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EFFECT OF COMPUTER GAMES INSTRUCTIONAL STRATEGY ON SECONDARY SCHOOL STUDENTS' ACHIEVEMENT AND GENDER IN DATA PROCESSING IN OGIDI EDUCATION ZONE

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Abstract

This study explored the effect of computer games instructional strategy on secondary school students' achievement and gender in Data processing. Two research questions and three hypotheses guided the study. The design was quasi-experimental. The population comprised of all senior secondary school one (SS1) students of 2021/ 2022 academic session offering data processing as one of the technical, vocational, education and training subjects as recommended and approved by FRN (2013) in her National Policy on Education. The sample was 288 students offering data processing data processing (164 males and 124 females) drawn from four schools through simple random sampling technique. The experimental groups (152 students; 88 males and 64 females) were taught using Computer Games Instructional Strategy (CGIS) while the control groups (136 students; 76 males and 60 females) were taught using the conventional method. The intact classes were assigned to treatment and control through balloting technique. Computer Games Instructional Manual (CGIM) and Achievement Test on Data Processing (ATODP) were the instruments used, which were given to two experts for perusal to ascertain their validity. Reliability index of 0.82 was obtained for the ATODP using Kuder-Richardson formula (K-R 20). The research questions were answered using mean with standard deviation while the null hypotheses were tested with Analysis of Covariance. Results showed that the CGIS enhanced students' academic achievement in Data processing better than the conventional method. Also, there was no significant effect of gender on students' academic achievement in data processing better than the conventional method. Based on the findings, the researcher recommended among others that data processing teachers should utilize the CGIS in their lesson deliveries to enhance higher academic achievement of the students.

Keywords: *Computer games instructional strategy (CGIS), achievement, gender*

Introduction

With the advent of technology in our present 21st century, it ushered various opportunities in every sector such as education, employment and globalization. This opportunities gears towards introducing individuals to the global world. Thus, data processing is an aspect of computer science – computer education which was created out from computer science – computer education few years ago by curriculum specialists. It is described as the manipulation of data by a computer. Hillier (2021) defined data processing as the collection and transformation of raw data into meaningful information. It is the conversion of raw data to machine-readable form, flow of data through the CPU and memory to output devices and formatting or transformation of output. It can be described as any use of computers to perform defined operations on data which can be included under data processing (Okekeokosisi, 2020). Furthermore, Duggal (2022) summarized the definition of data processing as the method of collecting raw data and translating it into usable information. The raw data is collected, filtered, sorted, processed, analyzed, stored and then presented in a readable format.

The importance of data processing to individual citizens and to the society at large has been emphasized. The Federal Republic of Nigeria (FRN, 2013) in the National Policy on Education included data processing as one of the technical, vocational, education and training subjects in secondary school. It also stated the aims of data processing to include acquisition of practical skills, attitude, understanding and knowledge relating to occupations

in various sectors of economic and social life. These aims are in line with the three core elements of MDGS (MDGS, 2015) recommendation that all studies should be geared towards economic growth, social inclusion and environmental protection. Besides, secondary school education prepares students for meaningful living in the society as well as further education. Secondary school level is the bridge between the primary and tertiary level. The underlining principle here is that, the secondary schools should be able to provide quality secondary education to all students (FRN, 2013).

The need to provide quality education made the National Council on Education (NCE, 2005) to direct and reform Nigerian education to meet the context of National Economic and Development Strategies (NEEDS) and to the Millennium Development Goals (MDGS). In line with this, the Nigerian Educational Research and Development Council (NERDC, 2009) reviewed the curriculum to expose the learners towards achieving the MDGS and the NEEDS. This action is to update and produce technical, vocational education and training with relevant knowledge, practical skills for life-long learning and for economic and social life.

The above stated objectives notwithstanding, the achievement of secondary school students in data processing which is one of the technical, vocational, education and training subjects is very discouraging. The evidence of this perception could be based on the reports of Chief Examiners of West African Examination Council (WAEC) on computer studies from 2019-2022. The reports indicated the candidates' persistent average performance and weakness as having little understanding of the content of the subject matter, acronyms, lack of knowledge of technical terms, lack of knowledge of practical skills, poor logical presentation of steps for performing tasks.

From the summary of results, it showed that greater percentage of students performed below average in the data processing examination. Data processing is far more than unprocessed data but deals more on facts and figures that a computer processed by following a set of instructions (Otuka, Akande, Iginla, 2015). This means that data processing is a subject that if effectively taught has applications in diverse human endeavours. However, there are some factors that have been attributed to be likely causes of students' weakness in making high achievement in data processing. Some of these factors include; methodology / instruction and gender.

Computer Games Instructional Strategy (CGIS) can be defined as teaching-learning process that deals with learning by doing. It embraces instructional techniques that engages and motivate learners during instruction. CGIS makes provision for knowledge construction, hands-on and minds-on activities rather than just listening to lessons only (Chinweoke, 2016). It is associated with behaviorism because of the variety of reinforcement mechanism inherent in game environment on which students are motivated by competition and game that strive to reach to the goal. As for Defreitas in Karakoc, Eryilmaz, Ozpolat, Yildirim (2020), computer games instructional strategy (CGIS) is an activity-engaged instructional approach that emphasizes students' active learning through encouraging learners to produce their materials, share learning experiences and rehearse their skills learnt for self-reliance and development of the world at large. Dewar (2023) and Rezayi, Tehrani-Doost and Shahmoradi (2023) states that computer games are highly interactive, adaptive, cognitive oriented and often induce the sense of psychological flows of learners. It is also described as an activity oriented approach that develops the three domains of learning (cognitive, affective and psychomotor). CGIS is a method in which the child is actively involved both mentally and physically. Learning by doing is the main focus in this strategy and more a person learns and longer he retains. The strategy deals with any organized behavior that the teacher and students engage in for a common purpose. It is an approach adopted by the teacher whereby activities are used to bring out effective learning experiences.

In summary, Charles and Mcalister in Salimi (2016) pointed out the futures of CGIS as an effective tools for training complex beliefs which aid in practice instead of explanation, mastery of concepts, learning skills and styles, personal satisfaction and motivation, interactive lesson and guided discovery takes place. Hence, it is expected that through guided discovery and inquiry, teachers involve students in creating and expanding their knowledge and understanding about the content area being studied. This leads to higher academic achievement.

Achievement is the feeling of getting things done as we desired or getting things that we expected. Emoefe and Achufusi- Aka (2022) described achievement as a mark of success for both students and teachers. It is scholastic standing of a student at a given moment which states individual intellectual abilities (Adeyemi in Ogoke, Otumegwu & Nwaneri, 2022). In Nigeria, the level of a student's academic achievement in the senior secondary school is determined by grades obtained from external and internal examinations. Achievement in data processing therefore identifies how good or poor students have accomplished a given data processing task or test. However, improved achievement could aid higher achievement of data processing concepts taught and favour male and female students.

Gender is a state of being male or female especially when considered with reference to social and cultural difference, rather than biological ones. It is referring to the social roles that the men and women play and the power relations between them, which usually have a profound effect on the use and management of natural

resources. According to Manukumari and Ajay in Ogeke and Okigbo (2021), scholars, policymakers and practitioners have observed and seem to agree upon socially constructed differences between male and female and its significant effects in their lives. Studies conducted across the world among the students studying in different levels found a significant gender difference in academic achievement. In this light, the study seeks to determine if the use of CGIS can enhance students' academic achievement in data processing irrespective of students' gender.

Statement of the Problem

Data processing plays a vital role in scientific, technological, socio-economic, political, election process and towards national development. However, there is evidence in literature that students' achievement in the subject is very poor. The poor achievements in data processing have been attributed to teachers' use of ineffective teacher-centred methods which make students passive in the teaching / learning process.

Researchers have recommended that teachers should adopt learner-centred methods that will actively involve the students in the teaching / learning process. One of the learner-centred methods that can engage students' actively and as well stimulate learning is computer games instructional strategy. The important question for which answer was sought in this study was; what is the effect of computer games instructional strategy on students' achievement in data processing.

Purpose of the Study

The main purpose of this study was to investigate the effect of computer games instructional strategy on students' achievement in Data processing. Specifically, the study sought to:

- Determine the mean achievement scores of students taught data processing using computer games instructional strategy (CGIS) and those taught with lecture method.
- Investigate the effect of computer games instructional strategy (CGIS) on the mean achievement scores of male and female students exposed to the instructional strategy

Research Questions

The following research questions guided the study;

1. What are the mean achievement scores of students taught data processing using computer games instructional strategy (CGIS) and those taught using lecture method.
2. What are the mean achievement scores of male and female students taught data processing using computer games instructional strategy (CGIS).

Hypotheses

The following null hypotheses tested at .05 level of significance guided the study.

H₀₁: There is no significant difference in the mean achievement scores of students data processing using computer games instructional strategy (CGIS) and those taught using lecture method.

H₀₂: There is no significant difference in the mean achievement scores of male and female students taught data processing using computer games instructional strategy (CGIS).

H₀₃: The interaction effect of method and gender on students' academic achievement in teaching data processing is not significant

Method

Quasi-experimental design was adopted for the study, precisely the pre-test, post-test, non-equivalent, control group. Quasi-experimental design proves most useful in situations where there are constraints and subjects could not be randomly assigned to treatment and control as was the case in this study.

The population was all senior secondary one (SS1) students of 2021 / 2022 academic session offering data processing as a subject in Ogidi Education Zone of Anambra State, Nigeria. The choice of this grade of students was because data processing is being offered as one of the technical, vocational, education and training subjects as recommended and approved by FRN (2013) in her National Policy on Education.

The sample for the study comprised 288 SS1 students in two intact classes from four public government own co-educational secondary schools in Ogidi Education Zone of Anambra State, Nigeria. The experimental groups were 152 students (88 males and 64 females) while the control groups were 136 students (76 males and 60 females). Intact classes are easier to organize and getting an intact class with fair representation of the samples along gender and scoring levels was difficult. In most cases, the distribution of students into classes on the basis of gender was also skewed. In the end the best available intact classes were randomly selected. The intact classes were assigned to treatment and control using balloting technique.

Two instruments named Computer Games Instructional Manual (CGIM) and Achievement Test on Data Processing (ATODP) were used for the study. It covered the following contents in Data Processing as contained in the NERDC curriculum for SS1 students in Data processing: information age, basic computing, information processing, information transmission, tools for processing information, computer maintenance ethics and human issues and data management. The ATODP consisted of 25 multiple-choice test items drawn from the various data processing topics and number of test items along three process categories of objective: knowledge, comprehension and application.

To ensure the validity of the instruments, they were content and face validated by two experts in data processing and one expert in Measurement and Evaluation from the Faculty of Education, Nnamdi Azikiwe University, Awka, Anambra State. The reliability of the ATODP was determined by administering it on 30 SS1 students offering data processing in one of public government owned secondary school in Idemili South Local Government Area (LGA) of Anambra State that is not part of the study. Applying Kuder-Richardson's formula (KR-20) the reliability index of the instrument was found to be 0.82, thereby establishing the fact that the instrument was reliable.

The researchers trained the regular teachers of the selected schools for one week on the use of Computer Games Instructional Strategy (CGIS) in the teaching of data processing. They were given copies of the CGIM which was tailored to the curriculum contents of the students. They were told to teach the control group using conventional (lecture) method. Before treatment commenced, each teacher administered the ATODP to the students, as pre-test and recorded their scores. The pre-test lasted for 50 minutes. Both experimental and control groups were taught topics in Data processing. The treatment lasted for four (4) weeks at the end of which post-test was conducted in all the groups. The pre-test was re-numbered in the post-test to make it look different at face value.

Data collected were analyzed by using mean and standard deviation to answer the research questions, while the hypotheses were tested using Analysis of Covariance (ANCOVA) using the pre-test scores as covariates.

Results

Research Question 1: What are the mean achievement scores of students taught data processing using computer games instructional strategy (CGIS) and those taught using lecture method (LM)?

Table 1: Mean achievement scores of students taught data processing using computer games instructional strategy

Instruction	N	Pretest \bar{X}	SD	Posttest \bar{X}	SD	Mean gain
CGIS	152	6.81	2.88	26.06	8.53	19.25
LM	136	6.46	2.69	17.55	5.38	11.09
Total	288	0.35	0.19	8.51	3.15	8.16

Results from Table 1 indicated that the mean achievement scores of students exposed to computer games instructional strategy (CGIS) and those taught using lecture method (LM) in the pre-test were similar. The difference in test scores between the groups was by 0.35. The table did not show whether the difference was significant. On post achievement test scores, the table shows that the CGIS group had higher mean score than lecture group by 8.51. The CGIS group had mean achievement score of 26.06 with standard deviation of 8.53. On the other hand, the lecture group had mean achievement score of 17.55 with standard deviation of 5.38. The table again did not show whether the difference in the mean achievement score was significant. In order to ascertain whether the observed difference is significant or can be attributed to error variance, the result was subjected to inferential testing as seen in Table 2.

Research Question 2: What is the effect of computer games instructional strategy on the mean achievement scores of male and female students taught data processing using computer games?

Table 2: Mean Post achievement scores and standard deviation of Male and Female students.

Instruction	Gender	N	\bar{X}	SD
CGIS	Male	88	27.24	8.07
	Female	64	26.70	8.60
LM	Male	76	17.58	3.72
	Female	60	17.88	5.17
Total		288		

Data seen in Table 2 portray that male students had slight higher mean score than the female students by 0.54. The table did not show whether the difference is significant. Also in the control (lecture) group, the female students had slight higher mean score than the male students by 0.30. Again, the table did not show whether this observed difference is significant or can be attributed to error variance, the result was subjected to inferential testing as shown in Table 4.

Hypotheses

Hypotheses were tested at 0.05 level of significance.

H₀₁: There is no significant difference in the mean achievement scores of students taught data processing using computer games instructional strategy (CGIS) and those taught using lecture method.

Table 3: Analysis of Covariance (ANCOVA) of students' overall achievement scores by teaching method

Source of variation	Type III Sum of squares	Df	Mean square	F-cal	P-value	Decision
Corrected model	675.108	2	364.840	5.703	.004	S
Intercept	111003.743	1	111003.743	1735.195	.000	S
Method	729.681	2	364.840	5.703	.004	S
Error	14003.057	285	60.358			
Total	142066.000	288				
Corrected Total	14463.549	287				

From Table 2, it points that there is significant difference in the academic achievement of students taught Data processing with CGIS and those taught with LM. This is because the probability value of 0.004 obtained is shown to be lower than the level of 0.05 at which it was tested. Therefore, the null hypothesis of no significant difference in the students' academic achievement is rejected. This means that the earlier observed difference between the two groups as shown in Table 1 is significant which cannot be attributed to error associated with the study. Moreover, the CGIS group had higher academic achievement than the lecture group.

H₀₂: There is no significant difference in the mean achievement scores of male and female students taught data processing using computer games instructional strategy (CGIS).

Table 4: Analysis of Covariance (ANCOVA) output for gender on students' achievement

Source of variation	Type III Sum of squares	Df	Mean square	F-cal	P-value	Decision
Corrected model	711.458	2	355.729	3.984	.009	S
Intercept	126301.879	1	126301.879	2121.549	.000	S
Gender	250.966	1	250.966	4.216	.272	NS
Error	13752.091	284	59.533			
Total	142066.000	288				
Corrected Total	14463.549	286				

Table 4 shows that a non-significant difference was found in the post achievement test scores between male and female students (0.272, $P > 0.05$). With this result, H_{02} was retained because gender did not significantly influence the effect of teaching methods on students' academic achievement in Data processing. This shows that the efficacy of the teaching methods in Data processing was not influenced by students' gender.

H0₃: The interaction effect of method and gender on students' academic achievement in teaching data processing is not significant

Table 5: Analysis of Covariance (ANCOVA) of interaction effect of teaching method and gender

Source of variation	Type III Sum of squares	Df	Mean square	F-cal	P-value	Decision
Corrected model	675.108	2	364.840	5.703	.004	S
Intercept	629.143	1	629.143	10.140	.001	S
Method X Gender	107.193	2	53.597	1.796	.182	NS
Error	13788.441	285	59.690			
Total	126643.000	288				
Corrected Total	15571.166	287				

In Table 5, a non-significant interaction effect was found between method and gender on achievement (0.182, $P > 0.05$). With this result, H0₃ was therefore retained. Hence, the two-way interaction of method and gender has no significant effect on students' academic achievement in Data processing. Since the interaction effect of method with gender is not significant, it therefore means that the method will not depend on gender to be effective.

Discussion

The findings of this study showed a significant difference in the mean achievement scores of students in the experimental group exposed to computer games instructional strategy (CGIS) and those in the control group taught using lecture method. The differences was in favour of the experimental group. Similar results have been reported in auto-mechanics, computer studies, physics and mathematics. For example Adekunle (2013), Salimi (2016), Anamezie (2018), Okechukwu and Okechukwu (2022) in their independent studies found out significant differences in the mean achievement scores of students exposed to computer games instructional strategy (CGIS) and those taught using lecture method in favour of experimental groups.

The findings of this study also revealed that there was a significant difference in the mean achievement scores of male and female students exposed to computer games instructional strategy (CGIS). This result was contrary to the findings of Okechukwu and Okechukwu (2022) which states that female students taught data processing using computer games significantly achieved higher than their male counterparts. It points out that females were highly motivated more than their male counterparts. This implies that gender was not a significant factor in determining learner's achievement in the learning process.

Conclusion

The poor academic achievement of learners being recorded in both internal and external examinations in senior secondary school Data processing in Nigeria, calls for improvement in the mode and methods of teaching and learning of the subject. This was one of the major factors that necessitated this study, to identify other strategies of teaching-learning Data processing in the secondary schools in Nigeria.

Recommendations

The following recommendations were made:

1. Data processing teachers should be encouraged to utilize CGIS in their lesson deliveries, while the usual stereotyped lecture method of teaching Data processing should be discouraged.
2. The current prevailing teaching / learning approach (lecture) should be restructured so as to give room for new instructional strategies, which will make learners good problem-solvers.
3. Teacher training institutions should run broad-based curricula that will encompass the different instructional strategies that promote problem-solving and enhance better academic achievement.

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