EFFECT OF COMPUTER ASSISTED TEACHING STRATEGY ON STUDENTS' ACHIEVEMENT IN AGRICULTURE IN SECONDARY SCHOOLS IN KENYA

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Abstract

The importance of Computer Assisted Teaching (CAT) has increased in schools and Kenya is no exception. CAT is a method that uses computers in a learning media and strengthens students' motivation and educational processes. Little or no information is known about the impact of the strategy in teaching agriculture and consequently on students achievement. The purpose of the present study was to investigate the effect of Computer Assisted Teaching (CAT) strategy on students' achievement in agriculture. The study employed Solomon Four-Quasi-experimental design. The study was conducted in eight county secondary schools in Tharaka Nithi County, Kenya. Stratified random sampling technique was used in selecting sample schools. A sample of 327 Form One students participated in the study. The research instrument was Agriculture Achievement Test (AAT) with a reliability coefficient of 0.91. Descriptive statistics (means and percentages) and inferential statistic (ANOVA) were used for data analysis. The findings of the study indicated that CAT strategy improved achievement in agriculture. The study concluded that CAT is an effective strategy in improving achievement in agriculture and therefore agriculture teachers should incorporate CAT strategy in their teaching.

Key Words: Achievement, Agriculture subject, Computer Assisted Teaching, Conventional Teaching

Introduction

Achievement is a measure of quality and quantity of success one has in the mastering of knowledge, skills or understanding. Academic achievement is designated by test and examination scores or

marks assigned by subject teacher (Adediwura & Tayo, 2007). According to Lewin, Wasanga, Wanderi and Somerset (2011), academic achievement of students at secondary level, is not only a pointer of effectiveness of schools but also a determinant of the wellbeing of youth in particular and the nation in general. Hence improving students' academic achievement in agriculture is necessary for promoting economic growth in Kenya. Performance of students in agriculture is an indicator of effective teaching in the subject.

The Kenya National Examination Council (KNEC), examines agriculture at KCSE level through three Papers, Paper 1, Paper 2 and Paper 3. Paper 1 is a theory paper that covers general agriculture, crop production, agricultural economics, and soil and water conservation. It has three sections, A, B and C. The paper is scored out of 90 marks. Paper 2 is also a theory paper that covers livestock production, farm machinery, farm structures and farm tools and equipment. It has three sections A, B, and C and it is scored out of 90 marks. Paper 3 is a project paper with two project questions, project A and project B. One of the projects is on animal production and the other on crop production. Candidates select and carry out only one of the two projects and the paper is scored out of 100 marks (KIE, 2006).The three papers test the candidates' competence in understanding the agricultural principles, concepts and practices as stipulated in the syllabus (KIE, 2006). The general performance of agriculture is indicated by the overall performance of candidates in the three papers. Performance in agriculture has been below 50% for the years 2008-2013. For the year 2013, the overall percentage mean score in agriculture was 34%.

One of the factors that affect students' achievement is the teaching strategy adopted by the teacher (Mills, 1991). Hence for successful teaching and learning agriculture, use of appropriate teaching strategy is necessary. Most of the teaching strategies practiced by agriculture teachers are expository and facts oriented assigning learners a passive role (Kathuri, 1990; Ngesa 2006). Teachers usually act as dispensers of knowledge while learners listen and make notes. Teaching methods are changing with a tendency of being learner-centred with less focus on the teacher (Lang, Arthur & Herbet, 1995). In the modern teaching environment, the learner is the main focus and is supposed to be responsible for his knowledge. Information communication technology tools such as computers are being integrated in teaching as a way of making learning more learner-centred.

Computer Assisted Teaching (CAT) is one of the terms that are used to refer to the use of computers in the teaching and learning process. Learners are actively involved in the learning process and this improves learning. Learners identify key principles for themselves rather than simply accepting the teacher's explanation (Anita, 2008). Students build knowledge and understanding from interaction with the computer. Use of computers in teaching has been shown to produce positive results in teaching difficult topics (Tanui, Kiboss & Nassiuma, 2008). Studies have shown that use of computers improves students' achievement in various subjects (Ahiatrogah, Madjoub & Bervel, 2013; Serin, 2011). Computers are being used to enhance effective delivery and learning concepts in various subjects. Despite the effectiveness of computers in improving achievement, research on this area in relation to secondary school agriculture is limited. It is against this background that the present study investigated the effect of computer assisted teaching strategy on students' achievement in agriculture in secondary schools in Kenya.

Study Objective

The overall objective of the study was to determine the effect of computer assisted teaching strategy on students' achievement in agriculture. The specific objective was to determine whether there is a difference in achievement in agriculture between students exposed to CAT strategy and those exposed to Conventional Teaching (CT) strategy.

Methods and Materials

Research Design

The study employed quasi-experimental research design and in particular Solomon Four Group design. Quasi-experimental design uses natural assembled groups such as classes in research. The design allows the researcher to randomly select a sample from the population without the random assignment of individual cases to comparison groups. Quasi-experimental design was found appropriate for the present study because the research participants (students) were not randomly assigned to experimental and control groups and the researcher worked with the existing intact classes. Secondary school classes once constituted exist as intact groups. According to Shuttleworth (2009), the design allows the researcher to exert complete control over the variables and to check the influence of pretest on the results. The design controls major threats to internal validity except those associated with interactions of maturity and history, selection and maturation and selection and instrumentation (Cook & Campbell, 1979). Random assignment of schools to experimental and

control groups controlled selection and maturation. To control interaction between selection and instrumentation, the conditions under which the instruments were administered were kept as similar as possible across the schools. Solomon Four-Group design is as follows:

Group I (E1)	O_1	X	O_2
Group II (C1)	O_3		O_4
Group III (E2)		X	O_5
Group IV (C2)			O_6

Key: O_1 and O_3 are pretests; O_2, O_4, O_5 and O_6 are posttests; X is the treatment.

Group I was the experimental group (E1) which received the pretest (O_1), the treatment (X) and the posttest (O_2). Group II was the control group (C1) which received a pretest (O_3), no treatment and the posttest (O_4). Group III was another experimental group (E2) which received treatment (X) and the posttest (O_5) but did not receive the pretest. Group IV was another control (C2) that received the posttest (O_6) only. Group 1 and III were exposed to CAT strategy. Group II and Group IV were taught agriculture using the conventional teaching strategy.

Data Collection and Analysis

The study was carried out in Tharaka Nithi County, Kenya. The county has a total of 136 secondary schools comprising of 2 national, 14 extra-county, 29 county and 91 sub-county secondary schools. County secondary schools that had well equipped computer laboratories participated in the study. The accessible population was the 8,140 form one students in secondary schools in the county. Form ones were selected because the topic on Livestock Production I (Common livestock breeds) is taught at this level (KIE, 2006).

Stratified random sampling technique was used to select participating schools. A total of eight schools consisting of four girls' and four boys' secondary schools formed the sample for the study. A total of 163 boys and 164 girls participated in the study. Simple random sampling technique was used to select a particular stream for data analysis in cases where there was more than one stream in a participating school. However, for schools in the experimental groups, treatment was administered to all the streams.

The research instrument used for the study was Agriculture Achievement Test (AAT). The AAT was constructed from what the students had learnt during the study period.The researcher developed the AAT using the objectives of the topic being taught (MoE, 2012). Livestock production I (Common livestock breeds) formed the topic for the study. Livestock breeds studied included, cattle (exotic and indigenous), sheep, goats, rabbits, poultry and camels. The agriculture achievement test included short answer and structured questions covering knowledge, comprehension, application and analysis levels in the cognitive domain. The test had 17 items with a maximum score of 50 marks. To ascertain the reliability of the AAT, a pilot study was carried out in the neighbouring Embu County. K-R 21 formula was used to estimate the reliability of AAT. A reliability coefficient of 0.7 and above was accepted. The AAT yielded a coefficient of 0.91 which was considered suitable for the study.

The researcher trained form one agriculture teachers in the experimental groups for one day on the use of CAT strategy in teaching. Teachers in the experimental groups taught agriculture by use CAT strategy while their counterparts in the control groups taught agriculture by use of Conventional Teaching (CT) strategy. The topic of instruction was Livestock Production I (Common livestock breeds) . All the teachers in the sampled schools used a common implementation schedule which was prepared by the researcher. Before commencement of the study, agriculture achievement test was administered to groups I and II as a pretest. This was followed by a three weeks intervention of the CAT strategy for groups I and III. After the intervention, AAT was administered to all the groups. Students' pretest and posttest results were scored to generate data for analysis. Data was analyzed by use of descriptive and inferential statistics.

Results and Discussions

The study sought to determine whether there is a difference in achievement in agriculture between students exposed to computer assisted teaching strategy and those exposed to conventional teaching strategy. In order to assess the students' knowledge in agriculture prior to the treatment, an analysis of the students pretest scores in AAT was carried out. The mean and standard deviation of pretest scores on AAT for experimental group E1 and control group C1 are presented in Table 1.

Table 1: Students' Pretest Mean Scores on AAT

Group	N	Mean	Standard Deviation
E1	82	7.27	2.33
C1	83	6.98	2.19

Results in Table 1 show that mean scores for experimental group E1 and that for the control group C1 for the pretest were 7.27 and 6.98, respectively out of a maximum score of 50 marks. The mean scores for the two groups were low. This can be attributed to the fact that testing was done before teaching the topic under study. Scores obtained from the students showed that students had prior knowledge on some aspects of the topic. An independent t-test was performed to determine whether there was any significant difference in the mean scores of the two groups and the results are presented in Table 2.

Table 2: The t-test of Pretest Mean Scores on AAT

	t	df	Sig. (2-tailed)
Equal Variances Assumed	.830	163	.408
Equal variances not assumed	.830	162.121	.408

Results in Table 2 show no significant difference in the two mean scores, $t(163) = .408$, $P>0.05$. The p (0.408) is greater than 0.05, so the difference is not significant. This implies that the level of achievement prior to the administration of computer assisted teaching strategy for the experimental and control groups were similar. The experimental and control groups were similar before administration of the treatment and therefore, suitable for the study. To determine the mean score gain after the intervention, a comparison was made on students' improvement from pretest to posttest. Table 3 presents the mean scores and mean gain obtained by students in experimental group E1 and control C1 in AAT.

Table 3: Mean Score Gain by Students in AAT

Group	N	Posttest Mean Score	Pretest Mean Score	Mean Gain
E1	82	31.23	7.27	23.96
C1	83	22.16	6.98	15.18

Results in Table 3 show the posttest mean scores for E1 and C1 as 31.23 and 22.16, respectively. Pretest mean scores were 7.27 and 6.98 for experimental and control groups, respectively. Results presented in Table 3 show that the experimental group E1 had a mean gain score of 23.96, and the control group C1 had a mean gain score of 15.18. The experimental group that was taught agriculture using computers had a higher mean score gain than the control group which was taught agriculture by use of CT strategy. This suggests that students gain more when taught agriculture using computers than by use of CT strategy. Results of the present study are consistent with the report of Kulik and Kulik (1987) on the review of studies on computer based instructions.

The report concluded that on average, Computer Based Instruction (CBI) assisted students in raising their achievement by 10 to 18% points compared to conventional methods. In order to find out the effect of exposure to CAT strategy on students achievement in agriculture, an analysis of student posttest mean scores was carried out. Table 4 presents the posttest mean scores on AAT for the four groups involved in the study.

Table 4: Posttest Mean Scores on AAT

Type of group	N	Mean	Standard Deviation
E1	82	31.23	7.91
C1	83	22.16	4.43
E2	81	31.28	5.53
C2	81	20.68	4.66
Total	327	26.33	7.60

Results in Table 4 show that the highest mean scores were obtained by experimental groups E1 and E2, which had mean scores of 31.23 and 31.28, respectively out of a maximum of 50 points. Control groups C1 and C2 had mean scores of 22.16 and 20.68, respectively. The experimental groups E1 and E2 which were exposed to computer assisted teaching strategy had higher mean scores compared to control groups that were taught agriculture with conventional teaching strategy.

To test for mean difference in posttest AAT, Analysis of Covariance (ANCOVA) was performed with KCPE marks as covariate. Analysis of Covariance was preferred for this study because it

allows comparing one variable in two or more groups taking into account variability in other variables called covariates. In the present study ANCOVA allowed for comparison of AAT mean scores in the groups and at the same time correcting variability in KCPE marks which were used as a measure of students' entry behaviour. This was deemed necessary to ensure that any significant difference in the mean scores was as a result of the intervention and not because of the ability of the students in terms of their entry behaviour. Results are depicted in Table 5.

Table 5: Analysis of Covariance of the Posttest Mean Scores with KCPE as Covariate

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8384.460(a)	4	2096.115	64.542	.000
Intercept	199.040	1	199.040	6.129	.014
KCPE	394.157	1	394.157	12.137	.001
GROUP	5113.300	3	1704.433	52.482	.000
Error	10457.528	322	32.477		
Total	245493.000	327			
Corrected Total	18841.988	326			

a R Squared = .445 (Adjusted R Squared = .438)

The ANCOVA results in Table 5 show that there were significant differences existing on posttest mean scores among the groups, $F(3,322) = 52.482$, $P<0.05$. The p(0.000) is less than 0.05, so the difference is significant. The difference can be attributed to the treatment effect. An examination of results in Table 4 show that experimental groups E1 and E2 had the highest mean scores of 31.23 and 31.28, respectively. Control groups C1 and C2 had the lowest mean scores of 22.16 and 20.68, respectively. This implies that the treatment was effective in groups E1 and E2. It can therefore, be inferred that the higher posttest mean scores of the experimental groups was due to the use of CAT strategy. This, therefore, led to the rejection of null hypothesis, which stated that there is no statistically significant difference in achievement in agriculture between students exposed to CAT strategy and those exposed to CT strategy.

Findings of the present study are consistent with those of Kiboss, Ndirangu and Wekesa (2004), on the effectiveness of Computer-mediated simulations in school biology on students' learning

outcomes. Results from the study indicated that the mean differences between the experimental and control groups were statistically significant in favour of the experimental group. Kiboss (2000) also reported similar findings on the study of teacher/pupil perspectives on computer-augmented physics lessons on a measurement in Kenyan secondary schools. The study revealed that Computer Based Instruction (CBI) had positive influence on the pupils' classroom interaction patterns which consequently led to an improvement in achievement.

Findings of the present study agree with findings of Serin (2011) on effects of computer based instruction on the achievement and problem solving skills of science and technology students in Turkey. Findings of the study indicated a statistically significant increase in the achievement and problem solving skills of the students in the experimental group that received computer based science and technology instruction. Ahiatrogah, Madjoub and Bervel (2013) also reported similar findings after comparing the effects of computer assisted instruction on the achievement of junior high school students in pre-technical skills in Nigeria after exposing them to Computer Assisted Instruction (CAI) and traditional methods of instruction. Findings of the study showed that the CAI group performed better than the group that was exposed to traditional methods of instruction. Findings of the present study also echoed findings of Ugwuadu and Joda (2013) on the effectiveness of CBI on academic performance of pre-degree students in Nigeria. The study showed that students taught biology with CBI performed better than those taught with conventional teaching strategy. Other studies comparing traditional instruction and computer assisted instruction have shown a significant difference in academic achievement of the two groups in favour of computer assisted group (McSweeney, 2003; Olusi, 2008).

Conclusion and Recommendation

Results of the study indicated that CAT strategy is beneficial in improving academic scores. Use of CAT strategy as a supplement to conventional instruction produces higher academic achievement than the use of conventional CT alone due to the fact that students learn instructional content faster with CAT strategy and retain what they have learnt better with CAT strategy than with conventional strategy alone. Use of computers gave the students the chance to use several senses during the learning process and this consequently improved learning. Agriculture teachers should be encouraged to incorporate CAT strategy in their teaching as a way of enhancing the teaching of agriculture, and consequently improve performance in agriculture.

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