UNIJERPS
Unizik Journal of Educational Research and Policy Studies VOL.19 (4);
January-June, 2025 https://unijerps.org
2023 Impact Factor: **6.834;** 2022 ***Impact Factor***: 5.156; ***2021 Impact Factor: 5.641;***
2020 Impact Factor: 5.355. *Indexing and Impact Factor URL: http://sjifactor.com/passport.php?id=21363*

EFFECT OF COMPUTER ASSISTED INSTRUCTION ON ACADEMIC ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS IN VISUAL ARTS IN ANAMBRA STATE

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ABSTRACT

The study was carried out to investigate effect of computer assisted instruction on academic achievement in visual arts of secondary school students in Anambra State. Two research questions were raised for the study while three hypotheses were tested. Quasi experimental design was adopted for the study. The population of the study consisted of all the 8,656 Senior Secondary One (SS1) students in the 193 co-educational secondary schools in Anambra State. The sample for the study comprised 193 SSI students drawn from the population from their respective educational zones in Anambra State using simple random sampling technique. Visual Arts Achievement Test (VAAT) constructed by the researcher was used to collect data. The instrument for data collection was validated by three experts, one from Measurement and Evaluation unit, one from Curriculum Studies, all from the Department of Educational Foundations, Nnamdi Azikiwe University, Awka, and one from a Visual Arts WAEC examiner in College of Education Nsugbe. The reliability of the VAAT was ascertained using Kuder Richardson reliability measure coefficient and yielded 0.76 coefficient. Data collected from the pretest and posttest were analyzed using mean and standard deviation. In order to compare the performance (mean scores) of the experimental groups (those taught with Computer Assisted Instruction) and control groups (those taught with conventional method), analysis of covariance (ANCOVA) was used to test the significance of the differences at 0.05 alpha levels. The findings of the study revealed that CAI is a more effective technique for enhancing students' academic achievement in Visual Arts more than the Conventional Method (CM) across all genders used in the study (male and female). The interaction of gender and CAI revealed that CAI and gender significantly influenced students' achievement in visual arts. Based on the findings of the study, it was recommended among others that CAI should be adopted in visual arts in secondary schools in Anambra State as it will go a long way to improve students' academic achievement in the subjects.

Keywords: Computer Assisted Instruction; Academic Achievement; Visual Arts.

Introduction

Secondary education is a structured stage of learning with the primary purpose of equipping students with the knowledge, skills, values, and attitudes necessary to become effective and productive members of society. It serves as a crucial bridge between primary and tertiary education and acts as an entry point into the workforce for those who, for various reasons, do not proceed to higher education. Nsude and Chukwu (2021) described secondary education as the foundation of the entire educational system, noting that it aligns with the adolescent years a pivotal time when individuals make significant life and career decisions. The authors emphasizes that this level of education greatly influences both the quality and quantity of students entering higher institutions, which are responsible for producing the nation's skilled workforce. The Senior Secondary Certificate Examination (SSCE) is a nationwide assessment in Nigeria that serves as a critical benchmark for students, determining their eligibility to pursue higher education or enter the workforce. Secondary school curricula are changed frequently to correspond with the most recent standards of education, and they are structured to help students prepare for this exam. Commonly, subjects like General Mathematics, Computer Studies/ICT, and English language occupy pride of places in the Nigerian secondary education curriculum. Nigerian secondary schools offer an extensive selection of elective subjects in addition to the required subjects. Students who take these elective courses should expect to gain a wide range of information and abilities that are applicable to many different areas. Physics, Chemistry, Biology, Agricultural Science, Economics, History, Government, Civic Education, and Visual Arts are just a few of the courses covered. However, this study is interested in visual arts.

In Nigeria, the curriculum for Fine Art and visual art at the secondary level is structured to cover both theoretical and practical aspects of art education (Uzoagba and Ugwu, 2017). In the opinion of Uzoagba and Ugwu, (2017), Fine Art at the Junior Secondary School (JSS) level is taught as part of the Basic Education curriculum (JSS 1 to JSS 3). The focus is on introducing students to fundamental concepts of art, basic techniques, and the study of art history and appreciation. Under it, core topics such as drawing, painting, sculpture, crafts, art history, elements and principles of design are enveloped. However, at the Senior Secondary School level (SSS 1 to SSS 3); students are exposed to visual arts with core topics like Advanced drawing and painting, graphic design, textile design, ceramics, sculpture, and art criticism, among others. Visual arts represent a profound and ever-evolving field that reflects humanity's diverse experiences, beliefs, and aspirations. Visual arts encompass a broad range of creative practices and forms that involve the creation and

appreciation of artworks primarily perceived through sight.

Understanding visual arts can vary depending on the perspective—whether historically, culturally and importantly, educationally (Geroimenko, 2019). Historically, visual arts are defined as the evolution of artistic practices over time, from ancient cave paintings and classical sculptures to modern digital art (Wilson, 2016). This acknowledges the changes and continuities in artistic practices and styles through different historical periods. Culturally, visual arts represent the artistic practices that reflect and shape cultural identities and traditions (Keifer-Boyd and Smith-Shank, 2017). This includes not only traditional forms like painting and sculpture but also contemporary practices that engage with cultural and societal issues. Aesthetically, visual arts are expressed as forms of artistic expression that are primarily experienced through visual perception (Freedman, 2015). This includes painting, drawing, sculpture, and printmaking, where the focus is on creating aesthetic experiences and exploring concepts of beauty and form. However, educationally, visual arts refer to a discipline or body of knowledge within the arts curriculum that includes the study and creation of artworks such as painting, drawing, sculpture, and photography (Delacruz, 2017). This definition emphasizes skill development, creativity and critical thinking. By virtue of this, visual arts become a subject for students to explore and express their ideas and emotions which include various techniques and processes that contribute to cognitive and emotional development, such as problem-solving, spatial awareness, and emotional expression.

Visual Arts play a crucial role in education and contribute to the development of students in various ways. In the opinion of Kallemeyn, *et al*. (2015), engaging with visual arts encourages students to analyze, interpret, and evaluate works of art, fostering critical thinking skills. To this end visual art is equipped to yield cognitive development for the students. The researchers further averred that, visual arts is equipped to yield creativity by allowing students to explore different media and techniques, encouraging innovative thinking. In the thoughts of Sommer (2016), visual art provides a medium for students to express their emotions and experiences, helping them to understand and articulate their feelings. Through creating and reflecting on art, students develop empathy and emotional awareness, enhancing their emotional intelligence (Anderson, 2019). The researcher further expressed that studying visual arts helps students appreciate diverse cultures and historical contexts, fostering a greater understanding of global and local cultural heritage. As such, it allows students to explore their cultural identities and personal experiences, contributing to their sense of self. In the opinion of Bamford (2015), owing to the fact that visual art projects often involve group work, it could be

said to promote teamwork and collaboration among students while encouraging them to communicate their ideas and critiques, enhancing their verbal and non-verbal communication skills.

Various teaching approaches have overtime been used to teach visual arts in a bid to make visual arts education more engaging and student-centred. For instance is experiential learning which involves hands-on activities where students actively create artworks, fostering creativity and problem-solving skills (Ajayi and Ogunleye, 2020). Another teaching approach is Collaborative learning encourages group projects, such as murals or collaborative sculptures, which help students develop teamwork and communication skills (Chikendu, 2022). Project-based learning which is another approach allows students to work on long-term art projects, integrating multiple skills and encouraging in-depth exploration of themes. However, as averred by Ajayi and Ogunleye (2020), the mostly widely used instructional approach for teaching visual arts in most Nigerian secondary schools is the conventional method.

The conventional method is a teacher-centred approach where instructors primarily rely on direct instruction, demonstrations, and verbal explanations to convey artistic concepts and techniques (Abidogun and Akinola 2018). In this method, teachers guide students through structured activities, such as step-by-step demonstrations of drawing or painting, which students replicate to build foundational skills. It often includes the use of textbooks, art charts, and lectures to teach art theory, history, and design principles. In Anambra State public secondary schools, the teaching of visual arts has primarily relied on conventional methods, which have yielded steady but modest academic achievements. However, despite these gains, students' academic achievements in visual arts have rarely surpassed 70% Credit up to the 2023 external examinations. This underscores the limitations of the conventional approach, which, in the opinion of Eze and Nwosu (2020), is effective for teaching basic skills and theoretical knowledge but often stifles creativity and student autonomy. The method's emphasis on replication over exploration can hinder the development of innovative and critical thinking skills, essential in today's dynamic art landscape. To bridge this gap, there is a growing need to explore modern, technology (computer) driven teaching approaches such as Computer-Assisted Instruction (CAI).

A computer is an electronic device that can store, retrieve, process, and alter data (Bamidele, 2016). Bewley (2019) states that a variety of computer types, including minicomputers, PCs, mainframes, supercomputers, and microcomputers, are utilized in education. Microcomputers, often known as personal computers (PCs), are the most popular kind of computer used in education. They can be used for word processing, web research, multimedia presentations, and educational applications,

among other things (Bewley, 2019). Teachers and students can exchange resources and communicate with one another by connecting their PCs to a network. However, Bamidele opined that because they are small and convenient to use, laptops are the best option for students who need to do tasks outside of the classroom. Teachers who have to carry their work home can also benefit from them. On the other hand, tablet computers are more compact and portable than laptops. They are frequently utilized in classrooms for engaging instructional games and activities. Conversely, smartphones are compact, portable devices that have a wide range of uses, such as communication, educational apps, and internet research. Students frequently utilize them to interact with teachers and peers as well as to obtain instructional materials. Last but not least, wearable computers are a relatively new class of body-worn computing devices (Ikemenjima, 2015). They are frequently utilized in education for augmented and virtual reality, as well as for tracking health and fitness.

In the education system, computers were first used for administrative purposes in educational institutions, as stated by Ogunsola and Aboyade (2015). But as time went on, computer-based instruction which refers to any application of a computer for instruction in both instruction and the management of the teaching and learning process became believed to be the technological process that will bring about the desired revolution in education and training in order to meet the rapid advances in technology, the need for lifelong learning, and the growth of computer-age students (Bhalla in Adigwe and Akudolu, 2024). The researchers claimed that CBI, which encompasses CAL (Computer-Aided Learning), CMI (Computer-Managed Instruction), and CAI (Computer-Assisted Instruction), has come to refer to the use of computers in both instruction and the management of the teaching and learning process. Of interest to this study is the CAI. The use of CAI in scientific classes, according to Kareem (2015), may enhance students' exposure to and capacity for developing knowledge, skills, and access to information in a technologically advanced environment. According to Gambo in Adigwe and Akudolu (2024), CAI enables teachers and students to interact instructionally through a range of content, either with or without the teacher's help. With no help from the teacher, CAI accomplishes this by focusing the learners' attention on various parts of a learning sequence. According to Danjuma (2015), CAI has the ability to increase the learning proportion, meaning that students can acquire a comparable quantity of knowledge in a shorter amount of time than those who receive traditional instruction. As a result, it can promote the development of students' critical thinking and decision-making skills as well as their data processing and communication abilities. Given the above, CAI, which consists of tutorial, simulation,

and drill-and-practice activities, could be quite helpful.

The investigator is cognizant of the apparent endeavours undertaken by scholars to employ CAI in the delivery of education. Attempts to understand how CAI can support meaningful learning abound in the literature. Research such as those by Samkange (2016), Suleman *et al.* (2017), Kumar (2017), Kumar and Kumar (2017), Rani (2017), Ekpenyong and Akwagiobe (2018), Falalu and Atadoga (2020), Rani, Renu, and Anju (2021), Yusuf and Afolabi (2019), Adigwe, et al, (2024) and others have demonstrated that CAI is more effective in enhancing students' academic achievement. Ekundayo (2022) found, however, that the use of CAI did not demonstrate any greater effectiveness in terms of student accomplishment, in contrast to other research that shown the good influence of CAI on teaching and learning. Thus, it appears from the above that CAI does not always result in students achieving their goals. These inconsistencies in the utilization of CAI further awakened the researcher's interest to seek out the effect of CAI on students' achievement and interest in visual arts.

Stakeholders in secondary education system have expressed serious concerns about students' academic achievement. The researcher is also intent on ensuring the acceleration of the little academic progress observed in students' academic achievement in visual arts in secondary schools in Anambra State. In the light of this study, academic achievement is the learning goal that a student has reached at the conclusion of a learning process based on the teacher's evaluation through quizzes and exams. Academic achievement is defined as "what the student has learned or what skills the student has acquired (Young-Jones, Fursa, Byrket, and Sly, 2015). Assessments such as standardized exams, performance assessments, portfolio assessments, and continuous assessments are typically used to measure academic achievement. In the thoughts of Anekwe (2016), academic achievement is a representation of performance outcomes that show how well a person has achieved particular objectives that were the main emphasis of the activities in the instructional environment, particularly in schools. Similarly, Brown (2017) described academic achievement as the extent to which a student, teacher, or institution meets short- or long-term learning objectives. Roberts (2017) further emphasized that academic achievement is used to gauge students' proficiency in the material they have been taught. In visual arts, where creativity, skill application, and aesthetic appreciation are integral, academic achievement not only reflects mastery of techniques but also the ability to express ideas innovatively. However, the possibility of gender disparity in students' academic achievement in visual arts cannot be overlooked, as societal expectations and biases may impact the level of encouragement and opportunities provided to male and female students. Students' academic achievement in school subjects

such as Visual Arts may vary irrespective of their gender.

Gender is not to be mistaken with sex or the biological traits of men and women (Nwaubani, Okechukwu, and Ogbonnaya, 2018). Rather, gender refers to the socially constructed definitions of women and men in society. Gender is defined by the duties, responsibilities, and tasks that are given to men and women in society (Ibe, Nwosu, Obi, and Nwoye, 2016). Studies have shown that when it comes to arts, male students do worse than female students and vice versa (Amedu, 2015; Nwona and Akogun, 2015). A number of studies have found that there is a gender gap that favours men in science but not in arts (Ifamuyiwa, 2014; Nwona and Akogun, 2015; Iwendi, 2017); some have reported that women are superior (Balart and Oosterveen 2019, Szameit, Hamaida and Sayfik 2015); still others have found no gender gap at all (Jackman and Moraine-Webb 2019). On the other hand, when it comes to the application of CAI, Kumar and Kumar (2017) found no statistically significant difference in the academic achievement of male and female students taught using the method; meanwhile, Ekundayo (2022) found that the method seemed to favour females over males when both gender were taught using the method. The aforementioned implies that student accomplishments are ambiguous and contradictory, which piques the researcher's curiosity about gender variations in visual arts learning outcomes while employing CAI. Against this backdrop, the researchers are interested in determining how Computer Assisted Instruction (CAI) affects students' academic achievement towards visual arts at selected public schools in Anambra State, Nigeria.

Research Questions

The following research questions were raised to guide the study:

1. what is the mean achievement scores (pre-test and post-test) of students taught visual arts with Computer Assisted Instruction (CAI) and those taught with Conventional Method (CM)) in selected public secondary schools in Anambra State?
2. What is the mean achievement scores(pre-test and post-test) of male and female students taught visual arts with CAI and those taught with CM in selected public secondary schools in Anambra 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 visual arts with Computer Assisted Instruction (CAI) and those taught with Conventional Method (CM) in selected public secondary schools in Anambra State.
2. There is no significant difference between the mean achievement scores

of male and female students taught visual arts with CAI and those taught with CM in selected public secondary schools in Anambra State

3. There is no interaction effect of CAI, CM and gender on students' academic achievement and interest in visual arts in selected public secondary schools in Anambra State.

Materials and Method

Quasi experimental design was adopted for the study. The population of the study consisted of all the 8,656 Senior Secondary One (SS1) students in the 193 co-educational secondary schools in Anambra State. The sample for the study comprised 193 SSI students drawn from the population from their respective educational zones in Anambra State using simple random sampling technique. Visual Arts Achievement Test (VAAT) constructed by the researcher was used to collect data. The instrument for data collection was validated by three experts, one from Measurement and Evaluation unit, one from Curriculum Studies, all from the Department of Educational Foundations, Nnamdi Azikiwe University, Awka, and one from a Visual Arts WAEC examiner in College of Education Nsugbe. The reliability of the VAAT was ascertained using Kuder Richardson reliability measure and yielded 0.76 coefficient. Data collected from the pretest and post test were analyzed using mean and standard deviation. In order to compare the performance (mean scores) of the experimental groups (those taught with Computer Assisted Instruction) and control groups (those taught with conventional method), analysis of covariance (ANCOVA) was used to test the significance of the differences at 0.05 alpha levels.

Results

Research Question 1: What Are The Mean Achievement Scores (Pre-Test And Post-Test) Of Students Taught Visual Arts With Computer Assisted Instruction (CAI) And Those Taught With Conventional Method (CM) In Selected Public Secondary Schools In Anambra State?

Table 1: *Mean Achievement Scores (Pre-Test and Post-Test) of Students Taught Visual Arts with Computer Assisted Instruction (CAI) and those taught with Conventional Method (CM)*

Source of Variance	N	Pre-test Mean	SD	Post-test Mean	SD	Mean Difference	Remark
Experimental Group	92	48.76	9.44	60.43	9.69	11.67	Effective
Control Group	101	48.49	9.13	48.68	7.55	0.19	Not Effective

Data in Table 1 reveals that the pre-test mean achievement scores of students taught visual arts with CAI (experimental group) were 48.76, while the pre-test mean achievement scores of those taught with the conventional method (control group) were 48.49. At the end of the experiment, the post-test mean achievement scores of students taught visual

arts with CAI (experimental group) increased to 60.43, whereas those taught with the conventional method (control group) recorded a post-test mean of 48.68. This indicates that the experimental group achieved an 11.67-point gain in post-test mean scores for visual arts, compared to a minimal 0.19-point gain in the control group. This demonstrates that CAI, used for the experimental group, resulted in significantly better achievement than the conventional method used in the control group. CAI can therefore be considered more effective than the conventional method for enhancing the visual arts achievement of SS I students.

Research Question 2: What is the Mean Achievement Scores (Pre-Test And Post-Test) of Male and Female Students Taught Visual Arts With CAI and Those Taught With CM In Selected Public Secondary Schools In Anambra State?

Table 2: *Mean Achievement Scores (Pre-Test and Post-Test) of Male and Female Students Taught Visual Arts with CAI and those taught with CM*

Source of Variance	N	Pre-test Mean CM	CAI	SD	N	Post-test Mean CM	CAI	SD	Mean Difference	Remark
Male	54	42.7	44.5	.50	48	45.5	57.2	9.07	11.7	Effective
Female	47	55.0	53.3		44	53.2	63.8	9.25	10.6	Effective
Mean difference		12.3	8.8	7.33		7.79	6.61			Effective

Data in Table 2 reveals that the post-test mean achievement scores of male and female students taught visual arts using the conventional method were 45.5 for males and 53.2 for females, while the post-test mean achievement scores of those taught with CAI were 57.2 for males and 63.8 for females. This indicates that, under the conventional method, females outperformed males with a mean difference of 7.7, and similarly, under CAI, females still outperformed males with a mean difference of 6.6. Furthermore, the post-test mean achievement scores of students taught visual arts with CAI were higher than those taught with the conventional method for both genders, with a mean difference of 11.7 for males and 10.6 for females. This highlights that while CAI proved to be more effective than the conventional method for enhancing achievement in visual arts, there remains a noticeable gender effect, with female students consistently performing better than their male counterparts across both instructional techniques.

Hypothesis 1: There is no significant difference between the mean achievement scores of students taught visual arts with Computer Assisted Instruction (CAI) and those taught with Conventional Method (CM) in selected public secondary schools in Anambra State.

Table 3: *ANCOVA on Mean Achievement Scores of Students taught Visual Arts with Computer Assisted Instruction (CAI) and those taught With Conventional Method (CM).*

Source	Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6154.251[a]	1	6154.251	79.434	.000
Intercept	573639.813	1	573639.813	7404.087	.000
Instruction Technique	6154.251	1	6154.251	79.434	.012
Error	14797.935	191	77.476		
Total	594592.000	193			
Corrected Total	20952.187	192			

a. R Squared = .494 (Adjusted R Squared = .490)

The ANCOVA analysis in Table 3 revealed that the mean achievement scores of students taught visual arts using CAI and those taught using the conventional method were compared, yielding $F(1, 193) = 79.4$, $p < .05$. The p-value ($p \leq .012$) was found to be less than 0.05, indicating statistical significance. Additionally, the adjusted R^2 value showed that the difference in instructional techniques accounted for 0.490 (49%) of the variance in students' achievement in visual arts. Based on this finding, the null hypothesis, which posited no significant difference in achievement scores between the two groups, was rejected. This implies that the type of instructional technique—CAI or the conventional method—had a significant effect on students' achievement in visual arts. Specifically, students taught with CAI performed better, underscoring the efficacy of this innovative teaching approach in enhancing academic achievement.

Hypothesis 2: There is no significant difference between the mean achievement scores of male and female students taught Visual Arts with CAI and those taught with CM In Selected public secondary schools in Anambra State

Table 4: *ANCOVA on Mean Achievement Scores of Male and Female Students Taught Visual Arts with CAI and Those Taught With CM.*

Source	Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8670.175[a]	2	4335.088	67.063	.000	.414
Intercept	38771.405	1	38771.405	599.785	.000	.759
Gender	2515.924	1	2515.924	38.921	.001	.170
Instruction Technique	6051.964	1	6051.964	93.623	.001	.330
Error	12282.011	190	64.642			
Total	594592.000	193				
Corrected Total	20952.187	192				

a. R Squared = .414 (Adjusted R Squared = .408)

The data analysis in Table 4 revealed a comparison of the mean achievement scores of male and female students taught visual arts using Computer-Assisted Instruction (CAI) and those taught using the conventional method. The analysis showed $F(1, 193) = 38.9$, $p < .05$, indicating a statistically significant difference in achievement. The p-value ($p \leq .001$) was well below the threshold of 0.05, confirming the significance of the results. Additionally, the adjusted R^2 value revealed that the observed difference accounted for 0.408 (40.8%) of the variance in the students' achievement scores, attributed to the instructional techniques employed. Consequently, the null hypothesis, which posited no significant difference in the achievement of male and female students across instructional methods, was rejected. This finding implies that the instructional technique significantly impacted the achievement of both male and female students in visual arts. Specifically, students taught using CAI—both male and female—outperformed their counterparts taught using the conventional method.

Hypothesis 3: There is no interaction effect of CAI, CM and gender on Students' academic achievement in Visual Arts in selected public secondary schools in Anambra State

Table 5: *Interaction Effect of CAI, CM and Gender on Students' Academic Achievement in Visual Arts In Selected Public Secondary Schools In Anambra State*

Source	Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	16,372.093	2	5,457.364	37.649	.000	.371
Intercept	1,323,880.620	1	1,323,880.620	8,923.564	.000	.979
Instructional Approach	13,468.308	1	13,468.308	90.942	.000	.325
Gender	2,510.859	1	2,510.859	16.314	.000	.085
Instructional Approach Gender	1,667.045	1	1,667.045	10.227	.021	.072
Error	28,047.576	191	148.377			
Total	1,358,712.000	193				
Corrected Total	44,419.669	192				

The data analysis in Table 5 reveals the interaction effect of instructional approach (CAI and CM) and gender on students' academic achievement in visual arts. For academic achievement, the interaction effect was significant at $F(1, 193) = 16.26$, $p < .05$. The p-values for both variables are less than 0.05, indicating that the combined effects of instructional approach and gender on students' achievement in visual arts were statistically significant. To this end, the null hypothesis was rejected. The rejection of the null hypothesis signifies that instructional

approach and gender significantly influence students' achievement and in visual arts. The adjusted R^2 value for achievement was .405 (40.5%). This value indicated that 40.5% of the variance in students' academic achievement in visual arts could be explained by the combined effects of instructional approach and gender. The remaining percentages can be attributed to other unexplored variables. The above interaction of gender and instructional approach suggests that the effect of CAI and CM varies across male and female students.

Discussion of the Findings

The findings of the study revealed that that the pre-test mean achievement scores of students taught visual arts with CAI (experimental group) were 48.76, while the pre-test mean achievement scores of those taught with the conventional method (control group) were 48.49. At the end of the experiment, the post-test mean achievement scores of students taught visual arts with CAI (experimental group) increased to 60.43, whereas those taught with the conventional method (control group) recorded a post-test mean of 48.68. This indicates that the experimental group achieved an 11.67-point gain in post-test mean scores for visual arts, compared to a minimal 0.19-point gain in the control group. This demonstrates that CAI, used for the experimental group, resulted in significantly better achievement than the conventional method used in the control group. CAI can therefore be considered more effective than the conventional method for enhancing the visual arts achievement of SS I students. The test of hypothesis saw the rejection of the null hypothesis to posit that there is a significant difference between the mean achievement scores of students taught visual arts with Computer Assisted Instruction (CAI) and those taught with Conventional Method (CM) in selected public secondary schools in Anambra State. The findings of the study agrees with Yusuf and Afolabi (2010) who in their study revealed that students exposed to CAI performed better than their counterparts taught with conventional lecture methods. The same could be said of Bayrak and Bayram (2010) who in their study revealed that Computer-aided teaching positively impacted students' academic achievement, emphasizing the influence of well-designed materials and teaching duration. In a study, Gambo (2014) found out that the experimental group (CAI) outperformed the control group (CM) and showed better retention. The same could be said of Kumar (2017) who in a study found out that CAI was more effective than CM in teaching visual arts to 11th graders. Kumar and Kumar (2017) in their study revealed that the experimental group (CAI) had higher achievement than the control group (CM), a situation that was similar with the findings of Rani (2017) that students taught through CAI achieved significantly higher scores than those taught with CM. The findings of the study agrees with Ekpenyong and Akwagiobe (2018) who in their study found out that Achievement post-test scores were

higher for the CAI and collaborative group compared to CM. The same could be said for Rani, Renu, and Anju (2021) who in their study revealed that CAI improved students' academic achievement significantly more than CM. The findings of the study also agrees with Falalu and Atadoga (2020) who in their study revealed that CAI enhanced students' academic performance in science subjects compared to CM.

The findings of the study revealed that the post-test mean achievement scores of male and female students taught visual arts using the conventional method were 45.5 for males and 53.2 for females, while the post-test mean achievement scores of those taught with CAI were 57.2 for males and 63.8 for females. This indicates that, under the conventional method, females outperformed males with a mean difference of 7.7, and similarly, under CAI, females still outperformed males with a mean difference of 6.6. Furthermore, the post-test mean achievement scores of students taught visual arts with CAI were higher than those taught with the conventional method for both genders, with a mean difference of 11.7 for males and 10.6 for females. This highlights that while CAI proved to be more effective than the conventional method for enhancing achievement in visual arts, there remains a noticeable gender effect, with female students consistently performing better than their male counterparts across both instructional techniques. The test of hypothesis saw the rejection of the null hypothesis to reveal that there is a significant difference between the mean achievement scores of male and female students taught visual arts with CAI and those taught with CM in selected public secondary schools in Anambra State. The finding of the study agrees with Ekundayo (2022) who in a study revealed that CAI favored females more than males, indicating some gender bias. However, the finding of the study disagrees with Yusuf and Afolabi (2010) who in their study revealed that no significant gender difference was found among students exposed to CAI. The same could also be said for Gambo (2014) who in a study revealed that gender differences were insignificant for both retention and achievement, so also was Kumar (2017) who found out that CAI was equally effective for male and female students. The findings of the study agrees with Kumar and Kumar (2017) who found out that that there is no significant gender difference was observed among students taught with CAI.

The result of the study indicated that for academic achievement, the interaction effect was significant at $F(1, 193) = 16.26$, $p < .05$. The p-value for academic achievement was less than 0.05, indicating that the combined effects of instructional approach and gender on students' achievement in visual arts were statistically significant. To this end, the null hypothesis was rejected to assert that instructional approach and gender significantly influenced students' achievement in visual arts. The adjusted R^2 value for achievement was .405 (40.5%). This value indicated that 40.5% of the

variance in students' academic achievement in visual arts could be explained by the combined effects of instructional approach and gender. The remaining percentages can be attributed to other unexplored variables. The above interaction of gender and instructional approach suggests that the impact of CAI and CM varies across male and female students. The findings of the study agrees with Samkange (2016) who in their study found out that limited use of CAI in visual arts and predominant reliance on CM negatively affected student performance and interest. The same could be said for Rani (2017) who found out that CAI was more effective across genders, with no significant interaction effect observed between gender and instructional methods. The findings of the study agree with Ekpenyong and Akwagiobe (2018) who in their study found out that the combination of CAI and collaborative methods proved effective, suggesting the interaction of CAI with other approaches enhances teaching and learning outcomes. This was in disagreement with Kumar (2017) who revealed that the interaction of CAI and gender had no significant influence on achievement or interest, demonstrating equal effectiveness. Ekundayo (2022) also found out that interaction effects of CAI showed higher achievement and interest among females, suggesting some gender-specific influences.

Conclusion

Instruction approach employed in instructional delivery has been adjudged as a critical component of curriculum delivery in education because it could affect both students' academic achievement in a particular subject amidst other factors. Given this background the current study examined the effect of CAI on students' academic achievement in visual arts using gender as the moderator variable. Furthermore, the study ascertained whether the interaction of the independent variables (instruction approach and gender) would affect the dependent variable (students' academic achievement in visual arts). The study revealed that CAI is a more effective technique for enhancing students' academic achievement in Visual Arts more than the Conventional Method (CM) across all genders used in the study (male and female). The interaction of gender and CAI revealed that CAI and gender significantly influenced students' achievement in visual arts.

Recommendations

Based on the findings of this study, the following recommendations were made:

1. CAI should be adopted in visual arts in secondary schools in Anambra State. This will go a long way to improve students' academic achievement in the subjects.
2. The curriculum should be adapted to promote the use of low-cost CAI tools and alternative digital resources, ensuring alignment with the realities of public secondary schools in Nigeria. This should include

provisions for teacher guidance on leveraging such tools.

3. Teachers should adopt CAI within the constraints of their available resources, such as shared computers or multimedia devices, to make visual arts lessons more interactive and engaging for students.

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