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Evaluating the Use of Gamification on Students Academic Achievement in Biology in Colleges of Education in the South East, Nigeria.

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ABSTRACT

The study evaluated the use of gamification on students' academic achievement in college of education in South East, Nigeria. The study adopted descriptive survey research design. Three research questions guided the study. The population comprised all the biology students in the Colleges of Education in the South East of Nigeria. There are five states in the South East. Three states and 500s NCE students were used as sample obtained through simple random sampling. Instrument for data collection was a twenty eight (28) questionnaire, well structured items of the Likert Scale type, termed "Use of Gamification on Students Academic Achievement (UGSAA), was developed in line with the research question. The validity was tested by two experts in biology and one from Measurement and Evaluation unit of Psychology Department. Their suggestions modifications were reflected in the final draft of the instrument. The reliability was tested using the test-re-test method. The internal consistency was determined using Pearson Product Moment Correlation Coefficient (r). A value of 0.71 was obtained, showing that the instrument was reliable. Findings from the study revealed among others that gamification has a very big impact on students' motivation in learning biology, in enhancing and promoting students understanding of biology concepts. Conclusion was drawn and recommendations made among which is that gamification should be integrated as a key teaching method in biology lessons, in Colleges of Education especially in the South East, Nigeria.

Key Words: Teaching, gamification, academic achievement, pre-service education, students, teaching/learning process.

Introduction:

All over the world, education remain paramount. Hence education develops innovation to making teaching and learning easy, so that there is a paradigm shift from the conventional teaching methods. Several teaching methods have been developed. The paramount is making the teaching, students oriented. Conventional teaching methods remain insufficient today and it is emphasized that students should be responsible for their own learning process, while teachers should serve as guides (Harsen, 2019). With the rapid development in technology, changes have occurred in teachers' and students' manner of teaching and learning (Elmas and Geban, 2012).

The gamification-based approach has gained momentum in educational research as an innovative strategy for enhancing the comprehension of complex concepts, particularly in resource constrained or conventional classroom environment. Analysis of literature shows that gamification fosters deeper cognitive engagement improves motivation and positively impacts learners academic performance. This is achieved through the incorporation of game elements such as rewards, levels, feedback crops, badges, etc into the teaching and learning process. Gkintoni *et al* (2024), observed that gamification supports cognitive restricting, allowing students to construct new knowledge by engaging interactively with difficult concepts. The best approvach is to explore the current teaching methods teat will increase the academic achievement of students, especially in College of Education. The College of Education, as teacher trainers, are expected to have resources for the production of efficient teachers, especially science teachers, as no education can rise above its teachers.

Gamification of learning, according to Wikipedia (2024)), is an educational approach that seeks to motivate students by using game elements; where affordable, video game in the learning environment. The goal is to maximize enjoyment and engagement by capturing. The interest of learners and inspiring them to continue learning. Harsen (2019), on his own part, stated that gamification is the process of defining the elements which comprise games; make those games fun and motivate players to continue playing, then using these elements in a non-game context to influence behavior. In other words, it is the introduction of a game elements into a traditionally non-game situation. The application of gamification in education created a positive impact on the learning motivation of student for science (Harsen, 2019). From the focal point of research, gamification is a multifaceted concept with the potential to be adapted across a multitude of inter disciplinary subjects (Zumrot and Melike, 2024). In the context of biology education, gamification has gained popularity through the emergence of biotic games (Zumrot and Melike, 2024). Oke *et al* (2023), highlighted that gamification transforms the learning experience into a more rewarding journey by integrating progressive milestones, competition and recognition systems. Instead of just reading from the textbooks or listening to long lectures, preservice teachers can get to interact with the lesson in a more playful and exciting way. This keeps them motivated, helps them focus better, and often makes even tough topics easier to understand. Teaches can use gamification in different ways; like

through educational games, quizzes, strong-based adventures, or digital apps where students earn points and badges as they learn, (Ahmed *et al*, 2025). Thus, Salimon *et al* (2021), found that gamification encourages deeper engagement because it places students in control of the learning process. Since game based learning relies heavily on collaboration between students, it is an approach related to the theory of constructivism: students learn not only by themselves, but also from fellow students. (Athanasiou and Papadopoulou, 2015). Thus to enhance the learning of a variety of biological concepts, some carefully selected educational games could be introduced as soon as students are taught the basic components of a particular course (Spiegel *et al*, 2018).

Educational games, in general are a useful teaching tool at various educational levels, because they often motivate students, contribute to a better understanding of abstract concepts and principles of science/biology (Cheng *et al*, 2015), evoke pleasure and joy and can improve retention of information in the long term. (Van Gaalen *et al*, 2021). In the context of biology education, gamification has gained popularity through the emergence of biotic games (Cira *et al*, 2015; Kim *et al* 2016). These games while offering and enter training and interactive approach to the subject matter by simulating the manipulation of living organisms in the classroom, impose a technological limitation due to their development for digital platforms. (Coil, Ettinger and Eisen, 2017). Research in relevant literature found that a game covering the topic of genetics improved students' understanding and application of genetic concepts (Clark *et al*, 2015).

Pre-service teacher education programme is a core element of education systems, providing a foundation of knowledge and skill that new teachers rely on in the classroom (Akyeampong *et al*, 2013). These teachers are produced in Colleges of Education, which is the unit of tertiary institution saddled to obtain a non-degree but qualitative professional certificate in education. They occupy the third cadre in the ladder of tertiary educational provisions in the country. As an important citadel of academic learning, they play a pivotal role in producing highly qualitative, motivated, conscientious and effective class room teachers for the Nigerian educational system. Thus the Pre-service teachers need to be equipped with the right skill that will make their classroom, learning friendly, through exposure to many modern skills of teaching, like gamification.

The need for qualitative teacher education has become so important in the light of technological development, which (hitter to) brought about many innovation in the field of education (Onuoha and Odo, 2020). The unique power of education acts as a catalyst for wider development goal of any nation. The development goal can only be fully realized if education is equitable beyond mere enrolment or completion rates, but to meet the science development goals, (S.D.G.) It is therefore vital that nations focus on the quality of teaching and learning in the classroom through our education life cycle (Olafare, Adeyanju and Fakorede, 2017). Various researches have been conducted and innovative teaching methods proposed to improve the standard of teaching and learning, especially in making the students the centre of teaching. Through the modified versions of lecture method commonly used have made steps to make the process more student centred although activities like brief questions and answer sessions, the core framework, is still the same. Thus there is needed to explain innovations in instructional design enhance the learning outcomes of teaching, hence the use of gamification. It is therefore appropriate to investigate how gamification can help increase the academic achievement of the biology pre-service teachers in the South East, Nigeria.

Purpose of the Study

The study would evaluate how the use of gamification can enhance the students' academic achievement in biology in College of Education in the South East, Nigeria.

Specifically, the study would:

1. investigate the impact of gamification on students' motivation in learning biology in Colleges of Education, South East, Nigeria.
2. determine the effectiveness of gamification in improving students' understanding and retention of biology concepts in College of Education in South East, Nigeria.
3. identify the challenges of implementing gamification in biology education in Colleges of Education in the South East, Nigeria.

Research Questions

These research questions guided the study:

1. what is the impact of gamification on students motivation in learning biology in Colleges of Education, in the South East, Nigeria?
2. how effective is the use of gamification in improving students' understanding and retention of biology concept in College of Education in the South East, Nigeria?
3. what are the challenges of implementing gamification in biology education in Colleges of Education in the South East, Nigeria?

Method

The study adopted a descriptive survey design. Three research question were developed to guide the study out of five states in the South East, 3 states were sampled and 500 NCE students were randomly sampled across the selected Colleges of Education in the three Eastern States in Nigeria. The instrument for data collection was a 28-itemed, questionnaire drawn, using the Likert scale method, termed, "Use of Gamification on Students Academic Achievement UGSAA), that was validated by two experts from biology and one from Measurement and Evaluation Unit of Psychology Department. Their suggestions, modifications, were effected in the final draft of the instrument. The reliability was tested using the test-retest method. The internal consistency was determined using Pearson Product Moment Co-rellation Coefficient(r). A value of 0.71 was obtained, showing that the instrument was

reliable. Data were collected through on the spot and inter personal contact. 495 questionnaire was returned back; out of the 500 sent out. Data obtained were analyzed using mean and deviation mean (SD) using SPSS version 21. Any value below 2.50 was deemed rejected and verse versa.

Results

The results obtained from the analyses are presented in the tables below:

Research Question I

What is the impact of gamification on students' motivation in learning biology in Colleges of Education in the South East, Nigeria?

Table I

Table I, showing the responses of students on how gamification can impact students motivation in learning biology in College of Education in the South East, Nigeria.

S/NO	ITEM	$\overline{X}$	SD	REMARK
1.	I find gamified biology lessons more engaging than traditional lesson	3.21	0.41	Accepted
2.	Gamification In Biology Classes motivates me to learn more about the subject.	3.04	0.40	Accepted
3.	I feel more confident in my ability to understand biology concepts when they are presented in a gamified concept.	2.78	0.39	Accepted
4.	Gamified biology lessons help me to better retain information and recall later.	2.84	0.41	Accepted
5.	I enjoy participating in gamified biology activities more than traditional classroom activities	2.81	0.42	Accepted
6.	I feel more connected to my peers when we participate in gamified biology activities.	2.86	0.42	Accepted
7.	Gamified biology lessons provide me with a sense of accomplishment and pride in my learning.	2.85	0.41	Accepted
8.	Gamification in biology classes is an effective way to learn complex concept	2.65	0.35	Accepted
9.	I enjoy learning biology more when it is presented in a gamified format.	2.68	0.38	Accepted
10.	Gamification in biology classes makes me fee more motivated to learn.	2.61	0.32	Accepted
11.	Gamification in biology classes help me to develop a more positive attitude towards learning biology.	2.78	0.41	Accepted
12.	Gamified biology lessons help me to see the relevance and importance of biology in real-life situation.	2.65	0.42	Accepted

From table one above, all the items 1-12, scored above the acceptance level of 2.50, showing that the respondents agreed that the listed items are the impact gamification can, have on students motivation in learning biology in Colleges of Education in the South East.

Research Question 2

How effective is the use of gamification in improving students understanding and retention of biological concepts in Colleges of Education of Education in the South East, Nigeria.

Table II

Table III showing the responses of students on how effective the use of gamification is in improving students understanding and retention of biology concepts in College Education in the south East, Nigeria.

S/NO	ITEM	$\overline{X}$	SD	REMARK
13.	Gamified biology lessons improve my ability to recall key concepts and terminologies.	2.78	0.41	Accepted
14.	The use of gamification in biology classes enhance my engagement and participation in learning activities.	3.41	0.45	Accepted
15.	I find gamified biology lessons more effective than traditional teaching methods in promoting my understanding of biology concepts.	2.76	0.34	Accepted
16.	Gamification in biology classes help me to develop a deeper understanding of the relationship between different biology concepts.	2.71	0.31	Accepted
17.	The use of gamification in biology education improves my ability to apply biology concepts to real-world scenarios	2.61	0.39	Accepted
18.	Gamified biology lessons provide me with immediate feedback and assessment of my understanding, which helps me to identify areas of improvement.	2.42	0.31	Accepted
19.	The use of gamifcation in biology classes reduces my anxiety and stress, related to learning biology concepts.	2.64	0.33	Accepted
20.	Gamification is a valuable tool for improving students understanding and retention of biology concepts.	2.65	0.35	Accepted

Table II above, showed that the respondents accepted items 13-20, the items having scored above the acceptance level of 2.50, thus showing that the items listed are some of the effective ways gamification improves students understanding and retention of biology concepts in Colleges of Education in the South East.

Research Question 3.

What are the Challenges of implementing gamification in biology education in College of Education in the South East, Nigeria?

Table III

Table III showing the responses of students on the challenges of implementing gamification in biology education in Colleges of Education.

S/NO	ITEM	$\overline{X}$	SD	REMARK
21.	Limited access to technology (e.g computers, tablets, internet) is a significant challenge to implementing gamification in biology education.	3.24	0.34	Accepted
22.	The lack of training and support for educators to effectively integrate gamification into their biology teaching is a major challenge.	2.65	0.21	Accepted
23.	insufficient gamified resources and materials are available to support implementation.	2.65	0.22	Accepted
24.	The time required to develop and implement gamified biology lessons is excessive.	2.78	0.38	Accepted
25.	Institutional support and resources (eg budget, infrastructure) are inadequate to support the implementation of gamification in biology education.	2.64	0.23	Accepted
26.	Balancing the use of gamifcation with traditional teaching methods in biology classes is a challenge.	2.64	0.23	Accepted
27.	Ensuring that gamificaed biology lessons are accessible and inclusive for all students is a signification challenge.	3.40	0.30	Accepted
28.	Integrating gamification into existing biology curricula is a significant challenge	2.68	0.35	Accepted

Table III, above showed that the items 21-28, are some of the challenges affecting the implementation of gamification in biology education in Colleges of Education; because all the items scored above the acceptance level of 2.50.

Discussion and Conclusion

The study evaluated the use of gamification on students' academic achievement in biology in Colleges of Education in the South East, Nigeria. Findings from table one showed that gamification impacts positively on students motivation to learn biology in Colleges of Education in the South East, Nigeria. The findings is in agreement with Ahmed *et al* (2025), who posited that instead of just reading from textbooks or listening to long lectures, students get to interact with the lesson in a more playful and exciting way. This method keeps them motivated, helps them to focus better and often makes tough topics easier to understand. Teachers can use gamification in different ways as students learn. When students are part of the learning process, making decisions and solving problem like in a game, the knowledge sticks better. Increasingly, research in game-based environments, their motivation, curiosity, and comprehension of complex concepts improve dramatically (Nyaaba *et al*, 2024). Educational games, in general, are a useful teaching tool at various educational levels because they often motivate students (Cheng *et al*, 2015), facilitate the acquisition of knowledge and skills, increase engagement in the learning process (Annetta *et al* 2009); improve performance and contribute to better understanding of abstract concepts and principle of science/biology (Cheng et al, 2015; Van –Gaalen *et al*, 2021).

From table II, the finding showed that gamification can improve students understanding and retention of biology concepts. The theory of gamified learning by Landers (2015), provides an instructional framework for the use of gamification in the instructional context. This theory posits that the use of game attributes in non-game context affect learning related behavior/attitude which in turn results into an improvement in students learning and strengthens the relationship between instructional design qualities and learning outcomes. The shift from traditional didactic methods to game-based learning according to Ogbu (2025), transforms the classroom into a dynamic environment where students feel more ownership of their learning journey.

Research question three explored the challenges of implementing gamification in biology education in the Colleges of Education in the South East Findings revealed that limited access to technology, lack of training, inadequate institutional support, among others, are some of the challenges the implementation of gamification in biology education faces. The finding in line with Darad (2024), who opined that schools face barriers related to budget constraints technology adoption and teacher training. Issues such as students misunderstanding the games, games deviating from teaching objectives, or distracting students' attention can arise (Dicheva *et al*, 2015) Additionally, Denny (2013), also attributed that cost factors related to the teaching material

and resources requirements of games also as hindrance to the effective use of gamification. However with a proactive approach, there challenges can be tackled head on, allowing schools to create a dynamic engagement learning environment that capture students' attention and improve learning out comes.

Conclusion

The study showed that gamification based approach, Nigeria enhances students academic achievement of preservice teachers in College of Education especially in the South East, Nigeria. This approach fostered higher engagement and motivation, which made them accept that the concept has positive impact on academic achievement, thus suggesting that it can be a pedagogical tool for teaching especially, biology in College of Education in the South East, Nigeria.

Recommendations

Bases on the findings, the following recommendations are made:

- Lecturers should align games with educational objects by using curriculum aligned challenges that help pre-service teachers grasp content and pedagogy.
- Lecturers should active learning by allowing for competition and collaboration to support different learner preference.
- They should use game elements strategically by using games to model best practices in teaching biology e.g inquiry-based learning, scientific method.
- Lecturers should differentiate for diverse learning styles by offering multiple modes of game interaction e.g. visual, textual, auditory etc.
- The Ministry of Education should provide professional development by training biology teachers and mentors on the effective use of gamification in biology education in Colleges of Education.

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