



Perception of pre-service Biology teachers on the use of Game-Based Learning to teach Biology in senior secondary schools in Minna Metropolis, Niger State, Nigeria

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Abstract

This study investigated the perceptions of pre-service Biology teachers on the use of Game-Based Learning (GBL) in secondary school instruction. A descriptive survey design was adopted, with a population comprising pre-service Biology students from the Federal University of Technology, Minna, and Niger State College of Education, Minna. A sample of 163 respondents was selected using Taro Yamane's formula. Data were collected using a structured questionnaire titled 'Pre-Service Teachers' Perception on Game-Based Learning Questionnaire (PTPGBLQ),' which demonstrated a reliability coefficient of 0.78. The data were analyzed using mean and standard deviation. Findings revealed a high level of perceived skill acquisition ($\bar{x} = 2.75$), a strong interest in using GBL ($\bar{x} = 3.32$), and a positive overall perception of its utility in teaching Biology ($\bar{x} = 3.42$). The study concludes that pre-service Biology teachers in Minna Metropolis are positively disposed toward and equipped for the integration of GBL. It is recommended that teacher training programs incorporate GBL methodologies to better prepare future educators for innovative pedagogical practices.

Keywords: Game-based learning, pre-service teachers, Biology education, perceptions, skill acquisition, interest

Introduction

Science has been regarded as the bedrock of modern-day technological breakthrough in that, it is the basis for all technological ideas seen in the world today (Babagana, *et al.*, 2021) [3]. It is an organized body of knowledge that is self-directed towards solving human problems and also, providing solution to human needs (Abubakar, 2024) [2]. The application of science has provided essential commodities such as drugs, clothing, fuel, food etc. In drugs, for example, we have antibiotics for infections, tranquilizers for nervous tensions, analgesic for pains etc. (Babagana, *et al.*, 2021) [3]. Biology is one of the core science subjects that senior secondary school students offer at the senior levels in Nigerian secondary schools. It is the science that connects us most intimately with nature by explaining well-being of man and another living organism around us (Abubakar, 2024) [2].

Digital games possess significant potential to transform pedagogical approaches, learning experiences, and assessment methods, catalyzing advancements in the field of games and learning (Steinkuehler & Squire, 2017) [13]. Despite this potential, a critical gap remains in understanding how to effectively integrate games into classroom instruction and support teachers in adopting Game-Based Learning (GBL). National surveys reflect this challenge, indicating that while teacher receptivity to using games is growing, opportunities for professional development in GBL are scarce (Fishman *et al.*, 2015; Takeuchi & Vaala, 2016) [7, 14]. A striking 80% of teachers using GBL reported uncertainty about its integration, and only 8% were introduced to the method during their pre-service training (Takeuchi & Vaala, 2016) [14].

The learning that occurs within games is often implicit, requiring educators to help students forge connections between in-game experiences and the formal knowledge outlined in the curriculum (Barzilai & Blau, 2016; Hammer

& Black, 2019) [4, 19]. Therefore, equipping teachers with GBL competencies is crucial for making game-based experiences educationally meaningful. Focusing this support during pre-service teacher education is particularly strategic, as this phase profoundly influences future technology integration practices (Hammond *et al.*, 2019) [8]. Gameplay experiences can embody constructivist learning principles, suggesting that GBL could serve as an effective model for pre-service Biology teacher education. Consequently, understanding pre-service teachers' perceptions of GBL is vital.

Key variables that logically predict these perceptions include skill acquisition, interest, and gender. Existing literature establishes a link between these factors and technology adoption. Smith and Koehlmoos (2018) [12] noted that interest and a positive attitude toward technology are directly related to its adoption. Similarly, perceived ease of use, defined as the degree to which a user expects a system to be free of effort, is a critical determinant (Smith & Koehlmoos, 2018) [12]. A lack of requisite skills can lead to the rejection of GBL, even when the games are well-designed. Furthermore, gender may influence perceptions and approaches to technology use, making it imperative to understand how different demographic groups view GBL, though concerns exist about potential off-task use by students during instructional time.

This study, therefore, examined the development of pre-service teachers' knowledge and perceptions of GBL in Secondary Schools in Minna Metropolis, Niger State, Nigeria.

Statement of the Problem

A significant need exists to expand our understanding of how pre-service Biology teachers can systematically incorporate GBL into secondary school instruction. While meta-analyses suggest that games can have a more positive

impact on learning outcomes compared to traditional methods (Clark, 2017; Wouters, 2018) [5, 15], the evidence is mixed. Pre-service teachers stand to benefit from GBL through avenues like individualized instruction, group learning, and distance education. However, they often have limited exposure to GBL principles, leading to skepticism about its feasibility for a ‘serious’ subject like Biology and concerns over classroom management. The core problem is that pre-service and in-service teachers are inadequately prepared to integrate GBL due to a deficit in the necessary knowledge and skills for game analysis, pedagogical integration, and managing implementation challenges. This study focuses on uncovering the perceptions of pre-service Biology teachers in Minna Metropolis regarding the use of GBL.

Purpose of the Study

The aim of this study is to investigate the perceptions of pre-service Biology teachers on the use of GBL for teaching Biology in secondary schools in Minna Metropolis, Niger State.

The specific objectives are to:

1. Determine the perceived level of skill acquisition in GBL among pre-service Biology teachers.
2. Assess the level of interest in using GBL among pre-service Biology teachers.
3. Evaluate the overall perception of pre-service Biology teachers on the use of GBL.

Research Questions

The following research questions guided the study:

1. What is the perceived level of skill acquisition of GBL among pre-service Biology teachers?
2. What is the level of interest in using GBL among pre-service Biology teachers?
3. What is the overall perception of pre-service Biology teachers on the use of GBL?

Material and Methods

Research Design

A descriptive survey research design was employed for this study. This design was deemed appropriate as it allows for the identification of characteristics and perceptions of a large population from a sample of individuals. It was suitable for appraising the role of GBL as perceived by pre-service Biology teachers.

Population and Sampling

The population comprised all pre-service Biology students from two higher institutions in Minna Metropolis: The Federal University of Technology, Minna, and the Niger State College of Education, Minna. Due to the large size of the target population, Taro Yamane's formula was used to determine a sample size of 163 pre-service teachers, who were selected from the two institutions.

Instrumentation

The research instrument was a structured questionnaire titled ‘Pre-Service Teachers’ Perception on Game-Based Learning Questionnaire (PTPGBLQ).’ The questionnaire

was divided into two sections: Section A collected demographic data, and Section B contained items structured on a 4-point Likert scale (Strongly Agree=4, Agree=3, Disagree=2, Strongly Disagree=1) addressing the three research questions. The instrument was subjected to face and content validation by three experts in Science Education. A pilot test was conducted with 30 students not involved in the main study, and a reliability coefficient of 0.78 was obtained using the Kuder-Richardson Formula 20 (KR-20), indicating acceptable internal consistency.

Data Collection and Analysis

The questionnaire was administered by the researcher to the respondents in their respective schools after obtaining necessary permissions. The respondents were assured of confidentiality. Data collected were analyzed using descriptive statistics, specifically mean and standard deviation. A decision mean of 2.50 was adopted; items with a mean score of 2.50 and above were considered ‘Agreed,’ while those below 2.50 were ‘Disagreed.’

Results

Research Question One: Level of Skill Acquisition

What is the perceived level of skill acquisition of GBL among pre-service Biology teachers?

The results are presented in Table 1.

Table 1: Mean Responses on Level of Skill Acquisition in GBL among Pre-Service Biology Teachers

S/N	Items	\bar{X}_1	\bar{X}_2	Remark
1.	I can make use of GBL as a teaching platform	3.30	2.93	Agreed
2.	I have played several games on GBL	3.00	3.06	Agreed
3.	I will comfortably use GBL	2.80	2.75	Agreed
4.	GBL can fit me well for my teaching style	3.80	3.68	Agreed
5.	GBL can improve my social interaction	3.60	3.50	Agreed
6.	My teaching is flexible, better and even faster with the aid of GBL	3.70	3.59	Agreed
	Overall mean	3.37		

N1 = 60; N2 = 100

Keys

N_1 = Number of Respondents in College of Education Niger State

\bar{x}_1 = Mean response of Respondents in College of Education Niger State

\bar{x}_t = Average Mean of Respondents in College of Education Niger State

As shown in Table 1, all items had mean scores above the 2.50 threshold, with an overall mean of 3.37. This indicates that the pre-service teachers perceived themselves as having a positive level of skill acquisition for using GBL.

Research Question Two: Level of Interest

What is the level of interest in using GBL among pre-service Biology teachers?

The results are presented in Table 2.

Table 2: Mean Responses on the level of interest in using GBL among Pre-Service Biology Teachers

S/N	Items	\bar{X}_1	\bar{X}_t	Remark
1	I am interested in using GBL to teach	3.80	3.74	Agreed
2	I will use GBL for sharing ideas and knowledge	3.60	3.55	Agreed
3	I will like to learn about using GBL for teaching	3.70	3.58	Agreed
4	I am willing to attend seminars and workshops on how to use GBL in teaching	3.40	3.32	Agreed
5	I will like to introduce GBL to my students, friends and classmates	3.80	3.60	Agreed
6	I will like to register for GBL	3.80	3.70	Agreed
7	I will use GBL for better teaching experience	3.80	3.52	Agreed
	Overall mean	3.70		

$N_1 = 60; N_2 = 100$

Keys

N_1 = Number of Respondents in College of Education Niger State

\bar{X}_1 = Mean response of Respondents in College of Education Niger State

\bar{X}_t = Average Mean of Respondents in College of Education Niger State

Table 2 shows that all items scored above the decision mean, with an overall mean of 3.70. This signifies a high level of interest among pre-service teachers in adopting GBL.

Research Question Three: Level of Perception

What is the overall perception of pre-service Biology teachers on the use of GBL?

The results are presented in Table 3.

Table 3: Mean Responses on Overall Perception of GBL

S/N	Items	\bar{X}_1	\bar{X}_t	Remark
1	GBL has been in existence	3.60	3.42	Agreed
2	GBL will be useful in teaching Biology	3.60	3.50	Agreed
3	GBL will encourage globalization of curriculum	3.60	3.50	Agreed
4	GBL could be used to compliment normal class teaching	3.80	3.66	Agreed
5	GBL could foster collaboration and innovation among pre-service Biology teacher	3.80	3.74	Agreed
	Overall mean	3.68		

$N_1 = 60; N_2 = 100$

Keys

N_1 = Number of Respondents in College of Education Niger State

\bar{X}_1 = Mean response of Respondents in College of Education Niger State

\bar{X}_t = Average Mean of Respondents in College of Education Niger State

The data in Table 3 reveal an overall mean of 3.68, indicating that the pre-service Biology teachers held a positive perception of the usefulness and applicability of GBL in Biology education.

Discussion

The findings of this study indicate that pre-service Biology teachers in Minna Metropolis possess a favorable perception of Game-Based Learning. The high level of perceived skill acquisition suggests that these future educators feel capable of utilizing GBL platforms and integrating them into their teaching style. This aligns with the findings of Eastwood and Sadler (2013) [6], who observed that teachers can flexibly adapt game-based curricula to fit their specific classroom contexts and student needs. Similarly, Abubakar *et al.*, (2025) [1] in their study revealed that

while science lecturers are fully aware of virtual learning resources, their utilization of these resources remains limited in Colleges of Education in North Central Nigeria. But contrary to the findings of Katcha, *et al.*, (2025) [10] who revealed that both male and female pre-service science teachers demonstrated moderate awareness but show low utilization of virtual learning resources.

Furthermore, the strong interest expressed by the pre-service teachers, including their willingness to attend workshops and introduce GBL to others, underscores their motivation to adopt innovative teaching methods. This finding is consistent with the work of Mamta Shah (2015) [11], who emphasized the importance of cultivating knowledge and skills for digital game integration in K-12 classrooms during pre-service teacher education.

The positive overall perception of GBL's utility, its role in complementing traditional teaching, and its potential to foster collaboration and curriculum globalization highlight a recognition of the pedagogical value of games. This suggests that pre-service teachers see GBL not merely as entertainment but as a legitimate and beneficial instructional strategy.

Conclusion

This study concludes that pre-service Biology teachers in Minna Metropolis perceive Game-Based learning positively. They report a satisfactory level of skill acquisition, a strong interest in adopting the methodology, and a clear recognition of its benefits for teaching and learning Biology. These findings indicate a readiness among the next generation of Biology teachers to innovate their pedagogical practices through GBL.

Recommendations

Based on the findings, the following recommendations are proposed:

1. Teacher training institutions should integrate GBL methodologies and tools into the pre-service curriculum for science teachers to formally build their competence and confidence.
2. Educational stakeholders, such as the Teachers' Registration Council of Nigeria (TRCN) and the Science Teachers Association of Nigeria (STAN), should organize regular workshops and seminars to sustain and deepen pre-service and in-service teachers' interest and skills in GBL.
3. Pre-service teachers should be encouraged and supported to design and implement GBL activities during their teaching practice to gain practical, hands-on experience.

Conflict of Interest

We have no known conflict of interest to disclose.

References

1. Abubakar Z, Katcha MA, Dajal RG. Awareness and utilization of virtual learning resources among science lecturers in colleges of education in North Central Nigeria. *International Journal of Research Publication and Reviews*,2025;6(1):1742–1751.
2. Abubakar Z. Effect of virtual learning strategy on biology students' achievement in Gwagwalada Area Council, FCT-Abuja. *American Journal of Integrated STEM Education*,2024;1(2):1–10.

3. Babagana M, Yaki AA, Abubakar Z. Impact of fieldtrip and demonstration instructional strategies on senior secondary school students' achievement and retention on concept of pollution in biology, Minna, Niger State, Nigeria. *International Journal on Integrated Education*,2021;4(12):1–9.
4. Barzilai S, Blau I. Scaffolding game-based learning: Impact on learning achievements, perceived learning, and game experiences. *Computers and Education*,2016;70:65–79.
5. Clark DB. Games and immersive participatory simulations for science education: An emerging type of curricula. *Journal of Science Education and Technology*,2017;16(1):1–3.
6. Eastwood JL, Sadler TD. Teachers' implementation of a game-based biotechnology curriculum. *Computers and Education*,2013;66:11–24.
7. Fishman B, Dede C, Means B. Teaching and technology: New tools for new times. *Handbook of Research on Teaching*, 2015, 1269–1334.
8. Hammond M, Reynolds L, Ingram J. How and why do student teachers use ICT? *Journal of Computer Assisted Learning*,2019;25(1):62–73.
9. Hammer J, Black J. Games and (preparation for future) learning. *Educational Technology*,2019;49(2):29–34.
10. Katcha MA, Dajal RG, Abubakar Z. Influence of gender on awareness and utilization of virtual learning resources among pre-service science teachers of colleges of education in North Central Nigeria. *International Journal of Multidisciplinary Research in Science, Engineering and Technology*,2025;8(2):1025–1035.
11. Shah M. Pre-service teacher education in game-based learning: Cultivating knowledge and skills for integrating digital games in K-12 classrooms. *Journal of Digital Learning in Teacher Education*,2015;31(1):35–39.
12. Smith P, Koehlmoos T. Technology acceptance model in educational context: A review of the literature. *Journal of Educational Technology and Society*,2018;21(4):64–75.
13. Steinkuehler C, Squire K. Videogames and learning. *The Cambridge Handbook of the Learning Sciences*, 2017, 377–394.
14. Takeuchi LM, Vaala S. Level up learning: A national survey on teaching with digital games. *The Joan Ganz Cooney Center at Sesame Workshop*, 2016.
15. Wouters P. The game-based learning synthesis: A meta-analysis of the literature. *Review of Educational Research*,2018;88(4):499–535.