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EDITORIAL

Journal of Science Education and Research (JSER) is a peer-reviewed published Bimonthly. It aimed at advancing knowledge and professionalism in all aspects of educational research, including but not limited to innovations in science education, educational technology, guidance and counselling psychology, childhood studies and early years, curriculum studies, evaluation, vocational training, planning, policy, pedagogy, human kinetics, health education and so on. JSER publish different types of research outputs including monographs, field articles, brief notes, comments on published articles and book reviews.

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Prof. Patrick C. Igbojinwaekwu
Editor-in-Chief

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EFFECT OF COMPUTER-ASSISTED INSTRUCTION ON STUDENTS' ACADEMIC ACHIEVEMENT IN COMPUTER STUDIES IN SECONDARY SCHOOLS IN ASABA EDUCATION ZONE

[1] Doris N. Akhator, [2]Inaya Adesuwa
[1]Akhatordoris@gmail.com, [2]debbietupsy@yahoo.co.uk
[1, 2] Department of Computer Science Education
[1, 2]Federal College of Education (Technical), Asaba. Delta State.

Abstract

This study investigated the effect of Computer-Assisted Instruction on students' academic achievement in computer studies in secondary schools in Asaba education zone. Two research questions guided the study and three hypotheses were tested at .05 alpha level of significance. The design of the study was quasi-experimental design. The pretest posttest non- randomized control group design was used. The total sample size of the study was 93 students offering computer studies using multistage sampling procedure. The instrument used for data collection is Computer Studies Achievement Test (CSAT). The reliability of the instrument was established using Kuder-Richardson Formula 20 (KR-20) and found to be 0.76. Data was collected through direct delivery approach and the mean achievement scores were used to answer research questions. In order to establish if the treatment group differ significantly in their mean achievement scores, hypotheses were tested using Two-way Analysis of Covariance at 0.05 alpha levels. The findings of this study revealed that CAI is a good strategy that leads to high achievement in computer studies. CAI was more effective because students were more actively involved during instructional process. The result of the study portrayed that there was significant difference in the mean achievement scores of male and female students taught computer studies using CAI. It was recommended that in-service training, workshops, seminars and symposia should be organized by Ministry of Education, Professional associations like Science Teachers Association of Nigeria (STAN), Curriculum Organization of Nigeria (CON) for practicing teachers so that they can understand and practice the use of various types of Computer-Assisted Instruction in computer studies classroom.

Keywords: Computer-Assisted Instruction (CAI), Students' academic achievement

Introduction

Education is an instrument for equipping individuals with skills and knowledge to become useful members of the society. It enables individuals to think and behave in a way which contributes to the development of the society. Ughamadu, Anagor and Chike (2021) noted that education plays indispensable roles for scientific and technological advancement of any nation by equipping students with requisite knowledge, essential skills and desirable behaviour which help become self-reliant and also contribute to the growth of the society. The education system can contribute to technological advancement of a nation through computer studies.

Computer studies is a subject taught at secondary school level. It is act of studying of operating and application of computers to process and disseminate information. Nwafor, Okpala and Oka (2019) defined computer studies as the study of computer science, meaning of computer and algorithmic processes, including the principles, hardware and software designs, applications and the impact on society. It is technological-based subject that provides opportunity for students to acquire knowledge and skills to operate computer. Similar to this, Ezeanyika and Okigbo (2021) referred to computer studies as a subject at the senior secondary school level of education targeted at equipping the students with the skills of efficient computer operation. Adigun, Onihunwa, Irunokhai, Sada and Adesina (2015) defined computer studies as the study of the theory, design, use and analysis of computer devices. Computer studies is taught at senior secondary school level to enables students acquire skills of designing and applying computer software and hardware in their daily activities. Edeh, Akindutire, Ugboaja, Ohwo, Umoke and Osijirin (2021) noted that computer science as a course is being taught as Computer studies or Information Technology at the secondary school level in Nigeria. Continuing, Edeh, et al asserted that computer science curriculum is often designed to equip learners with the skills and tools they need, to analyze, design and implement computer hardware and software and to adapt to digital era or knowledge-based society.

The lecture method is a teacher-centred instructional approach which is characterized by chalkboard, textbook and notebook in teaching the students. Ojonugwa, Igbo, Apeh and Ndukwu (2020) defined the lecture method as the chalk-talk instructional strategy that places the students at the passive corner of the class and the teacher as the principal actor. In lecture teaching approach, the teachers present the lesson with little or no explanation, while the learners simply listen and copy notes. Idika (2021) posited that the lecture method fail to promote students' reasoning and critical thinking capability,

the learners spend additional time on writing notes and practically, looking at the board or just listening to the teacher. One of innovative instructional approach that may meet the learning needs of students is computer-assisted technique.

Computer assisted instructional technique is the use of moving images to teach the students. According to Bello, Kamar, Yushau and Abubakar (2022), computer assisted instructional technique is the use of pictures, videos and animations or even combining text with pictures and videos to explain some concepts or phenomena during the lesson. Computer assisted is the use of slides in presenting lesson to students. The slides in computer assisted package are accompanied by audio that enable the teachers to easily explain any content of lesson that is difficult to convey. Opesemowo and Omideyi (2023) defined computer assisted instructional technique as an teaching aided package prepared by a computer-controlled machine and a response entry device that uses an amalgamation of text, graphics, sound, and video to boost educational outcomes by enhancing the learning process through interaction. Computer assisted instruction is used to present contents in text, images and slides to enable students to learn at their own pace in the classroom through computer-based software such as MicroSoft PowerPoint. Emiri (2020) noted that computer assisted instruction involved the use of several telecommunication gadgets such as laptops, projectors, projector slides and PowerPoint presentation in the teaching and learning process. The contents of Senior Secondary School Computer Studies curriculum that will be used in the study will be transformed into CAI software composed of digital tutorials, images, text, and videos. The (software) will be installed in the available computers of the experimental schools for the students to be exposed to treatment, while those in control groups are left to the teaching method. Computer assisted integration during instructional delivery could stimulate students' active participation in teaching and learning process which is likely to improve their academic achievement.

Academic achievement is the examination outcome of students exposed to instruction in the classroom. According to Ikwuka and Adigwe (2021), academic achievement is a product of education or learning which is commonly measured by examination or continuous assessment. It is the students' results which are assessed by their scores in tests and examination. According to Enoch and Asogwa (2021), academic achievement refers to the overall accomplishment of students which is evident in their scores in standardized examinations. There appears to be continuous poor academic achievement of students in computer studies in secondary schools in Delta State in particular and Nigeria at large. This ugly situation was buttressed by Edeh, Akindutire,

Ugboaja, Ohwo, Umoke and Osijirin (2021) who reported that there has been persistent decline in the academic achievement of students in computer studies at the senior secondary school level in Nigeria. The WAEC results analysis obtained from Delta State Ministry of Education (2020) indicated that the number of candidates that sat for WAEC examinations in Computer Studies in Delta State public secondary schools for the year 2021, 2022 and 2023 were 16,123, 19,124 and 21,543 and the number of candidates that obtained credit and above were 8,192, 9,019 and 11, 276 which represented 50.8%, 47.2% and 52.3% of the population that sat for the examinations. The 49.2%, 52.8% and 47.7% of candidate who failed to pass computer studies in 2021, 2022 and 2023 respectively usually brings about sadness and frustration to the individuals concerned and their parents as well as other members of the family. Similar to this, Ezeanyika and Okigbo (2021) observed that despite the relevance of computer studies in development of the nation, society and individuals, analysis of school performance in computer studies examination results show that students have not improved in their achievement and skills in computer studies as contained in reports on students' achievement in computer studies by the WAEC Chief Examiner in year, 2020. In the same vein, Nwafor, Okpala and Oka (2019) noted that the required standard expected of the students in computer studies examinations, and their performance assessment in examination which was reviewed by the Chief Examiner indicated that majority of the students/candidates had shown little or no understanding of the contents of the syllabus as evident in their responses which include inability to explain/define terms or acronyms, basic programming and use of keywords in defining terms, misinterpretation of computer file, inability to differentiate between data and information among others.

Gender is the behavioural characteristics and societal roles that differentiate males and females. According to Japari, Luka and Anthony (2021), gender referred to stereotyping, a collection of commonly held beliefs or opinions about what are appropriate behaviors and activities for males and females. Similar to this, Odo and Nwachukwu (2020) defined gender as a social or cultural construct, characteristics, behaviour and roles which society ascribes to females and males. Operationally, gender is physical biological characteristics and societal roles ascribes to males and females. Adigun et al (2015) reported that male students had slightly better academic achievement in computer studies compared to the female students. Ezeanyika and Okigbo (2021) found out that there is a significant difference between the mean achievement scores of male and female students taught computer studies in favour of males. On the contrary, Edeh, et al (2021) reported that female students' academic

achievement taught computer studies using computer assisted instructional technique was higher than that of their male counterparts. Change and innovation in education system has made it imperative to seek new ways to improve the teaching of computer studies. Usman and Jilang (2018) noted that the development of computer technologies has totally changed the methods of teaching and learning. They added that in this present era, computer assisted instruction technique which is the most advanced and sophisticated form of programmed instructions, was introduced in the education systems to bring about tremendous changes in the teaching and learning process. This prompted the investigation into the effect of computer assisted instructional technique on students 'academic achievement in computer studies in public secondary schools in Delta State.

Statement of the Problem

Effective teaching of Computer Studies is crucial in Nigeria which is rapidly undergoing social change and technological advancement. The average trends of students' academic achievement in computer studies between 2017 and 2020 seem to undermine Nigeria's quest for scientific development and technological advancement. The average academic achievement of students in Computer studies which tend to be source of worry to students, parents, educational stakeholders and the researcher could be attributed to the teachers' teaching methods.

The teachers appear to still use lecture method in teaching computer studies which have abstract concepts and phenomenon. The lecture method makes students passive listener and fail to properly address their learning needs probably due to the fact that some students prefer to learn by hearing, while some learn by watching images or videos of concepts taught. Consequently, some students lose interest in learning Computer studies, believing that it is too boring, abstract and too difficult to comprehend. Many researchers have attempted to respond to the problem by conducting studies on the effect of computer assisted instructional technique in teaching different subjects in varying geographical location. Thus, the problem of this study is would Computer-assisted instruction improve students' academic achievement in computer studies in Delta State.

Purpose of the Study

The purpose of the study is to find out the effect of computer assisted instructional technique on secondary school students' interest and academic achievement in Computer Studies in Delta State. Specifically, the study sought to:

1. Determine the effect of computer assisted instructional technique on students' achievement in computer studies in Delta State.
2. Find out the difference in male and female achievement of students' taught computer studies using computer assisted instructional technique in Delta State.
3. Determine the interaction effect of gender and teaching method on students' academic achievement in Delta State.

Research Questions

The following research questions guided the study:

1. What are the mean achievement scores of students taught Computer Studies using computer assisted instructional technique and that of those taught using lecture method in Delta State?
2. What are the mean achievement scores of male and female students taught Computer Studies using computer assisted instructional technique in Delta State?

Hypotheses

The following hypotheses were tested at 0.05 level of significance.

1. There is no significant difference between the mean achievement scores of students taught Computer Studies using computer assisted instructional technique and that of those taught using lecture method in Delta State.
2. There is no significant difference between the mean achievement scores of male and female students taught Computer Studies using computer assisted instructional technique in Delta State.
3. There is no significant interaction effect of gender and teaching method on the mean achievement scores of students taught Computer Studies in Delta State.

Methods

The design of the study was a quasi-experimental design. Nworgu (2015) defined quasi-experimental research design as an experiment where random assignments of subjects to experimental and control groups are not possible. This research design was considered suitable because participants were not randomly assigned to groups rather treatment condition was randomly assigned to two intact groups which were already organized. The design was chosen so as not to disrupt the school activities in terms of classroom arrangements and the schedule of lessons. Specifically, it used pre-test and post-test non-equivalent control group design. Non-equivalent control group design was used because the students were not sampled. The two groups of students were pretested. The study was conducted in Oshimili South Local Government Area (LGA) of Delta State. It is one of the 25 LGA making up Delta State. The choice of Oshimili South Local Government Area is because of students' poor performance in computer studies in both their external examinations NECO and WASSCE. The population of this study comprised 546 senior secondary computer studies students in the 13 public secondary schools in Oshimili South Local Government Area of Delta State (Source: Post Primary School Services Commission PPSSC, Asaba, 2023). The total sample size of the study was 93 computer studies students. Purposive sampling technique was employed to select only five (5) public co- educational secondary schools out of the thirteen (13) public co-educational secondary schools in Oshimili South Local Government Area of Delta state. This is because only five schools offer computer studies in external examination in the LGA. A Simple random sampling technique (balloting with replacement) was used to select two out of five public co-educational secondary schools. The researcher chose SS1 computer studies students from the two schools.

The instruments that were used for data collection are Computer Studies Achievement Test (CSAT). The CSAT consist of two sections namely; section A and section B. Section A is designed to generate information on the bio-data of the respondents. Section B is a 40-item multiple choice objective test with four options A-D derived from WASCE past questions. The item of CSAT Covers the knowledge, comprehension and application levels of Bloom's (1971) taxonomy of educational objectives. In order to ensure that the instrument was usable, acceptable and measured what it was meant to measure and establish content validity of CSAT; the researcher developed table of specification for CSAT. The reliability is concerned with the degree of consistency of the measuring instrument. For CSAT, the reliability of the instrument

was established using Kuder-Richardson Formula 20 (KR-20). This was to determine the internal consistency of the test items. The CSAT was administered to 40 SS1 computer studies students and the scores were obtained from students, The reliability of the instrument was found to be 0.76. The value 0.76 for CSAT was considered to be higher enough for the instrument to be used for the study.

Experimental Procedure

The research assistants who are the computer studies teachers from the sampled schools teaching in SS one were briefed for two weeks regarding the teaching methods. The experimental group research assistant was given detailed explanations on how to incorporate the computer assisted instructional method into the lesson and the general requirements of the research. The control group research assistant was briefed on the general requirements of the research since they were required to use a lecture method lesson plan to teach without (CAI). By the end of the briefing, the researcher organized a micro-teaching session for the participating research assistants to ensure that they have mastered the instructional technique expected of them. The experimental aspect of the study was conducted in three stages. The first stage was pre-test and familiarization when both (Experimental and control groups) were given pretest before the commencement of the experiment. The second stage involved teaching activities which lasted for five weeks. The activities for the five weeks are highlighted as follow: the first week were used for teaching the overview of the computer system. During the second week, the students were taught input devices. The topic covered in the third week was output devices. At the fourth week, the students were taught computer software. The students in the experimental group were taught using computer assisted instructional technique, while those in control group were taught the same four lessons (each a week) using lecture method. After teaching the students for four weeks, the final stage was post-testing. Here, both the experimental and control groups were given post-test using CSAT. Thereafter, the scripts were collected, marked and scored. Each of the 40 questions on the CSAT was scored 1 mark, giving a total of 40 marks. A student score was obtained by summing their score for all the items. The data was finally analyzed based on the scores.

Results

Research Question 1: What are the mean achievement scores of students taught Computer Studies using computer assisted instructional technique and that of those taught using lecture method in Delta State?

Table 1: Mean Pre-test and Posttest Achievement Scores of Students taught Computer Studies using Computer Assisted Instructional Technique and those taught using Lecture Method

Method	N	Pretest Mean	Posttest Mean	Pretest SD	Posttest SD	Mean Gain
CIA	49	14.02	31.08	3.23	3.66	17.06
LM	44	12.77	17.32	3.00	4.01	4.55
Mean Difference		**1.25**	**13.76**			**12.51**

Table 1 shows that students taught Computer Studies using computer assisted instructional technique had pre-test achievement mean score of 14.02 with standard deviation of 3.23, while their posttest mean achievement score was 31.08 with 3.66 value of standard deviation and mean gain of 17.06. Those students that were taught computer studies with lecture method had pre-test achievement mean score of 12.77 with standard deviation of 3.00, while their posttest mean achievement score was 17.32 with 4.01 value of standard deviation and 4.55 mean gain. The mean achievement scores difference of the pretest and posttest of control and experimental groups were 1.25 and 13.76 respectively. The mean achievement gain difference between students taught computer studies using computer assisted instructional technique and those taught using the lecture method was 12.51 in favour of the experimental group. The spread of score in the posttest is more homogenous among students taught using computer assisted instructional technique because the SD scores is smaller (3.66) compared to the SD score (4.01) of those taught using lecture method. The result indicated that students taught computer studies using computer assisted instructional technique had higher achievement score than those taught using lecture method.

Research Question 2: What are the mean achievement scores of male and female students taught Computer Studies using computer assisted instructional technique in Delta State?

Table 2: Mean Pre-test and Posttest Achievement Scores of Male and Female Students Taught Computer Studies using Computer Assisted Instructional Technique

Gender	N	Pretest Mean	Posttest Mean	Pretest SD	Posttest SD	Mean Gain
Male	17	16.00	30.00	4.15	3.41	14.00
Female	32	12.97	31.66	1.99	3.70	18.69
Mean Difference		**3.03**	**1.66**			**4.69**

The result presented on Table 2 shows that the pretest mean achievement score of male students taught Computer Studies using computer assisted instructional technique was 16.00 with standard deviation of 4.15; their posttest mean achievement score was 30.00 with 3.41 value of standard deviation and 14.00 mean gain. The pretest mean achievement score of female students taught Computer Studies using computer assisted instructional technique was 12.97 with standard deviation of 1.99; their posttest mean score was 31.66 with 3.70 standard deviation and 18.69 mean gain. The mean achievement scores difference of male and female students were 3.03 and 1.66 respectively. The mean achievement gain difference between male and female students taught Computer Studies using computer assisted instructional technique was 4.69 in favour of female students. The results showed that the female students taught Computer Studies using computer assisted instructional technique had greater achievement mean gain score than their male counterparts.

$H0_1$: There is no significant difference between the mean achievement scores of students taught Computer Studies using computer assisted instructional technique and that of those taught using lecture method in Delta State.

Table 3: Summary of ANCOVA on Difference between the Mean Achievement Scores of Students taught Computer Studies using Computer Assisted Instructional Technique and those taught using Lecture Method

Source of variation	SS	Df	MS	F	P-value	Decision
Corrected Model	4651.508	2	2325.754	195.025	.000	
Intercept	1646.782	1	1646.782	138.090	.000	
Pretest	259.931	1	259.931	21.796	.000	
Method	3864.879	1	3864.879	324.087	.000	S
Error	1073.288	90	11.925			
Total	61867.000	93				
Corrected Total	5724.796	92				

a. R Square = .813 (Adjusted R Square = .808)

Table 3 shows that at 0.05 level of significance, 1df numerator and 92 df denominator, the calculated F is 324.087 with P-value of .000 which is less than 0.05. Thus, the null hypothesis was rejected. Therefore, there is significant difference between the mean achievement scores of students taught Computer Studies using computer assisted instructional technique and that of those taught using lecture method in Delta State.

$H0_2$: There is no significant difference between the mean achievement scores of male and female students taught Computer Studies using computer assisted instructional technique in Delta State.

Table 4: Summary of ANCOVA on Difference between the Mean Interest Scores of Male and Female Students taught Computer Studies using Computer Assisted Instructional Technique

Source of variation	SS	Df	MS	F	P-value	Decision
Corrected Model	95.148	2	47.574	4.004	.025	
Intercept	1139.344	1	1139.344	95.896	.000	
Pretest	64.693	1	64.693	5.445	.024	
Method	73.175	1	73.175	6.159	.057	S
Error	546.526	46	11.881			
Total	47979.000	49				
Corrected Total	541.673	48				

b. R Square = .148 (Adjusted R Square = .111)

Table 3 shows that at 0.05 level of significance, 1df numerator and 48 df denominator, the calculated F is 4.004 with P-value of .057 which is greater than 0.05. Thus, the null hypothesis was not rejected. Therefore, there is no significant difference between the mean achievement scores of male and female students taught Computer Studies using computer assisted instructional technique in Delta State.

$H0_3$*:* There is no significant interaction effect of gender and technique of instruction on the mean achievement scores of students taught Computer Studies in Delta State.

Table 4: The Summary of ANCOVA for Testing Significance of Interaction Effect of Gender and Technique of Instruction on the Mean Achievement Scores of Students Taught Computer Studies

Source	SS	Df	Mean Square	F	Sig.	Decision
Corrected Model	4917.519	4	1229.380	134.013	.000	
Intercept	1264.544	1	1264.544	137.846	.000	
Pretest	287.402	1	287.402	31.329	.000	
Gender	2990.017	1	2990.017	325.937	.000	
Method	.617	1	.617	.067	.000	
Method * Gender	265.048	1	265.048	28.892	.000	S
Error	807.276	88	9.174			
Total	61867.000	93	.	.	.	
Corrected Total	5724.796	92				

Table 4 shows that at 0.05 level of significance, 1df numerator and 92 df denominator, the calculated F is 134.013 with p-value of 0.00 which is less than 0.05. Thus, the null hypothesis was rejected. Therefore, there is significant interaction effect of gender and technique of instruction on the mean achievement scores of students taught Computer Studies in Delta State.

Discussion

Mean achievement scores of students taught computer studies using computer assisted instructional technique and lecture method

The finding of the study revealed that students taught computer studies using computer assisted instructional technique had higher achievement score than those taught using lecturer method. This agreed with the finding of Ukaigwe and Goi-tanen (2022) which revealed that students taught with computer-assisted instructional strategy recorded higher mean achievement scores than those taught using lecture instructional method. This also supported the finding of Agwagah, Arua and Abugu (2019) which indicated that the mean achievement of students exposed to computer assisted instructional approach is higher than those exposed to lecture method in secondary schools. The agreement in findings could be attributed to the fact that the studies were conducted in the same level of education using students with similar maturity level. This finding

could be explained by the fact that computer-assisted instruction technique combined texts, graphs and images which make learning process more interactive and engaging that learning process lecture method which makes lesson to be boring and student to be passive listeners. The teachers' use of CAI technique in teaching Computer Studies stir up the enthusiasm needed by students to engage in teaching activities and understand lesson taught and thereby improve their academic achievement than the lecture method of technique.

Mean achievement scores of male and female students taught computer studies using computer assisted instructional technique

It was revealed that female students taught Computer Studies using computer assisted instructional technique had greater achievement mean gain score than their male counterparts. This is in line with the finding of Ekundayo (2022) which revealed that female students using computer assisted instructional technique had a little higher mean achievement score than their male counterparts. This also supported the finding of Agwagah, Arua and Abugu (2019) which indicated female students taught mathematics using CAI approach has slight higher mean scores than their male counterparts. This disagreed with the finding of Muchiri (2018) which revealed male students have better academic achievement mean score than female students after exposure to computer-assisted strategy. The difference in geographical location and time span of the studies could account for the disagreement with the finding. The possible reason for this finding could be attributed to the different pattern of behaviour, attitude and expectation of male and female students. Male students may probably prefer to get involved in more social and sports activities compared to the female students which could prefer to engage in studying to improve their academic achievement mean score when taught with computer assisted instructional technique.

Interaction effect of gender and teaching methods on the mean achievement scores of students taught computer studies

It was found that there is significant interaction effect of gender and technique of instruction on the mean achievement scores of students taught Computer Studies in Delta State. This supported the finding of Owenvbiugie and Ebhomien (2021) which indicated that there is a significant interaction effect between teaching method and gender on students' achievement taught business studies using computer assisted instruction (CAI). This disagreed with the finding of Nwosu and Ndanwu (2023)

which showed that there was no significant interaction effect of teaching method and gender on the mean achievement scores of students. The two studies were conducted in different levels of education using varied participants of different maturity level which could account for the disagreement in the findings. This finding shows that gender and technique of instruction have combined effect on the academic achievement of students in Computer Studies. The gender composition of students and technique of instruction applied by teachers has combined effect on the academic achievement of students in Computer Studies.

Conclusions

Based on the findings, it is concluded that computer-assisted instructional technique is an effective technique of teaching Computer Studies in secondary schools in Delta State. The teachers' use of computer-assisted instructional technique in Computer Students at secondary school level has significant effects on the interest and achievement of male and female students. Computer-assisted instructional technique is more effective than and superior to lecture method of teaching Computer Studies in secondary schools.

Recommendations

Based on the findings of the Study, the following recommendations were made;

1. Teachers should use computer-assisted instructional technique in teaching Computer Studies to improve the academic achievement and interest of male and female students.
2. Post Primary Schools Service Commission should expose teachers to annual training programme on use of computer-assisted instructional technique to enable them upgrade their skills in using the technique in presenting lessons to bring about improvement on academic achievement and interest of students.
3. State Ministry of Education should develop standardized software on computer-assisted instructional technique and make them available for teachers to boost their morale in using it to improve students' academic achievement and interest in Computer Studies.

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