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EFFECTS OF MULTIPLE INTELLIGENCE-BASED AND COMPUTER ASSISTED INSTRUCTIONS ON SECONDARY SCHOOL STUDENTS' ACADEMIC ACHIEVEMENT IN MATHEMATICS IN ONITSHA EDUCATION ZONE

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ABSTRACT

The study investigated the effects of multiple intelligence-based and computer-assisted instructions (MII & CIA) on secondary school students' achievement in Mathematics. Two research questions guided the study and three hypotheses were tested at 0.05 alpha level. Quasi-experimental design was used in the study, specifically, the pretest-posttest non-randomized control group design was used in the study. The study population comprised 5,561 SS2 students offering mathematics selected using purposive and random sampling techniques. The instruments used for data collection were Mathematics Achievement Test (MAT) validated by experts. The reliability of MAT was established using Kuder-Richardson Formula 20 which yielded coefficients of internal consistency of 0.81. Research questions were answered using mean and standard deviation while analysis of covariance was used to test the null hypotheses. The findings of the study showed that students taught Mathematics using CAI followed by those taught using MII had higher mean achievement score than those taught using DTI. Also, there was a significant difference between the mean achievement score of students taught Mathematics using MII, CAI and Direct Teacher Instruction (DTI) in favour of CAI followed by MII. It was recommended that seminars and workshop on the use of varies forms of CAI in teaching and learning mathematics should be conducted by educational stakeholders for mathematics teachers.

Keywords: Multiple-intelligence, Achievement, Statistics, Computer, Mathematics.

Introduction

Mathematics is an indispensable subject to all fields of human endavour, and academic discipline, therefore, it is offered by all students at the primary and secondary school levels despite their choice of discipline and career. A credit pass in Mathematics is also a prerequisite to gain admission into institutions of higher learning in Nigeria, except for a few disciplines where students may be given waiver considerations (Bessong and Felix, 2018). The importance of Mathematics notwithstanding, it is among the subjects that have recorded the greatest fluctuating performances in external examinations and has continued to be perceived as a difficult subject among secondary school students. The students' performance, as compared to the expectation, is evident in the report of students' performance in external examinations in the past.

In 2015 and 2016 respectively, 38.68 percent and 52.97 percent of the students who enrolled for West African Senior School Certificate Examination (WASSCE) passed Mathematics at credit level while in 2017, 59.22 percent of the students passed Mathematics AT credit level. By 2018, there was a significant decrease in the percentage number of students who passed Mathematics which was reported by the WAEC Chief

Examiner to be 786,016 candidates representing 49.98 percent of the students who sat for the examination. In 2019, there was a significant increase in the number of students who passed Mathematics at a credit grade and above which was reported to be 64.18 percent representing 1, 020, 519 students. There was a very disturbing decrease by 2020 with (24,491) candidates representing 39.82 percent passing Mathematics at a credit level and above. 1, 274,784 candidates, representing 81.7%, obtained credits and above in 2021. This could be attributed to the fact that students were given a lot of remedial classes owing to the Covid-19 pandemic both online and in television programmes. A lot of factors have been advanced for the fluctuating achievement of students in Mathematics in external examinations.

Literature has shown that one of the commonest factors responsible for the unstable achievement of students in Mathematics is the instructional method employed by Mathematics teachers which is often conventional expository method (Chiakwelu and Okigbo, 2020; Njoku and Okigbo, 2020). Duru and Okeke (2020) also reported that the teaching method adopted is the most common implicated factor for students' poor achievement in Mathematics among other main factors. This is because according to the authors, Mathematics teachers often employ direct teacher instruction which is teacher-centred. Nwigwe and Osuafor (2019) also adduced that factors such as the teacher, the home, government curriculum and textbook influence students' achievement in mathematics. Empirical evidence however show that instructional approaches that are student-centred and are focused on students' distinct intelligences bears the potential to boost mathematics achievement.

Multiple intelligences-based instruction according to Muhamed, Sitti and Andi (2018) is a learner-centered learning strategy, which focuses on identifying learners' intelligence, talent, and learning preferences and providing the best way for learning. In the present study, multiple intelligence instruction is one in which the teacher's effort is directed towards providing different learning contexts for students and engaging a variety of their senses as well as providing different learning experiences for the students (Inan and Erkus, 2017).

There are nine distinct and relatively independent intelligences according to Gardner (1999) theory that students may possess. They include: logical-mathematics intelligence, linguistic intelligence, spatial intelligence, musical intelligence, bodily-kinesthetic intelligence, intrapersonal intelligence, interpersonal intelligence and naturalistic intelligence. Logical-mathematical intelligence is the striking ability for problem solving such as puzzles, logic exercises, doing calculations and solving computer problems and mysteries (Ghonchepour, 2018). Linguistic intelligence is the ability to analyze oral and written languages with specific preferences for such activities as reading, talking, writing poems and learning languages. Spatial intelligence according Ezekiel and Raymond (2020) is the capacity to think in three dimensions required to solve problems in drawing and painting, reading maps, looking at pictures and solving mazes. Musical intelligence deals with the innate ability to learn sounds which translates into a great ability to sing, listen to different musics, play instruments and compose songs (Hanafin, 2015).

Bodily-kinesthetic intelligence according to Hanafin (2015) is the ability to use the whole body in the expression of ideas and feelings like in dancing, acting, imitating gestures or expressions, playing sports. Intrapersonal intelligence is the ability to recognize and understand other people's mood, feelings, strength and weaknesses.

Interpersonal intelligence deals with the knowledge of self in ways such as feelings, emotional responses, mediating conflicts and team work. Naturalistic intelligence has to do with the ability to identify and recognize as well as distinguish between plants, animals and objects in nature (Hanafin, 2015).

The multiple intelligences theory by Gardner (1999) is connected to multisensory learning, which states that students learn better with activities that involve more than one sense. Traditionally, secondary schools in Anambra State have emphasized the development of logical intelligence and linguistic intelligence (mainly reading and writing). While many students function well in this environment, there are those who do not. Using the different intelligences to teach Mathematics concepts may allow each of the diverse learners a chance to succeed at learning. This is because according to Ghonchepour (2018), multiple intelligences-based instruction (MII) presents instruction and learning as a representation of different intellectual abilities, thus, providing opportunities for authentic learning based on the students' needs, interests and talents. In the multiple intelligence classroom, illustrations used in a textbook and taught by a teacher are valuable learning experience as teachers tend to related them to the "real" world (Inan and Erkus, 2017). Such real-world experiences can be made clearer through the use of computer-assisted instructions.

Computer-assisted instruction (CAI) refers to instruction or remediation presented on a computer. It is a programme of instructional material presented by means of a computer or computer systems (Owolabi, babatunde and Gambari, 2019). CAI is defined as the use of computers and software applications to teach concepts or skills. It is the use of specific software programmes on computers in the classroom. Computer-assisted instruction has been defined as a systematic approach to developing students' knowledge and/or skills that uses a computer as a central feature to support instruction via activities including, but not limited to, presenting materials, assessing progress, and guiding activities (Ikwuka and Samuel, 2017). According to (National Technical Assistance Center on Transition, 2016) CAI is a subset of technology-aided instruction, and is distinct from online, internet, or other network learning in that CAI implies the software is local to the computer, not accessed via the internet. These tools improve instructional qualities.

The main purpose of CAI programs is to provide individual instruction to students according to their abilities and interests. According to Agbo (2021), there are various types or forms of CAI such as blended learning, Online distance learning, virtual classroom, computer projected instruction, use of multimedia and simulations, computer supported collaborative instructions and animated-media instruction among other. In this study, computer projected instruction embedded with video tutorials from mathhelp.com would be used.

Computer programs are interactive and can illustrate a concept through attractive animation, sound, and demonstration. They provide one-to-one interaction with a student, as well as an instantaneous response to the answers elicited, and allow students to proceed at their own pace (Catherine, 2018). Students can work individually or solve problems in a group. Computers provide immediate feedback, letting students know whether their answer is correct. If the answer is not correct, the programs shows students how to correctly answer the question. Computers offer a different type of activity and a change of pace from teacher-led or group instruction which has been noted in literature to enhance academic achievement.

Academic achievement represents the performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college, and university (Chiakwelu and Okigbo, 2020). Academic achievement is the extent to which a student or institution has achieved either short or long term educational goals (Ricarda, Anja, Anne, and Linda, 2015). Students' achievement measures the amount of academic content a student learns in a determined amount of time. It can be affected by such factors as students' state of mind, attention, teaching methods, school environment among others. Achievement could be poor, fair or high and are often graded. Achievement therefore, is the grades students attain in Mathematics test or examinations. However, according to Schenkel (2020), students' achievement could be a function of their gender.

Mazana and Montero and Casmir (2020) conducted meta-analyses on 100 studies of gender differences in Mathematics performance and 70 studies of gender differences in Mathematics-related effects. For Mathematics performance, the average effect size across all studies was 0.15, indicating a slightly better performance by males. Differences in Mathematics performance among male and female students appear to be small to moderate. Also, these contradictory reports need to be resolved in the present research.

Purpose of the Study

The purpose of the study was to determine the effects of multiple intelligence-based and computer-assisted instructions on secondary school students' academic achievement in Mathematics in Onitsha Education Zone of Anambra state, Nigeria. Specifically, the study determined the:

1. mean achievement scores of students taught Mathematics using multiple intelligence-based instruction (MII), computer assisted instruction (CAI) and those taught using direct teacher instruction (DTI).
2. mean achievement scores of male and female students taught Mathematics.
3. interaction effect of instructional approaches (MII, CAI, DTI) and gender on students' achievement in Mathematics.

Research Questions

1. What are the mean achievement scores of students taught Mathematics using multiple intelligence-based instruction (MII), computer assisted instruction (CAI) and those taught using direct teacher instruction (DTI)?
2. What are the mean achievement scores of male and female students taught Mathematics using MII, CAI and those taught using DTI?

Hypotheses

1. There is no significant difference between the mean achievement scores of students taught Mathematics using multiple intelligence-based instruction (MII), computer assisted instruction (CAI) and those taught using direct teacher instruction (DTI).
2. There is no significant difference between the mean achievement scores of male and female students taught Mathematics using MII, CAI and those taught using DTI.
3. There is no interaction effect of instructional approaches (MII, CAI, DTI) and gender on students' achievement in Mathematics.

Research Method

The study adopted quasi-experimental research design; specifically, the pretest-

posttest non randomized control group design was used. The design for the study is presented in Figure 1.

E_1	0_1	X_1	0_2
E_2	0_1	X_1	0_2
C	0_1	~ X	0_2

Figure 1: Design of the Experiment

Where,
E_1 = Experimental group one on
E_2 = Experimental group two
C = Control group
0_1 = Pre-test
0_2 = Post-test
X_1 = Treatment with Multiple Intelligence-based Instruction (MII)
X_2 = Treatment with Computer Assisted Instruction (CAI)
~X = No experimental treatment (treatment with Direct Teacher Instruction, DTI)
…… = Non-randomized groups (meaning that the three groups were not randomly composed)

The study was conducted specifically in Onitsha Education Zone. The population of the study comprised 5,561 (2,448 males, 3,113 females) senior secondary year two (SS2) students offering Mathematics in Onitsha Education Zone. The sample size for the study is 209 SS2 students drawn using a multi-stage sampling procedure. The instrument for data collection was Mathematics Achievement Test (MAT). MAT is made of 50items multiple choice objective test with four response options lettered A to D on the concept of statistics. MAT was adapted from the standardized West African Examination Council (WAEC) past question papers from 2012-2021. The content coverage on each concept was drawn using a table of specification. Each correct answer on each item of the MAT carried two marks totalling 100marks for the 50 items. The highest possible mark is 100 and the lowest possible mark is 0.

Mathematics achievement test was validated by three experts, one each in the Departments of Science Education and Educational Foundations in Nnamdi Azikiwe University, Awka and one other in the Department of Computer and Mathematics Education, Enugu state university of science and technology, Enugu. The reliability of MAT was established using Kuder-Richardson Formula 20 (KR-20) and the reliability coefficient obtained was 0.81.

The multiple intelligence instruction was carried in the regular classroom of the students using instructional materials that incites each intelligence as described by Gardner. The lessons began with set inductions which was a puzzling question that engaged the students' logical-mathematic intelligence. The teacher then introduced the topic and explain it using pictorial illustrations and stimulus variations while posing different questions and engaging their visual-spatial and verbal-linguistic intelligence. The students solved the exercise to engage their logical–mathematical intelligence. The teacher provided explanations of the practical applications of the concept taught to engage the students' naturalistic intelligence and asked students to move around to share what they have learnt to engage their interpersonal

intelligence. After this, the student came back to their seat to analyze what they both learnt from the teacher and from their fellow students and evaluate themselves using the end of lesson questions given by the teacher. The stage by stage procedure is presented below for the first lesson.

Step I: The teacher reviewed the past lesson and summarized the important points of the lesson. The teacher introduces the new topic with the following question asking the students to look at a given set of numbers on a chart and indicates the number of times each number appeared as their frequency. The students observed the numbers carefully applying their visual-spatial intelligence. They tried to indicate the frequency of the numbers through critical calculations using their logical-mathematics intelligence and communicate their answers to the teacher according to their verbal linguistic intelligence.

Step II: The teacher presented a chart of frequency table and explaining grouped and ungrouped data. The teacher using questioning techniques asked the students to define grouped and ungrouped data in their own terms. The students tried to answer the question by applying their verbal linguistic intelligence. The teacher then used examples to present and explain group and ungrouped data computing the frequency, class midpoint and cumulative frequency. The students on their part put down the table and computed the frequency, class midpoint and cumulative frequency with the teacher applying their logical mathematics intelligence, visual spatial intelligence and bodily kinaesthetic intelligence and asking questions.

Step III & IV: The teacher explained the class limit, class boundary and class mark using examples. The students wrote down the notes and computed the class boundary and class marks as the teacher solves related questions on the board. The teacher asked the students to make a music note out of the meaning of class limit, class boundary and class marks. The students consulted among their group and using interpersonal intelligence, bodily-kinaesthetic intelligence, they composed musical notes in the form of mnemonics to serve as advanced organisers that helped them remember the meaning of class limit, class boundary and class marks. The teacher then explained cumulative frequency to the students asking them to form a cumulative frequency from the frequency tables they already have.

Step V - Evaluation: The teacher asked the students to solve within their groups the questions following from the lesson that were written on the board. The students gathered in their groups and try to solve the questions by creating the following table below and using their visual-spatial intelligence to observe the numbers in other to apply solutions to their. They use their verbal linguistic intelligence to exchange ideas and communicated solutions among themselves in their groups and solve the problem using their logical mathematical intelligence and bodily kinaesthetic intelligence.

In the CAI group the same content was taught. The teacher used computer to project the lesson on a screen. The lessons were characterized with tutorial videos, motion pictures. There were exercises or questions that helped the students to evaluate their learning and monitor their progress. The attempts made on each quiz or question was related as a feedback to the teacher and researcher. The steps to the lesson for one week are given as follows.

Step I: The teacher reviewed the past lesson and summarizing the important points of the lesson. The teacher introduced the new topic projecting a question on the screen on frequency of numbers. The students observed the numbers on the screen carefully and try to indicate their frequency, they made frequency

tables indicating the numbers of times each number appeared.

Step II: The teacher projected the meaning, questions and solutions to grouped and ungrouped data and used it for explanation. The students observe the screen carefully. The teacher after explanations projected questions relating to grouped and ungrouped data and ask the students to answer them. The students put down notes as they listened to the teacher and tried to answer the teacher's questions posted on the screen by trying to define ungrouped data. They developed a frequency table and computed the frequency, class midpoint and cumulative frequency with the teacher.

Step III & IV: The teacher projected and explain using tutorial videos and animated text, class boundaries and class marks of grouped data. The students put down the notes and compute the class boundary and class marks. They tried to first determine the lower and upper class limits in order to find the class limit. They observe the tutorials and the example being presented to them and computer the cumulative frequencies of data from the frequency tables they have developed.

Step V: The teacher asked the students to solve the question that were displayed on the screen in order to evaluate their mastery of the concepts taught. The students try to solve the questions.

The control group was taught using the direct teacher instruction. No use was made of computers and students were not exposed to varied instructional situations and classroom conditions. The interaction in the classroom was controlled and championed by the teacher. The students however, were not allowed to ask questions and get clarification on the unit areas they are confused or solutions they did not understand.

The research questions were answered using mean and standard deviation while the hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). ANCOVA was used because it eliminated the initial group differences among the students and at the same time take care of the two dependent variables and two dependent variables together with gender. The decision rule was to reject the null hypothesis if Probability value (p-value) is less than or equals significant value of 0.05 ($P \leq 0.05$) and to accept the null hypothesis if P-value is greater than 0.05 ($P > 0.05$).

Presentation of Results

Research Question 1: What are the mean achievement scores of students taught Mathematics using multiple intelligence-based instruction (MII), computer assisted instruction (CAI) and those taught using direct teacher instruction (DTI)?

Table 1: Mean Achievement Scores of Students taught Mathematics using MII, CAI and DTI

Source of Variation	N	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Gained Mean
MII	68	28.68	6.91	68.25	6.55	39.57
CAI	77	26.90	4.05	78.70	10.32	51.80
DTI	64	19.55	7.45	50.75	10.85	31.20

Table 1 reveals that the students taught Mathematics using MII has pretest mean achievement score of 28.68 and posttest mean achievement score of 68.25 with gained mean achievement score of 39.57, and those taught using CAI having pretest mean achievement score of 26.90 and posttest mean score of 78.70 with gained mean 51.80 while those taught using DTI has pretest mean achievement score of 19.55, posttest mean of 50.75 and gained mean of 31.20. Students taught using Mathematics using CAI had the

most homogeneous score in their pretest (4.05) followed by those taught using MII (6.91) whereas students taught using DTI had the most heterogeneous score in their pretest (7.45). In the posttest, students taught mathematics using MII also had the most homogeneous score (6.55) while students taught using CAI had a more heterogeneous score (10.32) and students taught using DTI had the most heterogeneous scores (18.85).

Research Question 2: What are mean achievement scores of male and female students taught Mathematics using MII, CAI and those taught using DTI?

Table 2: Mean Achievement Scores of Male and Female Students taught Mathematics using MII, CAI and DTI

Method	Gender	n	Pretest Mean	Pretest SD	Posttest Mean	Posttest SD	Gained Mean
MII	Male	39	29.59	4.78	68.15	6.11	38.56
	Female	29	27.45	8.98	68.38	7.21	40.93
CAI	Male	33	25.39	3.82	80.73	6.82	55.34
	Female	44	28.02	3.89	77.18	12.18	49.16
DTI	Male	22	21.86	6.44	54.77	4.84	32.91
	Female	42	18.33	7.73	48.64	12.47	30.31

Table 2 indicates that male students taught Mathematics using MII have gained mean achievement score of 38.56 while female students have a gained mean score of 40.93 with females having a higher mean gain achievement score and a more heterogeneous score in the posttest. Male students taught Mathematics using CAI have a gained mean achievement score of 55.34 while female students have gained mean score of 49.16 with males having a higher mean gain achievement score and a more homogeneous score in the posttest. Again, male students taught Mathematics using DTI have a gained mean achievement score of 32.91 while female students have gained mean score of 30.31 with males having a higher mean gain achievement score and a more homogeneous score in the posttest.

Hypothesis 1: There is no significant difference between the mean achievement scores of students taught Mathematics using MII, CAI and those taught using DTI.

Table 3: ANCOVA on Difference between the Mean Achievement Scores of Students taught Mathematics using MII, CAI and DTI

Source of variation	SS	Df	MS	F	P-value	Decision
Corrected Model	28401.865[a]	6	4733.644	54.577	.000	
Intercept	53806.077	1	53806.077	620.360	.000	
Pretest	86.319	1	86.319	.995	.320	
Method	21586.217	2	10793.109	124.440	.000	Sig.
Gender	520.309	1	520.309	5.999	.015	Sig.
Method * Gender	327.208	2	163.604	1.886	.154	Not Sig.
Error	17520.183	202	86.734			
Total	976901.000	209				
Corrected Total	45922.048	208				

Table 3 shows that there was a significant main effect of the treatment on students' achievement in mathematics, F (2, 202) = 124.440, P =0.00 < .0.05. Therefore, the null

hypothesis was rejected meaning that there is a significant difference between the mean achievement scores of students taught Mathematics using MII, CAI and those taught using DTI. The order of the significance of difference in achievement was determined using Scheffe PostHoc analysis and presented in Table 4.

Table 4: Scheffe PostHoc on Significant Difference between in Achievement of Students in MII, CAI and DTI Groups

(I) Method	(J) Method	Mean Difference (I-J)	Std. Error	Sig.[b]	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
MII	CAI	-10.494*	1.578	.000	-13.607	-7.382
	DTI	17.459*	1.902	.000	13.707	21.210
CAI	MII	10.494*	1.578	.000	7.382	13.607
	DTI	27.953*	1.776	.000	24.452	31.454
DTI	MII	-17.459*	1.902	.000	-21.210	-13.707
	CAI	-27.953*	1.776	.000	-31.454	-24.452

Based on estimated marginal means
*. The mean difference is significant at the .05 level.

Table 4 reveals that a significant difference exists between the mean achievement scores of students taught Mathematics using MII and CAI in favour of CAI. Table 4 also reveals that a significant difference exists between the mean achievement scores of students taught Mathematics using MII and DTI in favour of MII. Table 4 further shows that there is significant difference between the mean achievement scores of students taught using CAI and DTI in favour of CAI. The most effective method is therefore CAI followed by MII.

Hypothesis 2: There is no significant difference between the mean achievement scores of male and female students taught Mathematics using MII, CAI and those taught using DTI.
Data relating to hypothesis 2 is contained in Table 3. Table 3 shows that there was a significant influence of gender on students' achievement in Mathematics, F (1, 202) = 5.999, P =0.015< 0.05. Therefore, the null hypothesis was rejected meaning that there is a significant difference between the mean achievement scores of male and female students taught Mathematics using MII, CAI and those taught using DTI.

Hypothesis 3: There is no interaction effect of instructional approaches (MII, CAI, DTI) and gender on students' achievement in Mathematics.
Data relating to hypothesis 3 is contained in Table 3. Table 3 shows that there is no significant interaction effect of instructional approaches and gender on students' achievement, F (2, 202) = 1.886, P =0.154> 0.05. Therefore, the null hypothesis was accepted meaning that there is no interaction effect of instructional approaches (MII, CAI, DTI) and gender on students' achievement in Mathematics.

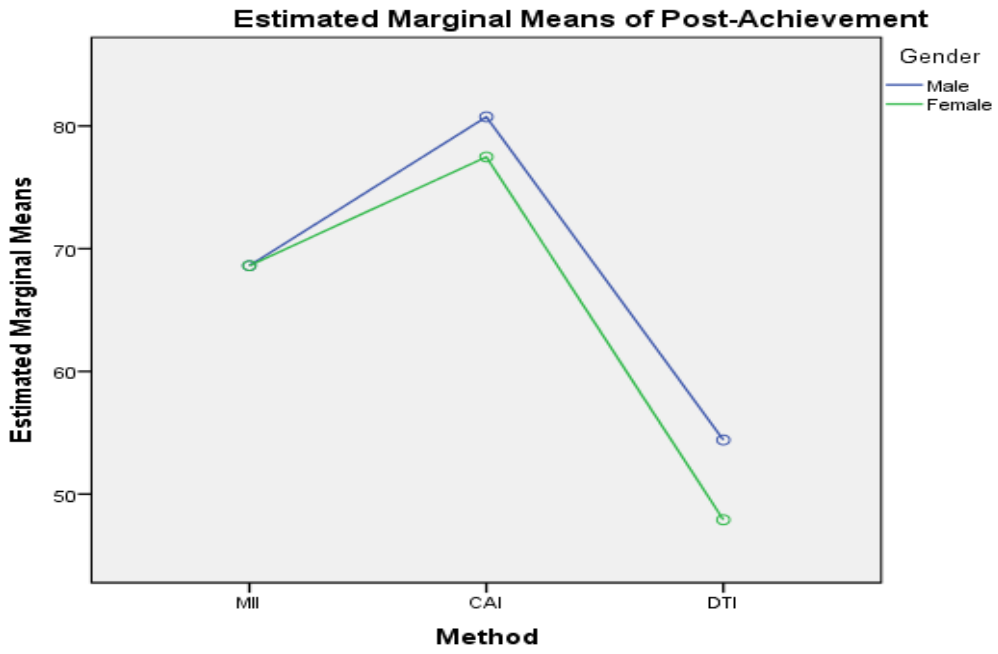


Figure 2: Plot of interaction between instructional methods and gender on students' achievement in Mathematics

Figure 2 shows that the plot of interaction between instructional methods and gender on achievement in mathematics. The plot shows that there is a disordinal interaction between teaching methods and gender on students' achievement in Mathematics meaning the instructional methods are gender sensitive.

Discussion of Findings

The findings of the study revealed that there was significant difference in the mean achievement scores of students taught mathematics using MII, CAI and DTI in favour of CAI. This is because CAI was very interactive, involving students and making them agents of their own learning as well as increasing their stake in the whole of the treatment. The interaction was between students and students as their shared their new knowledge among each other given the excitement that comes with learning with CAI where multiple experiences are provided. The students also interacted with the learning materials as the use of CAI arouses and sustains interest, a factor necessary for learning to meaningful, in-depth and resulting in improved achievement. The use of many learning experiences and media played a significant role in enhancing the efficiency of mathematical language teaching process via text, graphics, sounds and videos, making students more creative and providing them an individualized learning environment. In the interaction with teachers, students attain greater clarity in their understanding of the concepts leading to improved achievement when evaluated than those in MII and DTI.

Again, the use of CAI facilitated material and learning retention. Students were able to remember, understand and use information which is one of the objective outcome difficult to achieve using DTI. To

achieve retention, the use of CAI dilutes the learning by providing a direct learning content that the learner can easily assimilate and reproduce in a common language with less difficulty. It developed in them a thinking pattern necessary for solving mathematical problems relating to the concepts taught as the solution are almost continually visible in their minds. This was achieved also due to the fact that CAI enabled students to learn at their own pace and immediate feedbacks revealed strength and weaknesses that needed attention. CAI helped the teacher to provide a wide range of experience giving many examples and illustrations and can make the concept clear even in an overcrowded classroom. The application was beneficial for students with a range of learning differences, too, giving greater access to those with different educational and learning needs. The personalized approach to meeting academic needs also led to higher level of engagement and stronger learning outcomes like improved achievement uncommon with MII and DTI.

The finding of the study supports the finding of Anayamele, Nwokolo, Anyachebelu and Anemelu (2012) that students taught using CAI package performed significantly better than their counterparts taught using the conventional method of instruction. The finding of the study is in line with the finding of Michael, Omiola, Awoyemi and Mohammed (2014) that there was a significant difference between the achievement scores of students taught Mathematics with CAI package and those taught using conventional in favour of CAI. The finding of Busari, Ernest and Ugwuanyi (2016) that there was a significant difference between the mean achievement scores of students taught chemical reaction and equilibrium using CAI and those taught same using conventional teaching strategy in favour of CAI lends credence to the finding of the present study. The findings of the study does not contradict the findings of Chukwuedozie (2016) that there was significance difference in the academic achievement scores of secondary school students exposed to computer assisted instruction and conventional method in favour of CAI. Agbo's (2021) finding that CAI significantly impacted the students' academic performance supports the finding of the study.

The finding of the study also showed that there was a significant difference in the mean achievement of students taught mathematics using MII and those taught using DTI in favour of MII. The use of MII enhanced students' learning experience by helping them understand the concepts fully while thinking about in different ways rather than having the sole academic objective of students taking test. By channelling learning of the concepts to the different intelligences that learners possess, the students understood the concept at their own terms and found the appropriate way to assimilate the concept taught. Thus, they did not just learn to pass which is common in DTI where rote learning is often resorted to. Students being aware of the strength and weaknesses also identified areas they needed improvement. Thus, the approach provided immediate feedbacks that are personal to the students. When these weaknesses are improved upon, achievement increased significantly.

The use of MII also allowed the students to learn in their own dominant intelligence and learning style, which is most effective to them. Combining learning style and dominant intelligence enhanced students' learning process, serving as an incentive and motive for further learning. Thus, different types of learners' needs are met while allowing for an individual learning process that will ultimately enabled each student to utilise his or her specific abilities and demonstrate learning. The incorporation of different examples along the lines of different intelligence allowed for a learning experience that not only allowed

different types of learners to learn but enriched every individual's understanding of the topic leading to improvement in achievement on the whole.

The finding of the study is in line with the findings of Mohd, Vasugi and Moses (2015) that there was significant difference between the achievement scores of pupils in science for the use of inquiry based multiple intelligence approach and non-inquiry based multiple intelligence approach in favour of the multiple intelligence approach. The findings of the study support the findings of Yi and Jeng-Feng (2018) that, after implementing MI-based instruction, the students in the experimental group significantly outperformed those in the control group in terms of science learning motivation, science learning value, and active learning strategies, while the students with low learning achievement showed an improvement in their learning which raised their class participation and preference for biology classes. The findings of the study did not contradict the findings of Pratiwi, Rochintaniawati and Agustin (2018) that most students have a high interest in learning matter after being taught by multiple intelligence-based learning and that multiple intelligence-based learning helped in improving students' concept mastery and gain students' interest in learning matter. The findings of Samuel and Abba (2020), and Ezekiel and Raymond (2020) that multiple intelligence learning strategies had significant effect on students' achievement in genetics. The finding of the study did not contradict the finding of Leandro and Chena (2021) that multiple intelligences-based classroom activities improves the students' academic performance in school as it broadens the range of talents and skills, understanding, build confidence, take educational risks, and retain more knowledge.

Conclusion

The findings of this study showed that students taught mathematics using CAI had significantly higher achievement in mathematics followed by those taught using MII. The study concludes that CAI is effective for helping students attain higher academic achievement in mathematics. It is also effective for improving students' achievement in mathematics as it provides varied learning experience for the students.

Recommendations

1. Seminars and workshop on the use of varies forms of CAI in teaching and learning mathematics should be conducted by educational stakeholders for mathematics teachers.
2. The government through the ministry of education should monitor and ensure that ICT facilities needed for effective of use of CAI installed in Anambra state secondary schools are operational. They should budget and executive the findings of projects aligned with the full operational use of computers assisted instruction in the classroom including for teaching mathematics.
3. Teachers of mathematics should ensure that both male and female students are given equal learning opportunity and where necessary, female students should be given extra attention to remediate the deficit in knowledge, achievement and resilience needed for mathematics learning.

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