Effect of computer-based instruction approach on students' academic achievement in agriculture in secondary schools in Baringo North Sub-country, Kenya

Evans Cheptirim¹*, Stephen W. Maina¹, Joel K. Ng'eno²

¹ Department of Agriculture Education and Extension, Egerton University, P. O. Box 536 Egerton, Kenya

² Department of Curriculum, Instruction and Educational Management, Egerton University, P. O. Box 536 Egerton, Kenya

Correspondence Author: Evans Cheptirim

Abstract

Computer use in education is vital as it makes learners active and creates a favorable environment for learning. Computer Based Instruction (CBI) is one way of using computer in teaching agriculture. CBI offers much benefits in learning since it aids the learners in self-evaluation and reflection on the learning process. This study sought to find out the effect of CBI as a teaching approach on students' academic achievement in agriculture in secondary schools in Baringo North Sub-county, Kenya. The study used Quasi-experimental design specifically the Solomon four non-equivalent control group research design. The target population of the study was all agriculture students in public secondary schools in the Sub-County. Purposive sampling was used to select schools that participated in the study. Simple random sampling was used to assign each school to either treatment or control group. Four sample schools from Extra County schools formed the sample size of the study. The study utilized the Agriculture Achievement Test (AAT) to gather data from learners. Data obtained was analyzed using both descriptive (frequencies and percentages) and inferential statistics (independent sample t-test and ANOVA) with the help of Statistical Package for Social Sciences (SPSS) version 25. The study findings revealed that CBI improved learners' academic achievement in agriculture. It was recommended that teachers of agriculture should use CBI in teaching as it improves academic achievement of learners to learn agriculture. Additionally, government needs to equip schools with computers to facilitate the use of CBI in teaching.

Keywords: academic, achievement, agriculture, learner, baringo

1. Introduction

Computer use in education has become necessary since it provides students with a more suitable environment to learn, serves to create interest and a learning centred-atmosphere and these increase students' motivation [8, 21]. Computer Based Instruction (CBI) is one way of using computer in teaching agriculture. [3] Defined CBI as a broad term used to refer virtually to any kind of computer use in educational settings, including drill and practice, tutorials, simulations, instructional management, supplementary exercises, programming, database development, writing using word processors, and other applications.

[35] Defined CBI as a delivery of instructional content using a computer to achieve learning goals and desired outcomes while [13] noted that CBI is the use of computers in the teaching and learning activities. The benefits of CBI include; enabling the students to learn through self-evaluation and reflection on their learning process; motivate the students to learn better by providing immediate feedback and reinforcement and also by creating an exciting and interesting game-like atmosphere and finally its more effective on less successful learners because it enables them to progress at their own pace and provides them with appropriate alternative ways of learning by individualizing the learning process [13, 3]. Also, [3] noted that CBI provides an interactive approach to teaching and learning and enhances learners' active participation.

[24] Noted that agriculture sector in Kenya enhances food security in the nation. [32] Stated that agriculture contributes to employment of rural people, food production, foreign exchange earnings and the main source of livelihood for nearly 80 per cent of Kenya's population living in rural areas. Despite these vital roles, secondary school students' academic achievement in agriculture in Baringo North Sub County for the years 2017- 2019 has been poor since it is below average as depicted by Table 1. Achievement is a measure of quality and quantity of success one has in the mastering of knowledge, skills or understanding [21].

Teaching methods employed by teachers affect students' performance in schools [21, 22, 12]. Inappropriate methods of teaching and persistent use of conventional teaching methods contribute to poor academic achievement of students at all levels [10]. [19] Noted that people remember 20% of what they hear, 40% of what they see and hear and 90% of what they say, see, hear and do. Computer is an important tool in enhancing learning since it can exercise the various senses and present information in a variety of media thereby promoting knowledge retention [22]. Further, [22] found out that Computer Assisted Teaching (CAT) strategy had improved students' achievement in agriculture compared to students exposed to Conventional Teaching (CT) strategy. [26] Revealed that computer assisted instruction with animation enhanced students' interest in mathematics.

Countries in the world including Kenya are faced with the challenge of providing quality education to its citizens [9, 34]. [14] Noted that the use of ICT in teaching is necessary in order to address quality education as it has the capacity to bring the world together even in the most remote and disadvantaged communities. [29] Stated that ICT transforms the teaching and learning process from traditional teacher-centered approach to a learner-centered approach with active participation of the learner. Teachers in secondary schools commonly use the talk and chalk approaches where they do most of the talking and pedagogic work while the student is regarded as passive recipients of information [2].

2. Materials and methods

2.1 Location of the study area

This study was carried out in Baringo North Sub-county, one of the sub-counties in Baringo county Kenya. Administratively, the sub-county is sub-divided into four divisions, five electoral wards, fourteen locations, forty-four sub locations and 355 villages scattered across its length and Breath. It lies at an average altitude that range between 1000 and 2200m above the sea level. The sub-county covers an area of 1 703.50 square kilometers [5]. The sub-county has a population of 104,871 persons, population density of 64 people square kilometer and 23, 500 households [16]. The main livelihood of the people in the area includes agro-pastoral, pastoral, irrigated farming and mixed farming. In terms of weather, temperature ranges between 15 to 32^0C and rainfall is Bimodal with long rains in March- June and short rains coming in September- November. The soil type was an aggregation of sandy clay loam with alluvial deposits. Land ownership was either communal or individual. Within the sub-county most people were self-employed through Jua kali firms and farming. There were no industries within the sub-county. The means of communication were poor in most places especially feeder roads which were almost impassable during rainy season. The sub-county had thirty registered public secondary schools with a student population of 8, 694. Some schools were single while others were mixed. There existed two tertiary institutions in the sub-county namely, Bartek Institute and Nehema Institute of Science and Technology. There was one vocational training institution in the sub-county. The sub-county was chosen because of poor academic achievement in secondary school agriculture.

2.2 Target population

The target population was the agriculture students in public secondary schools since the school's showed homogeneity in infrastructure depending on the school category. The Sub-county had a student population of 8, 694. In the sub county, there were four extra county and three county schools that have computers that learners can use for learning. Therefore, form two agriculture students in these schools constituted the accessible population. Most schools do subject selection in form two which is affected by student's interest and academic achievement [12] hence the choice of form two students.

2.3 Sample size and sampling procedures

Sampling as the act, process or technique of selecting a suitable sample for the purpose of determining characteristics of the whole population while a sample is a set of respondents selected from a larger population for the purpose of a survey [4]. The unit of Sampling was the secondary schools rather than individual learners because secondary schools operate as intact groups [36]. Therefore, in this study each school was considered as one group. Extra County schools were selected to participate in the study as they exhibit homogeneity in terms of students' entry behavior. There were two both boys and girls schools in this category in the sub county and therefore all participated in the study. Simple random sampling was used to assign the schools to either treatment or control group. In schools that had more than one stream, all the streams were taught using similar method of teaching because of ethical reasons [36]; thereafter simple random sampling was used to choose one stream for the study. [23] Recommends at least 30 subjects per group. Form two students in the four different secondary schools were chosen to form the sample size.

2.4 Research instrument

The researcher used the agriculture achievement test (AAT) to obtain data from learners. The AAT was constructed from what the students learnt during the study period. The tests were developed using the objectives outlined in the topic- Livestock Health II (Parasites) that the students were taught. The topic was chosen because [15] agriculture analysis showed that students had difficulty in handling questions on it. The AAT was used to measure the students' academic achievement. The test included both short answer and structured questions that covered all the cognitive levels of learning such as knowledge, comprehension, application, analysis, synthesis and evaluation. To attain these cognitive levels, table of specifications was used. Pre-test was done to determine students' prior knowledge of the selected topic. The students' scores were recorded and then used by the researcher for analysis. Agriculture teachers in the experimental groups taught agriculture using CBI while those in control groups taught using Conventional teaching approaches.

2.5 Data collection

The researcher obtained permission to conduct the study from the National Commission for Science, Technology and Innovation (NACOSTI) through the recommendation of the graduate school of Egerton University. Once the research permit has been obtained, the researcher sought permission from the County Director of Education, Baringo county and Sub-county Director of Education, Baringo North to carry out the research in the selected schools. Then, request letters were distributed to various school administrators to include their students and teachers in the study. The AAT was administered in order to collect data on students' academic achievement in agriculture.

2.6 Data analysis

Descriptive statistics such as mean and standard deviation were used to examine the general characteristics of the sample. The

inferential statistical techniques used were the independent sample t-test and Analysis of Variance (ANOVA). All the data was analyzed at significant level of 5 percent or α= 0.05.

3. Results

3.1 The effect of CBI on students' academic achievement in agriculture

The effect of CBI teaching approach on students' academic achievement in agriculture was established by analyzing the AAT test mean scores of all the four groups namely, E1, E2, C1 and C2. The difference was done using AAT test mean scores of all the four groups E1, E2, C1 and C2. The achievement test means scores and the standard deviations of the four groups were as shown in Table 1.

Table 1: Achievement test Means Scores and Standard Deviations

Group	N	Mean	SD
E1	30	39.77	11.26
E2	46	34.91	9.97
C1	48	23.56	10.87
C2	38	22.97	9.17

The results in Table 1 indicate that the achievement mean scores of the experimental groups E1 (M = 39.77, SD = 11.26) and E2 (M= 34.91, SD = 9.97) were higher than those of the control groups C1 (M = 23.56, SD = 10.87) and C2 (M = 22.97, SD = 9.17). These results did not reveal whether the differences were significant hence ANOVA was carried out to determine this at the 0.05 level. The results were as shown in Table 2.

Table 2: ANOVA Test Results Comparing Achievement in Agriculture by Groups

Scale	Sum of Squares	Df	Mean Square	F-ratio	P-value
Between Groups	7817.139	3	2605.713	24.498	.000
Within Groups	16805.805	158	106.366		
Total	24622.944	161			

The results of the ANOVA test in Table 2 showed that the difference among the mean scores of E1, C1, E2 and C2 were statistically significant at the .05 level, $F(3,158) = 24.498$, $ρ<.05$. ANOVA test does not tell the experimenter which pair of the population has different mean. Therefore, it was necessary to carry out an additional analysis using Scheffe's multiple comparison to assess which pairs of the experimental population are different [37]. The results were as shown in Table 3.

Table 3: Scheffe's multiple comparison

Pairs	Mean Difference	SE	p-value
E1 and E2	4.85	2.42	.263
E1 and C1	16.20	2.40	.000
E1 and C2	16.79	2.52	.000
E2 and C1	11.35	2.13	.000
E2 and C2	11.94	2.26	.000
C1 and C2	-0.59	2.24	.995

The results in Table 3 revealed that the difference between pairs E1 - C1 ($p<.05$), E1 - C2 ($p<.05$), E2 - C1 ($p<.05$), and E2 - C2 ($p<.05$) were statistically significant. However, the difference between pairs E1 - E2 (p >.05), and C1 - C2 (p >.05) were not statistically significant. These results shows that academic achievement of students who were taught using CBI was better than that of those taught through conventional methods.

4. Discussion

The study established that CBI enhances students' academic achievement in agriculture. These findings were in agreement with those of [21, 22] who found out that Computer Assisted Teaching (CAT) strategy had improved students' achievement in agriculture compared to students exposed to Conventional Teaching (CT) strategy. Similarly, the findings conforms with the study of [27] who established that students taught using computer-based multimedia presentation performed better in agriculture achievement over those who were taught using conventional method of instruction.

Furthermore, this is line with the findings of [1] who found out those students taught mathematics using computer assisted instruction (CAI) performed better than students taught using conventional approach. The study findings also conform with the study of [6] who revealed that the mean score of students taught biology using computer assisted teaching strategy of instruction performed better than those exposed to traditional method of teaching. The study findings agree with [28, 32] in Mathematics and [30] in physics, all showed that CAI has significant positive effect on students' academic achievement. Similarly, these study findings agree with observations of researchers such as [31, 11] that showed that students' academic achievement taught using CAI was higher than those students same using conventional. In addition, the findings of the study agree with the study of [25, 7, 33] that revealed that the achievement of students taught using computer-aided instruction (CAI) was significantly better than the students taught without CAI. The findings of the present study resonates well with the findings of [20] that revealed that students taught using computer based simulations performed better than their counterparts who were taught using the regular teaching method.

5. Conclusion

CBI improved students' academic achievement in agriculture as compared to the conventional teaching methods. Therefore, CBI can be used to supplement the conventional teaching methods since there was significant difference on students' academic achievement in agriculture between those taught using CBI and those taught through conventional methods.

6. Recommendations

- Since CBI improved learner academic achievement in agriculture, therefore, agriculture teachers should incorporate CBI in teaching.

- The government through the ministry of education needs to equip schools with computers to facilitate the use of CBI in teaching.

References

1. Agwagah U, Arua SN, Abugu GN. Effect of Computer Assisted Instructional Approach on Students' Achievement in Mathematics. Abacus The Journal of The Mathematical Association of Nigeria. 2019;44(1):426-433.

2. Agyei DD. From Needs Analysis to Large-Scale Implementation: Using Collaborative Design to Support ICT Integration. Collaborative Curriculum Design for Sustainable Innovation and Teacher Learning, 2019, 305.

3. Anigbo LC, Orie MJ. Effect of PowerPoint Instruction on Students' Academic Achievement in Computer Science (database management system) in Colleges of Education in Rivers State. Computer Engineering and Intelligent Systems, 2018, 9(1).

4. Aseta JA. Landslide Occurrences and their Effects on Land Use Activities in Kittony Area of Elgeyo Marakwet County, Kenya. European Journal of Social Sciences Studies, 2018.

5. Baringo County Government. County Population Density and Distribution. Department of Finance and Economic Planning, 2018.

6. Cheruiyot GL. Effect of Computer Assisted Teaching Strategy on Students' Academic Achievement and Motivation in Biology in Public Secondary Schools in Baringo County, Kenya (Doctoral dissertation, Chuka University), 2019.

7. Egbodo BA. Effect of Computer-Aided Instruction on Junior Secondary Students' Achievement and Retention in Basic Science (Doctoral Dissertation, Benue State University, Makurdi), 2019.

8. Egolum EO. Effects of Computer assisted instruction and power point presentation on academic achievement of secondary school Chemistry students. Journal of Science Education. 2019;13:130.

9. Government of Nepal. Sustainable Development Goals, 2016-2030: National (Preliminary) Report. Kathmandu: National Planning Commission, 2015.

10. Hassan U. Effect of Computer Assisted Instruction in Nape Language on Student Achievement and Retention in Mathematics in Niger State. Journal of Research & Method in Education. 2018;8(2):22-28.

11. Julius JK, Twoli NW, Maundu JN. Effect of Computer Aided Instruction on Students' Academic and Gender Achievement in Chemistry among Selected Secondary School Students in Kenya. Journal of Education and Practice. 2018;9(14):2222-1735.

12. Kabugi SW. Challenges to Teaching and Learning of Agriculture in Secondary Schools in Kakuyini Division, Kangundo District, Machakos County. (Unpublished Master's Thesis). Kenya University, Kenya, 2013.

13. Kamalanehru K, Bhavana AR. Effectiveness of CAI Package in Teaching Mathematics at Higher Secondary Level. I-Manager's Journal on School Educational Technology. 2020;16(2):9.

14. Kennah M. The use of ICT in the Teaching and Learning Process in Secondary Schools: A Case Study of Two Cameroonian Schools, 2016.

15. Kenya National Examination Council. The Year 2014 KCSE Examination Candidates Performance. Kenya National Examination Council, Nairobi, Kenya, 2015.

16. KNBS. Kenya Population and Housing Census, Ministry of Planning, National Development and Vision 2030. Kenya National Bureau of Statistics, Nairobi, Kenya, 2019.

17. Limbe BD. Factors affecting student performance in certificate of secondary education examination in Tanzania: A Case of Newala District in Mtwara Region (Doctoral Dissertation, The Open University of Tanzania), 2017.

18. Machisu V, Opondo V, Nakhumicha A, Mosi RO. Influence of School Agricultural Farms on Academic Performance in Agriculture in Secondary Schools. Journal of Agriculture and Extension. 2022;4(1):390-399.

19. Masters K. Edgar Dale's Pyramid of Learning in medical education: Further expansion of the myth. Medical Education. 2020;54(1):22-32.

20. Mihindo WJ, Wachanga SW, Anditi ZO. Effects of Computer-Based Simulations Teaching Approach on Students' Achievement in the Learning of Chemistry among Secondary School Students in Nakuru Sub County, Kenya. Journal of education and practice. 2017;8(5):65-75.

21. Muchiri JM. Gender Differences in Motivation to Learn Agriculture in Secondary Schools in Tharaka Nithi County, Kenya. International Journal of Education and Research. 2018;6(2):63-74.

22. Muchiri JM, Barchok HK, Kathuri NJ. Effect of Computer Assisted Teaching Strategy on Students' Achievement in Agriculture in Secondary Schools in Kenya, 2018.

23. Njoroge GN, Changeiywo JM, Ndirangu M. Effects of Inquiry-based Teaching Approach on Secondary School Students' Achievement and Motivation in Physics in Nyeri County, Kenya. International Journal of Academic Research in Education and Review. 2014;2(1):1-16.

24. Ogada EO, Maina RN, Musili G. Assessment of Human Resource Capacity Building Interventions to Support Food Security and Nutrition in Kenya. J. Env. Sust. Adv. Res. 2020;6:80-88.

25. Oguama BE, Ugwoke DU, Ogbodo JN. Physics in Senior

Secondary School in Nkanu West Local Government Area, Enugu State, Nigeria, 2018.

26. Ojo SG. Effects of Animated Instructional Packages on Achievement and Interest of Junior Secondary School Student in Algebra. Mathematics Teaching Research Journal Spring. 2022;14(1):99-113.

27. Olori AL, Igbosanu AO. Effect of Computer-Based Multimedia Presentation on Senior Secondary Students' Achievement in Agricultural Science. Journal of Education and Practice. 2016;7(31):31-38.

28. Ozomadu EA. Effect of Two Models of Computer Assisted Instructional Packages on Senior Secondary School Students' Achievement. Interest and retention in Geometry. An unpublished Ph.D thesis. Enugu State University of Science and Technology, Enugu, 2020.

29. Singh MR, Tiwari S. Integration of ICT in Shaping Teaching-Learning Practices: Demand of the New Digital World. Integration. 2020;7(19):2020.

30. Suleman Q, Hussain I, Din MNU, Iqbal K. Effects of computer-assisted instruction (CAI) on students' academic achievement in physics at secondary level. Computer Engineering and Intelligent Systems. 2017;8(7):9-17.

31. Tantry F, Sofi T. Effectiveness of Computer Aided Instruction on Academic Achievement and Retention of Biological Science of Secondary School Students of Kashmir Division. Advances and Applications in Mathematical Sciences. 2022;21(9):5017-5032.

32. Thuku AG. Factors Affecting Access to Credit by Small and Medium Enterprises in Kenya: A Case Study of Agriculture Sector in Nyeri County (Doctoral dissertation, United States International University-Africa), 2017.

33. Ude VC, Onah E. Effect of Computer Assisted Instruction on Basic Concepts in Biology on Secondary School Students Achievement in Enugu Education Zone. Journal of Research in Science and Vocational Education (JRSVE). 2022;2(1):142-146.

34. UNESCO. UNESCO and the Education 2030 Agenda. Paris, France, 2017a.

35. Usman YD, Madudili GC. Assessment of the impact of computer assisted instruction on teaching and learning in Nigeria: A theoretical viewpoint. International Journal of Education and Development using Information and Communication Technology. 2020;16(2):259-271.

36. Wambugu PW, Changeiywo JM. Effects of Mastery Learning Approach on Secondary School Students' Physics Achievement. Eurasia Journal of Mathematics, Science and Technology Education. 2008;4(3):293-302.

37. Wanishsakpong W, Thaithanan J, Owusu BE, Mahama T. Comparing the efficiency levels of Multiple Comparison Methods for Normal Distributed Observations. Computer Science. 2022;17(1):469-483.