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RELATIVE EFFECTIVENESS OF GOOGLE CLASSROOM AND WHATSAPP INSTRUCTIONS ON STUDENTS' ENGAGEMENT IN BASIC BIOLOGY IN UNIVERSITIES IN SOUTH-EAST, NIGERIA

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ABSTRACT

The relative effectiveness of Google Classroom (GC) and WhatsApp (WSP) instructions on students' engagement in basic Biology in universities in South-East, Nigeria was examined. Two research questions and three null hypotheses were posed. A quasi-experimental, specifically nonrandomized, pretest-posttest comparison design was employed. The population comprised 252 first-year Biology education students admitted for the 2023/2024 academic session in federal universities in South-East, while the sample comprised 118 (36 male and 82 female) students purposively sampled from two universities. An adapted questionnaire titled Biology Education Student Academic Engagement Questionnaire (BESAEQ) was used. BESAEQ was duly validated by three professionals, trial tested and yielded internal consistency of 0.87, using tau-equivalent reliability. Research questions were answered using mean and standard deviation, while the null hypotheses were tested using Analysis of Covariance (ANCOVA) at a 0.05 level of significance. Results showed that undergraduates trained via GC instruction had an improved average engagement score compared to those trained with WSP instruction. Male undergraduates showed improved engagement compared to females, and gender was found to influence students' academic engagement significantly. Furthermore, no interaction effect was found between gender and methods of instruction on undergraduates' average engagement. Thus, it was recommended that lecturers should adopt a structured teaching platform like GC for effective instruction delivery in their classroom, with its collaborative and peer-driven interactions feature to enhance student engagement.

Keywords: *Google Classroom instruction, WhatsApp instruction, academic engagement, basic biology.*

INTRODUCTION

The main aim of education is to stimulate a fundamental but permanent and positive change in the behaviour of learners. Teachers and other education stakeholders have adopted various teaching methods to facilitate this process of knowledge transmission. The most fascinating aspect of this trend is the integration of technology into education systems, which is changing the educational landscape in recent times. Technology in classroom teaching and learning has emerged as a significant strategy for enhancing student engagement and learning outcomes (Olumorin et al., 2020). The rapid evolution of technology has significantly influenced various sectors of society, including education. Hence, its adoption in education requires both lecturers and students to embrace new methods of knowledge transmission that do not require a face-to-face traditional classroom, to e-learning platforms that defy the need for synchronous time and geographical distance. The utilisation of the traditional face-to-face

teaching methods in tertiary institutions, particularly in Biology education, often has met with many setbacks, such as limited class time, insufficient resources, and a lack of personalised learning opportunities. These limitations have contributed to suboptimal learning outcomes and a reduced interest in science-related courses among undergraduates, especially in Basic Biology (SED III).

Basic Biology for science education students (SED111) is a foundational course meant to introduce students to the meaning of Biology, major concepts in Biology, and Biology for national development. In the context of this study, SED111 content scope covers: concept of living things, organisation of life, the cell and genetics. The choice of these courses and topics is anchored on the fact that these topics are basic concepts in Biology, it is a prerequisite course for year one undergraduate Biology education students, and it serves as a preparatory course for the profession. It also widens students' understanding of Biology concepts and helps them to easily relate these concepts to real-life situations. The practical nature of SED111 would naturally encourage students' active participation when instructions are delivered using digital learning platforms.

The rise of digital platforms globally, escalated by the limitations of traditional methods, has revolutionised educational delivery in tertiary institutions (Ajayi et al., 2019; Eze & Obi, 2020). Digital platform such as Learning Management Systems (LMS), Computer Assisted Instructions (CIA), and mobile assisted learning have been shown to improve students' leaning outcome (Obasi, & Asodike, 2020) and encourage students' active participation in the learning process especially in science courses (Khawlah & Mujo, 2019). According to Adebayo (2021) and Agbo et al. (2022), ICT has presented new opportunities for universities to expand their instructional methodologies beyond the traditional classroom. This paradigm shift has been particularly evident in the rapid development of numerous e-learning/digital platforms like Google Classroom (GC) and mobile applications like WhatsApp (WSP) for instructional purposes, especially in South-East Nigeria, where infrastructure challenges often hinder traditional teaching methods of instruction delivery. According to Nannim et al. (2023), Universities in South-East Nigeria have increasingly adopted platforms like GC and WSP to enhance academic engagement, particularly during the COVID-19 pandemic and beyond. Obasi and Asodike (2020) highlighted factors that can influence the extent to which these tools can enhance academic outcomes, including platforms, but not limited to internet connectivity, technical literacy, and institutional support.

> GC is a free web-based learning management system (LMS) developed by Google to streamline the creation, distribution, and assessment of educational content. It is designed to enhance teaching and learning by providing a collaborative environment where educators and students can interact, share resources, and manage assignments efficiently. Launched in 2014, GC integrates seamlessly with other Google Workspace tools, including Google Docs, Sheets, Slides, and Drive, allowing for easy content creation, sharing, and storage. (Iftakhar, 2016, p.14)

GC supports a structured approach to learning, providing educators with tools to organise class materials, deliver assignments, facilitate discussions, and provide feedback. The intuitive interface is one of the key features of the platform, which simplifies course management for educators. Lecturers can create classes, invite students, and post announcements or materials in a centralised location. Assignments can be distributed with customizable due dates, and students can submit their work directly through the platform, enabling automatic organisation and easy access to submissions. It also provides other features like grading and real-time feedback, helping teachers monitor students' progress and performance effectively. Yusuf et al. (2021) opined that GC helps to engage students cognitively by encouraging deeper interaction with content and fostering a more organised academic experience, making it a popular choice among educators, particularly in higher institutions. These platforms enable students and educators to connect, share materials, and engage in discussions, albeit with varying capacities for academic enrichment. GC supports communication and collaboration through class comments, private messages, and real-time announcements. Additionally, the platform is accessible across devices, including desktops, tablets, and smartphones, making learning flexible and available anywhere with internet access. This fosters interactive engagement and promotes a sense of community within virtual learning environments, just as WSP instruction (Al-Maroof & Al-Emran, 2018).

WSP is a mobile instant messaging application that has gained significant popularity as an instructional delivery tool among educators and lecturers due to its accessibility, affordability, and usability. According to Bouhnik and Deshen (2014), WSP provides features that facilitate both synchronous and asynchronous learning, making it a flexible platform for educational purposes. As a tool for instructional delivery, WSP enables real-time communication between lecturers and students, encouraging immediate feedback and collaborative learning. Features like group chats can serve as virtual classrooms where students interact with peers, share resources, and participate in discussions. Similarly, lecturers can use the platform to distribute notes, post assignments, and send reminders about deadlines or upcoming activities.

WSP's ability to support multimedia content, including text, images, audio, and video, allows educators to deliver a wide range of instructional materials and engage students in diverse learning activities (Rambe & Chipunza, 2013). According to Ahmet and Durgungoz (2022), oftentimes WSP is used for quick updates, group discussions, and collaborative learning, making it more conducive to individualised learning and an attractive tool for student-to-student and lecturer-student interactions. GC and WSP offer complementary strengths. However, unlike GC, WSP offers a less structured learning environment, but its low data requirements, familiarity, and instant messaging capabilities facilitate frequent communication between students and instructors. This promotes collaborative learning, where students can engage in real-time discussions, share multimedia resources, and provide peer support to each other (Kominfo, 2022).

Studies show that both WSP and GC improve learning by using multimedia (Blankenburg et al., 2016) and have a positive impact on students' personal and academic lives (Denker et al., 2018). They promote collaboration and help lecturers better know their students' personalities and interests (Sivakumar, 2020) and improve students' participation (Pimmer et al, 2021). Also, "findings revealed that emotional engagement has the strongest positive effect undergraduate's engagement with educational technology (Teng & Wang (2021), as well as predict first-year undergraduate retention and interest" (Iroegbu & Agboola, 2019). Assunção and Swennen (2020) found that online interaction between lecturers and students involving knowledge-sharing predicts undergraduate students' level of engagement academically and consequently influences their learning outcome (Adeniji & Mabekoje, 2019).

Student academic engagement refers to the extent to which students are actively involved in and are committed to their learning experiences. It goes beyond mere attendance at lectures and involves students actively participating in class activities, completing assignments, interacting with course materials, and demonstrating a genuine interest in their academic pursuits. In the context of this study, student academic engagement involves the investment of time, effort, and other relevant resources by both students and their institutions, intended to optimise the student experience and enhance their learning outcomes, and the reputation of the institution. According to Mbah (2019), academic engagement is broadly defined as students' participation, involvement, and commitment to academic activities. This definition shows that it is critical in determining students' learning outcomes. It reflects students' level of engrossment, motivation, attentiveness and deep involvement that students exhibit in their academics (curricula activities) and other educational activities (extracurricular). Chaka and Govender (2021) defined academic engagement as simply the degree of active participation students exert during teaching and learning. According to Fredricks et al. (2016), academic engagement is a multidimensional construct encompassing behavioural, emotional, and cognitive components, which collectively influence students' learning outcomes, persistence, and overall educational success. These definitions imply that effective academic engagement is crucial for advancing deep learning, critical thinking, and a lifelong interest in knowledge acquisition. Fredricks et al. (2016) explained that cognitive engagement deals with the intellectual effort students invest in learning, behavioural engagement focuses on participation in academic tasks, and emotional engagement reflects the students' feelings of connection to their learning environment. Digital platforms have been shown to greatly affect these three dimensions of engagement in diverse ways. Chaka and Govender (2021) found that digital platforms like GC and WSP enhance students' academic engagement by supporting interactive learning and real-time communication irrespective of students' gender.

Gender refers to a socio-cultural construct that develops roles, behaviours, expressions, mental, emotional and recognition that a society considers suitable for people in line with their discernible biological sex. "Unlike biological sex, which is determined by physical and physiological differences (e.g., male, female, or intersex), gender encompasses the social, cultural, and psychological characteristics associated with masculinity, femininity, or non-binary identities" (Butler, 1990, p.87). Ukala (2018, p.33) defined gender to simply mean a "socially constructed character or characteristics of being male or female, man or woman, boy or girl". Leghara (2022) sees gender as a behavioural difference between males and females that is culturally based and socially learned. Gender issues have remained at the forefront of academic discussion over the years. In Nigeria, due to the strong affiliation to culture and religion, the "sex stereotype which is the social-cultural classification of human activities by sex in line with what the society considers as best for each sex remains the order of the day" (Nzewi, 2010, p.77). This has influenced and continues to influence how families and even the society at large, especially Africans, educate their children.

Gender is critical in shaping educational experiences and outcomes. In agreement, Chaka and Govender (2021) and Yusuf et al. (2021) opined that in Sub-Saharan Africa, the issue of gender plays a major role in the choices students make and their achievement and interest in core science subjects like Biology. Studies have shown that gender-based expectations can influence students' participation, motivation, and performance in various subjects. For example, stereotypes associating males with science and technology and females with nurturing careers can affect students' choices and confidence in these areas (Yusuf et al., 2021). In another study, Chaka and Govender (2021) found that males generally exhibit higher confidence in using technology, while females may prefer collaborative and communicative digital tools. Ajayi et al. (2019) added that male students' tendency to focus on task completion and technical interactions aligns well with the structured format of GC, while female students' strengths in communication and collaboration are well-supported by WSP's interactive features. Addressing gender biases and promoting inclusivity are critical for achieving digital literacy and engagement across genders in education.

The duo instructional strategy (GC and WSP) presents opportunities for addressing gender-based engagement preferences. While GC supports formal, content-driven engagement, its accessibility can be limited by technological barriers, particularly in rural areas where internet access is unreliable (Nannim et al., 2023). WSP, though more accessible due to its low data requirements and widespread use, may lack the necessary structure to adequately support in-depth academic engagement. Given these contrasting features, there is a pressing need to compare these platforms and establish the most effective in enhancing students' engagement. The problem, therefore, is the lack of empirical evidence comparing the effectiveness of GC and WSP instructions in improving academic engagement among undergraduates in this region. Without this knowledge, educators and university administrators may struggle to make informed decisions on which platform to prioritise, potentially hindering student learning outcomes and engagement.

Multimedia Learning Theory by Richard Mayer (1997)

The study was supported by the multimedia learning theory (MMLT). The theory, which is grounded in constructivism, was propounded by Richard Mayer (1997). The theory states that students learn better when information is presented in two channels (that is, visually and auditorily or images and words) rather than just through words or just graphics. Through the visual channel, the instructions are represented in the form of pictures, videos, charts, or printed words, while through the auditory channel, the instruction is represented in the form of spoken words in a narration and other non-verbal sounds. Supporting the theory, Khawlah and Mujo (2019) stated that the process of transferring knowledge from two channels (audio and visual) could be more successful when new information is linked with the existing knowledge. This is to help students actively process incoming information while using their existing knowledge to fast-track the process. This theory is therefore related to the study in that both GC and WSP instructions allow both lecturers and students to use both visual and audio channels in the teaching and learning process.

Studies like Ercan (2014), Yue et al. (2013), and Chang et al. (2010) support multimedia learning theory. Chang et al. (2010) found that students taught with multimedia learned more successfully than the groups taught with traditional methods. Ercan (2014) found that multimedia has an important role in students' achievement. Yue et al. (2013, p.192) theorised "that by combining information from the two channels, the information is transferred from short-term to working memory to be processed in-depth with the help of prior knowledge, and that processing helps the information stay in the learners' long-term memory".

Research Questions

1. What were the average engagement scores of undergraduates who received basic biology training via GC versus WSP?
2. How does gender influence the average engagement scores of undergraduates who received basic biology training via GC versus WSP?

METHODOLOGY

The study used a quasi-experimental research design, specifically, a non-randomised pretest-posttest comparison group design. Quasi-experimental design was considered appropriate as it does not permit random assignment of participants into experimental groups (Nworgu, 2015). The study was conducted in the federal universities in the South-East. The justification for the area was due to huge commerce and several money-making opportunities, students lack interest in learning and prefer activities that bring fast money instead of academic. Another justification is the consistent report of poor academic achievement among undergraduate students in the area.

The population comprised 252 (70 male and 182 female) first-year undergraduate Biology education students admitted for the 2023/2024 academic session in South-east federal universities, out of which 118 (36 male and 82 female) were sampled purposively from two universities.

A multi-stage sampling procedure was used to select the sample. At the first stage, a purposive sampling technique was used to select two Universities (University of Nigeria, Nsukka, Enugu State, and Michael Okpara University of Agriculture, Umudike) out of the five federal universities in the South-East. The criteria for purposively selecting the two federal universities for the study is because, they offer the course and they have the learning management system environments that permit online learning for both lecturers and students and also have other ICT resources such as; e-learning tools, Wi-Fi, interactive whiteboards, standby generator plants, computer laboratories, overhead projectors and skilled personnel which is lacking in others. At the second stage, a simple random sampling technique was used to assign the selected universities into groups A and B. A simple random sampling technique was employed to eliminate bias in assigning each university to a group, as well as in the method of instruction.

The instrument for data collection was the Biology Education Student Academic Engagement Questionnaire (BESAEQ). BESAEQ is a 28-item questionnaire adapted from Imran et al. (2023), Tortosa-Martínez and P´erez-Fuentes (2023), Sengsouliyai et al. (2020), Veiga (2016) and Maroco et al. (2016), respectively. BESAEQ consist of section A (respondents' bio-data) and section B, which contains 28 items, rated on a four-point Likert scale (Strongly Agree, Agree, Disagree, Strongly Disagree) with scores ranging from 4 to 1, respectively. BESAEQ was thoroughly validated by three experts and was trial tested on 20 students, yielding internal consistency of 0.87 using the Cronbach alpha technique.

Before commencement of the experiment, four lecturers (two from each institution) were trained as Research assistants for two weeks on how to teach basic biology concepts using GC and WSP instructions. The two trained lecturers for each group, one taught while the other served as backup in case of unforeseen circumstances. This is to ensure that there is no break during the treatment period for both groups. The treatment was administered by their regular lecturers who, in the context of this study, were addressed as research assistants, using the same school lecture hall and timetable. The treatment lasted for five weeks, with lectures held twice a week. The research assistants administered

the treatment following the instructions given to them. Their first contact was for familiarisation, setting the rules of engagement, collecting students' data for inclusion into the instruction platforms and administration of a pre-test. As the treatment progressed, measures were adopted to ensure extraneous variables like novelty effect (ensuring that the initial excitement and curiosity about the innovative instructions (GC and WSP) were sustained among the students) were controlled by developing a well-structured and concise lecture plan/note to avoid confusion and tiredness among students. Also, ensuring continuous interaction between students and their lecturers and even among students was encouraged. To analyse the study's generated data, SPSS version 22 was employed. Hypothesis testing was done via Analysis of Covariance (ANCOVA) at a 0.05 alpha level; while answering the research questions, descriptive statistics (mean and standard deviation) were used.

Ethical Considerations

The study adheres to ethical research guidelines, and the ethics committee of the institution granted ethical approval (Ref. No. FE/SE/VII/4326). Participants were assured of confidentiality and anonymity, and informed consent was obtained before data collection. This aligns with the approved guideline by the ethical review board of universities in educational research (Bryman, 2016). The study was consistent with national and international standards for conducting research with human subjects.

FINDINGS

Table 1. *Descriptive Statistics for Engagement Scores by Group*

Treatment	n	Pre-test		Post-test		Mean gain
		Mean	SD	Mean	SD	
GC Instruction	76	44.76	14.75	79.49	11.42	34.73
WSP Instruction	36	44.25	12.33	73.86	10.48	29.61

Table 1 shows that students taught with GC had a pre-test engagement mean score of 44.76 with standard deviation score of 14.75, and a post-test engagement mean score of 79.49 with standard deviation score of 11.42, while their counterpart taught using WSP had a pre-test engagement mean score of 44.25 with standard deviation score of 12.33, and a post-test engagement mean score of 73.86 with standard deviation score of 10.48.

The mean gain scores for both groups (GC and WSP) were 34.73 and 29.61 respectively. This imply that GC instruction improves students' engagement than WSP instruction.

Table 2. *ANCOVA for Significant Difference in Average Engagement Scores of Undergraduates Trained Basic Biology with The Platforms*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1623.350[a]	2	811.675	6.929	.001
Intercept	45230.940	1	45230.940	386.102	.000
Pretest_Eng	850.214	1	850.214	7.258	.008
Treatment_Group	745.208	1	745.208	6.361	.013
Error	12769.079	109	117.148		
Total	690196.000	112			
Corrected Total	14392.429	111			

a. R Squared = .113 (Adjusted R Squared = .097)

Table 2 revealed that the probability value associated with the calculated value of F (6.36) for the effect of GC and WSP instructions on students' engagement mean scores is 0.01. Therefore, because the p-value of 0.01 is less than the 0.05 level of significance, the null hypothesis is rejected. Thus, there is a significant difference in the mean engagement scores of students taught basic Biology using GC and those taught using WSP instruction in support of GC instruction.

Table 3. *Descriptive Statistics for Engagement Scores by Gender*

Gender	N	**Pre-test**		**Post-test**		**Mean gain**
		Mean	SD	Mean	SD	
Male	35	43.94	12.60	80.86	11.42	36.92
Female	77	44.90	14.61	76.23	11.15	31.33

Table 3 showed that male students pre-test engagement mean score of 43.94 with standard deviation score of 12.60, and a post-test engagement mean score of 80.86 with standard deviation score of 11.42, while their female counterpart had pre-test engagement mean score of 44.89 with standard deviation score of 14.61, and a post-test engagement mean score of 76.23 with standard deviation score of 11.14. The mean gain scores for males and females are 36.92 and 31.33, respectively. This indicates that male students had a higher mean engagement score than their female counterparts.

Table 4. *ANCOVA for Influence of Gender on Undergraduate Average Engagement Score in Basic Biology*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1436.667[a]	2	718.333	6.044	.003
Intercept	47343.562	1	47343.562	398.313	.000
Pretest_Eng	922.316	1	922.316	7.760	.006
Gender	558.525	1	558.525	4.699	.032
Error	12955.762	109	118.860		
Total	690196.000	112			
Corrected Total	14392.429	111			

a. R Squared = .100 (Adjusted R Squared = .083)

Table 4 shows that the probability value associated with the calculated value of F (4.69) for the influence of gender on students' mean engagement scores is 0.03. Since the p-value of 0.03 is less than the 0.05 level of significance, the null hypothesis is therefore rejected. Thus, there is a significant influence of gender on students' mean engagement scores in favour of the male students.

Table 5. *ANCOVA on Connection Between Gender and Methods of Instruction on Average Engagement Score in Basic Biology*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2377.560[a]	4	594.390	5.293	.001
Intercept	45567.511	1	45567.511	405.807	.000
Pretest_Eng	926.731	1	926.731	8.253	.005
Treatment_Group	587.215	1	587.215	5.230	.024
Gender	752.187	1	752.187	6.699	.011
Treatment_Group * Gender	95.987	1	95.987	.855	.357
Error	12014.869	107	112.288		
Total	690196.000	112			
Corrected Total	14392.429	111			

a. R Squared = .165 (Adjusted R Squared = .134)

Table 5 revealed that the probability value associated with the calculated value of F (0.86) for the interaction effect of methods of instruction and gender on students' mean engagement scores is 0.36. Hence, the p-value of 0.36 is greater than the 0.05 level of significance: the null hypothesis is therefore not rejected. Thus, there is no significant interaction effect of methods of instruction and gender on students' mean engagement scores in basic Biology for education students.

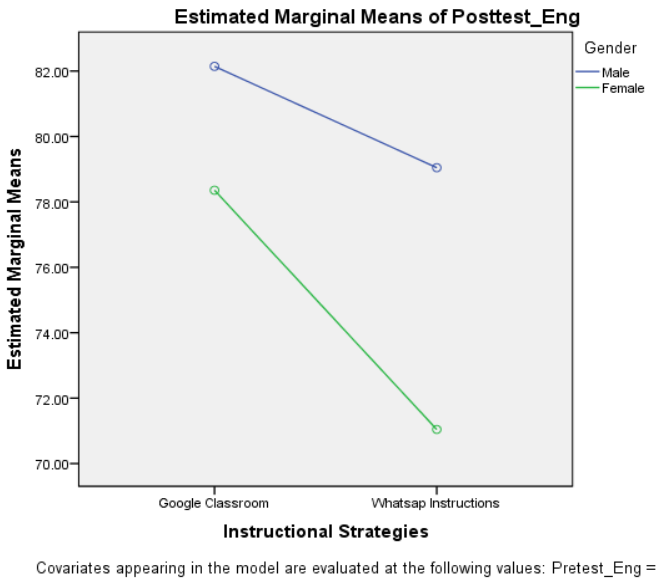

Figure 1. *Graph Showing the Connection Between Gender and Methods of Instruction*

Figure 1 shows that there was no connection between gender and methods of instruction and on undergraduates' average engagement scores. It was revealed by the parallel lines in the graph above.

DISCUSSION

Findings in Table 1 revealed that undergraduates taught basic Biology using GC instruction had improved average engagement scores compared to those tutored using WSP instruction. Also, Table 2 revealed further that the difference in average engagement scores among undergraduates taught with GC instruction and those trained using WSP instruction was significant, in favour of those taught with GC instruction. By inference, the superiority of the GC instruction over the WSP instruction could be due to its innovative nature and novelty as an instruction strategy in the education system. It could also be due to its structured learning environment that students can access freely, as well as its familiar interface.

This finding agrees with the findings of Olalerre and Soyemi (2022), who found that the academic engagement of students was improved most in the GC group, followed by those in the WSP group and then the traditional method. In a similar finding, Anjarwati and Sa'adah (2022), Sengsouliya et al. (2022), and Iliyasu et al. (2020) also found that GC improves students' academic engagement more than other instructional strategies or approaches. On the contrary, Gon and Rawekar (2017) found that the use of WSP as an instructional strategy enhances students' academic engagement than GC and recommend the use of WSP and not GC. The contradictory findings are proof that both strategies are effective.

Furthermore, the finding of the study corroborates with Anjarwati and Sa'adah (2022), whose findings reveal a significant difference in student engagement. On the contrary, Okeke et al.'s (2022) findings showed that the face-to-face method had a significantly positive effect on students' engagement than GC, while GC had a significantly positive effect on students' achievement than the lecture method. With these contradictory findings, it is almost impossible to state that one method is generally more effective than others. However, data from this study suggest that, students instructed using GC outperformed in their level of academic engagement than those instructed using WSP. Factors such as students' proficiency in using the platforms, access to internet connectivity, and novelty of the platforms may have contributed to the result.

The findings in Table 3 show that undergraduate biology education male students taught basic biology with GC and WSP instructions showed improved average engagement scores compared to the female students. This difference in average engagement of students based on gender could be attributed to sampling error. As Njoku (2019) stated, Biology is a gender-neutral subject, and student performance may not be linked to their gender. The finding revealed further in Table 4 that the difference is significant. This could be attributed to the fact that males are more skilled in manipulative skills than females (Manzano-Sánchez et al., 2020; Murphy et al., 2018).

Similarly, the findings agreed with Adebayo (2021), Eze and Obi (2020), and Mbah (2019), who reported differences in students' academic engagement based on gender in favour of males. In another study, Ajayi et al. (2019) found that male students have a greater tendency to focus on task completion and technical interactions using GC, while female students tend to align better with WSP instruction due to its interactive features that promote communication and collaboration. On the contrary, Okeke et al. (2022) found female students to have higher engagement than men in their study. Also, Manzano-Sánchez et al. (2020) and Murphy et al. (2018) reported in their study that female student outperformed their male counterpart, although no significant difference was established.

CONCLUSION

The effectiveness of GC and WSP in improving undergraduates' academic engagement in basic Biology for education students (SED III) in South-east Nigerian universities was revealed. Although both strategies were found to improve students' academic engagement to varying degrees, data from this study suggest that GC was superior in promoting structured, collaborative, and content-driven engagement among students in south-east Nigeria. A blended approach utilising the strengths of both platforms could offer an optimal solution for fostering comprehensive academic engagement among students in Nigeria.

Recommendations

1. Universities in Nigeria, especially federal universities, should consider adopting a hybrid model that combines the structured, formal environment of GC with the collaborative, peer-driven interactions of WSP to enhance student engagement across all disciplines.
2. Further studies should explore the impact of other emerging digital platforms on academic engagement, with a focus on scalability in resource-limited educational settings.

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Conflict of Interest

The authors declare that they have no competing/conflict of interests.

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Author's Contributions

We declare that the authors contributed actively from the sourcing of materials, through the brainstorming period, to the analysis and interpretation of results for the success of this study.

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