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USE OF COMPUTER SUPPORTED INSTRUCTION IN SECONDARY SCHOOL SCIENCE TEACHING

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Abstract

This study examined the chemistry test scores of senior high school students who had received computer-supported instruction (CSI). Additionally, the effect of gender on the performance of students exposed to the CSI learning environment was looked into. A control group design with a quasi-experimental pretest-posttest was used in the investigation. The study was guided by two research questions, and two hypotheses were tested for significance at the 0.05 level. A researcher-created Chemistry achievement test (CAT) was used to gather data for the study and compare the academic performance of students in the CSI group (the experimental group) with students in the Conventional Instruction Method group (the control group). Using Pearson Product Moment Correlation (PPMC), a dependability index of 0.76 was discovered. 100 Chemistry students from two public senior high schools in Rivers State, Nigeria made up the study's sample. The sample was chosen using a random assignment strategy between the experimental and control groups, using intact classes as the reference group. The gathered data were evaluated using descriptive statistics (mean and standard deviation) for the research questions and inferential statistics (t-test) for the hypotheses. The study's findings demonstrated that kids exposed to CSI did better academically than kids exposed to CIM. Additionally, results show that male students outperformed female students in Chemistry, with the difference favoring the male students. Based on the results of the study, it was recommended that relevant CSI packages be developed for the teaching of sciences in Nigerian secondary schools.

Keywords: Computer Supported Instruction, Conventional Instruction Method, ICT, Chemistry, Teaching, Learning.

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Introduction

In the teaching and learning process, computer supported instruction (CSI) is a very effective instructional technique because it enables interaction between a student and the computer, much like it does in the tutorial section between the teacher and the student, and it can show the student the instructional material (Olagunju, 2013). Based on the idea of programmed instruction, computer supported instruction combines instructional, computer simulation activities, drill, and practice programs. It is a crucial teaching technique because it helps students learn by giving them personalised education, effective interactions with them, and quick feedback (Tyagi, 2014). More significantly, it gives students access to text, graphics, audio, visual, images, animation, and simulation in the same media (Olagunju, 2013). Programs for computer-supported instruction are thus multi-media programs.

The use of multi-media programs in computer-supported instruction scaffolding enables students to complete tasks or reach goals that they would be unable to complete on their own but could with the aid of technological resources. It can help students both cognitively and emotionally. In terms of cognitive burden, CSI scaffolding reduces learners' cognitive load and keeps them from being discouraged by challenging activities (Larson, 2015). It does this by focusing learners' attention on material pertinent to the learning or activity at hand. Affectively, CSI scaffolding provides students with emotional support through stimulating situations that might result in successful learning; as a result, they build self-assurance or associate learning with positive feelings.

Schank (2014) summed up the advantages of CSI in instructional practice as follows: First of all, it allows teachers and students to deliver lessons more quickly, encourage student engagement in learning, raise motivation levels, offer students access to a wealth of knowledge, and foster collaborative learning. Second, it can shift the position of the instructor from one of

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knowledge transmitter to one of facilitator, from information source to knowledge navigator and co-learner, and from one of controlling and directing all facets of learning to one of allowing students more control and responsibility over their own learning. Last but not least, it can transform the learners' roles from being passive information consumers to being active learners, from copying knowledge to developing knowledge, and from learning alone to learning jointly with others. Teaching science takes imagination.

The instructor may need assistance from computer-supported education when teaching science (Chemistry), whether it be practical or theoretical work. This is due to the fact that CSI supports learners' knowledge, increases their confidence, and encourages their relationships with one another while they are learning. The components of matter (atoms, elements, and molecules), atomic structure and the periodic table, bonding, forms of carbon, organic compound structures, and metals are just a few of the chemistry curriculum topics that can be taught effectively through CSI.

Similar to this, CSI simulations can be used to teach practical subjects that require the creation of hazardous gases like chlorine and carbon (II) oxide. Contrary to experiments, in which actual activities must be carried out with the teacher present, CSI programmed experiments can be simulated, and students can replay the simulated program even without the teacher there. Because of this, CSI is becoming more popular in schools all across the world, even in Africa.

In the past thirty years, research on computer-supported collaborative learning has advanced to enable remote interactions with technologies for synchronous video conferencing like Skype as well as email, chat, and instant messaging. Dukuzumuremyi (2014) looked at the use of computer-supported collaborative learning software and applications in inclusive classrooms, as well as the associated learning theories and pedagogical models, as well as the notion of

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knowledge of various students in collaborative learning. The results show that computer-supported collaborative learning is a successful strategy for encouraging teamwork. Due to insufficient CSI resources, “many schools around the world have experienced significant challenges. In European schools, there are typically three to seven students per computer, and at least two out of every three computers are found in computer labs, according to a survey on ICT use in education that the European Commission conducted in 31 different countries throughout Europe (European Commission, 2013).” Additionally, the utilization of digital resources in lectures, such as computer simulations, was sporadic. The survey revealed that although teachers utilized computers to organize their lectures, they were informed about ICT integration. The majority of the teachers did not allow their students to use computers in their lesson plans, and even fewer did so.

Studies on CSI in educational settings in Africa typically corroborate the findings of other researchers worldwide. For instance, Kareem (2015) examined in Nigeria the impacts of CSI introduction on secondary school students' accomplishment when compared to the traditional style of teaching, and found that CSI use led to an improvement in students' academic achievement in Biology. In a similar vein, Olakanmi, et al. (2016) observed that pupils in Nigerian secondary schools who received computer-assisted education in chemistry had higher extrinsic and intrinsic motivation as well as achievement than those who received traditional instruction. In Kenya, CSI has not been used extensively or frequently in the teaching or learning of chemistry. In addition, Nduati (2015) found that the effectiveness of the computer assisted learning approach the experimental group's students were exposed to was responsible for their significant improvement in Chemistry performance. The study was intended to evaluate the effects of computer assisted learning (CAL) on Kenyan secondary school students' achievement in the subject. The positive effects of CSI on students' academic progress have

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been documented in research literature across the globe (Ahiatrogah et al., 2013; Kareem, 2013; Nduati, 2015).

As a result, CSI might have been able to remedy Nigeria's low science student performance. Because of the poor academic performance of the pupils, stakeholders in the education system are still concerned about the quality of scientific teaching and learning in Nigerian secondary schools. One of the causes of the low learning outcomes in science is the ineffective teaching strategies. This suggests that scientific instruction in secondary schools in Nigeria may not be as successful as needed. Conventional teaching approaches, which are typically teacher-centered and raise concerns about the caliber of science instruction in Nigerian schools, characterize the majority of science classes.

The research that is currently available on CSI indicates that its application in classroom instruction can assist students in “learning facts and skills, enhance their conceptual understanding, make learning more varied and interesting, and provide individualized instruction as well as effective interaction and prompt feedback to the student (Tyagi, 2014). The use of CSI in science lectures may thereby enhance students' learning.” The Nigerian government and a few non-governmental groups have made an effort to provide the infrastructure, guidelines, and materials needed to enable CSI integration in Nigerian schools. A number of initiatives have been put in place to make it easier to integrate CSI into the classroom, including increasing school power supplies, teaching staff development programs, and digitalizing learning resources. More crucially, secondary science instructors in Nigerian schools have received training on CSI integration. The use of appropriate teaching strategies is what makes for effective subject teaching and learning (Njoku & Mgbomo, 2021). It's crucial to take gender into account while analyzing the science performance of secondary school students.

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The social characteristics and opportunities that come with being male or female are referred to as gender. Being male or female is referred to as gender, and gender and success have been connected. It is one of the crucial elements influencing students' academic success in science. Gender equality is one of the Millennium Development Goals (MDGs), however some courses, like science and math, are stigmatized as being feminine, whilst others, like home economics and secretarial studies, are stigmatized as being masculine. Additionally, Odagboyi (2015) noticed a disparity against women in the fields of science, technology, and mathematics due to the perception that they are male-dominated fields. According to several studies (Nweke, et al. 2014; Ukor & Abdulbajar, 2019; Njoku, et al. 2020), there is no appreciable difference between male and female students' achievement in science. The main cause for concern is that secondary school pupils' academic performance, including both boys and girls, has remained subpar. According to Oviawe et al. (2015), there is no discernible connection between gender and instructional techniques and student performance. Ezenwosu and Nworgu (2013) took into account peer tutoring and gender, however, and claimed that male students slightly outperformed their female counterparts. However, this diversity in the outcome might be explained by variations in the scientific field, teaching strategy, and study population. According to a related study by Julius et al. (2018), there was a statistically significant difference in student performance between male and female students when Chemistry was taught using computer-assisted instruction. The study looked at the effect of computer-assisted instruction on students' academic performance and gender achievement among selected secondary school students in Kenya. According to Julius, et al. (2018), this achievement disparity favored the female pupils.

In order to fill the gap in the research literature, a study was required to look into how CSI affected students' academic performance and collaborative learning in science. Based on the

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constructivism theory, the current study examined the impact of Computer Supported Instruction (CSI) against Conventional Instruction Method (CIM) on students' achievement in chemistry in secondary schools in the Obio/Akpor Local Government Area.

According to Haralambos and Holborn (2018), a theory is a body of ideas that seeks to explain phenomena and provides an explanation for how and why events in the universe happen. Constructivism theory, as previously indicated, supports this investigation. It is a theory of knowledge having philosophical and psychological underpinnings. Vygotsky, Brunner, and John Dewey are the creators of this theory, and they hold the following beliefs: (1) knowledge is not passively acquired; rather, the cognizing subject actively constructs knowledge; and (2) the function of cognition is adaptive and assists the structuring of the experience world. As a result, learning entails creating one's own knowledge through experience. When it comes to instruction, the teacher should encourage students to find out about concepts on their own. In the teaching and learning process, both the teacher and the students should take an active role. The teacher's job is to provide the material in a way that corresponds to the student's level of comprehension at the moment. According to constructivism, learning occurs best when students are actively engaged in it (Achuonye, et al. 2019).

This study's goal was to determine how Computer Supported Instruction (CSI) affected students' science (Chemistry) achievement in secondary schools in the Obio/Akpor Local Government area. Two specific research questions served as the study's guiding principles: What are the differences between students who receive computer-supported instruction (CSI) versus those who receive traditional instruction (CIM) in their academic performance in Chemistry? (ii) Does the average chemistry score of male and female students who received computer-supported instruction differ in any way? Two study-guiding hypotheses were established and tested at the 0.05 level of significance in order to further test for significant

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difference. H01: The academic achievement scores of students in Chemistry for students taught using CSI and those taught using CIM do not significantly differ from one another. H02: When students are taught utilizing CSI, there is no appreciable difference in achievement results across genders in Chemistry.

Methodology

The research used a quasi-experimental approach. The use of pre-testing to establish group equivalence is the fundamental element of the quasi-experimental investigation. 100 Chemistry students from two public senior high schools make up the study's sample, which was specifically chosen due to the availability of equipment for computer instruction. The method for choosing the sample consisted of randomly assigning sample groups from intact classrooms (59 students in the CIM class and 41 students in the CSI class). A researcher-made Chemistry Achievement Test (CAT) was used to collect data for the study and compare the performance of students in the CSI group (the experimental group) with students in the CIM group (the control group). Two experts in chemistry education validated the instrument, and test-retest methodology was used to get a reliability rating of 0.79 using Pearson Product Moment Correlation (PPMC).

After the pre-test, which produced two sets of results for the experimental and control groups, there were four weeks of instruction. The four weeks of instruction included the following subjects: (1) matter's building blocks (atoms, elements, and molecules); (2) atomic structure and the periodic table; (3) bonding; and (4) carbon in its various forms. The four themes were covered in lesson plans that were created for experimental and control groups, respectively. A post-treatment test was administered following the four weeks of instruction, and two more sets of results were produced. For research questions, descriptive statistics (mean and standard

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deviation) were used to examine the data, and inferential statistics (t-tests) were used to test the statistical significance of the hypotheses at a level of significance of = 0.05.

Results

What is the difference between students taught using computer supported education and those taught using traditional instruction methods in terms of academic accomplishment in Chemistry?

Table 1: Mean and standard deviation on students' performance using Computer Supported Instruction and Conventional Instruction Method?

Strategies	N	Pretest		Posttest		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
CSI	41	18.65	5.27	30.12	5.31	11.47
CIM	59	17.35	3.54	23.16	3.04	5.83

According to Table 1, the experimental group, which employed CSI, had a mean pre-test score of 18.65, while the control group, which used traditional training methods, had a mean pre-test score of 17.35. Again, the post-test mean scores were 30.12 and 23.18, respectively, for the experimental and control groups. Once more, the mean gain based on the variations in each group's pre- and post-test scores showed 11.47 for the experimental group and 5.83 for the control group.

Research question 2: Are the average Chemistry test scores of male and female students who received computer-supported instruction different?

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Table 2: Mean and standard deviation showing the performance of male and female students exposed to Computer Aided Instruction.

Group	N	Pretest		Posttest		Mean Gain
		$\bar{x}$	SD	$\bar{x}$	SD	
Male	23	18.91	5.26	37.60	11.39	18.69
Female	18	18.33	5.41	30.44	5.11	12.11

Result in table 2 reveals that in the pretest group, male students had a mean 18.91 and a standard deviation 5.26 while female students had mean 18.33 with a standard deviation 5.41. Post test score shows that male students had a mean score 37.60 with standard deviation 11.39 while their female counterparts had a mean score 30.44 with standard deviation 5.11

H01: There is no significant difference in students' achievement scores in Chemistry between those taught using CSI and those taught using CIM .

Table 3: t-test showing mean scores of students taught Chemistry with CSI and CIM

Strategy	N	Mean	SD	Df	t-cal	t-critical	Decision
CSI	41	30.12	5.31	98	8.20	1.96	S
CIM	59	23.16	3.04				

Table 3 results show that the t-critical value at df = 98 was 1.96 and the t-cal was 8.20. The fact that the t-critical of 1.96 is lower than the t-cal of 8.20 suggests that there are substantial differences in the academic success scores of students in Chemistry between those who receive instruction from CSI and those who receive instruction from CIM. As a result, the null hypothesis—which states that there isn't a substantial difference—is disproved. This considerable difference in mean performances in favor of students who were taught Basic

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science through CSI was validated by their mean scores of 30.12 and 23.16, respectively, for CSI and CIM

HO2: When students are taught with CSI, there is no discernible gender difference in their achievement scores in chemistry .

Table 4: t-test showing gender difference in Chemistry achievement scores of students taught Chemistry with CSI

Group	N	Mean	SD	Df	t-cal	t-critical	Decision
Male	23	37.60	11.39	48	2.47	0.396	S
Female	18	30.44	5.11				

Table: 4 results show that the t-critical value at df = 65 was 0.396 and the t-cal value was 2.47. It is implied that there is a substantial difference between the scores of male and female students taught with CSI because the t-critical value of 0.396 is less than the t-cal of 2.47. As a result, the alternative is accepted and the null hypothesis, which states that there is no significant difference, is rejected.

Discussion of findings

The results demonstrate that students studying chemistry who received computer-supported instruction outperformed their peers who received traditional instruction. The results support those of Tyagi, (2014) and Nduati, (2015) who discovered that computer-assisted learning is a superior mode of instruction that has helped secondary school pupils become masters of chemistry. It also supports the findings of Ahiatrogah, et al. (2013), who investigated the impact of computer-supported teaching (CSI) on students' academic attainment and discovered that the CSI group outperformed the conventional method of instruction group.

Additionally, the results indicate a significant difference in favor of the male students between the scores of male and female students who were taught using CSI. This result is consistent with that of Ezenwosu and Nworgu (2013), who took into account gender and a teaching strategy and discovered that the male students outperformed the female pupils. While Julius, et al.'s (2018) findings on a substantial difference between male and female students' achievement in chemistry when taught via CAI are supported by this study, the difference

favors female students as opposed to this study, which favored male students. This discrepancy can be brought on by the fact that the research subjects are students from various fields of study.

The results contradict those of (Nweke, et al., 2014; Ukor & Abdulbajar, 2019; Njoku, et al., 2020), who discovered that there is no discernible difference between male and female students' performance when studying science in secondary school. This discrepancy in results could be caused by different science disciplines and teaching strategies.

Conclusion

The goal of the study was to determine whether adopting a computer-supported instruction strategy had any impact on students' academic performance in the subject of chemistry. According to the study, students who were taught with computer-assisted education received mean scores that were greater than those of students who were not. Therefore, it was determined that teachers need to learn how to instruct pupils utilizing computer-supported instructional approaches in order to help them understand not just abstract notions but also other challenging science subjects (Chemistry).

Recommendations

Based on the findings of this study, the following recommendations are made.

1. Computer literacy and use should receive the necessary attention in secondary schools. Additionally, Nigerian public schools should have the ICT infrastructure they require to fully utilize ICT's potential for science instruction.
2. Relevant computer For use in Nigerian school systems, supported instructional materials should be created.
3. Both male and female students should be encouraged to develop social interaction skills in the use of computers, since the study's findings indicated that students who were taught cooperatively using the CSI outperformed those who were taught via CIM. Computer literacy and use should receive the necessary attention in secondary schools. Additionally, Nigerian public schools should have the ICT infrastructure they require to fully utilize ICT's potential for science instruction.

4. Relevant computer For use in Nigerian school systems, supported instructional materials should be created.

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