

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

**Ityobee Seember<sup>1</sup>, Jirgba Mbakohol Christy<sup>2</sup>, Janet Ngunan Adzape<sup>3</sup>**

<sup>1&2</sup>Department of Integrated Science Education Joseph Sarwuan Tarka University Makurdi, Nigeria

<sup>3</sup>Department of Chemistry Education Joseph Sarwuan Tarka University Makurdi, Nigeria

**Corresponding author:** mikaseityobee@gmail.com

### Abstract

The study investigated the effect of blended learning instructional strategy on students' retention in Basic Science and Technology in Zone A, Benue State, Nigeria. The study adopted quasi-experimental research design. The population was 3041 Basic eight students from 85 schools. A sample of 361 students (180 males and 181 females) from 14 schools. The instrument used for data collection was Basic Science and Technology Retention Test (BSTRT). Mean and standard deviation was used to answer research questions while ANCOVA was used to test the hypotheses at 0.05 level of significance. The findings showed that blended learning significantly improved retention scores compared to traditional methods, favoring the experimental group, while retention scores did not differ significantly between male and female students taught using blended learning. Based on the study's findings, it was recommended that curriculum developers and educators adopt the blended learning instructional strategy, which integrates digital and interactive components with traditional teaching methods, to enhance knowledge retention in Basic Science and Technology.

**Keywords:** ICT, Blended learning, Gender, Retention, Basic Science and Technology

### Introduction

The focus on students' learning is fundamental to any discussion about academic success. It is clear that society has evolved from its past state, and this shift has also brought about changes in teaching methods within schools. Traditional teacher-centered teaching methods are no longer able to keep up with the changes in society. The rise of ICT has led to the global adoption of modern teaching methods that prioritize critical thinking and improve knowledge retention, with the learner placed at the center of the learning process (Karanezi, Rapti & Halimi, 2015). Unfortunately, Basic Science and Technology at the Upper Basic level is still being taught using traditional teaching methods. As a result, students struggle to fully grasp the concepts being taught, which leads to poor knowledge retention. This highlights the need to adopt teaching strategies that enhance students' knowledge retention in the subject, making it essential to incorporate modern approaches like blended learning. Therefore, the focus of this study is to examine the effect of blended learning instructional strategies on students'

retention in Basic Science and Technology in Upper Basic schools in Zone 'A' of Benue State.

With advancement in Information and Communication Technology (ICT) at present is influencing every aspect of human life. ICT is playing salient roles in work places, business, entertainment and education. Moreover, many people recognized ICT as a catalyst for change; change in working conditions, handling and exchanging information, teaching methods, learning approaches, scientific research and in accessing information communication technologies (Ratheeswari, 2018). In this digital era, ICT use in the classroom is important for giving students opportunities to learn and apply the required 21<sup>st</sup> century skills. In the views of Osang (2012), ICTs is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware, software, satellite systems as well as the various services and applications associated with them such as videoconferencing and distance learning. These electronic systems can be used for broadcasting, telecommunications and all forms of computer-mediated communications including

teaching in a classroom. Consequently, ICT has strengthened teaching and learning of Basic Science as it provides resources and services for students and teachers thereby enabling them to meet their educational needs. It also allows for networking between students and teachers to facilitate exchange of ideas and improve opportunities for connecting schools to the world as learning is expanding beyond the classroom (Dotimi & Hamilton-Ekeke, 2013).

The importance of Basic Science and Technology in science education can not be over emphasized. This is because Basic Science and Technology is the sole foundation to which all other science subjects and courses including other science related disciplines are built upon. Basic Science and Technology as a subject in the Nigerian curriculum comprises Basic Science, Basic Technology, Physical and Health Education and Computer Studies/Information and Communication Technology. Basic Science and Technology enable learners to apply scientific and technological knowledge and skills to meet contemporary societal needs. It also enables learners to acquire basic knowledge and skills in science and technology and to become prepared for further studies in the area of science and technology among others (FRN, 2013).

Basic Science is defined as a 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 (Omiko (2016) Sinha (2018) defines Basic Science as the scientific disciplines of Physics, Chemistry, Biology and Mathematics 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. It is therefore hope that with the aid of blended learning in communicating instructions to the learner, learning in this way will make the material more interesting and meaningful (Rona, 2017).

Blended learning is described as a formal education programme in which a student learns at least in part through online learning that is at least in part at a supervised brick-and-mortar location away from home and face-to-face traditional teaching and learning method (Christensen, Horn & Staker, 2013). Kuo, Blland, Schroder and Walker (2014), defines blended learning as an approach that combines face-to-face interactions with technology-based learning. Science teaching becomes all the more challenging

in the case of integrating technological tools and techniques into process of learning. In this context, blended learning has its relevance in enriching the quality of learning science by tapping the wide potentialities of providing more flexible ways of learning through online mode and the richness of the 'social presence' in the classroom. This is established in a study by Akgündüz and Akınoğlu (2017) on the impact of blended learning and social media-supported learning on the academic success and motivation of the students in Science Education whose results of the study revealed that blended learning increases academic success and motivation for learning science meaningfully. Similarly, Green and Owo (2021) investigated the effect of blended learning instructional strategy on junior secondary students' academic achievement in Basic science in Obalga, Rivers State and found that the blended learning strategy significantly improved students' achievement better than the lecture method.

This democratization of information has leveled the playing field, enabling students from different backgrounds and locations to access the same knowledge resources through E-learning platform. Blended learning through multimedia presentations, videos, animations and simulations can bring abstract concepts to life, making learning more enjoyable and memorable and through virtual classrooms and online discussion forums will create opportunities for students from different regions, cultures and backgrounds to collaborate on projects, share ideas and learn from one another. This global interconnectedness fosters cultural understanding and appreciation, promoting a sense of global citizenship. Moreover, video conferencing tools enable virtual guest lectures and educational exchanges, connecting classrooms across the world. Students can communicate with experts, practitioners, and educators beyond their local community, enriching their learning experience with diverse perspectives (Vimalkumar, 2010). In the context of the rapidly developing scientific and technical revolution, the education and training sector has actively implemented tasks and solutions to enhance teaching, learning, assessment, scientific research and the application of ICT (Acosta Sisley, Ross, Brailsford, Bhargava, & Jacobs, 2018; Baris, 2015; Bray and Tangney, 2017; Diabat and Aljallad, 2020). All these could be possible through the aspect of ICT called blended learning. It should be noted that learners are individuals with different learning needs. Therefore, there is need to seek for a teaching strategy that will address the individual learners' needs such as blended learning strategy to enhance the retention of concepts better in the subject.

Retention is the ability to store and retrieve correctly the ideas, facts or concepts learnt. It is the major determinant of pupils' academic performance. High degree of attention to be attached to knowledge retention in Basic Science learning could be elucidated by taking into consideration the ease to forget what is learned. Dwelling on two different types of memory might help understand what is required for knowledge retention to take place (Allison, 2014). When a stimulus is perceived, it is first routed to primary memory with short-term storage. As long as adequate rehearsal takes place, long-term storage can be ensured. The necessity of rehearsal for the transfer of the newly acquired knowledge from short term memory to long term memory is highlighted particularly in information-processing approach to memory (Allison, 2014). Udo and Ubana (2013) define retention as a term used to describe the remembering of a fact or idea after a passage of time. It is only by demonstration of such retention that learning could be judged to have taken place. Meaningful learning is deemed to have taken place if after a passage of time; the students can recall and apply information which he/she had been taught previously. Therefore, students' retention of concepts refers to the idea or facts he or she has in his or her memory after he or she has been exposed to some learning experiences (Igbojinwaekwu & Dorgu, 2015). Retention of concepts or information by the students can be seen as having the information stored in long-term memory in such a way that it can be readily retrieved (Bennett & Rebello, 2012).

Retention is the term used to denote a demonstration that meaningful learning has taken place, maintained and sustained over time which can be proved through recall, recognition, recitation or practice (Abu & Flowers, 2019). However, abject retention was reported which has been ascribed to the use of old teaching strategies like expository and lecture methods that are usually teacher-centered, inflexible and restrictive for students' meaningful learning (Ameh, 2014). When blended learning strategy is incorporated at the Upper Basic level of education with audio-visual activities, it is likely that, students will get motivated and become autonomy of their learning and consequently lead to durable learning. Maccoun (2016) explored effect of blended instructional method on students' achievements and retention among the 5th graders in biology in Baghdad. The result indicated a significant difference in performance and retention in favour of the experimental group. Relatedly, Suleiman, Salaudeen and Falode (2017) investigated the effect of computer-based blended learning

strategy on secondary school chemistry students' retention in individualised and collaborative learning settings in Minna, Niger State, Nigeria. The study provides empirical evidence that the use of computer-based blended learning collaborative setting enhances students' retention in moles concept. Findings also revealed that gender does not influence students' retention where as in computer-based blended learning individualise settings and lecture methods where gender plays great impact on their retention ability.

Gender is another factor that could influence students' retention in a subject. It is a variable that has so much effect on both teachers and students in the teaching and learning processes. Singh (2010) opines that gender refers to a socio-cultural construct that connotes the differentiated roles and responsibilities of men and women in a particular society. Gender refers to the roles and relationships between men and women in a given context (Akper, Gire & Orshi, 2014). Gender refers to the socially constructed roles, behaviours, expressions and identities of girls, women, boys, men, and gender diverse people (The Canadian Institutes of Health Research, 2023). Gender issues in the context of education is referred to as the differences, both real and perceived between boys and girls and their relative achievements and opportunities (Mankumari & Ajay, 2017). There are studies on gender gaps in students' learning attitude, but these results are inconsistent. Edem and Anar (2021) investigated the effect of blended instructional strategy on students' achievement and retention in Chemistry in Uyo local government area, Nigeria. The result indicated a significant difference in the mean performance scores of Chemistry learners instructed using blended strategy than those instructed using expository method in favour of the experimental group. A significant difference existed in the mean retention scores of Chemistry learners taught chemical combination with blended strategy than those taught with expository strategy. Gender was found not to be statistically significant. Based on the result of the findings, it was determined that blended learning strategy improved students' achievement and retention in chemistry. The inconsistent in the findings on gender and students' retention of knowledge 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. Therefore, the problem of this study is to investigate the effect of blended learning instructional strategy on students' retention in Basic

Science and Technology in Upper Basic Schools Zone A, Benue State.

### Research Questions

The following research questions guided the study:

1. What are the mean retention 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?
2. What is the mean retention scores between male and female Upper Basic students taught Basic Science and Technology using blended learning instructional strategy in Zone A, Benue State?

### Hypotheses

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

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

### Research Method

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. In the first stage, purposive sampling was used to select public co-educational Upper Basic

schools with ICT facilities and computer-literate BST teachers as research assistants. In the second stage, two schools were randomly selected from each local government in Zone A using the Hat and Draw method, with one assigned as the experimental group and the other as the control group. The Instruments used for data collection was Basic Science and Technology Retention Test (BSTRT). The BSTRT contains 30 multiple choice objective test questions that were developed using some topics in Basic Science and Technology which include habitat, growth and development, chemicals, energy, work, power, and thermal energy. These were chosen because they align with the third-term syllabus, ensuring relevance and consistency with the curriculum. Conducting the fieldwork during the third term allowed the study to proceed without disrupting the school calendar, facilitating smooth integration into the academic schedule. Since the instrument was developed by the researchers, they were subjected to validation by three experts; one in Measurement and Evaluation and two in Science Education.

The study involved two groups: the Experimental Group (E.G), taught using blended learning, and the Control Group (C.G), taught using traditional methods. To ensure validity, both groups were taught by the same teachers with consistent duration and syllabus content. Classrooms were matched for similar learning environments, and pre-test scores were used to adjust for prior knowledge, ensuring differences in outcomes were due to instructional strategies.

The mean was used to answer the research questions, with no specific rule for interpretation; however, the group with the higher mean score was favored. For the Analysis of Covariance (ANCOVA), the null hypotheses were tested at a 0.05 level of significance. The decision rule was to reject the null hypothesis if the p-value was less than 0.05, indicating a statistically significant difference, and to retain it if the p-value was equal to or greater than 0.05.



## Results

**Table 1: Mean Scores and Standard Deviation of Retention of Upper Basic students taught Basic Science and Technology using Blended Learning Instructional Strategy and those taught using Traditional Method**

Method	N	Post - test		Retention		Mean gain
		Mean	SD	Mean	SD	
Blended learning	183	35.41	8.78	29.87	7.18	<b>5.54</b>
Traditional method	178	30.94	8.04	25.98	7.67	<b>4.96</b>

Table 1 shows the mean and standard deviation scores between the retention 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. Students taught using Blended learning instructional strategy had a posttest mean score of 35.41 with a corresponding standard deviation of 8.78 with a retention mean scores of 29.87 with a standard deviation SD= 7.18 while

students taught using traditional method had a posttest mean score of 30.94 and a standard deviation of 8.04 with a mean retention score of 25.98 and standard deviation scores of 7.67. The table further shows the mean difference in retention scores of 0.58 in favour of students taught using Blended learning instructional strategy. This implies that, students taught BST using Blended learning instructional strategy had higher retention test scores than students taught using traditional method.

**Table 2: ANCOVA Tests of the mean Retention 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	1417.144 <sup>a</sup>	2	708.572	12.841	.000
Intercept	15205.682	1	15205.682	275.572	.000
Posttest	50.804	1	50.804	.921	.338
Method	1148.713	1	1148.713	20.818	.000
Error	19753.959	358	55.179		
Total	303188.000	361			
Corrected Total	21171.102	360			

Table 2, shows that  $F(1, 360) = 20.818$ ,  $P = 0.000 < 0.05$ . Since the P value is less than the alpha value, the null hypothesis which states that, there is no significant difference in the mean retention 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 was rejected. This means that,

there is a significant difference in the mean retention 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. It was concluded that students taught using blended learning strategy had high retention scores than those taught using the traditional method.

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

Gender	N	Post test scores		Retention		Mean Gain
		Mean	SD	Mean	SD	
Male	101	36.22	9.62	30.38	7.08	5.84
Female	82	34.41	7.56	29.24	7.30	5.17

Table 3 shows the mean retention scores difference between male and female Upper Basic

students taught Basic Science and Technology using Blended learning instructional strategy in Zone A,

Benue State. The post mean scores of male students was 36.22 with a corresponding standard deviation of 9.62 with a mean retention scores of 30.38 with a standard deviation of 7.08 while female students had a post mean score of 34.41 with a corresponding standard deviation of 7.56 with a mean retention

scores of 29.24 and a standard deviation scores of 7.30. The table further shows the mean difference scores of 0.67 in favour of male students. This implies that, male students taught BST using Blended learning instructional strategy had higher retention test scores as compare to female students.

**Table 4: ANCOVA Tests of Mean Retention 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	95.096 <sup>a</sup>	2	47.548	.920	.400
Intercept	8213.763	1	8213.763	158.946	.000
Posttest	37.069	1	37.069	.717	.398
Gender	48.359	1	48.359	.936	.335
Error	9301.756	180	51.676		
Total	172660.000	183			
<b>Corrected Total</b>	<b>9396.852</b>	<b>182</b>			

Table 4 shows  $F(1,182) = .936, p = .335 > 0.05$ . Since the P value is greater than the alpha value, the null hypothesis which states that, there is no significant difference in the mean retention scores of male and female Upper Basic students taught Basic Science and Technology using Blended learning instructional strategy in Zone A, Benue State was not rejected. This implies that, both male and female Upper Basic students have equal retention ability when taught using Blended learning instructional strategy. Therefore, it was concluded that both male and female students have equal retention level when taught using blended learning strategy.

### Discussion of Findings

The first finding shows that, there is a significant difference in the mean retention 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 finding suggests that the interactive and multimodal nature of blended learning enhances student engagement and reinforces understanding, leading to improved long-term retention of knowledge compared to traditional teaching methods. This finding is in agreement with Akgunduz and Akinoglu (2017) who found that blended learning increases academic success and motivation for learning science meaningfully. Similarly, Green and Owo (2021) found that the blended learning strategy significantly improved students' achievement better than the lecture method.

The second finding revealed that, there is no significant difference in the mean retention scores of male and female Upper Basic students taught Basic Science and Technology using blended learning instructional strategy in Zone A, Benue State. This suggests that gender does not affect the effectiveness of blended learning instructional strategy. Blended learning is therefore not gender sensitive. This finding indicates that the blended learning instructional strategy is equally effective in enhancing retention for both male and female Upper Basic students, demonstrating its gender-neutral impact on learning outcomes in Basic Science and Technology. This finding agrees with Edem and Anar (2021) who found no significant difference between male and female students' retention. Similarly, Suleiman, Salaudeen and Falode (2017) found no significant difference between male and female students' retention.

### Conclusion

Based on the findings of this study, it was concluded that students taught Basic Science and Technology using blended learning instructional strategy had high retention of knowledge than those taught using the traditional method. It was also concluded that blended learning instructional strategy enhance equal retention of male and female students' knowledge in Basic Science and Technology, indicating that blended learning benefits both male and female students equally in terms of their ability to retain information.

## Recommendations

The following recommendations were made based on the findings of the study:

1. Basic Science and Technology teachers should confidently implement blended learning instructional strategy to improve students' level of retention of Basic Science and Technology concepts.
2. Basic Science and Technology teachers should adopt and effectively use blended learning instructional strategy because it is proven to enhance equal retention of knowledge for both male and female students. This approach ensures that all students can achieve their full academic potential in Basic Science and Technology.

## References

- Acosta, M.L., Sisley, A., Ross, J., Brailsford, I., Bhargava, A., & Jacobs, R. (2018). Student acceptance of e-learning methods in the laboratory class in Optometry. *Public Library of Science*, 13 (12), 1-14.
- Akper, G. I., Gire, P. T., & Orshi, A. (2014). Gender as a challenge to educational development in Nigeria: Ubuntu as an ethic for taking up the challenge. *Journal of Women in Academics*, 4(91), 316- 324.
- Allison, E. S. (2014). Memory retention in second language acquisition and instruction: Insights from literature and research. *The IAFOR Journal of Language Learning*, 1(1), 1-13.
- Baris, M.F. (2015). Future of e-learning: perspective of European teachers. *Eurasia Journal of Mathematical Scienc and Technology Education*, 11(2), 421–429.
- Cai, L., & Cao, Y. (2019). A literature review on the academic achievement of college students. *Journal of Education and Social Sciences*, 20 (1).
- Bray, A., & Tangney, B. (2017). Technology usage in mathematics education research. A systematic review of recent trends. *Journal of Computer Education*, 114, 255–273.
- Christensen, C. M., Horn, M. B. & Staker, H. (2013). *Is K-12 blended learning disruptive? An introduction to the theory of hybrids*. San Mateo, CA: Clayton. Christensen Institute for Disruptive Innovation.
- Diabat, O.M.A., & Aljallad, M.Z. (2020). The effectiveness of employing blended learning on sixth-grade students' achievements and reflective thinking skills development in Islamic education in the United Arab Emirates. *Journal of Multicultural Education*, 6 (5), 216–223.
- Dotimi, D.A. & Hamilton-Ekeke, J.T. (2013). Information and communication technology. E Learning in Nigerian tertiary institutions. *The Librarian and Information Manager*, 6(1), 44-59.
- Green, B., & Owo, W.J. (2021). Blended learning instructional strategy and junior secondary students' academic achievement in Basic science in Obalga, Rivers State. *Journal of Mathematics and Science Education*, 3(1), 33-38.
- Igbojinwaekwu, P.C., & Dorgu, T.E. (2015). Igbo language as medium of instruction and enhancement of retention level of pupils in primary school mathematics. *British Journal of Education*, 3(4), 21-36.
- Karanezi, X., Rapti, E., & Halimi, G. (2015). Traditional and modern teaching methodologies: Which one is more successful and what are the challenges? *Academic Journal of Interdisciplinary Studies*, 4 (2) 52.
- Kuo, Y., Belland, B. R., Schroder, K. E., & Walker, A. E. (2014). K-12 teachers' perceptions of and their satisfaction with interaction type in blended learning environments. *Distance Education*, 35(3), 360-381.
- Mankumari, P., & Ajay, T. (2017). Gender differences in the academic achievement of students. *Journal of Development and Social Engineering*, 3(1), 39-47.
- Omiko, A. (2016). An evaluation of classroom experiences of Basic science teachers in secondary schools in Ebonyi State of Nigeria. *British Journal of Education*, 4(1), 64-76.
- Osang, A. M. (2012). The challenge of information and communication technology (ICT) for Nigerian academic libraries. *Global Review of Library and Information Science*, 1(1), 84-93.
- Sinha, S. (2018). What is basic science? Retrieved on 3<sup>rd</sup> of August, 2023 from <https://www.researchgate.net/post/WhatisBasicScience>.
- Suleiman, A., & Tanimu, S. (2018). Effect of blended learning on performance and retention of senior secondary school students in english language, in Kaduna State, Nigeria. *Journal of Enhanced Research in Educational Development*, 2(4), 7-12.
- Abu, R. B., & Flowers, J. (2019). The effects of cooperative learning methods on achievement, retention, and attitudes of students in North Carolina. *Journal of*



- Vocational and Technical Education*, 13 (2), 16-22.
- Akgündüz, D., & Akinoğlu, O. (2017). The impact of blended learning and social media supported learning on the academic Success and motivation of the students in Science Education. *Journal of Education and Science*, 42, (191), 69-90.
- Ahmed, Y. (2014). Effect of field-trip on retention and academic achievement in ecology among secondary school students in Zaria, Nigeria. A master's thesis submitted to the school of postgraduate studies, Faculty of education, Ahmadu Bello University, Zaria. Retrieve on 6<sup>th</sup> July, 2018 from [www.Kubanni.abu.edu.ng/jspui/handle](http://www.Kubanni.abu.edu.ng/jspui/handle)
- Bennett, A. G., & Rebello, N. S. (2012) Encyclopedia of science of learning. Retrieved 11<sup>th</sup> July, 2023 from <https://link.springer.com>>...
- Edem, U.P., & Mary Ideba Anar, M.I. (2021). Blended instructional strategy and students' achievement and retention in Chemistry in UYO L.G.A, Nigeria. *Noble International Journal of Scientific Research*, 5(03), 22-28.
- Maccoun, H. S. (2016). The Effect of Using Blended Learning on the Achievement of Students and Information Retention of Fifth Graders in the Biology Course. *Rivers State University Faculty of Education Journal*, 22(95): 209-240.
- Rona, R. (2017). The effect of teaching critical thinking skill through problem solving technique toward students' writing skill in Stkip Adzkia Padang. *Journal of Handayani*, 7(2), 24-32.
- Ratheeswari, K. (2018). Information and communication technology in education. *Journal of Applied and Advanced Research*, 3(1), 45-47.
- Singh, R. (2013). Information and communication technology usage among distance learners and their academic performance: A Multidisciplinary Study. *International Journal of Enhanced Research in Educational Development*, 1(7), 7-12.
- The Canadian institutes of health research. (2023). *What is gender? What is sex?* ALSP publishers.
- Udo, N.N., & Ubana, U.A. (2013). Teaching physics for retention. *International Journal of Modern Management Sciences*, 2(1), 18-25.
- Vimalkumar, P. (2010). Effectiveness of blog-based learning in Physics at higher secondary level. Retrieved from: <https://sg.inflibnet.ac.in/handle/10603/205647>