

## Effect of Gamification on Senior Secondary Students' Academic Achievement in Computer Studies in Enugu Education Zone of Enugu State.

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### ABSTRACT

*This study investigated the effect of gamification on senior secondary students' academic achievement in computer studies in Enugu Education zone of Enugu State. Two research questions guided the study while three hypotheses were tested at .05 level of significance. Quasi experimental research design was adopted for the study. The population for the study was 2,119 Senior Secondary School II (SS II) Computer studies students. The sample size of 356 was drawn using purposive random sampling technique. The instrument for data collection was Computer Studies Achievement Test (CSAT) which was developed by the researchers and validated by three research experts. Kuder-Richardson 20 (K-20) formula was used to estimate the reliability of the instrument and a reliability index of .81 was obtained. Mean and standard deviation were used for answering the research questions while Analysis of Covariance (ANCOVA) was used to test the null hypotheses. The findings of the study showed that students who were taught computer studies content (Central Processing Unit) using gamification had improved academic achievement than their counterparts who were taught with expository method. The test of hypotheses also showed that the mean difference in achievement was significant, in favour of the students in the experimental group. Based on the findings, the study recommended among others that Computer studies teachers should adopt gamification to enhance the effectiveness of their instructions and improve students' learning outcomes in Computer studies contents.*

**Keywords:** Gamification, Academic Achievement, Computer Studies, Central Processing unit, Gender

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### INTRODUCTION

Computer Studies is a crucial academic discipline that focuses on the understanding and utilization of computer systems, software, and related technologies. In the educational context, it plays a pivotal role in equipping students with the knowledge and skills necessary to navigate the digital landscape of today's world. Computer Studies is a crucial subject in today's educational landscape, preparing students for the increasingly digital and technology-driven world (Brookshear and Brylow, 2018). It encompasses the study of computer hardware, software, programming, digital literacy, and information systems in

secondary schools. The Federal Republic Nigeria (FRN, 2013) stated that senior secondary school shall be comprehensive with a core-curriculum designed to broaden the knowledge of students especially in science related subjects like computer studies.

Furthermore, computer studies drive technological advancements by fostering innovation and the development of new software, hardware, and technologies. This is crucial for progress in fields such as artificial intelligence, robotics, data analytics, and more. According to Siemens



(2005), computer studies foster innovation by encouraging creative problem-solving skills. Students and professionals in this field learn how to approach complex problems, break them down into manageable parts, and develop efficient solutions using programming and logical thinking. Despite the importance of computer studies, the consistent underachievement of Nigerian secondary school students has been a longstanding issue of concern which might be as a result of the teaching methods.

Teaching methods refer to the strategies, techniques, and approaches used by educators to facilitate learning and help students acquire knowledge, skills, and understanding of a subject or topic. According to Abimbola (2013), the educational system in Nigeria provides little opportunities for students to engage in self-instruction because they are always taught by either teacher in school or coaching classes. The expository teaching method with textbook as the main teaching tool has been the most widely practiced among the computer studies' teachers in Nigeria, especially in Enugu Education Zone of Enugu State. Studies by Knaving and Bjork (2013), and Ukeh, Okeke, Oliver, Eziokwu, Onovo and Orié (2020) asserted that many students find expository teaching to be ineffective in teaching and learning of computer studies contents like central processing unit (CPU).

A Central Processing Unit (CPU) is the primary hardware component of a computer system that performs the majority of processing tasks. It is often referred to as the "brain" of the computer because it executes instructions and processes data to carry out various functions (Patterson and Hennessy, 2017). The CPU interprets and executes instructions from computer programs, which are stored in the computer's memory (RAM) or on storage devices like hard drives. These

instructions are in the form of machine code, a language that the CPU can understand and execute. Patterson and Hennessy (2017), further stated that a powerful CPU is crucial for running modern, graphics-intensive games smoothly and efficiently. Gamification often involves interactive elements, animations, and graphics, all of which require significant processing power. A robust CPU ensures that these elements run seamlessly, enhancing the overall gamification experience.

Gamification is the incorporation of elements, techniques, and dynamics commonly found in games into non-game contexts, such as education or other fields. Gamification of education is a strategy for increasing engagement by incorporating game elements into an educational environment (Dichev and Dicheva 2017). Werbach and Hunter (2015), defined the term gamification as application of game design elements as well as game thinking during the state of non-game. Gamification involves using game-like features such as competition, challenges, rewards, points, levels, and feedback to engage and motivate individuals, encouraging desired behaviours and participation in a given activity or task. Gamification, being a distinctive educational approach, has the potential to provide instant feedback to students (Smiderle, Rigo, and Marques, 2020). This quality proves beneficial as it facilitates the identification of areas for improvement, enabling teachers to tailor their teaching to the specific requirements of each student.

Games have the ability to align objectives with varying levels of engagement (Smiderle et al. 2020). Gamification has emerged as a novel instructional approach gaining traction in education due to its potential to boost learners' motivation and enhance their academic accomplishments (Yildirim, 2017; Zainuddin, Chu, Shujahat

and Perera, 2020). This technique injects elements of games, like points, levels, badges, and leaderboards, into the teaching and learning process to make it engaging and enjoyable. A well-structured gamified classroom offers learners a playful and interactive learning experience, accompanied by spontaneous feedback, fostering their knowledge enhancement (Bouchrika et al., 2019). Parra-Gonzalez, Lopez-Belmonte, Segura-Robles and Moreno-Guerrero (2021), found that active gamification is more valuable as a methodology in secondary education than in other stages of education. The consensus is that incorporating gamification improves the overall learning experience, leading to heightened engagement, motivation, social interaction and academic achievement among students (Zainuddin et al., 2020). The interactive nature of games can help students remember and understand academic concepts more effectively, leading to improved academic achievement.

Academic achievement refers to the level of success a student has attained in an educational setting. Njoku and Eze-Odurukwe (2015), indicated that students' academic achievements are greatly improved when taught with computer animations. A study conducted by Bushra, Yousuf and Parveen (2023), showed that gamification has a significant effect on students' academic achievement. Meanwhile, a different research conducted by Gibson, Ostaszewski, Flintoff, Grant, and Knight (2015) demonstrated that the utilization of gamification and different types of rewards provided to students after completing the games enhanced the learning process and encouraged academic achievement. According to Okorie and Ezeh (2016), academic achievement of students has often been associated with their gender.

Gender is a division into which an organism is placed according to its reproductive

functions or organs. In this context gender is based on students' status of male and female. Findings from researchers such as; Oscar and Muigui (2018), Abdullahi (2014) stipulated that there is a general imbalance that exists in gender and in technology base teaching strategies use, access, career and curiosity among students. Gender is one of the characteristics that has been shown in the research to have a significant impact on a student's academic performance, particularly in scientific courses (Ala, 2014). Based on the above background, the study investigated the effect of effect of gamification on senior secondary students' academic achievement in computer studies in Enugu Education zone.

### **Statement of the Problem**

In recent years, the traditional methods of teaching and learning in senior secondary computer studies have faced challenges in engaging students effectively and promoting sustained academic achievement. Some students struggle to comprehend complex computer concepts due to the abstract nature of the subject. Enugu Education Zone is no exception, where students often exhibit declining academic achievement in computer studies contents. The advent of technology and digital platforms offers an opportunity to address this issue by integrating gamification into the educational process. However, the effectiveness of gamification on the academic achievement of senior secondary students in computer studies in Enugu Education Zone remains largely unexplored. Therefore, the integration of gamification in educational settings, particularly in Computer Studies at the senior secondary level, has gained substantial attention due to its potential to enhance students' academic achievement. However, there is a need to investigate and understand the specific effect of gamification on the academic achievement of senior secondary students in Computer

Studies in Enugu Education Zone of Enugu State.

### **Purpose of the Study**

The purpose of the study was to investigate the effect of gamification on senior secondary students' academic achievement in computer studies in Enugu Education zone. Specifically, the study sought to investigate the:

1. effect of gamification on Computer students' academic achievement when taught Central Processing Unit and those taught the same topic using expository method;
2. influence of gender (male and female) on Computer students' academic achievement when taught Central Processing Unit using gamification.

### **Research Questions**

The following research questions guided the study:

1. What are the mean achievement scores and standard deviations of SS II Computer studies students taught Central Processing Unit with gamification and those taught the same topic using expository method?
2. What are the mean achievement scores and standard deviations of male and female SS II Computer studies students taught Central Processing Unit with gamification?

### **Hypotheses**

The following hypotheses guided the study and they were tested at .05 level of significance:

**Ho<sub>1</sub>:** There is no significant difference between the mean achievement scores and standard deviations of SS II Computer studies students taught Central Processing Unit using gamification and those taught the same topic using expository method in both pre-test and post-test.

**Ho<sub>2</sub>:** There is no significant difference between the mean achievement scores and standard deviations of male and female SS II Computer studies students taught Central Processing Unit with gamification.

**Ho<sub>3</sub>:** There is no significant interaction effect of gender and method (gamification) on computer studies students' academic achievement in Central Processing Unit.

### **Research Method**

Quasi experimental research design was adopted for the study. Quasi experimental research design is described by Nworgu (2015) as the design where the treatment variable is manipulated but the groups not equated prior to manipulation of independent variable. The population for the study was 2,119 Senior Secondary School II (SS II) Computer studies students. The researchers used purposive sampling approach to draw the sample size of 356 (experimental group – 191(88 males and 103 females) and control group – 165) SS II computer studies students. The instrument for data collection was Computer Studies Achievement Test (CSAT) which was developed by the researchers and validated by three research experts. Kuder-Richardson 20 (K-20) formula was used to estimate the reliability of the instrument and a reliability index of .81 was obtained. A two-week training session was organized within the secondary schools by the researchers for the regular computer studies teachers.

Mean and standard deviation were used for answering the research questions while Analysis of Covariance (ANCOVA) was used to test the null hypotheses. The findings of the study showed that students who were taught computer studies contents (Central Processing Unit) using gamification had improved academic achievement than their counterparts who were taught with expository method. The

test of hypotheses also showed that the mean difference in achievement was significant, in favour of the students in the experimental group. The choice for the use of ANCOVA is because intact classes were used and initial differences cannot be guaranteed. The null hypothesis was rejected if probability value is less than or equal to the significant value of .05 ( $P \leq 0.05$ ) and if otherwise ( $P > .05$ ), it was not rejected.

## Data Analysis and Results

**Research Question 1:** What are the mean achievement scores and standard deviations of SS II Computer studies students taught Central Processing Unit with gamification and those taught the same topic using expository method?

**Table 1: Mean achievement scores and standard deviations of students taught central processing unit using gamification and those taught using expository method**

Groups	Number	Pre-test		Post-test		Mean Gain
		Mean ( $\bar{x}$ )	Standard Deviation ( $s$ )	Mean ( $\bar{x}$ )	Standard Deviation ( $s$ )	
Experimental	191	37.44	3.98	40.09	5.02	2.69
Control	165	35.89	3.43	37.98	4.57	2.09
<b>Mean Diff.</b>	<b>356</b>					<b>.06</b>

Table 1 shows that the mean achievement scores of students taught with gamification is higher than those taught using the expository method because the gain in mean of 2.69 for the experimental group is greater than 2.09 gain in mean for the control group. The mean difference is .06 in favour of experimental group.

**Research Question 2:** What are the mean achievement scores and standard deviations of male and female SS II Computer studies students taught Central Processing Unit with gamification?

**Table 2: Mean achievement scores and standard deviations of male and female students taught central processing unit using gamification**

Gender	Number	Pre-test		Post-test		Mean Gain
		Mean ( $\bar{x}$ )	Standard Deviation ( $s$ )	Mean ( $\bar{x}$ )	Standard Deviation ( $s$ )	
Male	88	33.61	4.13	36.91	4.90	3.30
Female	103	32.67	4.02	34.88	4.65	2.21
<b>Mean Diff.</b>						<b>1.09</b>

Table 2 shows that the mean achievement scores of male students taught with

gamification is higher than that of their female counterparts because the gain in

mean of 3.30 for the male students is greater than 2.21 gained in mean for the female students. The mean difference is 1.09 in favour of male students.

### Hypotheses

**Ho<sub>1</sub>:** There is no significant difference between the mean achievement scores and standard deviations of SS II Computer studies students taught Central Processing Unit using gamification and those taught the same topic using expository method in both pre-test and post-test.

**Table 3: Analysis of Covariance on the mean achievement scores of SS II computer studies students taught central processing unit using gamification and those taught using expository method**

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	310.90	2	155.45	6.90	.000	Rejected
Intercept	289.01	1	289.01	36.89	.000	
Pretest	311.78	1	311.78			
Group	344.82	1	344.82	13.63	.000	
Error	315.06	354	.89	8.09	.080	
Total	1571.57	356				
Corrected Total	1409.91	355				

Table 3 shows that the calculated F value of 13.63 is significant at .000 which is less than the .05 significant level set for the study. Thus, the null hypothesis is rejected. This implies that a significant difference exists between the mean scores of students taught central processing unit using gamification and those taught using expository method.

**Ho<sub>2</sub>:** There is no significant difference between the mean achievement scores and standard deviations of male and female SS II Computer studies students taught Central Processing Unit with gamification.

**Table 4: Analysis of Covariance on the mean achievement scores of male and female SS II students taught central processing unit using gamification**

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	180.90	2	90.45	7.01	.00	Rejected
Intercept	101.88	1	101.88	6.56	.00	
Pretest	265.46	1	265.46			
Gender	101.81	1	101.81	11.89	.00	
Error	771.94	189	12.91	7.56	.01	
Total	1421.99	191				
Corrected Total	1356.88	190				

Table 4 shows that the calculated F value is 11.89 which is found to be significant at .00. Since this significant level (.00) is less than the .05 significant level set for the study, the null hypothesis is, accordingly, rejected. This means that there is a significant difference between the mean scores of male

and female students taught central processing unit using gamification.

**Ho<sub>3</sub>:** There is no significant interaction effect of gender and method (gamification) on computer studies students' academic achievement in Central Processing Unit.

**Table 5: Analysis of Covariance on the interaction effect of gender and method (gamification) on SS II students' achievement in central processing unit**

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Decision
Corrected Model	179.34	2	89.67	8.54	.00	
Intercept	156.78	1	156.78	25.16	.00	
Method*Gender	167.88	1	167.88	32.45	.01	Rejected
Error	781.67	354	22.55			
Total	1285.67	356				
Corrected Total	1189.89	355				

Table 5 shows that the calculated F value of 32.45 is found to be significant at .01. Since this significant level (.01) is less than the .05 significant level set for the study, the null hypothesis is, accordingly, rejected. This means that there is a significant interaction effect between method and gender in students' academic achievement scores.

### Discussion of Findings

The research findings showed that students who were taught computer processing unit using the gamification performed better academically compared to those taught using the expository method. The finding is in agreement with Gibson et al. (2015), Zainuddin, Chu, Shujahat and Perera (2020) and Bushra, Yousuf and Parveen (2023), who posited that gamification has a significant effect on students' academic achievement. The finding is in disagreement with Gafni, Achituv, Eidelman, Chatsky (2018) who posited that using gamification did not affect students' achievement in the computer science field. The hypothesis

tested revealed that a significant difference existed between the mean scores of students taught central processing unit using gamification and those taught using expository method.

The finding of the study further indicated that male students performed better in computer processing unit when exposed to gamification compared to their female counterparts. The finding agrees with Gibson et al. (2015), who posited that male students performed more than their female counterparts when exposed to gamification methodology. The hypothesis tested revealed that there was a significant difference between the mean scores of male and female students taught central processing unit using gamification.

### Conclusion

The study delved into investigating the effect of gamification on senior secondary students' academic achievement in computer studies in Enugu Education Zone of Enugu

State. Through a thorough analysis of data and an in-depth examination of the implementation of gamification in the educational setting, the findings of the study revealed that integrating gamification into the teaching of computer studies positively impacted the academic achievement of senior secondary students. Secondly, male students achieved higher than their female counterparts when exposed to gamification.

### Recommendations

Based on the findings, the following recommendations were proffered:

1. Computer studies teachers should adopt gamification to enhance the effectiveness of their instructions and improve students' learning outcomes in Computer studies contents.
2. The Ministry of Education should arrange workshops, conferences, or seminars emphasizing the importance of integrating gamification techniques into the teaching process.

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