Effect of Computer Assisted Teaching Strategy on Students Achievement by Gender in Agricultural Education in Tharaka Nithi County, Kenya

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Abstract

Gender has remained relevant in education because it has been linked to achievement and participation in certain professions. Gender differences in achievement has been shown to vary according to school subject. This has partly been attributed to the teaching strategy adopted by the teacher. Computer Assisted Teaching (CAT) strategy is a method that uses computers in a learning media and strengthens student's motivation and educational processes. Little or no information is known about the impact of the strategy in teaching agriculture and consequently it's effect on achievement by gender. The purpose of the present study was to examine whether there is gender difference in achievement in agriculture among students exposed to CAT strategy. 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 study showed that CAT strategy improved achievement in agriculture but male students performed better than female students after exposure to CAT strategy. 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, Gender

Introduction

Agriculture is a subject that is offered as an optional subject at the secondary school level in Kenya (KIE, 2006; Vandenbosch, 2006). The aim of teaching agriculture in secondary schools is to ensure that learners are exposed to basic principles necessary for agricultural production in the country. Teaching of agriculture is expected to promote the acquisition of skills for self reliance in agriculture (Mwiria, 2002). Agriculture as a subject in secondary schools plays several core educational and economic roles which are geared towards improvement of human welfare (Vandenbosch, 2006).

Despite the importance of agriculture, students' performance at KCSE has remained below average with gender differences in favour of boys (KNEC, 2014). The average mean score for the years 2010, 2011, 2012, 2013 were 38%, 41% 38% and 34% respectively (KNEC, 2014). Research has shown that one of the

factors affecting students' achievement is the teaching strategy adopted by the teacher (Barchok, 2011; Ngesa, 2002), thus one of the possible reasons for the under achievement could be the teaching strategy employed by the teacher agriculture teacher.

Even with such students' dismal performance in agriculture, female students have had lower achievement as compared to male students in national examinations in Kenya. The male score for male students for the years 2011, 2012, 2013 were 39.31, 37.24 and 35.59 respectively. The mean score for female students over the same period were 34.26, 32.02 and 31.07 respectively. This implies that in agriculture male students perform better than females. If gender differences exist in general performance of boys and girls, then teaching strategies that minimizes this gender gap should be sought. Research has shown that the teaching strategy adopted by a teacher affects achievement in agriculture with respect to gender of the student (Kibett, 2002; Ngesa, 2002).

Taking into account that agriculture is the backbone of Kenya's economy, effective teaching strategies should be adopted in teaching the subject. The commonly used teaching and learning approaches in agriculture are teacher centred (Loveless & Ellis, 2002). Most agriculture teachers use lecture and discussion methods (Ngesa, 2006). These methods are teacher-centred where learning is highly teacher directed and students have little input during the teaching learning process (Ryder, Burton & Silber, 2006). There has been a paradigm shift and teaching methods are changing with the tendency of being learner-centred with less focus on the teachers (Lang, Arthur & Herbert, 1995). In the modern modern teaching learning environment, the learner is the main focus and is responsible for his knowledge. Information communication technology tools like computers are being incorporated in classroom teaching as an attempt to make learning more learner-centred, with less focus on the teachers. Computer assisted teaching strategy makes learners actively search for knowledge with the aid of computers. Computers are used as a medium of instruction to facilitate learning.

Studies have shown that a teaching strategy adopted by the teacher affects achievement with respect to gender of the student. A study by Ngesa (2002) on the impact of experiential and mastery learning programme on academic achievement in secondary school agriculture indicated that boys scored significantly higher than girls under both experiential and mastery learning programme. In another study it was shown that performance of boys in cognitive skills and practical skills was significantly higher than for girls after exposure to projects (Kibett, 2002).

Studies have been done to investigate gender differences in performance when students are taught by use of computers. A study Gambari, Falode and Adegbeno (2014) investigated the effectiveness of computer animation and geometrical instruction model on mathematics achievement and retention among junior secondary school students. Results indicated no significant difference in the mean achievement scores for males and their female counterparts when both groups were taught geometry using computer simulations. Studies done in Kenya indicate similar findings. In another study, (Kiboss, Ndirangu & Wekesa, 2004)

found that computer mediated program improved the learners outcome in cell biology. In the same study, findings showed no relationship between the learners' gender and their learning outcomes. The present study was designed to determine whether there was gender difference in achievement in agriculture among students exposed to CAT strategy.

Purpose of the Study

The purpose of the study was to investigate the effect of CAT strategy on students' achievement by gender in agriculture in secondary schools in Tharaka Nithi County, Kenya.

Objective of the Study

To examine whether there is gender difference in achievement in agriculture among students exposed to CAT strategy.

Hypothesis of the Study

The following null hypothesis guided the study.

$H_0$1: There is no statistically significant gender difference in achievement in agriculture among students exposed to CAT 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 target the 1,779, 876 secondary school students in Kenya. 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 analysed by use of descriptive and inferential statistics.

Results and Discussions

The study sought to find out whether there is gender difference in achievement in agriculture among students exposed to CAT strategy. To determine whether there was gender difference in achievement after students were exposed to CAT strategy, AAT pretest and posttest mean scores were analysed on the basis of gender. Comparisons were then made to determine whether there was a significant difference on the mean scores of male and female students. Table 1 presents the pretest mean scores and standard deviation of AAT on the basis of gender.

Table 1

Pretest Mean Scores Obtained by Students in AAT by Gender

Gender	N	Mean	Standard Deviation
Male	40	7.56	2.44
Female	42	7.00	2.22

Results in Table 1 show the mean score for male and female students was 7.56 and 7.00, respectively out of a maximum score of 50 marks. These scores are low probably because the testing was done before the content was taught in class. To determine whether there was a significant difference in the mean scores before the intervention, an independent t-test was performed. Results of the t-test are presented in Table 2.

Table 2

The t-test of the Pretest AAT Mean Scores Obtained by Students by Gender

	t	df	Sig. (2-tailed)
Equal variances assumed	1.069	80	.288
Equal variances not assumed	1.066	78.399	.288

Results shown in Table 2 revealed no significant difference in the mean scores of male and female students, $t(80) = 1.066$, $p > 0.05$. This implied that the level of achievement prior to administration of the treatment for the two groups was similar hence the two groups were equivalent before administration of CAT strategy. After the treatment, analysis of posttest mean scores obtained by students in the experimental groups was done on the basis of gender. Table 3 shows the mean and standard deviation of male and female students after exposure to CAT strategy.

Table 3

Posttest Mean Scores Obtained by Students in AAT by Gender

Gender	N	Mean	Standard Deviation
Male	81	32.37	7.84
Female	82	30.16	5.43

Results presented in Table 3 show that male and female students had mean scores of 32.37 and 30.16 respectively. Male students attained a higher mean score than female students. An independent t-test was performed to determine whether there was a significant difference in the mean scores. Results are shown in Table 4.

Table 4

The t-test of the Posttest AAT Mean Scores Obtained by Students by Gender

	t	df	Sig. (2-tailed)
Equal variances assumed	2.095	161	.038
Equal variances not assumed	2.091	142.168	.038

Results shown in Table 4 show that there was a significant difference in the two mean scores, t (161) =2.095, $p<0.05$ in favour of the male students. This implies that the intervention was more effective on male students than on female students. This therefore, led to the rejection of study hypothesis ($H_0 1$) which stated that there is no statistically significant gender difference in achievement in agriculture among students exposed to CAT strategy.

Findings of the present study are consistent with findings of Scofield (1991) on experimental evaluation of the effectiveness of a computer assisted instruction unit on sustainable agriculture. Male students attained a significantly higher mean score on the posttest than female students. Other studies in different subjects have shown that achievement gains by males tend to be significantly higher that the gains attained by females when taught by use of computers (Clarian, & Schultz, 1993; Hativa & Shorer, 1989; Neuwman, 1991; Olumide, 2013).

Findings of the present study differ from the findings of Kiboss, Ndirangu and Wekesa (2004) on the effectiveness of using computer-mediated simulations to teach cell theory. Findings of the study showed no relationship between the students' gender and their learning outcomes. Yusuf and Afolabi (2010), also reported no significant difference in performance in biology between male and female students exposed to Computer assisted Instruction (CAI) in either individual or cooperative setting. Other studies have also indicated no significant difference in mean score achievement between male and female students after exposure to CAT strategy (Dhindsa & Emran, 2011; Mudasiru & Adedeji, 2010; Okwuru & Achor, 2014). According to Jenks and Springer (2002), new studies should be carried out to clarify the effect of CAI in contemporary student environment.

Conclusion and Recommendation

The present study revealed that a significant difference existed in the mean achievement scores of male and female students in favour of male students after exposure to CAT strategy. Therefore male students benefit more than female students in terms of achievement when CAT strategy is employed in teaching agriculture. Although male students seem to benefit more from CAT,
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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