

Research Article

Blended Learning via WhatsApp: Enhancing Academic Performance of Secondary School Students in Physics

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Abstract

This study investigated the impact of using WhatsApp as a blended learning tool on the academic performance of physics students in Nigeria. Guided by three research questions and three null hypotheses, the study employed a quasi-experimental design to explore the relationship between variables. A sample of 100 respondents was selected for the study in an intact class settings. The findings revealed that students taught with blended learning tools performed significantly better than those in traditional classrooms. Additionally, male students exposed to blended learning tools performed better than their female counterparts, although the difference was not statistically significant. Similarly, urban students exposed to blended learning tools performed better than their rural counterparts, but the difference was not statistically significant. The study suggests that blended learning is an effective strategy for teaching and learning. The use of blended learning resources encourages and motivates students to learn, enhancing their performances. Well-packaged lessons on blended learning resources offer flexibility and accommodate students with different learning styles. Based on these findings, it is recommended that physics teachers be encouraged to utilize blended learning tools in schools. Furthermore, physics teachers should be gender-sensitive when adopting new teaching strategies, and the government should provide equal opportunities to both urban and rural schools.

Keywords

Academic Performance, Blended Learning, Secobdary School, WhatsApp, Physics

1. Introduction

Education is seen as the bedrock of a knowledge for any society. Hence no society can develop more than its educational sector. Quality of education is in the classroom and it takes a well-equipped environment and a skillful teacher with a good teaching method to get the best out of a learner. The primary purpose of teaching at any level of education is to bring a fundamental change in the learner through various teaching and learning methods as cited by [1]. The effectiveness of this teaching and learning process largely depends on the choice of the teacher's teaching method.

Whalen alludes that effectiveness of a teaching method is reflected in the outcome of the teaching-learning process inform of marks, grades and mean scores. as cited in as cited by [1]. The most important indicators of the effectiveness of teaching can be the academic performance of learners, which can be influenced by different factors such as learning methods and individual motivation [2]. One of the challenges students face in classroom today is lack of motivation, especially in science related subjects, such as physics due to boredom from the expository teaching Hence the researcher

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adopts blended learning resource, which is a method. This paper also compared the performance of students based on gender and school location. Hence, it utilises an innovative method known as blended learning with WhatsApp platform.

Blended learning also called hybrid learning is a formal education Programme in which a student learns at least in part through delivery of content in classroom and instruction via digital and online media with some element of student control over time, place or pace [3]. It is an approach to education that combines online educational materials and opportunities for interaction online with traditional on site-based classroom methods. The important features of blended learning environment are;

(i) student engagement in learning (ii) enhanced teacher and student interaction (iii) responsibility for learning (iv) time management (v) improved student learning outcomes (vi) time flexibility (vii) enhanced institutional reputation (viii) more flexible teaching and learning environment. The researcher utilises WhatsApp platform as blended learning tool for the teaching-learning process. Bani identified effectiveness of blended learning in improving students' achievement in the third grade's science in the traditional method, the findings indicated the presence of statistically significant differences in the post-achievement due to the teaching method in favor of the experimental group [4].

A study by Sivakuma & Selvakumar on blended learning package effectiveness on students' performance and retention in higher secondary physics course revealed a significant difference in the post-test scores of experimental and control groups and significant difference in the retention test scores of experimental and control groups [5]. A research conducted by Chan & Leung on the use of social media to facilitate communication and collaboration among users to support the student-centered learning environment, in this study, Twitter was used to support blended learning activities in two university courses. A survey revealed that Twitter is user-friendly and effective for sharing knowledge among learners, but its text-based format limits interaction. Additionally, students prefer popular social media platforms like Facebook for communication [6]. In a study carried out in Ghana, it was found that the use of WhatsApp has a positive effect on the academic performance of students so long as the dominant use is for study related purposes [7].

WhatsApp on the other hand, is one of the most popular social media platforms among the students. WhatsApp is an American freeware, cross-platform centralized messaging and voice-over-IP (internet protocol) service owned by Facebook, Inc. It allows users to send text messages and voice messages, it make voice and video calls, and share images, documents, user locations, and other content. WhatsApp's client application runs on mobile devices but is also accessible from desktop computers, as long as the user's mobile device remains connected to the Internet while they use the desktop app. To register for the service, users must provide a valid mobile phone number. The researcher also compared

academic performance based on gender and location.

Academic performance is typically evaluated through examinations or continuous assessments, but there is ongoing debate about the best methods and most important aspects to focus on, such as practical skills (procedural knowledge) versus factual knowledge (declarative knowledge). According to Onyenma in a study which found that blended learning increased the performance of Physics students who participated in the study, also found out that the performances of students were not dependent on their gender. In my view, blended learning is a learning style whereby students combine the conventional face to face learning method with online learning strategies [8]. Chinwendu & Abraham revealed that blended learning increased the performance of Physics students who participated in the study. It was also found that the performances of students were not dependent on their gender [9]. The result of (Thelal revealed statistical significant differences in achievement between the two groups, indicating that the experimental group (blended learning) performed better than the control group (traditional classroom), significant differences were also found in the respective groups' motivation to learn English [10]. A study that investigated the effect of flipped hybrid learning model on academic achievement among SS II students in Physics in Akwa Ibom North -West Senatorial District in Akwa Ibom State, Nigeria showed that the use of flipped hybrid learning model which is a type of blended learning enhanced students' academic achievement in physics. The study also showed a significant difference in mean achievement scores of students based on school location. Hence the researchers concluded that the use of flipped hybrid learning models enhanced students' academic achievement [11].

Gender is defined as a personal conception of oneself as male or female [12]. The concept of gender role is closely tied to gender identity, which is a personal and internal sense of being male, female, or something else. Gender identity is shaped by a mix of inherent and external factors, while gender role refers to the visible ways people express their gender through behavior, appearance, and social expectations. For instance, a person who identifies as male and prefers masculine pronouns has a male gender identity. Gender roles, on the other hand, are the societal expectations and responsibilities associated with being male or female, shaped by family, culture, and society. Gender role, on the other hand, is manifested within society by observable factors such as behaviour and appearance. The concept of gender also includes the expectations held about the characteristics, aptitudes and likely behaviours of both women and men (femininity and masculinity) [13]. Nnamani & Oyibe revealed that the mean achievement score of female secondary school students was higher than the mean achievement scores of male students [14].

Adigun studied the relationship between student's gender and academic performance in computer science in New Bussa, Borgu local government of Niger state, uses a questionnaire

which consist of 30 multiple-choice items drawn from Senior School Certificate Examination past questions as set by the West Africa Examination Council in 2014 multiple choice past question was used as the research instrument consist. A study found that male students performed slightly better than female students, but the difference was not significant. However, private schools had a more pronounced advantage in terms of male student performance. Based on these findings, the study recommends that parents provide equal access to quality education for their children regardless of gender. Additionally, the government should implement policies to encourage more female students to pursue computer science education. Finally, education stakeholders should use these findings to develop gender-sensitive policies and explore ways to address gender disparities [16]. Ogbianigene investigated the effect of gender on students' academic achievement in secondary school Social Studies and revealed that gender had no significant effect on students' achievement in Social Studies and there was significant interaction effect of treatment and gender on students' academic performance in Social Studies [15].

School location is the geographical location of the school. It may be classified into urban and rural. An urban area is the region surrounding a city, characterized by high human population density and extensive development, including residential and commercial buildings, transportation infrastructure, and other structures. In other words, urban areas are densely populated and heavily developed regions around cities, with a high concentration of human-made structures and infrastructure. Urban area can refer to towns, cities, and suburbs. Rural area in the other hand refer to as a geographic area that is located outside towns and cities. The Health Resources and Services Administration of the United States Department of Health and Human Services defines the word rural as all population, housing, and territory not included within an urban area. Whatever is not urban is considered rural. Awodun findings showed that there was no statistical significant difference in the academic achievement mean scores of male and female students in the urban rural school areas [17]. A study by Effiom found no significant difference in the mean performance scores between urban and rural school students [18].

The study adopted Connectivism theory by George Siemens (2004). According to Siemens, "Connectivism is a learning theory for the Digital Age. In Connectivism, learning is a process that occurs based upon a variety of continuously shifting elements. The starting point of learning is the individual who feeds information into the network, which feeds information back to individuals who in turn feed information back into the network as part of a cycle. Because there is so much information available in the connected network and the information is changing rapidly, it is very important for an individual to be able to filter content to determine which information is valuable to the user. Not only does the individual have to filter content, but also the belief

that the new information can change thinking so that future decisions are based on the latest information. Principles of connectivism are that learning and knowledge rests in diversity of opinions. Learning is a process of connecting specialized nodes or information sources. Learning can extend beyond human capabilities, and the ability to acquire new knowledge is more important than what is currently known. Building and maintaining connections is essential for continuous learning. Recognizing relationships between ideas, fields, and concepts is a vital skill. Connectivist learning aims to provide up-to-date knowledge, and decision-making is a learning process in itself. The meaning of new information is interpreted through the lens of a constantly changing reality, where what is correct today may not be tomorrow due to shifts in the information landscape. Connectivism offers a pedagogical approach that enables learners to connect with each other through social networking and collaboration tools, recognizing that learning is too complex to be limited to individual brains. Instead, we need to rely on a network of people and technology to access, store, and apply knowledge. Learning is multifaceted, and the approach used depends on the specific task at hand."

1.1. Statement of the Problem

It is a fact that students' academic performance is not very encouraging in external examination due to poor performance especially in physics and other science subjects. This is evident in the result of 2021 unified tertiary matriculation examination (UTME) as reported by Premium Time [19]. From past experience as a classroom teacher, I have witnessed many factors hindering student's academic performance, especially in Abak Local Government Area, some of them maybe; inability of teachers to be innovative in chosen teaching method that suit the students and subject, laziness in the part of students, students are also distracted by social media engagement. The nature of motivation and learning strategy used is vital to improving student learning outcomes [20].

Isa, opined that most of the teachers' methods of teaching have a great effect on students' academic performance, hence, student-centered method and teacher-student interactive method were recommended in order to improve students' academic performance [21]. Students can be motivated when they are well engaged with social media, in spite of its distractions.

1.2. Purpose of the Study

(1). to find out the difference in academic's performance of SS II physics students exposed to blended learning and those in traditional classroom.

(2). to find out the difference in academic performance of male and female SS II physics students exposed to blended learning.

(3). to find out the difference in academic performance of urban and rural SS II physics students exposed to blended learning.

1.3. Research Questions

(1). what is the difference in academic performance between SS II physics students exposed to blended learning and those in traditional classroom?

(2). what is the difference in academic performance of SS II physics students exposed to blended learning based on gender?

(3). what is the difference in academic performance of SS II physics students exposed to blended learning based on school location?

1.4. Research Hypotheses

Ho1: The academic performance between SS II physics students exposed to blended learning and those in traditional classroom do not differ significantly.

Ho2: The academic performance between male and female SS II physics students exposed to blended learning do not differ significantly.

Ho3: The academic performance between urban and rural SS II physics students exposed to blended learning do not differ significantly.

2. Materials and Methods

2.1. Design

This study is a quasi- experimental pre-test-post-test non randomised control group design. This design was considered suitable since intact class setting was used to observe the effect of treatment on students' academic performance.

2.2. Population of the Study

The population of this study comprised of 670 senior secondary two physics students in all the 11 public secondary schools in Abak Local Government Area of Akwa IbomA total of 100 respondents formed the sample size of the study, which comprises of 60 males and 40 females. Purposive sample technique was used in selecting schools from the target population. The researcher-made instrument called Physics Performance Test (PPT) was used for the study. The

PPT contained 20 multiple - choice items. The items were constructed based on the topics Speed, Velocity and Acceleration. The 20 multiple questions had options (A-D) with only one correct option. Each correct option carried 5 marks, making a total of 100 marks. The PPT on Speed, Velocity and Acceleration was used in measuring the performance of students in both pre and post- tests.

The instrument PPT was subjected to face validation by three validates; one from the department of Educational Technology and Library Science, one validate from the department of Educational Foundations, Measurement and Evaluation and one validate from the department of science Education, Physics unit, all in the faculty of Education, University of Uyo.

2.3. Reliability of the Instrument

In order to establish reliability, PPT was administered to 20 respondents who were not part of the main study but equivalent in all aspects to the students in the main study. The scores obtained from these respondents was analysed to determine internal consistency of the instrument. Split half method was adopted to arrange the responses for analysis. Pearson Product Moment Correlation (PPMC) was used in determining the correlation between the two halves; the r-value of (0.78) was converted using Spearman Brown Prophecy formula to have reliability co-efficient of (0.85). The instrument was therefore considered to be highly reliable and useful in collecting the required data for the study.

Physics Performance Test was administered to senior secondary two physics students in the selected schools in the study area by the researcher and research assistants as pre-test before the experimental procedure and the students were post-tested after the treatment which lasted for two weeks. A total number of 100 copies of PPT was administered, retrieved and used for analysis.

Mean and standard deviation were used in answering the research questions while analysis of covariance (ANCOVA) was used in testing the hypotheses at 0.05 level of significance.

3. Research Findings and Discussion

Findings of research question one is presented on [Table 1](#) below;

Table 1. Mean and Standard Deviation of Pre-test and Post-test Scores of Students' Performance in Physics taught using Blended Learning Tool and Those Taught with traditional Method.

Group	N	Pre-test		post-test		Mean Gain	Mean Diff.
		X	Sd	X	Sd		
Treatment	40	48.72	12.55	63.97	12.9	15.18	4.52
Control	60	42.17	14.42	52.83	10.66	10.66	

N=100

Data on Table 1 indicates that pre-test mean of 48.72 and post-test mean of 63.97 for students taught physics using blended learning tool, with standard deviation of 12.55 and 12.9 respectively.

The table also shows the pre-test mean of 42.17 and post-test mean of 52.83 for students taught physics using

expository method, with standard deviation of 14.42 and 11.11 respectively. The mean difference between the two group is 4.52. This shows that students taught with blended tool did better than those taught with expository method.

Findings of research question two is presented on Table 2 below;

Table 2. Mean and Standard Deviation of Pre-test and Post-test Scores of male and female Students' Performance in Physics taught using Blended Learning Tool.

Group	N	Pre-test		post-test		Mean Gain	Mean Diff.
		X	Sd	X	Sd		
male	23	48.83	13.73	64.87	12.71	16.04	2.39
female	17	48.59	11.17	62.24	11.17	13.65	

N=40

Data on Table 2 indicates that pre-test mean of 48.83 and post-test mean of 64.87 for male students taught physics using blended learning tool, with standard deviation of 13.73 and 12.71 respectively.

The table also shows the pre-test mean of 48.59 and post-test mean of 62.24 for female students taught physics

using blended learning resource, with standard deviation of 11.17 and 11.17 respectively. The mean difference between the two group is 2.39. This shows that male students did a little better than their female counterpart.

Findings of research question three is presented on Table 3 below;

Table 3. Mean and Standard Deviation of Pre-test and Post-test Scores of Urban and Rural Students' Performance in Physics taught using Blended Learning Tool.

Group	N	Pre-test		post-test		Mean Gain	Mean Diff.
		X	Sd	X	Sd		
Rural	23	48.83	13.73	64.87	12.71	16.04	1.49
Urban	20	59.4	8.02	73..95	7.17	14.55	

N=43

Data on Table 3 reveals that the pre-test mean of 48.83 and post-test mean of 64.87 for the rural students taught physics using blended learning tool, with standard deviation of 13.73 and 12.71, respectively.

The table also indicates the pre-test mean of 59.4 and

post-test mean of 73.95 for the urban students taught physics using blended learning tool, with standard deviation of 8.02 and 7.17, respectively. The mean difference between the two groups was 1.49. This shows that urban students did a little better than their rural counterparts.

3.1. Findings of Research Hypothesis 1 Is Presented on Table 4 Below

Table 4. Summary of ANCOVA Analysis of Students in Physics Taught with Blended Learning Tool and Those Taught with traditional Method.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Square
Corrected Model	19644.690	2	9822.348	1117.551	.000	.958
Intercept	1863.106.	1	1863.106	211.977	.000	.686
Pre	16705.384	1	16705.384	1900.678	.000	.951
Group.	528.767	1	528.767	60.161	.000	.383
Error	852.550	97	8.789			
Total	348368.000.	100				
Corrected Total	20497.240	99				

a. R Squared =.958 (Adjusted R Squared =.958)

Table 4 shows F-value of 60.161 and p-value of 0.000 at 0.05 level of significance. Since the p-value is less than 0.05 ($p < 0.05$), therefore the null hypothesis of no significant difference in academic performance between physics students exposed to blended learning strategies and those in

conventional classroom is rejected. Hence there is a significant difference in academic performance between physics students exposed to blended learning strategies and those in conventional classroom.

3.2. Findings of Research Hypothesis 2 Is Presented on Table 5 Below

Table 5. Summary of ANCOVA Analysis of Male and Female Physics Students Taught with Blended Learning Tool.

Source.	Type III Sum. of Squares	df	Mean Square	F	Sig.	Partial Eta Square
Corrected Model	5110.909	2	2555.455	137.692	.000	.882
Intercept	377.790	1	377.790	20.356	.000	.355
Pre	1070.809	1	1070.809	57.697	.000	.609
Group	17.346	1	17.346	.935	.340	.025
Error	686.691	37	18.559			
Total	169126.000	40				
Corrected Total	5797.600	39				

a. R Squared =.882 (Adjusted R Squared =.875)

Table 5 indicates F-value of 0.935 and p-value of 0.340 at 0.05 level of significance. Since the p-value is greater than

0.05 ($p > 0.05$), therefore the null hypothesis of no significant difference in academic performance between male and female physics students exposed to blended learning resource do not

differ significantly is upheld. Hence there is no significant difference between male and female physics students exposed to blended learning strategies.

3.3. Findings of Research Hypothesis 2 Is Presented on Table 6 Below

Table 6. Summary of ANCOVA Analysis of Rural and Urban Physics Students Taught with Blended Learning tool.

Source	Type III Sum. of Squares	df	Mean Square	F	Sig.	Partial Eta Square
Corrected Model	5135.245	2.	2567.622	143.431	.000	.886
Intercept	918.686	1	918.6863	51.319	.000	.581
Pre	5084.371	1	5084.371	284.019	.000	.885
Group	41.681	1	41.681	2.328	.136	.059
Error	662.355	37	17.901			
Total	169126.000.	40				
Corrected Total	5797.600	99				

a. R Squared = .886 (Adjusted R Squared = .880)

Table 6 shows F-value of 2.328 and p-value of 0.136 at 0.05 level of significance. Since the p-value is greater than 0.05 ($p > 0.05$), therefore the null hypothesis of no significant difference in academic performance between urban and rural physics students exposed to blended learning strategies is upheld. Hence, there is no significant difference between urban and rural physics students exposed to blended learning strategies.

4. Discussions

The findings of this study is in line with Sivakuma & Selvakumar (2019), whose study revealed that blended learning significantly improves students' achievement and retention capacity. This finding also agrees with Chinwendu & Abraham (2020), which found that blended learning increased the performance of Physics students. Thelal (2018) conducted a study on the effects of using a blended learning method on students' achievement and motivation to learn English, the study found the strategies to have motivated students, which agrees with this study.

The study is also inline with the investigation by Etukakpan et al. (2022) on effects of flipped hybrid learning model and academic achievement of secondary school, which was positive. This findings also agrees with Awodun, et al. (2018) and Effiom, et al. (2017) whose found no significant difference in the mean performance scores between urban and rural school students.

On the contrary, the findings is in contrast to Nnamani & Oyibe (2016), whose results revealed that the mean achievement score of female secondary school students was

higher than the mean achievement scores of male students. This differences maybe as a result of subject tested and method of teaching.

5. Conclusions and Recommendations

The main purpose of this study was to find out the effect of blended learning via WhatsApp on academic performance of students. Based on the findings, it is concluded that:

1 Students taught with blended learning tool performed significantly better than those taught with conventional method.

2 Male students exposed to blended learning strategies performed academically better than their female counterpart, though not significantly.

3 Urban students taught with blended learning strategies performed academically better than their rural counterpart, though not significant.

The implications of this study is that blended learning is a strategy found to be effective in teaching and learning processes. The use of blended learning resource motivates students thereby enhancing performance. A well package lesson on blended learning resource offers flexibility to students and accommodate students with different learning styles.

Based on findings and conclusion drawn, the following recommendations are made to improve students' academic performance in physics.

(1). Physics teachers are encouraged to utilise flexible teaching method like blended learning resource for students'

improved performance.

(2). Physics teachers should always be gender sensitive when introducing a new teaching strategy in classroom.

(3). Government should provide equal opportunity to both urban and rural schools when providing infrastructure and distribution of resources to schools.

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Author Contributions

Uduak Abel Etukakpan is the sole author. The author read and approved the final manuscript.

Ethical Statement

This research was carried out with full compliance with ethics. Consent forms were given to correspondence and the ethical committee approved of the different institutions approved it before proceedings.

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Conflict of Interest

The author declares no conflicts of interest.

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