**INCORPORATING BLENDED LEARNING INTO THE 21st CENTURY EDUCATIONAL PEDAGOGY AS LEARNING APPROACH AMONG UNDERGRADUATE STUDENTS OF PUBLIC UNIVERSITIES IN NORTH-WEST NIGERIA**

*Abstract*

*Blended learning is regarded as a pedagogical approach that combines traditional face-to-face instruction with online learning tools and resources. This study investigated the significance of incorporating a blended learning model into the traditional teaching and learning approach among universities in North-West Nigeria. Three objectives and two hypotheses guided the study. The study employed descriptive survey research design. The population of the study comprised of all regular undergraduate students (180,625) in public Universities in North-west Nigeria. Simple random sampling technique was used to select 380 participants from five (5) universities across the study area using Krejcie and Morgan (1970) table for determining sample size for specific population. A researcher structured questionnaire was employed for data collection. Descriptive statistics such as mean score and standard deviation were used to answer research question one, while question two and three were tested using inferential statistics such as t-test and multiple regression. Findings from the study revealed that there was positive perception of undergraduate students towards the incorporation of blended learning. The results also found a statistically significant difference in the effect of blended learning on students’ engagement. The results further revealed a statistically significant effect in the relationship among blended learning, students’ motivation and engagement in public universities in North-West Nigeria. Based on the findings, the study recommended among others that divergent methodology to blended learning approach such as flipped classroom and inverted classroom should be encouraged in order to enhance and stimulate Students motivation.*

*Keywords:* Educational Pedagogy,Blended Learning, Undergraduates, Public Universities

1. **INTRODUCTION**

Educational systems across the globe are witnessing a propounding paradigm shifts as a result of technological advancements and the increasing demands of a globalized economy. With advancement in technology and educational technology, comes various modern 21st century technological mediums, gadgets and tools which is aiding in augmenting to make the teaching and learning process less cumbersome, more effective, individualized and learner centered, with the opportunity of selecting the most appropriate and suitable teaching and learning pedagogy to aid critical thinking and problem solving ability in the teaching and learning process in 21st century global educational setting (Diffang et al., 2024).Yet, studies revealed that Nigerian universities, face a multitude of challenges, including inadequate infrastructure, large class sizes, and limited access to learning resources and these challenges are believed to be among the major factors hindering the delivery of high-quality education ( Gidado et al., 2023; Okoye & Arimonu, 2016; Gidado & Diffang, 2024; Kola et al., 2021,). These challenges necessitate innovative educational solutions that can improve student engagement, academic performance, and prepare graduates for the complexities of the modern workforce after graduation. Despite the challenges, some Nigerian universities have successfully implemented blended learning. For instance, the University of Lagos introduced a blended learning model for its distance learning program, resulting in increased student enrollment and satisfaction (Akinbode & Alaka, 2020). Similarly, Covenant University has integrated blended learning into its curriculum, leveraging its robust IT infrastructure to enhance teaching and learning (Oluwalola et al., 2022). Therefore, blended learning as an instructional approach that combines online and face-to-face learning environments, providing a flexible framework that leverages the strengths of both modalities, it could be considered as a possible solution to the outlined challenges (Munawar, et al.,2023).

According to Chew, Jones and

Turner, ‘blended learning involves the combina-

tion of two fields of concern: education and edu-

cational technology

According to Chew, Jones and

Turner, ‘blended learning involves the combina-

tion of two fields of concern: education and edu-

cational technology

According to Bryan and Volchenkova (2016), blended learning involves the combination of two fields of concern, which are education and educational technology and it defined as a pedagogical approach that combines traditional face-to-face instruction with online learning tools and resources. Furthermore, Szadziewska and Kujawski (2017) revealed that blended learning approach is believed to have an ability to offer a diverse array of learning opportunities tailored to the needs of individual students. In this approach of learning, experiences are supplemented with online components that allow more personalized and interactive learning experience among the learners. This pedagogical shift aligns with global trends toward learner-centered education, where students are encouraged to take more responsibility for their learning processes (Zhou, et al., 2019). Therefore, in Nigeria, where traditional teaching approach have dominated the educational system, the incorporation of blended learning can represent a significant step toward modernizing educational practices and addressing a range of systemic challenges facing the teaching and learning process. Generally, the term “blended learning” arouses diverse visions of the teaching and learning process on where and how it occurs. There is no doubt that teachers across the institutions of learning (K–12 and university) in some part of Nigeria have been using technological tools and platforms for teaching and learning activities to promote student engagement and motivation with course content to ensure academic success.

Student engagement is a particular area of interest, as it has become a central feature within the student educational experience (Bond & Bedenlier, 2019). Student engagement in their academics could be a determining factor on how they perform academically. Tomovic (2021) stated that When students are intellectually committed and absorbed in their academic work, they are more likely to go above and beyond what is required and to appreciate the challenges of learning. Blended learning approach has shown to be a contributing factor on students’ engagement. Zhou et al., (2019) highlighted that research has consistently demonstrated that blended learning can lead to increased student engagement and improved academic performance. Therefore, integrating technology into traditional learning environments, instructors can create interactive and collaborative learning experiences that encourage active participation. Alsalhi et al. (2019) also noted that blended learning can positively affect students' learning engagement and improves the student learning experience. According to Lalima and Dangwal (2017), undergraduate students who participated in a blended course reported significantly greater levels of competence and comfort in putting into practice what they learned than similar students enrolled in an online course only. Buttressing the finding from these studies Müller et al. (2023) noted that blended learning can foster a sense of autonomy among students, encouraging self-directed learning and critical thinking. Therefore, the ability for the learners to engage with course materials at their own pace they can understand complex topics, revisit challenging materials, and engage in peer-to-peer collaboration. Such an environment not only supports deeper learning but also promotes essential skills such as time management, problem-solving, and effective communication among students.

Blended learning could also encourage and enhance students’ motivation for learning which could improve their performance. Clark et al. (2018) indicated that blended learning enhanced understanding and a motivation for learning among students interviewed in focus groups. Yagci (2016) also highlighted that blended learning model has a positive effect on students’ motivation for learning. Blended learning due to its technological peculiarities which could gratify diverse learning experiences and needs of students can easily support and sustain students interest and motivation to learn. Blended learning allows for multimedia presentations, discussion forums, and interactive assessments that cater to diverse learning preferences which eventually support learner’s interest and motivation, particularly in a setting where traditional lecture-based methods may struggle to engage students fully (Bryan & Volchenkova, 2016).

Even though, blended learning has been identified to be very vital. Yet, its implementation in Nigerian universities is believed to have some challenges, such as reliable internet connectivity and access to computers. Additionally, some teachers are not well equipped on how to employ technological tools in the classrooms particularly for blended learning. This is because some studies indicated that educators may be unfamiliar with some digital learning platforms/tools or may lack the pedagogical expertise required to leverage technology in meaningful ways. Certainly, it is discovered that various international researches have extensively documented the benefits of blended learning and how it could impact students’ engagement and motivation. Yet, there is need for more studies focusing on Nigeria, particularly North-west Nigeria. Therefore, the researchers deemed it necessary to conduct this study so as to contribute to the growing body of literature on blended learning by providing empirical evidence from the Nigerian context particularly among the undergraduate students in North-west geopolitical zone.

**1.1 Statement of the Problem**

Certainly, the 21st century has brought about significant changes to the global educational landscape, driven by rapid technological advancements and the need for more flexible, student-centered learning approaches. The education sector in the country (Nigeria), more specifically higher education (Universities) is characterized by overcrowded classrooms, shortage of qualified instructors, limited access to physical resources, such as libraries and laboratories, exacerbates educational inequities, particularly for students in remote or underserved areas (Kola et al., 2021). Furthermore, these challenges identified to have created barriers for effective teaching and learning which may lead to a situation whereby some students graduate without the critical skills and competencies required by employers, leading to high levels of unemployment among graduates. Therefore, blended learning, which integrates traditional face-to-face instruction with online learning, has been identified as a potential solution to these challenges as it presents an opportunity to bridge these gaps by utilizing technology to enrich the educational experience and offer greater flexibility in teaching and learning process. For instance, online components can provide students with access to digital resources, such as e-books, research articles, and multimedia content, which may not be readily available in their immediate environment. This access not only enhances learning opportunities but also fosters the development of essential digital literacy skills that are critical in today's job market.

However, despite its potential, the adoption and implementation of blended learning in Nigerian universities remain limited due to several barriers, including poor internet connectivity, lack of digital infrastructure, resistance to change among faculty and students, and insufficient government support. While some Nigerian institutions have begun to explore blended learning models, there is a lack of comprehensive research on its effectiveness, scalability, and long-term impact on undergraduate education in the country. Furthermore, there is limited understanding of the specific strategies needed to overcome the unique challenges faced by Nigerian universities in adopting blended learning.

This study seeks to address these gaps by examining the potentiality of blended learning in transforming undergraduate education in Nigeria, identifying the key challenges, and proposing context-specific strategies for successful implementation. The problem, therefore, is the inadequate integration of blended learning in Nigerian higher education particularly in North-west Nigeria, which hinders the ability of undergraduate students to benefit from modern pedagogical approaches that could enhance their learning experiences, academic performance, and readiness for the 21st-century workforce.

The following were the objectives of this study.

**1.2 Research Objectives**

1. To examine the perception of undergraduate students towards the incorporation of blended learning approach in public universities in North-West Nigeria.
2. To investigate the difference in the effect of blended learning on students’ engagement in public universities in North-West Nigeria.
3. To determine the relationship among blended learning, students’ engagement and motivation in public universities in North-West Nigeria.

The following research questions raised, guided the course of this study.

**1.3 Research Questions**

(I) What are the perceptions of undergraduate students towards the incorporation of blended learning approach in public universities in North-West Nigeria?

(II) What is the difference in the effect of blended learning on students’ engagement in public universities in North-West Nigeria?

(III) What is the relationship among blended learning, students’ engagement and motivation in public universities in North-West Nigeria?

**1.4 Hypothesis**

The following null hypotheses which were tested at 0.05 level of significance were formulated for this study.

**H01.:** There is no significant difference in the effect in of blended learning on students’ engagement in public universities in North-West Nigeria.

**H02.:** There is no significant relationship among blended learning, students’ engagement and motivation in public universities in North-West Nigeria.

**Theoretical Framework**

**1.5 Experiential Learning Theory**

This theory was postulated by David Kolb in 1970s, it was grounded in the belief that knowledge is best constructed through direct experiences. The theory unfolds in a cyclical manner, comprising four key stages: (i) Concrete experience, (ii) Reflective observation, (iii) Abstract conceptualization, and (iv) Active experimentation. Each stage encourages learners to engage fully with the material, reflect on their experiences, form generalizations, and apply their insights in practical situations. On the other hand, blended learning approach represents a harmonious fusion of traditional face-to-face instruction with online learning. This model not only offers flexibility but also leverages technology to create a more personalized learning experience.

i. **Concrete Experience Meets Virtual Learning:**

In a blended learning framework, concrete experiences may manifest in a physical classroom setting where students participate in hands-on activities or simulations. For example, a science class might include a laboratory experiment that students conduct in person. Following the experience, students can continue their learning journey online by accessing supplementary materials, engaging in virtual discussions, or collaborating on projects that extend the classroom activities.

ii. **Reflective Observation Enhanced by Digital Tools:**

According to the theory, after a leaner engaged in a concrete experience, the next stage is reflective observation stage. Meanwhile, blended learning experiences provide an array of digital tools that facilitate reflection. Online journals, discussion boards, and peer feedback platforms enable students to articulate their insights and examine their experiences in depth. This digital reflection not only encourages critical thinking but also allows for a richer exchange of ideas, as students can share their thoughts with a broader audience outside the immediate classroom.

iii. **Abstract Conceptualization**:

With reflections in hand, students move to the next stage of abstract conceptualization, where they begin to form theories based on their previous experiences. The blended learning approach allows educators to deliver theoretical content through engaging online formats, such as video lectures, interactive simulations, and downloadable resources. Therefore, making connections between theory and practice, students can contextualize their learning, reinforcing their understanding and facilitating a deeper grasp of concepts.

iv. **Active Experimentation Through Online Applications:**

The final stage of Kolb’s model, active experimentation, this stage allows students to apply their newfound knowledge in real-world contexts. However, in a blended learning paradigm this can take the form of online projects, virtual case studies, or collaborative problem-solving exercises and by engaging in these activities students can test their theories and solutions, receive immediate feedback, and iterate on their practices.

The connection between experiential learning and blended learning is not just a theoretical alignment. But rather, it is also a practical framework that empowers students to take charge of their educational journeys, transforming them into active participants in their learning processes. As educators continue to explore innovative teaching strategies, the marriage of these two approaches presents a promising pathway toward more effective, personalized, and impactful education (Educational Pedagogy for 21st century).

**2.0 METHODOLOGY**

**2.1 Research Design**

The study employed a mixed-method approach. Descriptive survey research design was use to collect both quantitative and qualitative data from student, in which a quantitative survey was employed to measure the impact of blended learning approach in enhancing undergraduate students’ leaning engagements and motivation. Additionally, a researcher structured questionnaire was used to provide insights into the experiences and perceptions of undergraduate students towards the incorporation of blended learning approach in public universities in North-West Nigeria (Qualitative data).

**2.2 Population**

The target population for the study comprised of all regular undergraduate students in public Universities in North-western Nigeria. North-western Nigeria is one of the six geo-political zones in Nigeria and it is made up of seven (7) states (Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto and Zamfara) and all the states in the region have cultural and educational similarities. Available statistics from Statistical Digest a subsidiary of National Universities Commission (NUC) (2019) shows that there were one hundred and eighty thousand six hundred and twenty-five (180,625) students across North-west Nigeria

**2.3 Sample Size and Sampling Procedure**

The study using simple random sampling technique through balloting selected five (5) universities (public Universities) from the 16 public universities in North-western Nigeria comprising of both federal and states universities to participate in the study which constitute 31.25% of the total number of universities in the study area. A total number of 380 participants were randomly selected from five (5) universities across the selected public universities in the region (i.e. 76 students from each selected university) using simple random sampling technique.

**2.4 Instrumentation**

A questionnaire titled Significance of Incorporating Blended Learning Approach among Undergraduate Students Questionnaire (SIBLAUSQ) was designed for the study with 3 sections. Section A was made up of respondent’s background information, Section B was made of up 10 items with statements on Perception of Undergraduate Students in the incorporation of blended learning in Public Universities in North-West Nigeria while section C was centered on Impact of Blended Learning on Undergraduate Students Engagement and Motivation in Public Universities in North-West Nigeria. The questionnaire was design along the four-point scale options (Strongly Agree, Agree, Disagree and Strongly Disagree) against each statement for respondents to choose according to their perceptions (Likert, 1932).

**2.5 Validity and Reliability of the Instrument**

The instrument was subjected to face, content and construct validity. The validation of the instrument was carried out by experts in Measurement and Evaluation at Usman Danfodio University, Sokoto. After the validation, the items in questionnaire were subjected to pilot test in order to determine the reliability of the instrument. The pilot test was conducted using students of Bayaro University Kano who were not part of the main study. Thirty-five students (35) participated in the pilot test, where Cronbach alpha was used to determine the internal consistency of the instrument, which yielded a coefficient index of 0.83.

**2.6 Data Collection Procedure**

After obtaining the necessary clearance through the validation and the testing for reliability of the research instrument by experts in measurement and evaluation at Usman Danfodio University, Sokoto for content and construct validity and also the reliability of the instrument for the conduct of the study which was all adjudged to be reliable for the study. The researchers then proceeded with the data collection process, in which a total number of 380 questionnaires were administered to 380 respondents randomly from the five (5) selected universities in the study area; however, a period of 1-week was given to the respondents to fill-in the questionnaires.

**2.7 Method of Data Analysis**

All data were analyzed using the Statistical Software Package for Social Sciences (SPSS) (Version 27.0). Furthermore, descriptive statistics such as mean score and standard deviation were employed to answer research question one with a midpoint of 2.50 based on the 4-point Likert scale. While question two and three were tested using inferential statistics such as t-test and multiple regression to determine the difference in the effect of blended learning on students’ engagement and also, establish the relationship among blended learning, students’ motivation and engagement in public universities in North-West Nigeria.

**3. RESULTS**

**Research Question 1:**

What is the perception of undergraduate students towards the incorporation of blended learning approach in public universities in North-West Nigeria?

As shown in table 1, was the perceptions of undergraduate students towards the incorporation of blended learning approach in public universities in North-West Nigeria with a Sectional Mean of 2.91. From the analysis above, it was discovered that over average of the respondents agreed with all items in table 1 except item 7 and 8 which was disagreed upon and rejected, which is in line with the decision rule that 2.50 and above be accepted and below be rejected. Hence, the sectional mean for the items in regard to perceptions of undergraduate students towards the incorporation of blended learning approach in public universities in North-West Nigeria which was 2.91 is (greater than 2.50midpoint on a 4-point Likert scale). Research question two and three were translated into hypotheses one and two.

**3.1 Test of Hypotheses**

**Hypothesis one:**

There is no significant difference in the effect of blended learning on students’ engagement in public universities in North-West Nigeria.

As shown in Table 2, a t-test analysis to determine the significant difference in the effect of blended learning on students’ engagement among undergraduate students in public universities in North-West Nigeria was presented. The Table revealed a mean score of 68.31 with standard deviation of 4.95 for blended learning, while a mean score of 52.33 with standard deviation of 3.23 for students’ engagement. Table 2 equally indicated a calculated t-value of 3.638 with the Table value of .001 (p < 0.05). Therefore, the null hypothesis was rejected, which implies that blended learning could affect students’ engagement. This concludes that there is statistically significant difference in the effect of blended learning on students’ engagement in public universities in North-West Nigeria.

**Hypothesis two:**

There is no significant relationship among blended learning, students’ engagement and motivation in public universities in North-West Nigeria.

As shown in table 3, a multiple regression analysis on the relationship among blended learning, students’ engagement and motivation in public universities in North-West Nigeria was presented. The table indicates unstandardized coefficient (B = 2.860, p<.000) for students’ engagement, (B = 2.118, p<.005) for students’ motivation which reveals that for every one-unit increase in students’ engagement and motivation blended learning improves by 2.860 and 2.118 units respectively. The table also revealed a variance in students’ engagement and motivation indicating (R**² = 0.393**) with a significant F-statistic (**F (5. 508) = *p* < .014**). This infers that there is statistically significant effect in the relationship among blended learning, students’ engagement and motivation in public universities in North-West Nigeria.

**Table 1: Perception of undergraduate students towards the incorporation of blended learning approach in public universities in North-West Nigeria**

N=380

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S/N | Items | Mean | Std Dev | Decision |
| 1 | I have participated in a blended learning class since some of my lecturers incorporate it into traditional method | 3.20 | .99 | Agreed |
| 2 | Blended learning class is flexible, I feel very comfortable when merged together with traditional learning method | 3.03 | 1.00 | Agreed |
| 3 | Blended learning can enhance and improve my learning experience | 2.72 | 1.06 | Agreed |
| 4 | Blended learning do improve my academic engagement | 3.32 | .944 | Agreed |
| 5 | Blended learning can possibly improve my academic performance | 2.95 | 1.08 | Agreed |
| 6 | Blended learning is a very interesting innovation in teaching and learning process and should be encouraged | 3.30 | 1.18 | Agreed |
| 7 | Blended learning enhances easy access to learning materials at any time or place | 2.30 | 1.43 | Disagreed |
| 8 | I do experience some technical issues in the use of blended learning | 2.25 | 1.29 | Disagreed |
| 9 | Generally, I am not too comfortable using technology for learning | 3.03 | .158 | Agreed |
| 10 | My overall experience with blended learning is satisfactory | 3.00 | .000 | Agreed |
|  | **Sectional Mean** | **2.91** | **0.91** |  |

**Table 2: t-test Analysis of the significant difference in the effect of blended learning on students’ engagement in public universities in North-West Nigeria**

|  |
| --- |
| **No. Mean Standard p-**  **Variables of Students Scores Deviation t-value df value Decision** |
| Blended learning 68.31 4.95  380 3.638 378 0.001 Rejected  Students’ Engagement 52.33 3.23 |

*\*Significant at P-value < less than 0.05; and df = 378*

**Table 3: Coefficients of Multiple Regression Analysis on the relationship among blended learning, students’ engagement and motivation in public universities in North-West Nigeria**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | | | | | | |
| Model | | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. |
| B | Std. Error | Beta |
|  | (Constant) | 22.456 | 3.616 |  | 6.209 | .000 |
| blended learning | 2.860 | 1.150 | .602 | 3.187 | .005 |
| students’ motivation | 2.118 | 1.078 | .468 | 1.891 | .025 |

**Dependent Variable: students’ engagement**

**4. DISCUSSION**

The result of this study revealed a positive perception of undergraduate students towards the incorporation of blended learning in public universities in North-West Nigeria. This result is in corroboration with Müller et al. (2023) who indicated that blended learning can foster a sense of autonomy among students, encouraging self-directed learning and critical thinking. Also, Akinbode and Alaka (2020) supported the finding of this study by affirming that blended learning increased student enrollment and satisfaction. Similarly, Oluwalola et al. (2022) posited that the integration of blended learning into its curriculum, leveraging its robust IT infrastructure to enhance teaching and learning. Munawar et al. (2023) also proclaimed that blended learning as an instructional approach that combines online and face-to-face learning environments, providing a flexible framework that leverages the strengths of both modalities, it could be considered as a possible solution to the outlined challenges. Therefore, the ability for the learners to engage with course materials at their own pace they can understand complex topics, revisit challenging materials, and engage in peer-to-peer collaboration through blended learning approach.

On the issue of effect of blended learning on students’ engagement, the findings disclosed that there is statistically significant difference in the effect of blended learning on students’ engagement in public universities in North-West Nigeria. This corresponds with Alsalhi et al. (2019) who indicated that blended learning can positively affect students' learning engagement and improves the student learning experience. Zhou et al. (2019) also highlighted that research has consistently demonstrated that blended learning can lead to increased student engagement and improved academic performance. According to Lalima and Dangwal (2017), undergraduate students who participated in a blended course reported significantly greater levels of competence and comfort in putting into practice what they learned than similar students enrolled in an online course only.

Finally, on the issue of students’ motivation and engagement, the result of the finding demonstrates a statistically significant effect in the relationship among blended learning, students’ motivation and engagement in public universities in North-West Nigeria. This is in line with Clark et al. (2018) who in their study on blended learning and the flipped model used in the design of lessons in numerical methods courses at three engineering programs, discovered how blended learning enhanced understanding and a motivation for learning among students interviewed in focus groups. This is also corroborated by Yagci (2016) who indicated that blended learning model has a positive effect on students’ motivation for learning. Similarly, blended learning allows for multimedia presentations, discussion forums, and interactive assessments that cater to diverse learning preferences which eventually support learner’s interest and motivation, particularly in a setting where traditional lecture-based methods may struggle to engage students fully (Bryan & Volchenkova, 2016). Also, on students’ engagement, Alsalhi et al. (2019) had earlier highlighted how blended learning can positively affect students' learning engagement and improves the student learning experience.

**5. CONCLUSION**

This study has revealed the positive perception of undergraduate students towards the incorporation of blended learning in public universities in North-West Nigeria. The study has also shown how blended learning could be essential in enhancing students’ motivation and engagement which could be imperative in students’ learning process. Conclusively, modern pedagogical approach in teaching and learning process such as blended learning which has been observed to enhance students’ engagement and motivation, and could equally improve students learning experiences, critical thinking ability, academic performance, and heighten readiness to learn should as a matter of necessity be given the necessary environment and support by various public university managements to strive in North-West Nigeria. Which could as a matter of fact go a long way in enhancing students’ engagement and motivation to learn and possibly improve their academic performance.

**6. RECOMMENDATIONS**

Based on the findings of this research study, the following are the recommendations:

1. Blended learning approach should be implemented, incorporated and made compulsory for teaching and learning process by the various public university managements in North-West Nigeria.
2. Lecturers in the various public universities in North-West Nigeria should encourage and ensure that students’ participate fully in a blended learning approach since it could enhance students’ engagement.
3. Divergent methodology to blended learning approach such as flipped classroom and inverted classroom should be encouraged in order to enhance and stimulate Students motivation.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

**REFERENCES**

Alsalhi, N., Qatawneh, S., Eltahir, M. E., & Aqel, K. (2019). Does blended learning improve academic

achievement of undergraduate students in the mathematics course? A case study in higher education.

*Eurasia Journal of Mathematics*, *Science and Technology Education* 17 (4):em1951 DOI:

10.29333/ejmste/10781

Akinbode, M., & Alaka, M. (2020). Blended learning in Nigerian universities: A case study of the

University of Lagos. *African Journal of Educational Technology*, 10(1), 45-56.

Bond, M., & Bedenlier, S. (2019). Facilitating student engagement through educational technology:

Towards a conceptual framework *Journal of Interactive Media in Education*. Retrieved from

https://jime.open.ac.uk/articles/10.5334/jime.528/

Bryan, A., & Volchenkova, K. (2016). Blended learning: definition, models, implications for higher

education. *Bulletin of the South Ural State University Series Education, Education Sciences*, *8*(2), 24–

30. <https://doi.org/10.14529/ped160204>

Clark, R., Kaw, R., Lou, Y., Scott, A., & Besterfield-Sacre, M. (2018). Evaluating blended and flipped

instruction in numerical methods at multiple engineering schools. *International Journal for the*

*Scholarship of Teaching & Learning*, 12(1), 1-16.

Diffang, A. D., Mansur S., & Mohammed, H. M. (2024). Information and Communication Technology:

A Panacea for Addressing Teaching and Learning Pedagogy Among Teachers Using Fifth Generation

Technology in 21st Century Nigeria. *International Journal of Social Sciences and Management*

*Research,* E-ISSN 2545-5303. DOI: 10.56201/ijssmr.v10.no8.2024.pg386.394

Eze, S. C., Chinedu-Eze, V. C., & Bello, A. O. (2018). The utilisation of e-learning facilities in the

educational delivery system of Nigeria: A study of M-University. *International Journal of Educational*

*Technology in Higher Education*, 15(1), 34.

Gidado, B. K., Apeh, H. A., & Diffang, A. D. (2024). The implementation of virtual learning pedagogy

as perceived by lecturers and students of public and private universities in North-central Nigeria.

*International Journal of Current Science (IJCSPUB)* www.ijcspub.org*.* ISSN: 2250-1770.

Gidado, B. K., & Diffang, A. D. (2024). Enhancing graduate employability skills and self-reliance through

problem-solving and creative thinking among undergraduate students of public universities in North-

Central Nigeria*. Gulf Journal of Advance Business Research,* ISSN 3078-5294 (Online), ISSN 3078-

5286. DOI: https://doi.org/10.51594/gjabr.v2i6.50

Kola, A. J., Opeyemi, A. A., Sunday, O. S., & Tayo, O. O. (2021). Nigerian higher education research

and the challenges of sustainable development. *American Journal of Creative Education*, *4*(1), 1–9. <https://doi.org/10.20448/815.41.1.9>

Lalima, & Dangwal, K. L. (2017). Blended learning: an innovative approach. *Universal Journal of*

*Educational Research*, *5*(1), 129–136. <https://doi.org/10.13189/ujer.2017.050116>

Müller, C., Mildenberger, T., & Steingruber, D. (2023). Learning effectiveness of a flexible learning study

programme in a blended learning design: why are some courses more effective than others?

*International Journal of Educational Technology in Higher Education*, *20*(1). <https://doi.org/10.1186/s41239-022-00379-x>

Munawar, U., Khan, A. R., Suleman, Q., & Ali, M. M. (2023). Blended Learning’s Effects on Teenagers’

Secondary-Level Academic Performance in the matter of Chemistry. *VFAST Transactions on*

*Education and Social Sciences*, *11*(1), 231–245. <https://doi.org/10.21015/vtess.v11i1.1458>

Okoye, R., & Arimonu, M. O. (2016). Technical and vocational education in Nigeria: issues, challenges

and a way forward. *Journal of Education and Practice*, *7*(3), 113–118. Retrieved from <http://files.eric.ed.gov/fulltext/EJ1089786.pdf>

Szadziewska, A., & Kujawski, J. (2017). Advantages and disadvantages of the blended-learning method

used in the educational process at the faculty of management at the university of Gdansk, in the opinion

of undergraduate students. *ICERI Proceedings*, *1*, 3938–3946. <https://doi.org/10.21125/iceri.2017.1051>

Tomović, A. (2021). Engagement Theory based Interpretative Phenomenological Analysis of Computer

Science Students’ Perceptions of Their Learning Engagement Using Mobile Devices. Culminating

Projects in Higher Education Administration. 52. https://repository.stcloudstate.edu/hied\_etds/52

Yagci, M. (2016). Blended learning experience in a programming language course and the

effect of the thinking styles of the students on success and motivation. *The Turkish*

*Online Journal of Educational Technology*, 15(4), 32-45.

Yusuf, M. O., & Afolabi, A. O. (2020). Effects of computer-assisted instruction on secondary school

students' performance in biology. *Turkish Online Journal of Educational Technology*, 19(1), 22-

29.

Zhou, X., Chen, L., & Chen, C. (2019). Collaborative Learning by Teaching: A Pedagogy between

Learner-Centered and Learner-Driven. *Sustainability*, *11*(4), 1174. <https://doi.org/10.3390/su11041174>