. The target population was secondary school biology students of Vihiga county. Data collection was by use of questionnaires, interviews, and document analysis schedule. Sampling was by multistage sampling, purposive sampling, stratified sampling, proportionate sampling and simple random sampling. Sample size was 1003 students. The collected data was analysed using descriptive statistics such as frequencies, percentages and means and inferential statistics such as Pearson's r, using the Statistical Package for Social Sciences (SPSS). The significance level of the difference between the data was done at the alpha value of 0.05. This study found that there is no relationship between the general computer use and performance in biology.

Keywords: Computer, frequency, octile, performance.

BACKGROUND TO THE STUDY

Biology deals with the study of living things and how they relate with each other and with their environment. Consequently, knowledge of biology, if well applied, can improve the welfare of humans (Maundu et al., 1998). It is because of the uses of biology that countries include it in their curricula. This is because a curriculum is supposed to enable learners to acquire and develop the desired knowledge, skills and attitudes (Oluoch, 1982). In Kenya, the inclusion of biology in the secondary school curriculum is aimed at enabling the learner to understand and deal with the problems of the self, the environment, and the future (Republic of Kenya, 2002).

The establishment of whether the objectives of teaching biology have been achieved is done through tests and examinations. However, just like other sciences and in addition to mathematics, performance by secondary school students in biology examinations is generally poor as compared to non-science subjects. This is partly due to the unsuitable teaching methods employed by teachers (CEMASTEA, 2012; Republic of Kenya, 2012). This implies that the objectives of including biology in the curriculum are not being achieved. The national biology performance in Kenya Certificate of Secondary Education (KCSE) is shown in Table 1 below.

Table 1: National percentage scores in biology by year

Year	National percentage mean score
1998	29.79
1999	31.21
2000	27.81
2001	27.49
2005	29.63
2006	27.45
2007	41.95
2008	30.32
2009	27.43
2011	32.44
2012	26.21

Source: Kenya National Examination Council (KNEC) (2002, 2007, 2008, 2010), Nation Correspondent (2013)

All the mean scores shown in Table 1 are below average. The poor performance in science (biology included) is a national concern and is articulated in the Session Paper Number 1 of 2005 (Ministry of Education, Science and Technology (MOEST), 2005b). Vihiga is one of the counties that perform poorly in biology, both in pre-KCSE assessment and final examination at the end of form four. For example, in addition to a national mean score of 4.63 in 2008 (Kwega, 2009) and 4.36 in 2012 (Republic of Kenya, 2012), the biology mean scores in Vihiga County pre-KCSE assessments are as shown in Table 2 below.

Table 2: Vihiga county biology pre-KCSE mean scores by year

Year	Vihiga county biology mean scores in pre-KCSE assessment out of 12 points
2004	3.74
2005	4.36
2006	4.18
2007	4.37
2011	4.08
2013	4.60

Source: Vihiga District (2007), Republic of Kenya (2011, 2013)

The mean scores shown in Table 2 above are very much below average, on a 12- point scale. Hence, there is need to put in place strategies that can lead to improvement. One of such strategy could be the use of educational technology, such as computers in teaching and learning biology.

Educational technology is the development, application and evaluation of systems, techniques and aids to improve the process of human learning (Percival and Ellington, 1988). Jaffer et al. (2007) point out that educational technology has a key role to play as one of the strategies for addressing teaching and learning concerns. The educational technology enhances communication between the teacher and the learner and also enhances the ability to control and adapt to the environment (Wikipedia, 2009). Therefore, if well used, the technology can increase the efficiency and effectiveness of learning.

Initially communication was through signs, then speaking and then writing (Shelly et al., 2000). Therefore, teaching initially involved verbal communication between the teacher and the learner (Ellis, 1997). Later on audio technology, visual technology and then audiovisual technologies were adopted in education with the aim of enhancing learning. One of the audio technologies, the radio, and the audiovisual technologies, the TV, have had great impacts on education. For example Sadker and Sadker (2000) argue that to ignore the impact of TV on education is to ignore a major educational influence on children. They argue further that by the time an average student reaches 18 years of age, he or she would have attended 11000 hours of school and watched 15000 hours of TV. Exposure of children to programs designed around an education curriculum is associated with cognitive and academic enhancement whereas exposure to pure entertainment and violent content is associated with poor cognitive development and lower academic achievement (Kirkorian et al., 2008). However, students are now growing up in a world that is far different technologically from the world in which their parents and grandparents were children (Santrock, 2004). For example, right now there is an increased acquisition and use of computers in schools, homes and even offices (Johnson et al., 1988 ; Santrock , 2004). Besides, computers are more versatile than TVs

(Ahiatrogah et al., 2013). Moreover, although there is a lot of research on experimental designs, very little research is available to show the influence of the general use of computers on the learners' performance in biology, in Vihiga County. In addition, most researches available are based in developed countries that did not initially clearly show whether CAI improved students' academic achievement (Collins et al., 2008). Right now research shows that CAI enhances the achievement. Furthermore, Kenya and even Vihiga County are not at the same computer development stage as developed countries. For example in 1994, 35% of public schools in the United States had access to the Internet and nine years later the figure had risen to 100% (Schmidt and Vanderwater, 2008). Internet access among Kenya's public schools is still low. Some of the schools do not even have electricity.

A computer is a programmable electronic device that can input data, process it, and produce an output (Shelly et al., 2000; Percival and Ellington, 1988). The computer is fast, accurate, never gets tired (Kerre, 2006) and evolves very fast. The computer processor doubles in complexity every 2 years, a phenomenon called Moore's law (Wikipedia, 2013). The computer can also motivate, excite and enthuse children (Collins et al., 2008; Tekbiyik and Akdeniz, 2010). Motivation is very important in enhancing learning (Kwong, 2001).

A computer can do some things that a teacher cannot do. Indeed, almost any conceivable manipulation of data can be done by computers (Ryan and Cooper, 1998). For example, a computer can remind exactly what problems every member of the class got wrong or right two days ago, can check spellings and grammar in seconds (Geisert and Futrel, 2000) and can also simulate a wide variety of situations (Ahiatrogah et al., 2013). However, they sometimes miss errors that exceed their grammatical knowledge and can sometimes tell one that something is wrong when it is not (Feldman, 2004). This implies that if one only relies on the options provided by the computer in editing his/her work, he/she may end up being misled in some things. Overuse of computers may interfere with handwriting (Owston et al., 1992), disrupt students, reduce effort levels and restrict the creativity of students (Gamboa and Garcia-Suaza, 2011). Hence, one must always carefully edit and proofread his/her own work. Consequently, a teacher can do some things better than a computer and therefore a teacher and a computer can make such a great teaching team.

Computers can create word documents, do computation, present information, manage data, or talk to students. In data management, the computer can store and facilitate subsequent retrieval of vast amounts of information. Such computerized databases have not only revolutionized the world's library systems, but are also having a tremendous impact on education. For example, students who wish to do literature search no longer have to do it manually but can do it by linking up with appropriate bibliographic databases. Users can also create their own custom-built databases. Furthermore, because of virtual resources such as e-mail and Internet, one can learn a subject without stepping in class (Feldman, 2004).

As presentation tools, computers can combine text, graphics, audio, video, and virtual environments to communicate complex ideas, concepts and scenarios (Ryan and Cooper, 1998; Tekbiyik and Akdeniz, 2010). Unlike other presentation devices such as posters, overheads, and videos, computerized presentations can be interactive, editable and network transportable and the user can maintain precise control over pacing (Collins et al., 2008). It can also be an artist, entertainer, research assistant, librarian, measuring instrument for science experiments, and a historian (Geisert and Futrel, 2000). For the computer to accomplish all these, it needs to have the right programs. However, the computers available in most Kenyan secondary schools and homes only have general computer software that were not specially made to address particular instructional objectives. In addition, some materials available on the Internet are not tailored to the Kenyan education system. Some other materials presented on computers are boring to some learners and therefore need a written textbook to guide them (Robinette, n.d.). The learner may also need written communication with the teacher (Holubova et al., 2008). Holubova et al. add that real experiments and the world of the teacher are irreplaceable for such learners.

One method used by the Kenya Government to motivate school children and other people to acquire and use computers is by reducing taxes on computers and their accessories. In addition, there is a computer supply program to selected secondary schools in each constituency through the economic stimulus program (ESP). Furthermore, the increased installation of electricity in rural areas is likely to make many people to access computers, making computers to become part of our lives (Laudon et al., 2002). This is likely to have some effect on the education of children.

STATEMENT OF THE PROBLEM

Students' performance in Kenya Certificate of Secondary Education (KCSE) examination in biology in Vihiga County has remained below average despite several interventions such as content reduction and reorganization; increased time allocation from 3 lessons in form 1 and 2, and 4 lessons in form 3 and 4 before the year 2003 to 4 and 5 lessons, respectively, starting with form 1 in 2003 (MOEST, 2000; MOEST, 2003); and Strengthening Mathematics and Science Education (SMASE) programme. SMASE is an in-service programme aimed at improving the teaching skills of science teachers (CEMASTEA, 2012). The continued poor performance in biology implies that the problem still needs to be addressed. Moreover, some researchers, while studying some content areas have demonstrated that the use of computers in class influences academic performance positively. For example Wekesa et al. (2008) and Akwee et al. (2012) in their research publications pointed out that computer based instruction (CBI) enhances scores in the subtopics *Cell Division* and *Gene Concepts,* respectively. However, Wekesa et al. (2008) and Akwee et al. (2012) only experimentally focused on the learners' use of computers in class without taking into consideration their use outside the class. Kirkorian et al. (2008) argue that influences of electronic media on academic achievement can be for good and for ill. Moreover, most schools only have general computer software rather than the software that address specific curriculum objectives. Hence, this study investigated the relationship between secondary school students' frequency of computer use and performance in biology. This study investigated the learners' use of computers in general because human beings do not behave the same way in natural conditions and experimental conditions. Furthermore, there is a division among researchers on the academic benefits of computers (Noll, 2005; O'hara, 2004; Collins et al., 2008). Consequently, in addition to providing information that would contribute towards showing the effect of computer use on students' performance in biology, this study would also contribute towards shedding light on the academic benefits of computers.

METHODOLOGY

This study used descriptive survey research design. Sampling involved multistage sampling, purposive sampling, simple random sampling, and stratified proportionate random sampling. Multistage sampling was used to sample schools, streams, and then the learners who were included in the study. Purposive sampling was used to select the schools and the streams that were included in the study. The schools included those that offered computer studies, and/or SMASE centers. In the classes that all students did computer studies or computer literacy, sample streams were selected by simple random sampling. In the classes that had specific streams for computer studies, the streams that were included in the study were those that were offering computer studies. In form 1 and 2 sample students were selected by simple random sampling while in form 3 and 4 the learners in the sample streams were stratified into those that did computer studies and those that did not do computer studies. In the mixed schools, the learners were also stratified into boys and girls. After creating the strata, respondents were selected from each stratum by proportionate random sampling. The learners were then investigated on their computer use and performance in biology. Table 3 shows sampling procedures and the components of the study sampled.

Table 3: Sampling procedures and the components of the study sampled

Sampling procedure	Components of the study sampled			
Multistage	School	stream	gender	learners
Purposive	School	stream		
Simple random		stream		
Stratified proportionate random			gender	learners

The teachers who took part in the study were obtained by multistage sampling and purposive sampling. Multistage sampling was used to sample schools and then teachers who took part in the study. Purposive sampling was used to sample the schools whose teachers participated in the study. All the trained biology teachers in the schools that provided learners for the study were included in the sample.

To calculate sample size, n, there was need to have some idea of the standard deviation in the population and also decide how large a standard error that could be tolerated. According to Frankfort-Nachmias and Nachmias (1996), sample size can be calculated using the formular:

$$n=S^2/(SE)^2$$

where

S^2 = Sample variance
SE=Standard error

However, Frankfort-Nachmias and Nachmias (1996) add that if the sample size is too large relative to the population, the finite population correction is added and the final sample size is thereby calculated by the formular:

$$nf = \frac{n}{1 + n / N}$$

Where

N= population size. In this study the population size, N, was 40564 students.
n= sample size
nf =optimal sample size

This study considered a standard error of 0.03 to be acceptable. Moreover, the standard deviation during KCSE 2011 form four county evaluation in biology was 0.95 (Vihiga County Mock Results, 2011).

Hence,

$n = 0.95^2/0.03^2$
$= 1002.77$
$= 1003$ students

Optimal sample size would therefore be

$$nf = \frac{n}{1 + n / N}$$

=1003/ (1+1003/40564)
=978.796
=979 students

Nevertheless, a boy school, a girl school and a mixed school were purposively sampled in each of the four districts of the county. The sample schools had a total of 8342 students. The optimum calculated sample formed 11.73% of the students in the sample schools. This was approximately 12%. Consequently, this study used a sample of 12% students in each of the sample schools. However, as a result of rounding off some of the figures, a total sample of 1003 students was arrived at. Kathuri and Pals (1993) argue that it is a rule to use the largest sample possible in order to avoid the likelihood of making an error in hypothesis testing. Furthermore, because the study involved correlation and because Kathuri and Pals (1993) recommend a minimum sample size of 30 cases for studies involving correlation, then the sample size of 1003 students was considered very adequate. Apart from students, this study used a sample of 37 teachers. This is considered adequate because Kathuri and Pals (1993) recommend a minimum sample size of 20-50 individuals for the minor subgroup in survey research, and 15 cases for causal comparative and experimental research.

The data collection instruments that were used in this study were questionnaires (Biology Students' Questionnaire (BSQ), Biology Teachers' Questionnaire (BTQ), interview schedule (Biology Students' Interview Schedule (BSIS), and Mark Book Analysis Schedule (MBAS). A questionnaire is a collection of items or questions to which a research subject is expected to respond (Kathuri and Pals, 1993). The questions are used to elicit information from respondents and are not intended to show whether the respondent is right or wrong. A questionnaire is used in educational research to obtain information about certain conditions and practices and to inquire into opinions and attitudes of individuals or groups (Koul, 1993). A questionnaire is cheaper and can also be used on many respondents at a lower cost (Frankfort – Nachmias and Nachmias, 1996). Among the questionnaires that were used in this study were BSQ and BTQ. BSQ was used to collect data concerning frequency of computer use (on a likert scale), attitude towards computer use, and the relationship between computer use and performance in biology. BTQ was used to collect data concerning factors that influence computer use by secondary school biology students. The problem with questionnaires is that respondents can misunderstand the questions or could give biased answers. In order to deal with this problem, the questionnaires were piloted, in order to be validated.

An interview schedule is an outline of questions that form a basis for and guide the interviewing process (Kathuri and Pals, 1993). Among the advantages of interview are that it is flexible and probes the respondents deeper (Frankfort-Nachmias and Nachmias, 1996). Moreover, interview has a higher response rate than questionnaires. The interview schedule that was used to collect data in this study was the Biology Students' Interview

Schedule (BSIS), which was used to collect the same data as BSQ. Document analysis involves analyzing the data obtained from records and documents (Frankfort-Nachmias and Nachmias, 1996). In this study, Mark Book Analysis Schedule (MBAS) was used to collect data from students' mark books or files that contained students' marks.

The instruments were developed by the researcher with the guidance of experts in Masinde Muliro University of Science and Technology. The instruments were used together for triangulation purposes. Triangulation is the use of two or more methods of data collection to test hypotheses or measure variables (Frankfort-Nachmias and Nachmias, 1996). This is done in order to enhance the validity of the results. The instruments for data collection were piloted in order to assess their appropriateness. Mugenda and Mugenda (1999) recommend a pilot sample of between 1% and 10%. Piloting was done in one school from Kakamega County. The pilot school was chosen purposively. Cronbach's coefficient alpha was used to estimate reliability. Cronbach's coefficient alpha is the average split-half correlation based on all possible divisions of the measuring instrument into two parts. Cronbach's coefficient alpha was considered appropriate for this study because it is suitable for both open ended and closed items (Gall et al., 1996; Salvia and Ysseldyke, 2001). Instruments in this study had both open-ended and closed items. The reliability co-efficients of the tools were considered acceptable because they were more than 0.7 (Frankfort-Nachmias and Nachmias, 1996). The reliability coefficients for the tools were 0.9073 for BSQ, 0.8957 for BSIS and 0.7688 for BTQ.

BSQ and BTQ were delivered to the respondents by the researcher himself. The respondents completed the questionnaires and returned them to the researcher. Those who were not in a position to complete them were allowed more time after which the researcher came to collect them. This was done in order to ensure that the response rate was high (Ndagi, 1984). A biology teacher in the sample schools administered the interview. The teacher who conducted the interview was trained on how to do it. The researcher himself administered document analysis.

Out of the 1003 questionnaires that were delivered to schools, only 974 were returned. This gives a response rate of 97.11%. This response rate is above the 70% response rate that is considered to be very good (Mugenda and Mugenda, 1999). However, out of the questionnaires that were returned, three of them were not filled to completion. Consequently, they were not included in the analysis. Hence, 971 questionnaires were the ones that were analysed. Moreover, all the interview schedules that were delivered to schools were returned, giving a response rate of 100%. Furthermore, out of the 37 BTQs that were delivered to schools, only 34 were returned, giving a response rate of 91.89%.

Data was collected concerning students' computer use, and their performance in biology. Performance in biology involved scores attained by learners in tests and examinations. Computer use involved frequency use of computers on a likert scale. The instruments that were used for data collection had both open-ended and closed items. The data was coded and then entered into a computer. Both descriptive and inferential statistics were used for data analyses. The descriptive statistics that were used for data analysis included frequencies, percentages and means. These were summarized using tables and graphs. The inferential statistic that was used for data analysis was Pearson's r. Pearson's r is used to measure the association between pairs of interval variables (Frankfort-Nachmias and Nachmias, 1996). The significance of the statistical tests was done at the alpha value of 0.05. The analyses of the data were done using Statistical Package for Social Sciences (SPSS).

RESULTS, ANALYSES AND DISCUSSIONS

This study set out to determine the effect of secondary school students' frequency of computer use on their performance in biology. In addition, their attitudes to computers were explored. Two approaches were used to find out the relationship between the frequency of computer use on biology students' performance. The approaches included asking students to respond to the Biology Students' Questionnaire (BSQ) and involving them in an interview using Biology Students' Interview Schedule (BSIS). The two data collection approaches were used together for triangulation purposes. Triangulation, which enhances the validity of the results, involves the use of two or more methods of data collection to test hypotheses or measure variables (Frankfort-Nachmias and Nachmias, 1996). For example, a structured questionnaire can be supplemented with in-depth interviewing. The biology students' performance was measured in the form of the octiles of the students' scores. The octiles ranged from 8 (First octile) to 1 (Eighth octile). The students also responded to the questions in BSQ and BSIS requiring them to state how frequent they used computers. The frequency of computer use was on a scale ranging from 10 (Daily computer use) to 1 (No computer use). The results are presented in Table 4 below.

Table 4: Comparison between questionnaire and interview means, standard deviations and standard errors of the octiles and frequencies of computer use

Variable	Questionnaire or interview	N	Mean	Std. Deviation	Std Error of mean
Octile	Questionnaire	971	5.4480	2.0972	6.730E-02
	Interview	107	5.8505	2.1315	0.2061
Frequency of computer use	Questionnaire	971	6.1627	3.3786	0.1084
	Interview	107	6.1028	3.2993	0.3190

From Table 4 above, the questionnaire and interview results show mean frequencies of computer use of 6.1627 and 6.1028, respectively, on a scale ranging from 1 to 10. The fact that these mean frequencies are above average could be because of the purposive selection of computer studies students, who use computers while learning computer studies. Table 5 below shows an independent samples t-test for the scores.

Table 5: Levene's test for equality of variances and t-tests for equality of means of the octiles and frequencies of computer use

Variable	Assumption	Levenes test of equality of variances		t-test for Equality of means						
		F	Sig.	T	Df	Sig. (2 tailed)	Mean Difference	Std. Error Difference	95% Confidence interval of mean	
									Lower	Upper
Octile	Equal variances assumed	.207	.649	-1.881	1076	.060	-.4025	.2140	-.8223	1.736E-02
	Equal variances not assumed			-1.857	129.8	.066	-.4025	.2168	-.8314	2.640E-02
Frequency of computer use	Equal variances assumed	.661	.416	.174	1076	.862	5.992E-02	.3434	-.6138	.7336
	Equal variances not assumed			.178	131.7	.859	5.992E-02	.3369	-.6065	.7263

Table 5 above shows an independent samples t-test conducted to compare the mean frequency of computer use for questionnaire responses (M=6.1627, SD=3.3786) and interview responses, M=6.1028, SD=3.2993; T (1076) = 0.174, P=0.862 (two-tailed). The magnitude of the differences in the means (mean difference =5.99E-02, 95% CI: -0.6138 to 0.7336) was very small (eta squared =0.00003). Pallant (2007) considers partial eta squared of 0.01-0.06 to be small, between 0.06 and 0.14 to be moderate and above 0.14 to be large. As the significance value for the t-test is greater than 0.05 then this indicates that there is no significant difference between the questionnaire and interview means. Moreover, because the Levene's test for equality of variances shows a significance value of 0.416, which is greater than 0.05, then this indicates that the variances between questionnaire and interview responses are approximately equal. This is because the questionnaire and interview samples came from the same population. Table 6 below shows the distribution of students in the various frequencies of computer use by schools.

Table 6: Questionnaire and interview schedule distribution of students in the various frequencies of computer use by schools

Tool	School	Frequency of computer use										Total
		1	2	3	4	5	6	7	8	9	10	
Questionnaire	Bunyore	12	2		5	5	1	8	22	64	11	128
	Ebubayi	33		3	4	6	5		7	6		66
	Ebunangwe	6		2	1		1	1	6	7	2	26
	Nyang'ori	25		2	6	6	3	12	3	45	24	126
	Tigoi	23		1	3	5	3	5	6	23	4	73
	Museywa	7		2	2	2	1		2	1		17
	Vokoli	60		10	9	1	7		6	6	5	104
	Chavakali	4			2	1	4	3	64	42	16	136
	Lusengeli	36		5	3	4	3	2	2	1		56
	Vihiga				3				1	110	2	116
	Madzuu	6		3	1	17	4	11	17	9	7	74
	Vigina	26		2	1	1	3	4	4	6	1	49
	Total	238	2	30	40	48	35	46	140	320	72	971
Interview	Bunyore	1			1			2	4	5	1	14
	Ebubayi	5		1	1		1					8
	Ebunangwe				1		1		1	1		4
	Nyang'ori	4							2	6	1	13
	Tigoi	1			2	1	1	2		7		8
	Museywa	1							1			2
	Vokoli	4		1			1		2	1	1	10
	Chavakali								7	4	3	14
	Lusengeli	3		1			1	1				6
	Vihiga				1				1	10		12
	Madzuu	1			1	3	1	1			2	9
	Vigina	5							1	1		7
	Total	25		3	7	4	6	6	19	29	8	107

From Table 6 above, it is evident that out of 971 and 107 questionnaire and interview respondents, respectively, more than half of them (532 (54.79%) questionnaire respondents and 56 (57.94%) interview respondents) had a frequency of computer use of at least 8 out of 10 while less than half of the students (439 (45.21%) questionnaire respondents and 51 (42.06%) interview respondents) had a frequency of computer use of 7 out of 10 and below. The reason why most students are in the upper half could be due to the purposive inclusion, in the study, of the streams whose students did computer studies.

In relation to performance in biology, questionnaire and interview results indicate mean octiles of 5.4480 and 5.8505, respectively (Table 4). An independent samples t-test was conducted to compare the mean octiles for the questionnaire responses (M=5.4480, SD=2.0972) and the interview responses, M=5.8505, SD=2.1315; T (1076) = -1.881, P=0.060 (two-tailed). The magnitude of the differences in the means (mean difference = -0.4025, 95% CI: -0.8223 to 1.736E-02) is very small (eta squared =0.0033) (Table 5). Consequently, because the significance value for the t-test is greater than 0.05, then this indicates that there is no significant difference between the questionnaire and interview means. The distribution of students in the various performance categories is shown in Table 7 below.

Table 7: Questionnaire and interview schedule distribution of students in the various performance levels by schools

Tool	School	Octile								Total
		8th	7th	6th	5th	4th	3rd	2nd	1st	
Questionnaire	Bunyore	15	7	6	13	21	22	25	19	128
	Ebubayi	4	11	14	4	10	6	9	8	66
	Ebunangwe	1	2	1	3	5	4	7	3	26
	Nyang'ori	11		10	7	21	15	33	29	126
	Tigoi	1	7	10	8	13	7	12	15	73
	Museywa	2		1	2	2	3	3	4	17
	Vokoli	7	7	9	16	11	16	21	17	104
	Chavakali	1	2	5	7	38	19	28	36	136
	Lusengeli	2	3	2	5	7	10	8	19	56
	Vihiga	3	2	4	6	44	14	20	23	116
	Madzuu	13	9	10	10	4	9	7	12	74
	Vigina	1		9	9	5	7	6	12	49
	Total	61	50	81	90	181	132	179	197	971
Interview	Bunyore	1	1	1		4		5	2	14
	Ebubayi		1	2	1	2			2	8
	Ebunangwe				1	1	1	1		4
	Nyang'ori				1	1	3	3	5	13
	Tigoi		2	2	1				3	8
	Museywa						1		1	2
	Vokoli	1		1			1	4	3	10
	Chavakali					1	1	5	7	14
	Lusengeli				1		1	1	3	6
	Vihiga	1	1			3	2	2	3	12
	Madzuu	1	1	3	1	1		2		9
	Vigina			2		1	1		3	7
	Total	4	6	11	6	14	11	23	32	107

Findings in Table 7 above show that out of 971 and 107 questionnaire and interview respondents, respectively, 689 (70.96%) questionnaire respondents and 80 (74.77%) interview respondents) fall between first and fourth octiles. The remaining 282 (29.04%) questionnaire respondents and 27 (25.23%) interview respondents fall between 5th and 8th octiles. This implies that most of the sample students were in the first half, in relation to performance. This could be because schools only allow high academic achieving students to do computer studies. Alternatively, only students who know that they are high academic achievers are the ones who select computer studies as one of their optional subjects.

The relationship between the frequency of computer use (as measured by the BSQ and BSIS) and biology students' performance (as indicated by the octiles) was investigated using Pearson product-moment correlation coefficient. The students' scores were converted into octiles so that their performance could be comparable across the schools. However, before the comparison was done, preliminary studies were conducted to find out whether there was violation of the assumptions of normality, linearity and homoscedastity. For example, the assumption of normality was tested and it was found that the Kolmogorov-Smirnov statistic for the scores was less than 0.0005 for both questionnaire and interview results. This indicates that the distribution of the scores on the dependent variable is not normal. The distribution is not normal because sampling was not randomly done. Pallant (2007) points out that random sampling is not often the case in real-life research. Consequently, the fact that the scores are positively skewed implies that most of the students who do computer studies are the high academic achievers.

A scatter plot was generated to explore the relationship between the frequency of computer use and performance in biology for both questionnaire and interview results (Figure 1). Because the figure does not show any indication of a curvilinear relationship, then it indicates that it was appropriate to calculate Pearson product-moment correlation for the two variables. In addition, because the points are spread all over the graph, then this indicates a weak relationship between the variables, both for questionnaire and interview results. Moreover, the fact that the scores produce a straight line in the scatter plot indicates that the scores did not violate the assumption of homoscedastity.

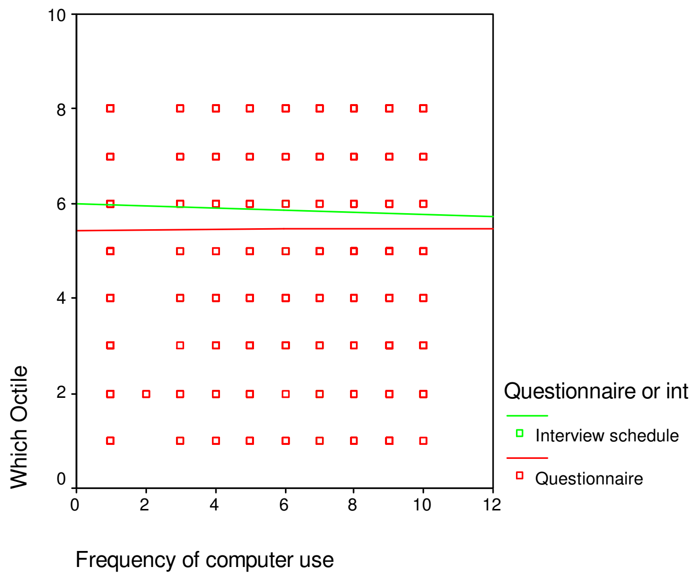

Figure 1: Scatter plot for the questionnaire and interview results to show octile against frequency of computer use

The relationship between the frequency of computer use (as measured by the BSQ and BSIS) and biology students' performance (as indicated by the octiles) was investigated using Pearson product-moment correlation coefficient and a correlation matrix was generated. The questionnaire results are shown in Table 8 below.

Table 8: Coefficients of correlation between the general frequency of computer use and the octiles as indicated by questionnaire results

	Octile	Frequency of computer use
Octile	1	
Frequency of computer use	.004	1

The questionnaire results in Table 8 above show a very weak positive correlation between the two variables, r = 0.004, n=971, p=0.906. Pallant (2007) points out that an r of 0.10 to 0.29 indicates a small correlation; 0.30 to 0.49, a medium correlation; and an r of 0.50 to 1.0, a large correlation. A majority of the students who used computers mostly used them at a frequency of 9/10 and 8/10 (Table 6). This could be during computer studies lessons. The results in Table 9 below show relationship between frequency of computer use (as measured by the BSQ and BSIS) and biology students' performance (as indicated by the octiles) as indicated by interview results.

Table 9: Coefficients of correlation between the general frequency of computer use and the octiles as indicated by interview results

	Octile	Frequency of computer use
Octile	1	
Frequency of computer use	-.033	1

Interview results in Table 9 above indicate that there was a very weak negative correlation between the two variables, r = -0.033, n=107, p=0.738. Consequently, because the r -value is less than 0.10, then it can be argued that there is no relationship between the general frequency of computer use and performance in biology. There seems to be no relationship due to the fact that, in comparison with other sciences, biology has fewer abstract concepts that need computer mediation (Tekbiyik and Akdeniz, 2010). In addition, the use of computers for schoolwork and other purposes such as games, social networking and other entertainments offset each other (Fairlie and Robinson, 2013).

Although BSQ and BSIS results do not show a relationship between frequency of computer use and performance in biology, teachers were asked to respond to the question: Who among the one who uses computers most and the one who uses them less performs better in biology. The results are shown in Table 10 below.

Table 10: Student who is likely to perform better in biology as viewed by teachers

Computer User/ Non user	Frequency	Valid percent	Cumulative percent
User	19	55.9	55.9
Undecided	12	35.3	91.2
Both	3	8.8	100
Total	34	100	

Findings from Table 10 above show that 19 (55.9%) Biology Teachers' Questionnaire (BTQ) respondents indicated that more computer use impacts positively on biology students' performance. Biology teachers and students also responded to the questions related to their attitude towards computers. The results are shown in Table 11 and 12 below.

Table 11: Teachers' attitude towards effect of computer use on biology students' performance in various aspects of the subject

Attitude	Descriptive statistic			
	Min	Max	Mean	Std. Deviation
Makes learning biology enjoyable	1	5	4.5294	.8956
Possible to learn biology practically	1	5	4.4412	.8596
Makes one to perform better in data question	1	5	4.2353	1.0747
Enables one to perform better in short answer question	1	5	3.8824	1.2001
Enables one to perform better in practical exam	1	5	3.5000	1.1078
Enables one to perform better in essay question	1	5	3.5588	.9595
Average	1	5	4.0245	1.0163

N=34

From Table 11 above it can be seen that the overall mean attitude was 4.0245 on a scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). As this mean attitude is much above average, it implies that biology teachers have a positive attitude towards computers. The students' attitude towards computers is shown in Table 12 below.

Table 12: Students' attitude towards computers in relation to performance in biology

	Attitude	MEAN	
		QUESTIONNAIRE	INTERVIEW
1	Makes learning biology enjoyable	4.18	4.24
2	Makes one to perform well in practical exams	3.49	3.50
3	Makes one to perform well in short answer questions	3.66	3.90
4	Makes one to perform well in essay questions	3.51	3.62
5	Computers are useful for learning biology	3.85	3.83
6	One should increase time with computers in order to do well in biology	3.25	3.22
7	Computers make lessons satisfying	3.63	3.57
8	I wish all lessons were taught using computers	3.49	3.39
9	I do not easily forget when I revise using computers	3.56	3.66
10	Frequent computer use improves scores	3.42	3.53
	Average	3.60	3.65

Table 12 above shows that the overall mean attitudes, as shown by questionnaire and interview results are 3.60 and 3.65, respectively, on a scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). As these mean scores are above average, it implies that students have a positive attitude towards computers. However, because the overall attitude for teachers (4.02) is greater than the overall mean attitudes for students (3.60 from questionnaire results and 3.65 from interview results) implies that teachers have a higher attitude towards computers than students. This could be because students do not fully understand the academic value of computers. Alternatively, teachers over-rate the computer's educational value.

The students' and teachers' general attitude that computers make students to have better scores corroborate earlier findings by Collins et al. (2008); Odera (2011); Bakac et al. (2011). Chiang and Jacobs (n.d.) argue that CBI has positive effects on students' academic performance, motivation and attitude. Among the reasons given by the students in response to the question: In your opinion, state how you think computer use influences performance in biology are shown in Table 13 below.

Table 13: Students' opinion on the effect of computer use on performance in biology

	Student's opinion on the effect of computer use on performance in biology	Questionnaire				Interview			
		YES		N/A		YES		N/A	
		F	%	f	%	f	%	f	%
1	Gives more information	398	41.0	573	59.0	48	44.9	59	55.1
2	Interesting and enjoyable	177	18.2	794	81.8	20	18.7	87	81.3
3	Sometimes cheats students	9	0.9	962	99.1	0	0	107	100
4	Can distract learning	42	4.3	929	95.7	3	2.8	104	97.2
5	Exposes non-computer students to computers during the lesson	9	0.9	962	99.1	1	0.9	106	99.1
6	Provides illustrations	280	28.8	691	71.2	27	25.2	80	74.8
7	Effective in theory not practical	26	2.7	945	97.3	3	2.8	104	97.2
8	Can make one lazy	22	2.3	949	97.7	1	0.9	106	99.1
9	Improves attitude towards biology	33	3.4	938	96.6	4	3.7	103	96.3
10	Breaks monotony of being in class	22	2.3	949	97.7	4	3.7	103	96.3
11	Enhances learning of practical	92	9.5	879	90.5	11	10.3	96	89.7
12	Internet helps exchange notes	20	2.1	951	97.9	2	1.9	105	98.1
13	Can revise on your own	10	1.0	961	99.0	0	0	107	100
14	Stores notes, past papers, etc	31	3.2	940	96.8	2	1.9	105	98.1
15	Stimulates thinking	6	0.6	965	99.4	1	0.9	106	99.1
16	Saves time	20	2.1	951	97.9	3	2.8	104	97.2
17	Improves observation, drawing and interpretation skills	2	0.2	969	99.8	0	0	107	100

From Table 13 above, as the reasons such as computers give more information, are interesting and enjoyable, provide illustrations and enhance learning of practicals were given by more students (398, 177, 280 and 92 questionnaire respondents and 48, 20, 27 and 11 interview respondents), which translates to 41.0%, 18.2%, 28.8% and 9.5%, respectively, for questionnaire results and 44.9%, 18.7%, 25.2% and 10.3%, respectively, for interview results implies that if well used, computers enhance learning. The fact that computers can provide more information to learners is corroborated by Bakak et al. (2011), Tekbiyik and Akdeniz (2010) who argue that computers can provide more information to learners than any other teaching aid. In addition, those who pointed out that computers provide illustrations corroborate earlier findings by Serin (2011) and Tekbiyik and Akdeniz (2010) who argue that computers can provide illustrations to what could be difficult to illustrate using other teaching aids.

However, students can only benefit academically from computers if they use them for schoolwork. For example, although 398 (41.0%), 177 (18.2%) and 280 (28.8%) questionnaire respondents and 48 (44.9%), 20 (18.7%) and 27 (25.2%) interview respondents pointed out that computers give more information, make learning interesting and enjoyable and provide illustrations, respectively, most students could have used them for other purposes other than for academic purposes in biology. This is exemplified by the responses students gave to the question that required them to specify how frequent they used computers for the purposes specified in Table 14. The results are shown in Table 14 below.

Table 14: Mean frequency of use of computers for learning biology

Frequency of use of computers for	Descriptive statistics			
	MIN	MAX	MEAN	Std Deviation
Sending/receiving email	1	5	2.3852	1.5618
Preparing notes in biology	1	5	2.2585	1.3870
Playing computer games	1	5	2.9557	1.5942
Listening to music	1	5	2.8908	1.5868
Watching video	1	5	2.7961	1.6565
Browsing	1	5	2.5984	1.5390
Data analysis	1	5	2.6601	1.6143
Programming	1	5	2.6004	1.5928
Business	1	5	1.4078	.8702
Research	1	5	2.2729	1.3783

N=971

Results in Table 14 above show that the highest frequency of computer use is playing computer games then listening to music, then watching video with frequencies of 2.9557, 2.8908 and 2.7961, respectively. The lowest frequencies of computer use were for business, preparing notes in biology and research with frequencies of 1.4078, 2.2585 and 2.2729, respectively. This implies that learners use computers for entertainment more than for academic purposes. Consequently, the purposes for which computers are more frequently used limit time for academics (Mitchell and Savill-Smith, n.d.). The fact that computers can limit learning is exemplified by the fact that 42 (4.3%) and 22 (2.3%) questionnaire respondents and 3 (2.8%) and 1 (0.9%) interview respondents pointed out that computers can distract learning or make learners lazy, respectively (Table 4.12 on page 72). Hence, while some students benefit from computers, others are affected negatively. Yet others who do not use them for their studies gain from other media such as books, TVs, radios and realia (Kulik et al., 1985). For other learners, uses for academic purposes and other purposes offset one another (Fairlie and Robinson, 2013). This could be the reason why there is a negligible correlation between frequency of computer use and biology students' performance, as indicated by questionnaire and interview results. Furthermore, this could be the reason why out of 34 teachers who returned their questionnaires, 12 (35.3%) of them were undecided on who among the computer users and non- computer users would perform better than the other; and 3 (8.8%) of them thought that both non- computer users and computer users would perform the same way in biology (Table 10). Moreover, while 19 (55.9%) of the teachers indicated that a computer user would perform better, none of them indicated that a non- computer user could perform better than the computer user.

CONCLUSION

This study concludes that schools generally only allow the high academic achievers to register for computer studies at KCSE. This is the reason why the general frequency of computer use is above average. This is also the reason why the general academic performance as shown by the octiles is above average. In addition, the Pearson product moment correlation coefficient for the overall computer use is very low (below 0.1). This is because while some students use computers for academic purposes, others use them for non-academic purposes such as entertainment. For some other students the use of computers for academic and non-academic purposes offset each other. These are some of the reasons why there is no relationship between the frequency of computer use and performance in biology. Consequently, the null hypothesis that there is no significant relationship between frequency of computer use and performance in biology is accepted.

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