Gender-related difference in using computer assisted teaching strategy on student academic achievement in biology in public secondary schools Kenya Baringo County, Kenya

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Abstract

Variations in biology achievement based on gender are of great concern to educators. Some of these differences are can be due to gender discrimination, exhibited in the instructional resources, environment and the patriarchal worldview predominant in most societies. Thus, this study sought to investigate the effects of computer-assisted teaching methods on student academic performance based on gender in public secondary schools in Baringo County. Experimental design, precisely Solomon's four techniques, was used. Schools selected for the study had a computer for integrating computer-assisted teaching strategies. These schools were purposively sampled, and eight different county schools were established. Further, the investigator used a stratified sampling method to sample 324 biology students from the county schools. Simple random sampling was used to select the experimental and the control groups. The experimental groups chosen were treated with a computer-assisted teaching strategy, while the control group was subjected to traditional instruction. The researcher used the instruments of the Biology Achievement Test and Biology Motivation Questionnaires to collect data. The data were analysed descriptively with frequencies and percentages and inferentially with Analysis of Variance and t-test. The study established that, students exposed to CATS performed better than those exposed to the traditional teaching strategy. The results also indicated no statistically significant difference in student academic achievement in Biology based on gender when taught using the strategy. The study findings will aid curriculum makers at the Kenya Institute of Curriculum Development in developing policies and standards for integrating, designing, and implementing CATS in school curricula to increase learning, student accomplishment, and motivation. As a result, to boost academic attainment in biology, teachers should incorporate the computer teaching technique into their lessons.

Keywords: computer assisted teaching strategy, achievement, student gender

1. Introduction

Gender is a term used to describe the behaviors and characteristics expected of a person born male or female [25]. Academic achievement in biology subjects in the classroom is different for each student, male or female, even if they are studying the same biology curriculum. However, attitude, learning style, and motivation may contribute to biological effects, among other factors. Gender is one of the factors that influence student performance in science. Gender research is, in conclusion, unresolved [14]. Some researchers found that male students performed better than female students [16]. Other studies have confirmed the superiority of female students over male students. Yet others did not find a significant difference between male and female performance [15, 4]. Similarly, [3] also reported no significant difference between gender and scientific subject selection [27]. Also observed a substantial difference between male and female science performance. In addition, [19] reported subtle differences between boys and girls in their knowledge of biological concepts.

According to [2], a study on the impact of constructive educational approaches on student performance in the ecological concept of biology is statistical in student performance testing with post-test assessments between boys and girls. There was no difference, but pretesting revealed a difference in scores between girls and boys. In addition, [1] compensates for differences in male and female student performance by using superior methods, materials, and appropriate educational strategies to improve student performance in biology lessons [18]. Affirmed that teachers who understand learners' academic abilities and pursue diverse teaching methods focus on promoting and achieving academic excellence in the classroom.

Differences in biology performance based on gender were of great concern to educators. According to [28], girls were second to none in mathematics and Science. Some of these differences are believed to be due to gender discrimination, reflected in the teaching materials and environment and the patriarchal worldview predominant in most societies. Some scientists conclude that girls think, learn, and use devices differently than boys. These differences also show up in biology education and learning. Studies show that girls and boys have different approaches to learning [16]. According to [20], there are studies investigating the effects of computer simulations and packaging and gender prediction on student performance in biology. This study reported the significant impact of gender on student performance in biology. Male students achieved significantly higher biological scores than female students after being taught genetic knowledge using computer simulations.

[14] Argued that biology as a science is of interest to women. Perhaps because biology is a human-centered science, I think

it is less attractive than the more abstract scientific principles and methods. In addition, they are more interested in healthcare providers such as medicine, in line with the discovery that they are interested in biology. Boys, on the other hand, prefer careers in engineering, computer science, and applied Science in medicine, but they don't help people. Girls are interested in biology, and boys are interested in physics and chemistry [14]. Therefore, it shows different performances between boys and girls in biology. In the United States, the [16] reports that boys outnumber girls and that the gender gap widens as students attend school. Post-assessment by the [16] showed that males in grades 4, 8, and 12 (4th, 8th, and 3rd grade) outperformed women in scientific performance. It was relatively slightly above at all levels. My rates have improved. In the final year of secondary Education, boys far outnumbered girls in scientific literacy in all participating countries [7].

In Africa, according to a study conducted in Niger [25], girls and boys have equal access to schools, but the curriculum is inadequate and restricted, and schools are a modern way for girls. Girls do not have access to school because of the widespread belief that they are teaching—a norm of local things of behavior. Next, a study was conducted in Uganda to examine gender differences in the performance of practical chemical skills among 6-year-old high school students in Kampala. A total of 50 students participated (25 boys and 25 girls), and there was no difference in their device operating abilities. The report showed that most students believed that boys performed better than girls. Showed low confidence in his ability [23].

The difference in grades in non-math subjects narrows as boys and girls mature.[22] show that girls perform better than boys at school. For example, reading tests show that girls perform significantly better than boys. Still, the gender gap in math and Science academic performance, which is now considered dominant by boys, has narrowed.

According to [13], life sciences such as home science are classified as Ugandan cultural subjects, rejected academically by most schools, and branded as girls-only subjects. Many girls' schools do not offer technical and scientific courses. This is because these are considered men's subjects. There are not enough teachers in these subjects.

Business studies were designed for girls, but many poor schools don't offer them because they don't have the money to buy typewriters or computers or pay teachers. Due to the poor and loose grouping of subjects, many girls tended to choose subjects in the arts and humanities. Most new girls' schools did not offer practical courses in exchange for pure Science, which provides general Science, due to a lack of sufficient facilities. The lack of school materials and equipment has hampered girls' achievements at Olevel, especially in math, Science and engineering. The form of secondary school does not encourage the high demands of girls [21].

In Kenya, [9] looked at the overall performance of college students in KCSE and discovered comparable consequences during technology topics with boys who carried out higher in chemistry and physics than women who carried out higher in biology. [10] found that self- idea of cap potential and venture cost in arithmetic and technology declined for each gender among first and 12th grades and not using an actual distinction among women and boys over time. By the 12th grade, women valued arithmetic and technology greater than boys while controlling for self-idea of cap potential in arithmetic. Further [5] argued that even though girls have made tremendous strides withinside the law, medical, and social technology professions, only a few may be discovered in graduate programs or careers in Mathematics, Computer Science, Physics, Engineering, or Information Technology jobs. Many thoughts have been placed forth on why excessive reaching girls might not be coming into those professions, including discrimination, gender-typed socialization, self-idea of cap potential in those areas, and the cost and hobby that girls have in those professions.

According to [26], the Compendium on Gender and Education for All stated that some instructors portrayed bad attitudes or stereotypes regarding women's educational capacity; that there are very few women's clothing and mentors available to women; unequal access to textbooks or written materials and that women are embarrassed by their male peers. This record also supports the conclusion of [11] about a view of gender differences in high school science subjects in Kenya. The thesis examined the instructor's asking or reflective steps about the gender gap in school attendance, especially in technology subjects. The assessment affirms that the majority of instructors have a perception of women and that technology is stereotypical and traditional. However, a smaller group of teachers had a relatively favorable perception of girls. Thus, research from the Kenyan context suggests that textbooks, curricula, and instructors can be important factors contributing to the gender gap in schooling and especially in public subjects-current technology.

This lowers the graduation rate in secondary Education, with the national graduation rate in Kenya in 2004 being 91.5% for boys and 87.5% for girls, a 4% difference for boys in secondary school [24]. This created a case study of low female college transition, admission, retention, and graduation rates. An incident partly due to a strict school curriculum for girls. This scenario is repeated with the secondary school diploma (KCSE) grades in Kenya. This steadily improves boys' rates, often outperforming girls in significant subjects such as English, math, biology, physics, and chemistry. In language and humanities, girls are generally more talented than boys [24].

2. Materials and methods

2.1 Location of the study area

The survey was conducted in Baringo County, one of the counties of Kenya. Various schools carry out research. The scientific results of KCSE, especially biology, which is a nationally representative sample, were consistently inadequate. Extra-county schools with computers were selected for the survey. The survey was conducted in Baringo County, one of Kenya's schools. The schools are Out-of-County Schools, Peer Schools, Private Schools, Private Schools, In-County Schools, Sub-County Schools, and Public Schools. At KCSE, especially in biology, which is a cross-section of the entire school district, the science achievement of the county is meager. Other county

schools were selected for the study, in which I.T. research was examined.

2.2 Population of the study

The study population consisted of high school students in Baringo County. The reachable population includes third-year biology students from 85 high schools, and the target population is 7,650 biology students.

2.3 Sample size and sampling procedures

A Baringo County public high school equipped with computers to integrate CATS into the classroom was tested using a particular model. The form field is divided into two parts. Only boys and girls. The areas in the selected sample are managed using a stratified random selection method. This method is implemented by voting, which is assigned a number to the area. The numbers are written on a small piece of paper that is folded and placed in different boxes representing the layers. As shown in the sampling grid in Table 1, the researchers randomly selected eight schools with the same ratio of 4 boys and four girls.

Table 1: Sampling grid table

School type	Number of schools	Sample school	Total population	Student		
				Experiment group	Control group	Total
Boys only	38	4	145	64	80	144
Girls only	47	4	179	99	81	180
Total	85	8	324	163	161	324

In deciding on faculties with many streams, easy random samples were used to pattern from 3 biology college students and assigned them to take a look at and manipulate groups. We used an easy, unexpected way to pick a particular flow for statistics analysis. Three hundred twenty-four respondents participated in the survey and were divided into four classes from 8 faculties.

2.4 Research instrument

The achievement and skills of biology students in the subject of cell division are assessed by a biocompatibility test. The BAT test covers the items covered in the cell division subtopic during the study. The content of the test is mitosis and biological cell division. Short answers and structured questions on the topic included ten items. The trial tests knowledge, understanding, and application of what has been learned with a possible score of 30 points. The best version was reorganized and used as a post-treatment test. This trial was performed in the experimental (E1) and control (C1) groups before the start of the course and then in all groups after the procedure. The tests are intended to test students' skills, and this understanding is central to the research. The trial was piloted in a high school with similar characteristics to schools in the Baringo area. This is used to determine reliability. Items are evaluated according to a standardized assessment scheme, and the scores obtained are recorded and analysed.

2.5 Data collection

The investigator visited the model school, talked to students and faculty, and asked permission. The investigator used the manual to guide the experimental team on classifying the CAT materials. Cell division is a taught subtopic of plant and animal reproduction. Teachers from all schools in the sample followed a standard implementation plan. Before the start of the study, the experimental group E1) and control group (C1) conducted the trial first, then the CAT approach was carried out for two weeks. The experimental groups (E1) and (E2) were taught using computer-based techniques, and the control group was led using standard teaching strategies. All four groups received BAT and BMQ tests, scored, and coded for data collection and analysis.

2.6 Data analysis

Collected data was evaluated, coded, and organized for analysis. Descriptive and inferential statistics were used to analyse the data and test our research hypotheses. ANOVA was used to analyse the differences between the four means and see if there were any significant differences between the four groups. The test was used to determine the difference between the two means of the control group and the experimental group. The T-test is also used to test the gender of different groups and students. Rejection or acceptance of the null hypothesis was given at the significance level of $\alpha = 0.05$ in ANOVA and test, assuming identical or minor differences between groups. Survey data were analysed using the Social Science Statistical Package (SPSS) version.

3. Results

The researchers also compared the average student performance scores by gender before and after treatment. It was used to determine significant differences in student performance in biology based on gender when taught using Baringo County's computer-aided teaching strategy. Researchers conducted BAT pre-studies in the experimental and control groups involved in the study. The purpose of the pretest was to determine if students who chose to participate in this study had comparable characteristics before intervention. Table 2 shows the analysis results of the pretest average.

Table 2: Pretest Mean Score Obtained by Students in BAT by Gender

Group	Gender	N	Mean	Std. deviation
Experimental Pretest	Male	44	7.87	2.001
	Female	38	6.43	1.861
Control Pretest	Male	36	3.81	1.112
	Female	38	4.48	1.231

The results showed an average pretest biology score based on gender in one category of control and experimental groups. The mean score for Experimental Group 1 (E1) was 7.87 for boys, 2.001 for standard deviation, 6.243 for girls, and 1.861 for standard deviation. On the other hand, the mean biological score of the pretest for each gender of control group 1 (C1) showed that the mean for boys was 3.81, and the standard deviation was 1.112. The girl's average score was 4.48, and the standard deviation was 1.231. Researchers also sought to compare the results of the average scores of the post-test experimental and control groups to determine the effectiveness of the CAT education strategy compared to gender-based student performance. The analysis results are shown in Table 3.

Table 3: Posttest Mean Score Obtained by Students in BAT by Gender

Group	Gender	N	Mean	Std. Deviation
Experimental Posttest	Boys	64	5.81	1.93
	Girls	99	9.00	2.99
Control Posttest	Boys	80	5.23	3.59
	Girls	81	6.16	3.64

The results in Table 3 show the gender-based mean scores of the experimental and control groups after testing in biology. In the experimental group (E1 and E2), boys had a mean score of 5.81 and a standard deviation of 1.93, and girls had a mean score of 9.00 and a standard deviation of 2.99. On the other hand, the gender-based posterior averages of biology in the controls (C1 and C2) showed a mean of 5.23 for boys and a standard deviation of 3.59. The average for girls was 6.16, and the standard deviation was 3.64.

Based on the results, there was a significant difference in performance by gender. The average score for boys in the experimental group was 5.81, which was higher than that for boys in the control group, 5.23. On the other hand, the mean score of the experimental group was 9.00, higher than the mean score of the girls in the control group, which had an average score of 6.16. This means that students exposed to CATS perform better than traditional educational strategies. However, this requires de facto justification. Therefore, tests are conducted to accept or reject the hypothesis that there is no statistically significant difference in the academic performance of gender-based biology students when taught using a computer-assisted instruction strategy in Baringo County. It was done. The analysis results are shown in Table 4.

Table 4: T-test results of posttest mean score obtained by students by gender exposed to CATS

	N	Mean	SD	t-value	Df	*p*-value
Boys	163	14.81	6.016	1.531*	161	0.201
Girls	161	11.39	4.429			

*denotes the smallest value of α=0.05

Table 14 shows a significant difference in test of the mean difference between the average scores of students exposed to Computer Assisted Instruction Strategy (CATS) and traditional teaching methods. The average post-test score for boys is 14.81, and the average score for girls is 11.39. The results show that t-value = 1.531, p > 0.05, and there is a statistically significant difference in the performance of biology subjects between boys and girls when exposed to computer-based teaching strategies. It suggests that there isn't.

3. Discussion

The results of this study are also consistent with the results of [8], a survey of the effects of computer animation and geometric education models on the achievement and retention of mathematics in high school students in Mina, Nigeria. In this study, we investigated the effect of gender on the performance of students teaching geometry using computer animation packages and geometry education models, respectively. The study's results showed no gender effect on the performance of male and female students teaching geometry using computer animation and geometry education models. This means that male and female students will benefit equally, regardless of the teaching method.

The results of this study are inconsistent with the results of [20], a computer simulation of student performance in biology and studies on packaging and gender predictors. The primary purpose of this study was to determine a student's academic performance in biology when exposed to a computer simulation package in a secondary school genetics class. This study reported the significant effect of gender on student performance in biology when taught using computer-based educational strategies. After being taught genetics using computer simulations, male students achieved significantly higher biological scores than females.

The results of this study also contrast with the results of [12] on the effects of computer-assisted simulation programs in school biology on student learning outcomes in cell theory. The study results did not show a correlation between the gender of the participants and the learning outcomes. This finding is consistent with the conclusion of [2], who reported no gender effect on academic performance in the ecological framework of biology.

4. Conclusion

The study's results showed that gender does not affect student performance in biology when taught using computer-based educational strategies. This indicates that CATS was effective in motivating both boys and girls.

5. Recommendations

Biology teachers should be encouraged to use CAT strategies to improve biology education and academic performance.

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