Journal of Education and Learning (EduLearn)
Vol. 19, No. 3, August 2025, pp. 1533~1540
ISSN: 2089-9823 DOI: 10.11591/edulearn.v19i3.22252

Computer-aided instruction on social studies student's achievement and retention

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Article Info

Article history:

Received May 7, 2024
Revised Jul 27, 2024
Accepted Aug 28, 2024

Keywords:

Achievement
Computer-aided instruction
Innovative instructional strategy
Retention outcome
Social studies
Social studies students

ABSTRACT

The study explored innovative instructional strategy: effect of computer-aided instruction on social studies students' achievement and retention outcome. The study was an experimental study. The sample of the study was 180 students. The instrument used for the study was the scholarly achievement test (SAT). Descriptive statistics were utilized to provide answers to the research questions and analysis of variance (ANOVA) was employed to test the hypotheses. The result established that computer-aided instruction (CAI) impacted social studies students' achievement. The result also established a significantly improved retention of students instructed with CAI and that gender-wise, female students achieved better than the male students in the university. It was suggested that teachers should incorporate CAI into social studies lessons. Educators should be educated on the use of CAI.

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1. INTRODUCTION

Every society aspires to be at par or above others in a world of success in every aspect, especially in education. This has led to various innovative ways of engaging students to enhance their school scholarly achievement. Social studies are not left out in this aspiration for success. Social studies amongst others aim to link the discipline with the everyday life of individuals and innovative learning powered by information and communication technology (ICT). Uwaifo and Ogheneakoke [1] and Obro [2] alluded that utilization of ICT devices is increasing across the continent. Therefore, Uwaifo [3] recommended the use of computers and the internet use from the onset and its infusion into teaching social studies in the university is of paramount interest because it will boost the students' educational achievement and enable them to contribute their quota to the nation and the world after graduation. Sawere [4] opined that traditional approaches prioritize memorization and mastery of certain knowledge and information sets, which has led to social studies education in this nation falling short of the primary goals that drove its establishment and implementation in schools and universities. According to Uwah and Ogheneakoke [5] and Obro [6], the underperformance of social studies products over time can be attributed to tutors' use of traditional methods of instruction. Also, it is Ebegha and Ogheneakoke [7] observed that social studies have been taught through the conventional method of face-to-face teacher-student interaction which has not yielded good results, hence the need for more innovative teaching strategies.

Computers are tools that allow for quick computation and knowledge exploration. The shortcomings of the widely utilized traditional teaching methods have been greatly mitigated by the usage of computers [8]. With the development of technology, the use of computers, the internet, social networks, visual applications, and video technologies, will boost the academic achievement of students in the teaching and learning of social studies concept in the digital world [9].

Computer-aided instruction (CAI) is very important in instructing students at various levels of learning. The importance of CAI in the university cannot be overemphasized [10]. CAI helps to present virtual content in texts, graphs, maps, charts, videos, pictures, games, audio videos, projectors, and computers using special techniques to engage the students to learn independently [11]. It makes learning more meaningful, creates a supportive learning environment, helps with mastery skills, and is stress-free improving students' achievement rate [12]. Roschelle *et al.* [13] worked on a study that compared the traditional method in typical homework in mathematics and online homework using CAI and discovered that the seventh-grade students who used CAI had greater advantages and greater achievement scores. Osah [14] alluded that CAI is more of a student-centered instructional strategy rooted in ICT. Students feel fulfilled if allowed to discover and solve problems on their own [15]. In their study, Busari *et al.* [16], established that CAI motivates students and engages them as active participants in the classroom and beyond. Furthermore, Samuel and Okonkwo [17] also discovered that numerous complex ideas are clarified with the use of teaching strategies like CAI, and e-visual explanations, so complex abstract concepts are easily understood. Ekundayo [18] investigation on effect of CAI on the academic performance found significant difference between male and female students' performance with exposure to CAI the female students performed higher.

Furthermore, Sawere [4] did a comparative study on the use of CAI and lecture methods in teaching social studies students. The study established a statistical difference in the performance of the students in favour of students taught using CAI. Lawal and Abdullahi [19] and Okwuoza and Olajumoke [20], established a significant difference in the performance of students in favor of those exposed to CAI instruction. Rogayan *et al.* [21] studied the impact of CAI on student motivation and academic performance in social studies. The study revealed that following the introduction CAI, the interest and achievement of the students improved.

Owede [22] asserted that CAI transforms teachers into guides, reduces students' fear and embarrassment, and enhances improved achievement of students. CAI reduces rote learning and memorization to actual real-life participation and long-lasting retention of what was learned [23]. CAI has made youngsters more focused and confident in their academics with the provision of an individualized learning environment [24].

2. LITERATURE REVIEW

2.1. Concept of CAI

CAI is an educational method that utilizes a computer to deliver instructional content and assess the resulting learning achievements. It is an innovative teaching method that minimize the problem of rote learning and memorization. It has brought into the world of learning include breaking down of complex and abstract ideas into simple and meaningful ideas [25]. CAI usage has made students more focused and results oriented. The learning process incorporates a combination of graphs, words, sounds, and videos [26]. Educational technology encompasses a wide range of computer applications used in instructional settings [27]. Kareem [28] stated that computer-assisted instruction (CAI) is focused on the learner and emphasizes engaging activities. CAI is a teaching approach that allows individual learners to engage with a computer. It can present educational information in a similar way to how a teacher would in a tutorial system [29]. According to Suson and Ermac [30], CAI is a method of teaching or providing additional support through computer-based activities that reinforce the materials taught by teachers [31]. Such reinforcement has become necessary for social studies education in this digital era based on global acceptance of ICT in education practice. Digital facilities such as CAI could improve academic performance as its aid retention of facts by students [32].

2.2. Retention of students

Retention refers to the capacity to remember what has been heard, seen, or taught. It is associated with memory, so it is the ability to remember what is in the mind at any given time or after exposure to instruction. Retention is very pivotal in students' academic exploits in school. Their ability to recall what was learned goes a long way to determining their grades and eventual success. According to Eze *et al.* [27], it is the capacity to remember what has been learned and to pull it up when needed. This implies that retention is the aftermath of what has been learned and retained in one's subconscious for future use or application. In an investigation into the efficiency of CAI and retention by Tantry and Sofi [26], the study found a substantial difference in retention of students in favor of those exposed to CAI. This is a piece of clear evidence that those taught with CAI had a better retention capacity than those taught with the lecture method. Ude and Onah [33] investigated the influence of CAI on students' achievement and retention on auto mechanic technology. The study confirmed that the experimental group (EG) had higher post-test retention mean scores than the control group (CG).

CAI is applauded for the various merits inherent in its usage which include a high level of instructional and evaluation outcome, inherent speed and accuracy in learning, retention, and feedback mechanism, and improved students' performance. Although lots of studies on CAI and how its usage has led to improved scholarly achievement have been done by various researchers, the usage is still not common in public higher

institutions such as universities in Nigeria. The paucity of studies on the usage of CAI in university especially in social studies and students' retention outcomes is the gap to be filled in the literature with this study.

The goal of this study is to explore the effectiveness of CAI on social studies students' achievement and retention by providing answers and testing the following research questions: i) what is the difference in the mean scores of social studies students instructed with CAI and conventional instructional methods in the university? ii) what is the difference in the mean scores of social studies students' retention after exposure to CAI and conventional instructional methods in the university? and iii) will there be a difference in the mean scores of social studies students instructed with CAI and conventional instructional methods in the university based on their sex? and test the following formulated hypotheses, H1: there is no significant difference in the mean scores of social studies students instructed with CAI and conventional instructional methods in the university, H2: there is no significant difference in the mean scores of social studies students' retention after exposure to CAI and conventional instructional methods in the university, and H3: there will be no significant difference in the mean scores of social studies students instructed with CAI and conventional instructional methods in the university based on their sex. The research questions and hypotheses provided the basic data for conclusion on the effectiveness of CAI on social studies students' achievement and retention.

3. METHODS

3.1. Research design

This study is experimental and involves the conventional teaching method as a CG and CAI as an experimental group. The study utilized a 2×2 factorial design, incorporating two instructional methods: CAI and the conventional teaching method without researcher influence, and two gender levels (male and female). There was a CG and an EG in the study. The conventional method of instruction (control group) and CAI (treatment group) are two different approaches to education. As a result, the treatment was deemed responsible for any discrepancies found in the subsequent learning or study results.

3.2. Sample and sampling technique

The population for the study was 382 undergraduates at the 100 level from six universities. The sample size for this study was 180 representing 39.3% of the total population drawn from four universities. 1 EG from each university and 1 CG from each university. The universities have the same course content as specified by the National University Commission, Benchmark Minimum Academic Standard (BMAS), and all the students are at equal levels.

3.3. Instrument

The study's instrument was the scholarly achievement test (SAT). The SAT consists of 2 instruments divided into 2 sections. Section A was the bio data of the students, while section B contained 50 items of multiple-choice questions carefully selected and modified by the researcher. These questions are previous examination questions from the university question bank. The multiple questions had four options with one correct answer. The SAT topics' scope were socialization and agents, marriage, religion, and civic rights and responsibilities. A test blueprint was used to construct the SAT.

Prior to treatment, all the students underwent pre-testing using the SAT. The students were then exposed to CAI and conventional method and the post-test was administered after being taught the topics for six weeks to ascertain the difference in their mean scores. Furthermore, after 2 weeks the students took the SAT once more to ascertain their retention level. Descriptive statistics was used to analyses the pre-test and post-test scores to generate answers to the research questions and ANOVA was used to test the hypotheses at a 0.05 level of significance.

4. RESULTS AND DISCUSSION

The effectiveness of CAI on students' achievement and retention is investigated in this study. The research findings are presented and explained in this section along with a detailed discussion. The data generated and analyzed were presented in Tables 1-6 for the convenience of the readers.

- RQ1: What is the difference in the mean score of social studies students instructed with CAI and conventional instructional methods in the university?

Table 1 shows the descriptive statistics comparing pre-test and post-test scores between students instructed with CAI and those using conventional instructional methods in social studies. At pre-test the CAI group was slightly higher (45.33) than that of the conventional method group (42.3), suggesting a potential initial advantage for the CAI group. After instruction, the CAI group exhibited a notably higher mean post-test score (58.20) compared to the conventional method group (52.37). The mean variation between the two groups in the post-test scores was 5.83, indicating a considerable variation in means after the instructional intervention. Hypothesis 1: There is no significant difference in the mean score of social studies students instructed with CAI and conventional instructional methods at the University.

Table 2 shows the ANOVA results for the comparison of mean scores among social studies students instructed through CAI and conventional instructional methods. At pre-test, the calculated F-value of 1.277, associated with a p-value of .281. At the post-test level, scores analysis reveals a F-value of 16.867 corresponds to a very low p-value of .000, signaling strong evidence to reject the null hypothesis. This outcome indicates a significant difference in mean post-test scores between students instructed with CAI and those using conventional methods. Therefore, a notable divergence in the effectiveness of the two instructional approaches, implying that the impact of CAI versus conventional methods differ concerning the post-instructional outcomes among social studies students at the university level in favor of CAI.

Table 1. Difference in the mean score of social studies students instructed with CAI and conventional method in the university

CAI and conventional method	Group	N	Mean	Std. deviation	Std. error mean	Mean difference
Pre-test	Conventional	180	42.3000	11.22844	1.44959	3.0333
	CAI		45.3333	14.80685	1.91156	
Post-test	Conventional		52.3667	10.30216	1.33000	5.8333
	CAI		58.2000	9.37324	1.21008	

Table 2. Summary of ANOVA result for students instructed with CAI and conventional instructional methods at the University

CAI and conventional method		Sum of squares	df	Mean square	F	Sig.
Pre-test	Between groups	449.644	2	224.822	1.277	.281
	Within groups	31157.333	177	176.030		
	Total	31606.978	179			
Post-test	Between groups	2719.511	2	1359.756	16.867	.000
	Within groups	14269.133	177	80.617		
	Total	16988.644	179			

- RQ2: What is the difference in the mean score of social studies students' retention after exposure to CAI and conventional instructional methods in the university?

Table 3 shows the result that answered the question what is the difference in the mean score of social studies students' retention after exposure to CAI and conventional method? The mean retention score for the CAI group (12.8667) appears slightly higher than that of the conventional method group (10.0667), suggesting a potential advantage in retention for the CAI group. The calculated mean difference between the two groups for retention scores stands at 2.80000, indicating a numerical variance between conventional instructional and CAI groups. To draw more robust conclusions about the significance and practical relevance of this disparity, further statistical analyses would be imperative. These additional assessments are necessary to determine whether the observed variation in mean retention scores between the CAI group and the conventional method group is statistically significant and holds meaningful implications within the context of the study.

Hypothesis 2: There is no significant difference in the mean scores of social studies students' retention after exposure to CAI and conventional methods in the university.

Table 4 shows the summary of ANOVA results on Hypothesis 2 which shed light on the comparison of mean scores among social studies students' retention after exposure to CAI and conventional methods at the university, examining both pre-test and post-test scores. For the pre-test scores, the computed F-value of 5.854, with a p-value of .000. This suggests a substantial difference in mean pre-test scores between students instructed with CAI and the students instructed with conventional methods. Similarly, the analysis of post-test scores presents a significant F-value of 2.229, accompanied by a p-value of .000. This outcome also rejects the null hypothesis, indicating a notable variance in mean post-test scores between the instructional groups. In essence, these findings suggest that before and following exposure to instructional methods, there exists a significant variation in retention among social studies students, highlighting distinct impacts of CAI versus conventional instructional methods on retention within the university setting.

Table 3. Difference in the mean score of social studies students' retention after exposure to CAI and conventional instructional methods in the university

Retention to CAI and conventional method	Group	N	Mean	Std. deviation	Std. error mean	Mean difference
Retention	Conventional	180	10.0667	14.82310	1.91365	2.80000
	CAI		12.8667	16.08080	2.07602	

Table 4. Summary of ANOVA result for social studies students' retention after exposure to CAI and conventional methods in the university

Retention to CAI and conventional method		Sum of squares	df	Mean square	F	Sig.
Pre-test	Between groups	23608.213	60	393.470	5.854	.000
	Within groups	7998.764	119	67.217		
	Total	31606.978	179			
Post-test	Between groups	8989.880	60	149.831	2.229	.000
	Within groups	7998.764	119	67.217		
	Total	16988.644	179			

- RQ3: Will there be a difference in the mean scores of social studies students instructed with CAI and conventional instructional methods in the university based on their gender?

Table 5 shows the result for research question 3 which stated if there will be a difference in the mean score of social studies students instructed with CAI and conventional methods based on their gender. The descriptive statistics offer insights into the mean scores of social studies students instructed via CAI and conventional instructional methods within a university context, distinguished by gender. Analyzing the pre-test scores, male students displayed a mean score of 42.4603, while female students exhibited a slightly higher mean of 45.6154. At post-test, male students achieved a mean of 52.7937, while female students demonstrated a notably higher mean of 59.9658. The mean differences between genders were 3.15507 for the pre-test scores and 7.17216 for the post-test scores. These statistics reveal a consistent trend where female students, on average, outscored the males in both pre-test and post-test scores, suggesting a potential gender-based divergence in response to the instructional methods employed.

Hypotheses 3: There will be no significant difference in the mean scores of social studies students instructed with CAI and conventional method in the university based on their gender.

Table 6 shows the ANOVA results for Hypothesis 3 on the comparison of mean scores among social studies students instructed through CAI and conventional instructional methods based on gender. At pre-test, the calculated F-value of 2.326 corresponds to a p-value of 0.129, indicating that the observed difference in the mean-based students' gender. However, at post-test, the computed F-value of 25.195 associates with a highly significant p-value of 0.000, signifying a significant difference in mean post-test scores between male and female students instructed with CAI and conventional methods. This outcome strongly rejects the null hypothesis, indicating a notable variance in post-instructional performance between genders. Thus, exhibit a significant substantial divergence in the impact of instructional methods on social studies students based on their gender.

Table 5. Difference in the mean score of social studies students instructed with CAI and conventional instructional methods in the university based on their gender?

CAI and conventional method based on gender		N	Mean	Std. deviation	Std. error mean	Mean difference
Post-test	Male	63	52.7937	10.47756	1.32005	7.17216
	Female	117	59.9658	8.34383	.77139	
Pre-test	Male	63	42.4603	11.15987	1.40601	3.15507
	Female	117	45.6154	14.22652	1.31524	

Table 6. Summary of ANOVA result for social studies students instructed with CAI and conventional method in the university based on their gender

CAI and conventional method based on gender		Sum of squares	df	Mean square	F	Sig.
Pre-test	Between groups	407.635	1	407.635	2.326	.129
	Within groups	31199.343	178	175.277		
	Total	31606.978	179			
Post-test	Between groups	2106.464	1	2106.464	25.195	.000
	Within groups	14882.181	178	83.608		
	Total	16988.644	179			

4.1. Discussion of findings

Studies explored CAI using variables such as self-concept in chemistry, self-reliance skills, and motivation [17], [19], [21]. These studies have not explicitly showcased its effect on social studies students in the university hence the gap to be filled in this study. The result of Hypothesis 1 (ANOVA results) indicates a substantial variation in mean post-test scores between students instructed with CAI and conventional methods ($F=25.195$, $p=0.000$). This suggests that the choice of instructional method significantly influences post-instructional outcomes in social studies. It therefore affirms that the choice of CAI for instruction is a buster to students' academic outcomes. We found that our study confirms that of Okwuoza and Olajumoke [20] that

CAI enhances student scholarly achievement in social studies in secondary school. Recent analyses [34] suggested the potential efficacy of CAI across various subjects, emphasizing its advantage in knowledge retention. However, these results also stress the importance of considering contextual factors, as elucidated in the work of Ukaigwe and Goi-tanen [35], who discussed the need to evaluate the efficacy of instructional methods within specific subject domains and instructional contexts.

The result of Hypothesis 2 (ANOVA analysis) indicates a significant difference in mean retention scores between students instructed with CAI and those using conventional methods. The mean retention score for CAI was 12.8667, while the conventional method was 10.0667. This difference suggests that the retention of knowledge or skills post-instruction varies notably between the two instructional methods employed. Recent studies [18], [36] highlighted the potential advantages of CAI in improving long-term knowledge retention, aligning with the observed higher mean retention scores among students exposed to CAI in this study. Our study thus, collaborates high knowledge retention having been exposed to the CAI method.

The significant difference between the mean retention scores implies that CAI might offer a more effective means of retaining knowledge or skills compared to conventional methods. However, it is important to bear in mind that the ANOVA indicates a difference in mean scores without directly comparing the effectiveness or superiority of one method over the other. Further research, such as longitudinal studies tracking retention over time and assessing the practical application of retained knowledge, would provide more information on the sustained effectiveness of CAI compared to conventional approaches in fostering long-term retention in social studies among university students. These findings confirm that CAI offers an advantage in retaining lasting knowledge or skills post-instruction compared to conventional methods in the context of social studies education. Our finding is in agreement with Ude and Onah [33], and Tantry and Sofi [26] that CAI can increase student retention. Our study suggests that educators and institutions could potentially leverage CAI to be a means to enhance retention among social studies students. This proposed learning method will enhance students' performance. However, a holistic approach considering various factors like instructional design, student engagement, and learning styles remains crucial in designing effective instructional strategies for long-term retention.

The result of hypothesis 3 (ANOVA results) for the pre-test scores suggests that there is no statistically significant difference in the initial performance (pre-test scores) between male and female students instructed with CAI and conventional methods ($F=2.326$, $p=0.129$). This implies that, before the instructional intervention, gender doesn't appear to play a significant role in shaping the baseline knowledge or capabilities in social studies and the students involved. Recent literature in educational psychology, emphasized the evolving landscape of equality between genders in educational settings, aligning with these findings by showing parity in initial knowledge levels irrespective of gender differences. All the same, the post-test scores demonstrated a substantial difference in performance favoring females. This finding collaborates with Ekundayo [18] who reported that female students outperformed their male counterparts.

4.2. Limitation

This study explored the effect of CAI on social studies students' achievement in some selected universities and also to ascertain the level of their retention after being exposed to both CAI and conventional methods. All the lecturers used for this study were lecturers in the universities and were not scrutinized. This fact may be a limitation. This study was carried out in only four public universities. However, further and in-depth studies may be needed to confirm its findings for proper generalization. There is a need to increase the scope by including private universities.

4.3. Implications

Very often, most empirical studies on CAI were done in secondary schools. Less emphasis was placed on university students. It has also been observed by the researcher that although these students make use of sophisticated phones, they do not utilize them for academic work. Exposing them to CAI became amazing and boosted their level of interest and desire to achieve success. Another important implication is that using CAI significantly improves student post-instructional outcomes suggesting the potential efficacy of CAI across disciplines and levels of institutions.

Worthy of note is the role of CAI in extending the students' ability to retain knowledge and skills longer than the normal conventional method of instruction. It is pivotal at this juncture to note that before the treatment, gender did not play any significant role in ascertaining the efficacy of the conventional instruction. The introduction of CAI made the disparity in achievement clearer and was significantly in favor of the female gender. Future studies may explore CAI with other teaching methods to ascertain a way of achieving and extending knowledge.

5. CONCLUSION

Recent observations suggest that the use of CAI enhances performance by students. Our findings have provided empirical evidence that CAI significantly increased social studies students' achievement in

comparison to the conventional instructional method in the university. The study again demonstrated that CAI possesses the ability to improve and retain knowledge and skills after being used for instruction. The study further concluded that based on gender. Thus, students who received CAI instruction fared significantly better than those instructed with the conventional method in favor of female students and that among those instructed with CAI female students' mean scores were significantly better. It was suggested that. Teachers should incorporate CAI into social studies lessons. Educators should be educated on the use of CAI. The approach to teaching social studies should be reviewed by education officials to incorporate CAI. Innovative pedagogical practices, such as CAI, should be required coursework in all teacher preparation courses.

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