MSI Journal of
Education and Social Science

Volume: 2, Issue: 4 (Oct-Dec 2026)
Published by *MSI Publishers*
ISSN 3107-5940 (Online)

Received: 25-10-2026
Accepted: 10-11-2026
Published: 18-11-2026

Students' Awareness and Engagement with Technology-Based Instructional Media on Academic Performance in Secondary Schools

Authors Details

Bright Godwin Udoetukudo[1]
Department of Science Education, Akwa Ibom State University.

Anyanime Okopide Akpan[2]
Department of Science Education, Akwa Ibom State University.

Edima Sylvanus Sunday[3*]
Department of Science Education, University of Uyo, Uyo.

Kartay, Radiance Amebe[4]
Department of Science Education, Akwa Ibom State University.

Corresponding Author: *Edima Sylvanus Sunday*

ABSTRACT: The study examined the awareness and students' engagement with technology-based instructional media on academic performance in secondary schools in Abak Local Government Area. The research design adopted for this study was correlational research design. The population of the study consisted of 1,281 senior secondary one students (SS1) in the ten (10) public secondary schools in the study area. The sample size for the study consisted of one hundred and twenty (120) students. Purposive sampling technique was adopted to select four (4) government secondary schools in the study Area. From each of the four purposively selected schools, thirty (30) students were also randomly sampled to participate in the study. The instrument used was Technology-Based Instructional Media Awareness and Engagement Questionnaire (TBIMAEQ). Also, second terminal result was used to determine the students' academic performance. The reliability

DOI: *10.5281/zenodo.24331025*

established using the Cronbach's Alpha method, which yielded a coefficient of 0.81, indicating that the instrument was reliable and suitable for the study. The data collected for the study were analyzed using Mean, Standard Deviation, and Pearson Product Moment Correlation (PPMC). The results of findings revealed that there is a significant relationship between students' awareness of technology-based instructional media and academic performance. There is a significant relationship between students' engagement with technology-based instructional media and academic performance. There is a significant relationship between students' combined awareness and engagement with technology-based instructional media and academic performance. It was recommended among others that students should be encouraged to embrace and actively engage with technology-based instructional media to supplement classroom teaching and enhance their academic performance.

Keywords: *Awareness, Engagement, Technology-Based, Instructional Media, Academic Performance*

Introduction

The world today resides in an ever-changing era in which new developments continue to emerge, particularly in the field of technology. These developments have increasingly influenced different aspects of human life, including the way knowledge is created, communicated and acquired. Education, as an important means of preparing individuals for participation in society, has consequently experienced considerable changes arising from technological advancement. The growing presence of digital technologies has created new possibilities for accessing information, presenting learning materials and supporting classroom instruction. Thus, the role of technology in education has continued to expand from the use of basic instructional resources to the integration of digital tools that can support different dimensions of teaching and learning (Arkorful et al., 2021). This development has also attracted increasing attention to the place of digital technologies in science, technology, engineering and mathematics (STEM) education, where technology can provide additional means of representing, communicating and exploring subject matter (Akpan, Itighise, & Umo, 2022).

The increasing influence of technology on education has placed greater responsibility on schools and teachers to respond to the demands of a technology-oriented society.

 DOI: *10.5281/zenodo.24331025*

Contemporary learners encounter technological resources in many areas of their daily lives, making their inclusion in educational settings increasingly relevant (Akpan et al., 2025a). Mobile devices, computers, internet resources and multimedia applications, for instance, have broadened the ways in which instructional materials can be presented and accessed (Moffat, et al., 2023). Educational technology devices can therefore serve as important resources for supporting instructional planning and delivery, particularly when they are appropriately incorporated into classroom activities (UmoAbasi et al., 2026; Atabang et al., 2026). The integration of such resources can also provide teachers with alternative means of presenting information and learners with additional opportunities to access instructional content. Consequently, technology in education should not be viewed merely as a collection of electronic devices, but as a means through which teaching and learning processes can be enriched (Chen, 2020; Arkorful et al., 2021; Akpan et al., 2022).

However, the educational value of technology does not depend solely on the availability of technological resources. The manner in which technology is selected, organized and incorporated into instruction is equally important. When technological resources are appropriately matched with instructional purposes and learners' needs, they can support interaction with learning materials and create opportunities for students to participate more actively in the learning process (Akpan, 2024; Ntegwung, et al., 2026). This is particularly important because effective technology integration should contribute to meaningful learning rather than simply introduce new devices into the classroom. Sharlovych et al. (2023) and Balalle (2024) emphasized the importance of purposeful technology integration in contemporary education, particularly in relation to learners' participation and learning experiences. Similarly, research on educational technologies and academic achievement has drawn attention to the potential contribution of technology-supported instructional environments to students' learning in science subjects (Umana & Akpan, 2024; Uboh et al., 2026). Evidence indicates that although digital technologies are available for STEM teaching and learning, the extent of their integration and students' competence in their use remain important considerations (Akpan et al., 2022). These considerations suggest that the educational significance of technology lies not only in its presence but also in how it is made meaningful within the teaching and learning process.

The development of technology-supported teaching has consequently contributed to a shift from exclusively conventional forms of classroom instruction toward approaches that

 DOI: *10.5281/zenodo.24331025*

incorporate digital and other technology-based resources. This shift is evident in secondary education, where teachers increasingly have opportunities to use technology to present concepts, demonstrate processes, provide learning materials and facilitate interaction with subject content (Adeyemi & Olayemi, 2020). Technology-based instruction may therefore be understood as the use of technological resources and applications as part of the process of planning, presenting, facilitating and supporting learning. Such instruction can take different forms, including computer-based visualization, modelling, computer-assisted instruction, animation, online learning environments and other technology-supported instructional resources (Itighise & Babayemi, 2023; Sunday, et al., 2025b). Other technology-based resources, including computer simulation, virtual reality and animated instructional materials, have also been examined within science education contexts (Atabang & Babayemi, 2023; Etukakpan et al., 2025; Umanah & Atabang, 2025). In science education, where learners are often required to understand abstract processes and concepts, these forms of instructional support can provide alternative representations that complement conventional classroom explanations. Studies on computer-based visualization and cloud-based e-learning within secondary school science contexts further demonstrate the growing relevance of technology-supported approaches to the teaching of subject content (Sunday et al., 2026; Ukpong et al., 2026).

Technology-based instruction can also provide learners with opportunities to encounter instructional content through different modes of presentation. Rather than relying exclusively on verbal explanations and printed materials, teachers can combine text, images, animations, simulations, visual representations and electronically delivered resources to support the presentation of concepts. Akpan (2026) described technology-based instruction as an approach capable of supporting learners' motivation, participation, creativity and problem-solving activities. The availability of these different forms of instructional media may be particularly useful when learning involves concepts that are difficult to observe directly or understand through verbal explanation alone. Computer-assisted instruction, computer animation and visualization, for example, can provide learners with additional representations of instructional content and may complement the teacher's explanation during classroom activities (Sunday et al., 2025a; Sunday et al., 2026). Similarly, computer simulation, animated instructional materials and virtual reality provide technology-supported ways of representing subject content and creating

 DOI: *10.5281/zenodo.24331025*

opportunities for learners to interact with instructional materials (Etukakpan at al., 2025; Umanah & Atabang, 2025; Atabang & Babayemi, 2023). Nevertheless, differences in access to technological resources, familiarity with their use and understanding of their educational purposes may influence the extent to which learners benefit from such media (Umoetuk, & Akpan, 2023; Kormos & Wisdom, 2023). This makes attention to learners' awareness of technology-based instructional media particularly important.

Awareness of technology-based instructional media refers to the extent to which students recognize, understand and have knowledge of the technological resources that can be used to support their learning. It involves more than simply seeing or having access to a technological device; it encompasses students' recognition of available instructional media and their understanding of how such media may be relevant to learning activities. Adeyemi and Olayemi (2020) drew attention to the importance of learners' knowledge and familiarity with educational technologies in the context of their use for learning. Research concerning knowledge, utilization and perception of emergent digital technologies in pedagogy likewise points to the importance of understanding technological resources as a basis for their meaningful use in educational settings (Akpan, 2024; Sunday, et al., 2025c). This position is further supported by research on awareness and utilization of Web 2.0 technologies among science teacher trainees in Akwa Ibom State, where awareness and utilization were examined as related aspects of engagement with technology for learning (Itighise, Akpan, & Babayemi, 2023). In this sense, awareness constitutes an important starting point for students' interaction with technology-based instructional media because learners are more likely to make meaningful use of resources when they recognize their availability, purpose and relevance to learning.

The importance of awareness becomes more apparent when considering the increasing range of technological resources available for educational purposes. A learner may have physical access to a computer, smartphone, internet resource or other instructional medium without necessarily understanding how that resource can contribute to learning. Awareness can therefore influence students' readiness to recognize and explore technology-based opportunities provided during instruction. It also has implications for equitable participation because differences in familiarity with technological resources may result in differences in how students respond to technology-supported learning activities. Usman

 DOI: *10.5281/zenodo.24331025*

and Sani (2019) emphasized the relevance of awareness in relation to the adoption and effective use of educational resources. In a similar vein, knowledge of available educational technologies and their possible applications can provide a foundation upon which learners develop more active forms of interaction with technology-based instructional materials. The study on awareness and utilization of Web 2.0 technology among science teacher trainees further illustrates the relevance of learners' awareness of technology to their utilization of technology-based resources for learning (Itighise, Akpan, & Babayemi, 2023). Thus, awareness should be considered not as an end in itself, but as one of the conditions that may support students' meaningful engagement with technology-based media.

Students' engagement with technology-based media concerns the degree to which learners actively and meaningfully participate in learning activities through technological instructional resources. Engagement may be reflected in students' attention to technology-supported learning materials, participation in activities, interaction with digital content, persistence in learning tasks and willingness to make use of available technological resources. Akpan et al. (2026) and Alabdulkareem (2021) noted the importance of learner engagement in understanding students' participation and involvement in educational activities. Akpan et al., (2025b) study on enhancing academic performance of students using print and electronic instructional resources noted that electronic /digital resources used in classroom interactions enhance students' engagement in activities and academic performance. When technology-based instructional media are incorporated into classroom instruction, students may be provided with additional opportunities to interact with subject content, explore representations, respond to learning tasks and participate in instructional activities. The integration of digital technologies in STEM teaching and learning has likewise been discussed in relation to their use as means of engaging students and supporting learning activities (Akpan et al., 2022). Borup et al. (2019) and Zhang (2020) similarly highlighted the relevance of students' engagement to technology-supported learning experiences. Therefore, while awareness concerns students' recognition and understanding of technology-based instructional media, engagement reflects the extent to which students actively involve themselves in learning through those media. The distinction between these two concepts is important because being aware of a technological

 DOI: *10.5281/zenodo.24331025*

resource does not necessarily mean that a student will actively engage with it or use it meaningfully for learning.

However, existing studies have largely focused on the availability, utilization, integration, or effectiveness of specific technology-based instructional media, with limited attention to the relationship between students' awareness and engagement with such media. In particular, there is insufficient empirical evidence on how students' awareness and engagement with technology-based instructional media relate to their academic performance at the secondary school level. Therefore, the present study seeks to fill this gap by examining the relationship among students' awareness, engagement with technology-based instructional media, and their academic performance.

Statement of the Problem

The rapid integration of technology in education has transformed the teaching and learning landscape, offering diverse opportunities for improving students' academic achievement, motivation, and engagement. However, one major issue contributing to poor performance among secondary school students is the limited awareness and inadequate engagement with technology-based instructional media. Many students are either unaware of the tools available to support their learning or lack the skills and motivation to use them effectively. This results in underutilization of digital resources that could otherwise enhance critical thinking, problem-solving, and overall academic performance. Although awareness of technology-based instructional media and student engagement with technology have been widely discussed in global educational research, few empirical studies have explored the two variables simultaneously within the Nigerian secondary school context. More so, while several studies have examined the general use of technology in teaching and learning, limited attention has been given to how students' awareness and engagement collectively shape their learning outcomes. This creates a knowledge gap, particularly in Akwa Ibom State, where technology integration in education is growing but unevenly distributed. The need for the study therefore arises from the recognition that the success of technology-driven instruction depends not only on the availability of digital tools, but also on how well students are aware of them and how actively they engage with them. The present study is designed to fill this gap by investigating the awareness of technology-based instructional

 DOI: *10.5281/zenodo.24331025*

media, students' engagement with technology-based media, and their relationship to students' academic performance in secondary schools in Abak Local Government Area.

Purpose of the Study

The purpose of this study was to investigate on the awareness and students' engagement with technology-based instructional media on academic performance in secondary schools in Abak Local Government Area. Specifically, the study sought to:

determine the relationship between students' awareness of technology-based instructional media and academic performance.

determine the relationship between students' engagement with technology-based instructional media and academic performance.

determine the relationship between students' combined awareness and engagement with technology-based instructional media and academic performance.

Research Questions

The following research questions were formulated to guide the study:

What is the relationship between students' awareness of technology-based instructional media and academic performance?

What is the relationship between students' engagement with technology-based instructional media and academic performance?

What is the relationship between students' combined awareness and engagement with technology-based instructional media and academic performance?

Hypotheses

There is no significant relationship between students' awareness of technology-based instructional media and academic performance.

There is no significant relationship between students' engagement with technology-based instructional media and academic performance.

There is no significant relationship between students' combined awareness and engagement with technology-based instructional media and their academic performance.

 DOI: *10.5281/zenodo.24331025*

Method

This study adopted the correlational research design. The study was conducted in Abak Local Government Area of Akwa Ibom State. The population of the study consisted of 1,281 senior secondary one student (SS1) in the eleven (11) public secondary schools in Abak Local Government Area. The sample size for the study consisted of one hundred and twenty (120) students. Purposive sampling technique was adopted to select four (4) government secondary schools in the study Area. The schools were chosen based on specific criteria such as the availability and use of technology-based instructional media, as well as accessibility to the researcher. From each of the four purposively selected schools, thirty (30) students were also randomly sampled to participate in the study.

The instrument used was Technology-Based Instructional Media Awareness and Engagement Questionnaire (TBIMAEQ). The instrument was developed by the researcher and consisted of two sections; Section A and B. Section A which sought to obtain personal data of the respondents and section B which consisted of 20 items with a four-point Likert scale. Also, second terminal result was used to determine the students' academic performance. The internal consistency of the instrument was then established using the Cronbach's Alpha method, which yielded a coefficient of 0.81, indicating that the instrument was reliable and suitable for the study. The data collected for the study were analyzed using Mean, Standard Deviation, and Pearson Product Moment Correlation (PPMC). The research questions were answered using Mean, Standard Deviation, and the R-value of the PPMC, which provided the degree of relationship between variables.

Results

Research Question One: What is the relationship between students' awareness of technology-based instructional media and academic performance?

Table 1: PPMC results on the relationship between students' awareness of technology-based instructional media and academic performance

Variables	N	Mean	SD	(r)
Awareness of technology-based	120	38.51	3.07	0.649
Academic Performance	120	69.51	14.62	

DOI: *10.5281/zenodo.24331025*

The results in Table 1 show the Pearson Product-Moment Correlation (PPMC) coefficient (r) for the relationship between students' awareness of technology-based instructional media and their academic performance. The mean score for students' awareness of technology-based instructional media was 38.51 with a standard deviation of 3.07, while the mean academic performance score was 69.51 with a standard deviation of 14.62. The correlation coefficient (r = 0.649) indicates a moderate to strong positive relationship between students' awareness of technology-based instructional media and their academic performance. Hence, students with higher awareness of technology-based instructional media tend to perform better academically. The results highlight the importance of integrating technology-based instructional media in education to enhance student learning and performance.

Research Question Two: What is the relationship between students' engagement with technology-based instructional media and academic performance?

Table 2: PPMC result on the relationship between students' engagement with technology-based instructional media and academic performance (n=120)

Variables	**N**	**Mean**	**SD**	**(r)**
Students Engagement	120	36.68	4.92	0.808
Academic Performance	120	69.51	14.62	

The results in Table 2 present the Pearson Product-Moment Correlation (PPMC) coefficient (r) for the relationship between students' engagement with technology-based instructional media and their academic performance. The mean score for students' engagement with technology-based instructional media was 36.68 with a standard deviation of 4.92, while the mean academic performance score was 69.51 with a standard deviation of 14.62. The correlation coefficient (r = 0.808) indicates a strong positive relationship between students' engagement with technology-based instructional media and their academic performance. This implies that students who actively engage with technology-based instructional media tend to achieve higher academic performance.

Research Question Three: What is the relationship between students' combined awareness and engagement with technology-based instructional media and academic performance?

 DOI: *10.5281/zenodo.24331025*

Table 3: PPMC result on the relationship between physics teachers' technological knowledge and students' academic performance in secondary schools (n=120)

Variables	N	Mean	SD	(r)
Awareness/Engagement	120	75.18	7.54	0.791
Academic Performance	120	69.51	14.62	

The results in Table 3 present the Pearson Product-Moment Correlation (PPMC) coefficient (r) for the relationship between students' combined awareness and engagement with technology-based instructional media and their academic performance. The mean score for students' awareness and engagement with technology-based instructional media was 75.18 with a standard deviation of 7.54, while the mean academic performance score was 69.51 with a standard deviation of 14.62. The correlation coefficient (r = 0.791) indicates a strong positive relationship between students' combined awareness and engagement with technology-based instructional media and their academic performance. This implies that students who are both aware of and actively engaged with technology-based instructional media tend to perform better academically.

Hypothesis One: There is no significant relationship between students' awareness of technology-based instructional media and academic performance.

Table 4: PPMC result on the relationship between students' awareness of technology-based instructional media and academic performance (n=120)

Variables	N	Mean	SD	(r)	P
Awareness of Technology-based	120	38.51	3.07	0.649*	0.000
Academic Performance	120	69.51	14.62		

*Correlation is significant at the 0.05 level (2-tailed).

The results in Table 4 present the Pearson Product-Moment Correlation (PPMC) coefficient (r) and p-value (P) for the relationship between students' awareness of technology-based instructional media and their academic performance. The mean score for students' awareness of technology-based instructional media was 38.51 with a standard deviation of 3.07, while the mean academic performance score was 69.51 with a standard deviation of 14.62. The correlation coefficient (r = 0.649) indicates a moderate to strong positive relationship between students' awareness of technology-based instructional media and their academic performance. The result also shows that the p-value (P = 0.000) is less

 DOI: *10.5281/zenodo.24331025*

than 0.05, meaning the relationship is statistically significant at the 0.05 level. Since the p-value is significant, the null hypothesis one of the study is rejected. Hence, there is a significant relationship between students' awareness of technology-based instructional media and academic performance. This implies that students with higher awareness of technology-based instructional media tend to achieve better academic performance, reinforcing the importance of technology integration in education.

Hypothesis Two: There is no significant relationship between students' engagement with technology-based instructional media and academic performance.

Table 5: PPMC result on the relationship between students' engagement with technology-based instructional media and academic performance (n=120)

Variables	**N**	**Mean**	**SD**	**(r)**	**P**
Students Engagement	120	36.68	4.92	0.808*	0.000
Academic Performance	120	69.51	14.62		

*Correlation is significant at the 0.05 level (2-tailed).

The results in Table 5 present the Pearson Product-Moment Correlation (PPMC) coefficient (r) and p-value (P) for the relationship between students' engagement with technology-based instructional media and their academic performance. The mean score for students' engagement with technology-based instructional media was 36.68 with a standard deviation of 4.92, while the mean academic performance score was 69.51 with a standard deviation of 14.62. The correlation coefficient (r = 0.808) indicates a strong positive relationship between students' engagement with technology-based instructional media and their academic performance. Also, the result shows that the p-value (P = 0.000) is less than 0.05, meaning the relationship is statistically significant at the 0.05 level. Since the p-value is significant, the null hypothesis two is rejected. Hence, there is a significant relationship between students' engagement with technology-based instructional media and academic performance. This suggests that students who actively engage with technology-based instructional media tend to perform better academically, emphasizing the role of technology-driven learning in enhancing student achievement.

Hypothesis Three: There is no significant relationship between students' combined awareness and engagement with technology-based instructional media and their academic performance.

 DOI: *10.5281/zenodo.24331025*

Table 6: PPMC result on the relationship between students' combined awareness and engagement with technology-based instructional media and their academic performance (n=120)

Variables	N	Mean	SD	(r)	P
Awareness/Engagement	120	75.18	7.54	0.791*	0.000
Academic Performance	120	69.51	14.61		

*Correlation is significant at the 0.05 level (2-tailed).

The results in Table 6 present the Pearson Product-Moment Correlation (PPMC) coefficient (r) and p-value (P) for the relationship between students' combined awareness and engagement with technology-based instructional media and their academic performance. The mean score for students' awareness and engagement with technology-based instructional media was 75.18 with a standard deviation of 7.54, while the mean academic performance score was 69.51 with a standard deviation of 14.61. The correlation coefficient (r = 0.791) indicates a strong positive relationship between students' combined awareness and engagement with technology-based instructional media and their academic performance. The p-value (P = 0.000) is less than 0.05, meaning the relationship is statistically significant at the 0.05 level. Since the p-value is significant, the null hypothesis three is rejected. Hence, there is a significant relationship between students' combined awareness and engagement with technology-based instructional media and academic performance. This implies that students who are both aware of and actively engaged with technology-based instructional media tend to achieve higher academic performance.

Discussion of Findings

The findings from analysis on the relationship between students' awareness of technology-based instructional media and academic performance indicate that a significant positive relationship exist between students' awareness of technology-based instructional media and their academic performance. This suggests that students who are more aware of technology-based instructional media tend to perform better academically. Awareness of these instructional tools likely enhances students' motivation, access to diverse learning resources, and engagement with course materials. The results align with previous studies such as Adeyemi and Olayemi (2020) and Usman and Sani (2019) who found that emphasize the importance of technology awareness in modern education, as students who recognize the benefits of technology are more likely to utilize it effectively for learning.

 DOI: *10.5281/zenodo.24331025*

The findings analysis of the relationship between students' engagement with technology-based instructional media and academic performance revealed a strong and significant relationship between students' engagement with technology-based instructional media and their academic performance. This implies that students who actively engage with technology-based instructional media, such as simulations, online resources, and digital learning platforms, demonstrate better academic outcomes. Increased engagement with technology may provide students with interactive and self-paced learning experiences that reinforce understanding and retention of subject content. The findings support the growing body of research such as Balalle (2024) and Owede (2024) that highlights the role of technology in fostering student academic performance, improving comprehension, and enhancing problem-solving skills. The findings from the analysis of the relationship between students' combined awareness and engagement with technology-based instructional media and academic performance indicate a significant and strong relationship between students' combined awareness and engagement with technology-based instructional media and their academic performance. This suggests that students who are both aware of and actively engaged with technology-based instructional media tend to achieve better academic success. Awareness alone may not be sufficient; actual engagement with these resources plays a crucial role in reinforcing knowledge and improving learning outcomes. The result agrees with Akpan et al., (2025a) and Balalle (2024) who found that integrating both awareness and active participation in technology-driven learning enhances students' ability to process information, apply concepts, and improve their overall academic achievement.

Conclusion

Based on the findings of this study, it was concluded that students' awareness and engagement with technology-based instructional media significantly influence their academic performance in secondary schools in Abak Local Government Area. The results further indicated that students who are more aware of and actively engaged with technology-based instructional media tend to perform better academically. This suggests that technology-based instructional media are not only relevant but also essential tools in enhancing students' learning outcomes in secondary schools.

 DOI: *10.5281/zenodo.24331025*

Recommendations

Based on the findings of the study, the following recommendations were made:

Students should be encouraged to embrace and actively engage with technology-based instructional media to supplement classroom teaching and enhance their academic performance.

Teachers should increase their use of technology-based instructional media in lesson delivery, ensuring that students are guided on how to maximize these tools for better learning outcomes.

Curriculum planners should incorporate the use of technology-based instructional media into subject curricula, making it a mandatory part of the teaching-learning process.

Government should provide adequate funding, infrastructure, and training programs for schools to adopt and sustain the use of technology-based instructional media effectively.

References

1. Adeyemi, A. O., & Olayemi, A. F. (2020). Awareness and utilization of information and communication technology (ICT) resources among secondary school students in Nigeria. *Journal of Education and e-Learning Research, 7*(2), 182–188.

2. Akpan, A. O. (2026). Assessment of Tech-Infused Pedagogical Innovations on Integrated Science Teaching

3. and Learning Among Tertiary Institution Pre-Service Teachers in Akwa Ibom State. *Zamfara International Journal of Education (ZIJE) DOI:* https://doi.org/10.64348/zije.2026499.

4. Akpan, A. O. (2024). Knowledge, utilization and perception of emergent digital technologies in

5. pedagogy by pre-service science teachers in Nigeria. *Journal of Institutional Research, Big Data Analytics and innovation, 1(1), 44 – 55.*

 DOI: *10.5281/zenodo.24331025*

6. Akpan, A. O., Atabang, A. A., & Udofia, S. E. (2025a). Online learning platforms and bridging of

7. digital knowledge gap among postgraduate students in Akwa Ibom State. *International Journal of Education Framework (IJEFA),University of Uyo, 5(1), 43-56.*

8. Akpan, A. O, Udofia, S. E. & Uko, P. J. (2025b). Enhancing academic performance of science education

9. undergraduates in atmospheric photochemistry using print and electronic instructional resources in Akwa Ibom State. *AKSU International Journal of Research in Education (AKSUIJRE), 1 (2), 52-61.*

10. Akpan, A. O., Udo, A. L., & Umoh, E. B (2026). & Etim, B. U. (2026). Digital Technologies Integration

11. in STEM Teaching Practices in Tertiary Institutions in Akwa Ibom State, Nigeria. *Kashere Journal of Education 2026, 10(1): 470-480.*

12. Akpan, A. O., Itighise, A. E., & Umo, E. B. (2022). Integration of digital technologies in STEM teaching and learning in universities in Akwa Ibom State. *The Nigerian Academy of Education Conference Proceedings*, 162–177.

13. Alabdulkareem, S. A. (2021). Exploring the relationship between student engagement and academic achievement in technology-integrated classrooms. *Education and Information Technologies, 26*(3), 3435–3452.

14. Arkorful, V., Barfi, K. A., & Aboagye, I. K. (2021). Integration of ICT in higher education: A review of challenges, trends, and pedagogical implications. *Education and Information Technologies, 26*(3), 2431–2454.

15. Atabang, A. A., Harrison, V. E. & Sunday, E. S. (2026). Effect of Ai-generated contents on secondary school students' mastery of physics concepts. *International Journal of Social Science Humanity & Management Research, 5*(2), 292-298.

 DOI: *10.5281/zenodo.24331025*

16. Balalle, H. (2024). Exploring student engagement in technology-based education in relation to gamification, online/distance learning, and other factors. *Social Sciences & Humanities Open, 9,* 1–10.

17. Borup, J., Chambers, C. B., & Stimson, R. (2019). Student engagement in blended learning: Understanding the impact of interactions with teachers, peers, and content. *Journal of Online Learning Research, 5*(2), 123–145.

18. Chen, J. (2023). Technology-enhanced learning and the development of critical thinking: A systematic review. *Computers & Education, 195,* 104677.

19. Etukakpan, J. U., Umanah, F. I., & Akpan, A. O. (2025). Team-pair-solo, computer simulation, guided discovery teaching approaches and secondary school students' academic performance in cell structure in Biology. *British Journal of Education, 13*(11), 42–56. https://doi.org/10.37745/bje.2013/vol13n114256

20. Itighise, A. E., & Babayemi, J. O. (2023). Utilization of virtual reality technology in science education instructional delivery in Akwa Ibom State University, Nigeria. *International Journal of Developmental Research in Education, 3*(1), 106–120.

21. Itighise, A. E., Akpan, A. O., & Babayemi, J. O. (2023). Awareness and utilization of Web 2.0 technology for learning among science teacher trainees in Akwa Ibom State. *Zamfara International Journal of Education, 3*(6), 104–108. https://doi.org/10.5281/zenodo.10675721

22. Kormos, E., & Wisdom, K. (2023). Digital divide and teaching modality: Its role in technology and instructional strategies. *Education and Information Technologies, 28*(8), 9985–10003.

23. Moffat, U. S., Thomas, N. A., & Umanah, F. I. (2023). Media devices and students‟ academic achievements in Biology among co-educational secondary schools in Eket Local Government Area, Akwa Ibom State, Nigeria. *Journal of Research in Education and Society*, *14*(2), 71-79.

24. Ntegwung, G. J., Atabang, A. A., Sunday, E. S & Edoho, B. A., (2026). Effects of Ai-assisted inquiry and concept mapping learning strategies on students' academic

 DOI: *10.5281/zenodo.24331025*

performance and attitude in biology in secondary schools. *Journal of Current Research and Studies, 3*(4), 89-99.

25. Sharlovych, V., Vilchynska, I., Danylyuk, S., Huba, N., & Zadilska, O. (2023). Technology integration in secondary education: Opportunities for engagement and creativity. *Education and Information Technologies, 28*(4), 567–584.

26. Sunday, E. S. Edet, A. A. & Akpan, E. I. (2025a). Effects of computer assisted instructions and computer animation on the teaching of chemistry in secondary schools. *International Journal of Modern Science and Research Technology*, *3*(11), 499-509.

27. Sunday, E. S., Umanah, F. I. & Udofia, S. E. (2025b). Enhancing students' academic performance in chemical reactions through computer-based molecular modelling, hackathon teaching strategies. *International Journal of Research and Innovation in Social Science (IJRISS), IX(IIIS)*, 1815-1824.

28. Sunday, E. S., Umanah, F. I., Abasi, A. U. & Joseph, R. E. (2025c). Utilization of artificial intelligence powered tools in enhancing undergraduate students' entrepreneurial skills amidst economic downturn in Nigeria. *AKSU International Journal of Research in Education (AKSUIJRE)*, *1*(2), 11-18.

29. Sunday, E. S., Umanah, F. I., Ntegwung, G. J., & Akpan, E. I., (2026). Effect of computer-based visualization model on students' academic achievement in the periodic table concept in chemistry. *IJCER (International Journal of Chemistry Education Research)*, *10*(1), 76–85. https://doi.org/10.20885/ijcer.vol10.iss1.art8

30. Uboh, D. E., Thomas, N. A., Sunday E. S. & Utibe, U. J., (2026). Influence of teachers' instructional practices and educational technologies on students' academic achievement in science subjects. *American journal of Innovation in Science, Research and development, 3*(7), 360-372.

31. Ukpong, F. A., Ntegwung, G. J., Sunday, E. S., Obo, I. J., Sunday, M. D., Ubong, N. C., & Ndon, U. U. (2026). Cloud-Based E-Learning Model and Students' Academic Achievement in Biology in Mkpat Enin Local Government Area. *International*

 DOI: *10.5281/zenodo.24331025*

Journal of Social Science Humanity & Management Research, 5(4), 760-766. https://doi.org/10.58806/ijsshmr.2026.v5i4n23

32. Umanah, F. I & Anyanime O. Akpan (2024). Effects of 5E and 7E learning cycle models on students' academic achievement and retention in chemistry. *Global Journal of Academic Research Forum, 12(1), 92-106.*

33. Umanah, F. I., & Atabang, A. A. (2025). Effect of animated and static infographic instructional materials on students' academic performance in isomerism in Chemistry. *International Journal of Research and Innovation in Social Science, 9*(3S), 1515–1524. https://doi.org/10.47772/IJRISS.2025.903SEDU0118

34. UmoAbasi, E. A., Abasi, A. U., & Sunday, E. S. Effect of educational technology devices on pre-service science teachers' instructional planning and delivery in Akwa Ibom State University. *International Journal of Research Publication and Reviews, 7*(7), 2643-2652.

35. Umoetuk, E. & Akpan, A.O. (2023). Computer graphics, flipped classroom instructional strategies and students' performance in Basic Science and Technology in Akwa Ibom State. *Inter-Disciplinary Journal of Science Education, 5(1), 34-41.*

36. Zhang, L. (2020). Student engagement in technology-enhanced learning environments: A review of the literature. *Interactive Learning Environments, 28*(3), 257–271.

 DOI: ***10.5281/zenodo.24331025***