



VillageMath Educational Review

An International/Multidisciplinary Journal of
Network for Grassroots Science and Mathematics
Education (The VillageMath Network)

A publication of VillageMath Educational Services
(CAC RC: 4097888)

Volume 6, Issue 1

October, 2024

CODEN: VERIAU

Effect of Blended Learning Instructional Strategy on Students' Interest and Achievement in Basic Science and Technology in Upper Basic Schools in Zone A Benue State, Nigeria

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DOI: <https://doi.org/10.5281/zenodo.13935146>

Article History: Received 26th September, 2024; Revised 10th October, 2024; Published 15th October, 2024.

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How to Cite this Article:

Ityobee, S., Okwara, O. K., Jirgba, M. C. & Atsuwe, B. A. (2024). Effect of Blended Learning Instructional Strategy on Students' Interest and Achievement in Basic Science and Technology in Upper Basic Schools in Zone A Benue State, Nigeria. *VillageMath Educational Review (VER)*, 6(1), 166-180. <https://ngsme.villagemath.net/journals/ver/v6i1/ityobee-okwara-jirgba-atsuwe>

Abstract

This study investigated the effect of blended learning instructional strategy on students' interest and academic achievement in Basic Science and Technology in Zone A, Benue State, Nigeria. The study adopted quasi-experimental non-randomized pretest posttest control group design. The study was guided by three research questions and three hypotheses. The population of the study was 3041 Basic VIII students from 85 co-educational public secondary schools which cut across the seven local government areas in Education Zone A, Benue State. A sample of 361 students (180 males and 181 females) was drawn from 14 schools. The study is made up of two groups: the experimental and the control groups. The

experimental group was taught using blended learning instructional strategy while the control group was taught using the traditional method. The Instruments used for data collection were Basic Science and Technology Interest Rating Scale (BSTIRS) and Basic Science and Technology Achievement Test (BSTAT). The reliability of BSTIRS was ascertained using Cronbach Alpha which yielded a reliability coefficient of .89 while the reliability of BSTAT was established at 0.84 using Kuder-Richardson formula 21. Mean and standard deviation were used to answer research questions while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The findings revealed that there is a significant difference in the mean interest ratings of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using traditional method. There is a significant difference in the mean achievement scores of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using traditional method in favour of the experimental group however, there is no significant difference in the mean achievement scores between male and female Upper Basic students taught Basic Science and Technology using blended learning instructional strategy. The study concluded that blended learning instructional strategy increases students' interest and improves students' academic achievement than the traditional method. Based on the findings of this study, it was recommended that curriculum developers and educators should consider adopting blended learning instructional strategy which combines digital and interactive elements with traditional teaching methods to increase student interest and academic achievement in Basic Science and Technology.

Keywords: Science Education, ICT, Blended Learning, Interest, Academic Achievement, Gender, Basic Science and Technology

Introduction

Science is an important enterprise which all nations of the world depend on as a hub for socio-economic development and technological advancement. It is imperative therefore that every individual should have some basic knowledge and skills of science in order to live successfully in this modern age that is dominated by scientific and technological ideas, as well as understanding their products and processes. No wonder, Turner (1997) in Ebele and Mangut (2015) view science firstly as representing one end of a vital pipeline which channels science-oriented students from secondary to postsecondary institutions. Secondly, as a pipeline that will eventually culminate in the provision of highly trained scientific and technological personnel who may by and large, contribute to economic development of the nation and global competitiveness.

Today, science applications are widely used by various stakeholders, including students, trainers, academic staff and information and communication technology staff (Alsabawy, Cater-Steel & Soar 2016). Basic Science and Technology (BST) is not an exception. BST is a science subject taught at Upper Basic school level. Basic Science and Technology (BST) is a subject in which concepts and principles are drawn from the areas of Biology, Chemistry and Physics. Omiko (2016) defines BST as science in which concepts and principles are presented so as to express the fundamental unity of scientific thoughts and avoiding premature or undue stress on the distinction among various scientific fields. This entails that BST principles and concepts are related and so can be taught as integrated

and related concepts. It offers basic training in the scientific skills required for human survival, sustainable development and societal transformation.

Basic Science and Technology (BST) is considered to be the foundation for further studies in Science, Technology and Engineering. Nwafor (2012) and Oka (2015) observed that BST is a subject taught at both public and private schools at the Upper Basic level. It is a foundation to the study of sciences at the senior secondary school level. Consequently, since the introduction of the subject in Nigeria Basic Education curriculum, it has suffered some challenges towards its effective implementation prominent among which is the shortage of instructional materials in teaching and learning of the subject. It is hoped that with the incorporation of ICT in the education sector for classroom instructional delivery, it will bring relief in the shortage of materials because students can easily access the learning materials online using the internet. BST is not an exception for the integration of ICT tools for its lesson delivery. When technology is integrated into classroom lessons, students are interested in the subject, and this can only be achieved through the application of teaching strategy like blended learning that will fully engage and place the learner at the centre of the learning process (Henderson, 2020).

Information and Communication Technology (ICT) has become an important aspect of life in all the sectors of the economy. Therefore, the application of ICT like blended learning in the educational sector is believed to have revolutionized the methods of teaching and learning in all the subjects' areas. This has prompted educational institutions and experts in curricula to introduce radical changes in their policy and educational planning to respond and align with this change and development (Choshin & Ghaffari, 2017). Information and Communication Technology is defined as any communication device or application, encompassing radio, television, cellular phone, computer and network hardware, software and satellite systems as well as the various services and applications associated with them such as videoconferencing and distance learning (Margaret, 2015).

There is a broad range of technological equipment such as computers, media player 3 and 4 (MP3/MP4), storage devices, satellites, world wide web (WWW), videos, compact disk (CD), floppy disks and flash drives which are used in ICT thereby providing many opportunities to make learning more fun and enjoyable in terms of teaching same things in new ways. Information and communication technology has introduced interactive and engaging teaching strategies that capture students' attention and foster a deeper understanding of the subject matter. Unfortunately, the teaching and learning of BST in Upper Basic schools have been challenging to both teachers and students. The development to which according to Achor and Ityobee (2020) can be attributed to lack of resources to prepare for BST lessons, innovative teaching strategies and the confidence to teach topics outside the expertise of the teacher are the major challenges facing BST subject. Therefore, bringing teaching strategies that will place the learner at the centre of learning while incorporating ICT in teaching and learning is key to increasing students' interest and achievement hence the need for blended learning instructional strategy.

Blended learning is a style of education in which students learn through electronic and online media as well as traditional face-to-face teaching. Blended learning is a student-centered learning method (Vasileva-Stojanovska, 2015) that combines traditional face-to-

face classrooms with e-learning activities (Attard & Holmes, 2020; Kerzic Tomazevic, Aristovnik & Umek, 2019).

Blended learning through virtual classrooms can bring abstract concepts to life, making learning more interesting and retentive. Blended learning in this regard helps in connecting classrooms across the world. Blended learning consists of five components, of which two are face-to-face and three are online (Alammary, 2019). Basic Science and Technology is not an exception for the integration of ICT tools for its lesson delivery. When technology is integrated into classroom lessons, students are interested in the subject, and this can only be achieved through the application of teaching strategy like blended learning that will fully engage and place the learner at the centre of the learning process (Henderson, 2020). Students' interest in teaching and learning remains inevitable to enhance achievement.

Interest refers to activities or things a person likes or dislikes (Okoro in Ndudi & Chinedu, 2016). Interest is the feeling one has in wanting to know or learn more about something (Agogo & Achor, 2014). Students' interest in the subject is a powerful driving factor that triggers and promotes learning and is considered essential for academic success. It is characterized by increased attention, effort, experienced in any particular moment, as well as an enduring predisposition to reengage with a particular object or topic over time. Students' interest in the learning tasks determines their learning styles and cognition, which in turn determines their mean terminal cognitive achievement (Ndudi & Chinedu, 2016).

The presence of interest ensures active and meaningful engagement in a classroom when appropriate teaching strategies are used which is key to academic success (Georgia & Kallery, 2021). The major determinant of students' interest in the learning task on any subject matter is the existing instructional system or teaching methods adopted by teachers especially in science-based subjects like Basic Science and Technology. Students' poor academic achievement in some subjects in the views of Ndudi and Chinedu (2016) may be related to lack of interest and commitment to their studies and use of conventional "talk and chalk" method rather than strategies that involve students' participation. Consequently, students lose interest in learning and hence low academic achievement.

Academic achievement of Upper Basic Schools students is an important factor affecting the achievement of higher education goals (Zhu, 2016). Academic achievement is a direct manifestation of learning effectiveness and a valid indicator to evaluate the effectiveness of teaching. Achievement refers to the completion and attainment of a certain level that a student can achieve after a series of education or training (Lamas, 2015). Academic achievement in a narrow sense refers to the measured performance of students through examinations at a certain study stage. It is the result obtained through study which represents performance outcomes that indicate the extent to which a student has accomplished specific goals that were the focus of activities in instructional environments, specifically in school, college, and university (Cai & Cao, 2019 in Zheng & Mustapha, 2022).

Poor achievement is attributed to students lack of interest in the subject on the part of students, insufficient textbooks and instructional materials (Ogbu, 2018). To address the poor achievement of students, efforts have been made by science education scholars

towards making BST simple and interesting. This has not yielded the desired result. In order to fully achieve the aims of education as enunciated by the Federal Republic of Nigeria, through its National Policy on Education (NPE, 2013), educational activities should be learner-centered for maximum self-development, self-fulfillment and teaching should be practical (activity-based); experiential and ICT-supported. The poor academic achievement of male and female students is linked primarily to the fact that the concepts taught are not retained by learners (Jackman & Morrain-Webb, 2019). These gender differences in academic achievement have attracted the attention of so many scholars in the education sector.

Gender is another factor that could influence students' interest, achievement and retention in a subject. It is a variable that has so much effect on both teachers and students in the teaching and learning processes. Gender is a psychological experience of being a male or female (Oyibe, 2016). It has to do with personality and central components of self-concept. Unlike sex, which is concerned with, only the distinction between male and female based on biological characteristics, gender encompasses other personality attributes as roles, orientation and identity based on individual's conceptualization of self.

Gender differences in academic achievement have been of great concern to researchers and education policy makers, both at local and international levels. It is one of the current academic issues under deliberations all over the world (Abdu-Raheem, 2012). Today, equality between boys and girls has become a major scourge plaguing the world, particularly in developing countries and also in sciences. In society today, girls are looked at as second-class citizens, which does not help nurture their careers in sciences (Abdu-Raheem, 2012).

Studies about gender difference in science education has remained inclusive as some studies reported men outperforming their female counterparts whereas other findings showing female performing higher than their male counterparts in science educations (Olasehinde & Olatoye, 2014; Bursal, 2013), whereas other studies like (Oludipe, 2014) indicated no difference in the achievement between male and female students in science education. Therefore, the inconsistent in the findings on gender and students' interest and academic achievement has called for more research efforts and innovative teaching and learning strategies like blended learning that could help address the gender gap between male and female students in science education.

Statement of the Problem

Students' learning remains central in any academic achievement debate. It is obvious that society has changed from what it used to be, and this has led to the change in teaching methodologies also in schools. The traditional teaching methodologies where the teacher is at the centre can no longer meet up with changes in society. With the advent of ICT, modern teaching methodologies that focus on promoting critical thinking and enhance students' interest to improve achievement with the learner at the centre are being encouraged and implemented all over the world (Karanezi, Rapti & Halimi, 2015). Sadly, Basic Science and Technology at Upper Basic level is still taught with the traditional method of teaching. This has resulted in students not having proper understanding of the concepts taught thereby

leading to students' low interest in the subject and subsequent poor academic achievement. This calls for the need to adopt teaching strategies that will improve the academic achievement of students in the subject hence the need to incorporate modern teaching learning strategies like blended learning. Thus, the problem of this study is to investigate the effect of blended learning instructional strategy on students' interest and academic achievement in Basic Science and Technology in Upper Basic schools in Zone 'A' Benue State, Nigeria.

Research Questions

The following research questions raised guided the study:

- i. What are the mean interest ratings of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using traditional method in Zone A, Benue State?
- ii. What is the mean achievement of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using the traditional method in Zone A, Benue State?
- iii. What is the mean achievement of male and female Upper Basic students taught Basic Science and Technology using blended learning instructional strategy in Zone A, Benue State?

Research Hypotheses

The following null hypotheses formulated were tested at 0.05 level of significance:

- i. There is no significant difference in the mean interest ratings of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using lecture method in Zone A, Benue State.
- ii. There is no significant difference in the mean achievement scores of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using the traditional method in Zone A, Benue State.
- iii. There is no significant difference in the mean achievement scores of male and female Upper Basic students taught Basic Science and Technology using blended learning instructional strategy in Zone A, Benue State.

Methodology

The study adopted quasi-experimental non-randomized pretest posttest control group design. The population of the study was 3041 Basic eight students from 85 co-educational public secondary schools which cut across the seven local government areas in Education Zone A, Benue State. A sample of 361 students (180 males and 181 females) was drawn from 14 schools using multi-stage sampling technique. The Instruments used for data collection were Basic Science and Technology Interest Rating Scale (BSTIRS) and Basic Science and Technology Achievement Test (BSTAT). The BSTIRS contains 20 items on a Likert-like scoring scale of Strongly Agree (SA=4 points), Agree (A=3 points), Disagree

(D=2 points) and Strongly Disagree (SD=1 point). The BSTAT contains 30 multiple objectives questions that were developed using some topics in Basic Science and Technology. Since the instruments were developed by the researchers, they were subjected to face and content validation by three experts: one in Measurement and Evaluation and two in Science Education. The validated instruments gave the reliability coefficient of 0.89 for BSTIRS using Cronbach Alpha and 0.84 for BSTAT using Kuder Richardson formula 21. The study was divided into two groups. The groups were Experimental Group (E.G) and the Control Group (C.G). The E.G were taught using the blended learning instructional strategy while the C.G were taught using the traditional method. Mean and standard deviation scores were used to answer research questions while Analysis of Covariance (ANCOVA) was used to test the null hypotheses at 0.05 level of significance.

Results

Results of the study are presented according to research questions and hypotheses posed.

Research Question One

What are the mean interest ratings of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using traditional method in Zone A, Benue State?

Table 1: Mean and Standard Deviation of Interest Ratings of Upper Basic Students taught Basic Science and Technology using Blended Learning Instructional Strategy and those taught using Traditional Method

Method	N	Pre-interest		Post-interest		Mean gain
		Mean	δ	Mean	δ	
Blended learning	183	2.02	.842	3.36	.672	1.34
Traditional Method	178	1.92	.732	2.40	.929	0.48
Mean difference		0.10		0.96		0.86

Table 1 shows the mean interest ratings of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using traditional method. Students taught using blended learning instructional strategy have a pre-interest mean score of 2.02 with a standard deviation of .842 and post-interest mean scores of 3.36 with standard deviation of .672 respectively. While students taught using traditional method had mean scores of 1.92 with standard deviation of .732 at pre-interest and post-interest mean scores of 2.40 with standard deviation of .929 respectively. The table further shows the mean gain of 1.34 for students taught using blended learning instructional strategy and a mean gain of 0.48 of students taught using traditional method. The mean difference between the groups was 0.86 in favour of students taught using blended learning instructional strategy. This implies that students taught using blended learning instructional strategy had higher mean interest as compared to students taught using traditional method.

Research Question Two

What is the mean achievement of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using lecture method in Zone A, Benue State?

Table 2: Mean Scores and Standard Deviation of Mean Achievement of Upper Basic Students taught Basic Science and Technology using Blended Learning Instructional Strategy and those taught using Traditional Method

Method	N	Pre-test		Post-test		Mean gain
		Mean	δ	Mean	δ	
Blended Learning	183	20.40	6.54	35.41	8.78	15.01
Lecture Method	178	19.00	6.21	30.94	8.04	11.94
Mean Difference		1.40		4.47		3.07

Table 2 shows the mean achievement scores of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using traditional method. Students taught using blended learning instructional strategy had a pre-test mean scores of 20.40 with a standard deviation of 6.54 and post-test mean scores of 35.41 with standard deviation of 8.78. While students taught using traditional method had a mean score of 19.00 with standard deviation of 6.21 at pre-test and post-test mean scores of 30.94 with standard deviation of 8.04. The table further shows the mean gain of students taught using blended learning instructional strategy had a mean gain of 15.01 whereas students taught using traditional method had a mean gain of 11.94. The mean difference between the groups was 3.07 in favour of students taught using blended learning instructional strategy. This implies that students taught using blended learning instructional strategy had higher mean achievement scores as compared to students taught using traditional method.

Research Question Three

What is the mean achievement of male and female Upper Basic students taught Basic Science and Technology using blended learning instructional strategy in Zone A, Benue State?

Table 3: Mean Scores and Standard Deviation of Achievement of Male and Female Upper Basic Students taught Basic Science and Technology using Blended Learning Instructional Strategy

Gender	N	Pre-test		Post-test		Mean gain
		Mean	δ	Mean	δ	
Male	101	20.97	6.66	36.22	9.62	15.25
Female	82	19.17	6.25	34.41	7.56	15.24

Mean Difference	1.8	1.81	0.01
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Table 4 shows the mean achievement scores of male and female Upper Basic students taught Basic Science and Technology using blended learning instructional strategy in Zone A, Benue State. Male students taught using blended learning instructional strategy had mean achievement scores of 20.97 with a standard deviation of 6.66 at pre-test and post-test mean scores of 36.22 with a standard deviation of 9.62; while female students taught using blended learning instructional strategy had mean achievement scores of 19.17 with standard of 6.25 at pre-test and post-test scores of 34.41 with a standard deviation of 7.56. The mean difference between the mean achievement scores of male and female students taught using blended learning instructional strategy was 0.01. This mean difference was in favour of male students, though it was a slight difference.

Research Hypothesis One

There is no significant difference in the mean interest ratings of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using traditional method in Zone A, Benue State.

Table 5: ANCOVA Tests of Mean Interest rating scores of Upper Basic Students taught Basic Science and Technology using Blended Learning Instructional Strategy and those taught using Traditional Method.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	83.557 ^a	2	41.779	63.704	.000
Intercept	424.260	1	424.260	646.908	.000
Preinterest	.090	1	.090	.138	.711
Method	83.495	1	83.495	127.312	.000
Error	234.786	358	.656		
Total	3326.000	361			
Corrected Total	318.343	360			

Table 5 reveals that $F(1,360) = 127.312, p = 0.000 < 0.05$. Since the p-value (0.000) is less than the level of significance (0.05), the null hypothesis which states that there is no significant difference in the mean interest ratings of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using traditional method was rejected. This implies that there is a significant difference in the mean interest ratings of Upper Basic students taught Basic Science and Technology using blended

learning instructional strategy and those taught using traditional method in Zone A, Benue State.

Research Hypothesis Two

There is no significant difference in the mean achievement scores of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using traditional method in Zone A, Benue State.

Table 6: ANCOVA Tests of Mean Achievement scores of Upper Basic Students taught Basic Science and Technology using Blended Learning Instructional Strategy and those taught using Traditional Method

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	1830.945 ^a	2	915.473	12.882	.000
Intercept	39694.578	1	39694.578	558.541	.000
Pretest	31.227	1	31.227	.439	.508
Method	1830.123	1	1830.123	25.752	.000
Error	25442.473	358	71.068		
Total	425368.000	361			
Corrected Total	27273.418	360			

Table 6 reveals that $F(1,360) = 25.752, p = 0.000 < 0.05$. Since the p-value (0.000) is less than the level of significance (0.05), the null hypothesis which states that there is no significant difference in the mean achievement scores of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using traditional method was rejected. This implies that there is a significant difference in the mean achievement scores of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using traditional method in Zone A, Benue State.

Research Hypothesis Three

There is no significant difference in the mean achievement scores of male and female Upper Basic students taught Basic Science and Technology using blended learning instructional strategy in Zone A, Benue State.

Table 11: ANCOVA Tests of Mean Achievement Scores of Male and Female Upper Basic Students taught Basic Science and Technology using Blended Learning Instructional Strategy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	157.377 ^a	2	78.688	1.021	.362
Intercept	20442.377	1	20442.377	265.201	.000
Pretest	10.225	1	10.225	.133	.716
Gender	133.996	1	133.996	1.738	.189
Error	13874.885	180	77.083		
Total	243488.000	183			
Corrected Total	14032.262	182			

Table 8 reveals that $F(1,182) = 1.738$, $p = .189 > 0.05$. Since the p-value (1.89) is greater than the level of significance (0.05), the null hypothesis which states that, there is no significant difference in the mean achievement scores of male and female Upper Basic students taught Basic Science and Technology using blended learning instructional strategy was not rejected. This implies that, there is no significant difference in the mean achievement scores of male and female Upper Basic students taught Basic Science and Technology using blended learning instructional strategy in Zone A, Benue State.

Discussion

The first finding reveals that there is a significant difference in the mean interest ratings of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using traditional method. The findings of this study indicate that, students who were taught Basic Science and Technology using blended learning strategy showed more interest compared to students taught using traditional method. This finding agrees with Asseke and Fabinu (2022) who found that, Blended learning approach is more effective in promoting and arousing students' interest and enthusiasm in learning than the conventional lecture method. Similarly, Adeleye and Atinuke (2020) found that, blended learning enhanced the interest of students than the conventional strategy. Therefore, students' interest in Basic Science and Technology can be enhanced through the use of blended learning instructional strategy.

The second finding revealed that there is a significant difference in the mean achievement scores of Upper Basic students taught Basic Science and Technology using blended learning instructional strategy and those taught using traditional method in Zone A, Benue State. This means that Upper Basic students who learned Basic Science and Technology through blended learning instructional strategy achieved higher compared to those taught using traditional method. This finding corroborates Abidoye (2015) who found that, blended learning instructional approach was more effective in improving students' achievement than the traditional teaching method. Similarly, Green and Owo (2021) also found that, blended learning strategy significantly improved students' achievement better than the traditional method. In the same vein, Saritepeci and Çakır (2015) found that, blended learning environment had a significant increase in academic achievement of students.

The third finding revealed that, there is no significant difference in the mean achievement scores of male and female Upper Basic students taught Basic Science and Technology using blended learning instructional strategy in Zone A, Benue State. The finding depicts that gender does not significantly influence the effectiveness of blended learning instructional strategy. This agrees with Amogne, (2015), Olasehinde and Olatoye (2014), Oludipe (2014), and Jack (2013) whom in their separate studies found no significant difference between male and female students' academic achievement. Similarly, Okoronka (2018); Chawla (2015); Cheronon (2021) in Umar, Lameed and Ayodel (2022) found no significant difference in the achievement of male and female students. Therefore, both male and female students can effectively be taught using blended learning instructional strategy.

Conclusion

Based on the findings of this study, it was concluded that students taught Basic Science and Technology using blended learning instructional strategy had higher interest and higher achievement scores than those taught using the traditional method. It was also concluded that blended learning instructional strategy enhance equal academic achievement of male and female students in Basic Science and Technology.

Recommendations

The following recommendations were made from the findings of the study:

- i. Curriculum developers and educators should consider adopting blended learning instructional strategy which combines digital and interactive elements with traditional teaching methods to increase student interest and achievement in Basic Science and Technology.
- ii. Policymakers and schools should consider implementing blended learning instructional strategies more widely to enhance students' academic achievement in Basic Science and Technology at the Upper Basic level.
- iii. The Ministry of Education should work with curriculum developers to create and implement blended learning materials that cater for the diverse interests and learning preferences of both male and female students.
- iv. Basic Science and Technology teachers should adopt the use of blended learning instructional strategy to enhance equal academic achievement of male and female students because it is proven to favour both gender groups.

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