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# Biology Teachers Attitudes, Self- Efficacy and Intention toward Integrating Information and Communication Technology for Teaching in Plateau State Secondary Schools, Nigeria

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### ABSTRACT

This study investigates Biology Teachers' Attitudes, Self-efficacy and Intention toward integrating Information and Communication Technology in Teaching in Plateau State Secondary Schools, Nigeria. The research was guided by four (4) Research Questions and three null hypotheses. The research adopted correlational research design. The population of the study comprised of two hundred and thirty-five (235) Biology teachers and one hundred and ninety-eight (198) Biology teachers were selected as sample using proportionate stratified sampling technique. Forty (40) items 'Biology Teachers Level of ICT integration, Attitudes, Self-efficacy, and Intention Questionnaire' (BTIIASEIQ) was used for data collection. BTIIASEIQ was validated by three experts, two from Science Education Department and one from Guidance and Counseling department. The reliability of BTIIASEIQ was established using Cronbach' Alpha which yielded reliability index of 0.74. The data collected was analyzed using mean and standard deviation, the null hypotheses were tested using Pearson Product-Moment Correlation Coefficient (PPMC). The findings of the study revealed that Biology teachers have high level of ICT integration, Positive attitudes toward ICT, high self-efficacy toward ICT and are willing to integrate ICT in their teaching practice. The study also revealed that there is significant relationship between Biology teachers' attitudes and ICT integration, Self-efficacy and ICT integration, intention and ICT integration in their teaching. The study concluded that, in Plateau State Biology Teachers have integrated ICT, have positive attitude, high self-efficacy and were willing to integrate Information and Communication Technology. It was recommended that, Educational policymakers, curriculum planners, stakeholders in education, such as Students, teachers, administrators, staffs, parents and guardians, Local communities, Government agencies, Private sectors and employers, higher Education Institution, community organization and Alumni, others include Researchers and academics, Media and Journalist working via Ministry of Education, should offer the essential teaching and learning ICT tools to teachers and provide periodic ICT workshops, training and re-training for serving, in-service and pre-service teachers to keep them up to speed on current ICT technologies in teaching and learning.

Keywords: ICT Integration, Attitude, Self-efficacy, Intention, Biology Teacher

### INTRODUCTION

Information and Communication Technology (ICT) refers to a wide range of digital tools, technologies, and resources that facilitate the storage, retrieval, manipulation, and communication of information (Mathew, Onimisi, Meligah & Abuh, 2018). In the context of biology teaching, ICT may include computers, tablets, multimedia resources, online platforms virtual labs, and other digital resources that can support teaching and learning in the subject. The advancement of technology has made a significant impact on the evolution of teaching methods from traditional face-to-face teaching to Computer Based Learning (CBL) or – E-learning systems in all levels of education. Today, a variety of ICT can facilitate not only delivery of instruction, but also learning process itself (Mathew, *et al* 2018).

Information and communication technology (ICT) integration in education refers to incorporating computer-based communication into the regular classroom instructional process. Teachers are seen as critical players in using ICT in their regular classes and training students for the new digital age. This is because of ICT's ability to create a dynamic and proactive teaching-learning environment (Arnseth & Hatlevik, 2020).

According to Winzenried, Dalgarno, and Tinkler (2010), teachers who have taken ICT courses are more successful at teaching with technology resources than those who have not. According to Warwick and Kershner (2018), in order to deliver a good lesson using ICT, teachers must be aware of the value and benefits of ICT. Biology teachers, self-efficacy translates into a "judgment of their capabilities" to attain the proposed outcomes by involving students in learning using ICT, even when they may be difficult or unmotivated, (Barni, Danioni and Benevene 2019). Biology teachers' Self-efficacy in using ICT in teaching is influenced by various factors, including pedagogical integration, technological competence, professional development, student outcomes, reflection, and contextual considerations.

Teachers' attitude, skills (self-efficacy), and intention towards ICT integration in teaching, are essential human factors involved in the integration of ICT in the classroom. An equally important finding was that appropriate equipment, technical assistance, a stable Internet connection, etc. are material factors that guarantee quality technology integration, (Kawane and Sain 2015, Stephan, Markus and Glaser-Zikudam, 2019). ICT integration into the teaching and learning process may depend on the level of these factors to a greater or lesser extent, but what is certain is that when the scores of these factors are high, the chances of integrating ICT in the classroom increase.

## LITERATURE REVIEW

This study was based on two Theories. The Unified Theory of Acceptance and Use of Technology (UTAUT) and The Theory of Planned Behavior (TPB). The Unified Theory of Acceptance and Use of Technology (UTAUT) which was initially proposed by Venkatesh (2003) and subsequently revised by Rana and Weerakkody (2017). This theory has been widely used by researchers to explain the acceptance and use of information systems and technology. The UTAUT consolidates elements from eight individual models, including the "Theory of Reasoned Action, the Theory of Planned Behavior, the Technology Acceptance Model, the Model of Personal Computer Utilization, the Diffusion of Innovation Theory, the Social Cognitive Theory, and the Motivational Model.

The Unified Theory of Acceptance and Use of Technology consolidate various models of technology adoption to provide a more comprehensive understanding of how users accept and use technology. This information systems model has been found to explain a significant amount of variability in the behavioral intention and usage behavior of technology. The theory consists of four main constructs, which include performance expectancy, effort expectancy, social influence and facilitating conditions. These constructs are believed to influence the user's intention to use technology, which in turn affects their usage behavior. Facilitating conditions are assumed to have a positive relationship with technology usage and a direct influence on its use.

The Unified Theory of Acceptance and Use of Technology (UTAUT) has a significant relationship with ICT integration in education. UTAUT posits that the likelihood of technology adoption is influenced by four key factors: performance expectancy, effort expectancy, social influence, and facilitating conditions. In the context of ICT integration, these factors play a crucial role in determining teachers' and students' acceptance and use of ICT. For instance, if teachers perceive ICT as improving their teaching performance (performance expectancy), they are more likely to adopt and integrate ICT. Similarly, if ICT is easy to use (effort expectancy) and supported by colleagues and administrators (social influence), teachers are more likely to integrate ICT. Furthermore, the availability of necessary resources and infrastructure (facilitating conditions) also influences ICT adoption. By understanding these factors, educators can design effective ICT integration strategies, provide necessary support and resources, and promote positive attitudes towards ICT adoption, ultimately enhancing teaching and learning outcomes.

The theory is utilized in this study to investigate Biology teachers' acceptance and use of information and communication technology for teaching and learning. The theory is an appropriate tool to identify critical factors and contingencies on the intention of Biology teachers to integrate information and communication technology in secondary schools as seen in figure 1.

Source: (Venkatesh (2003).

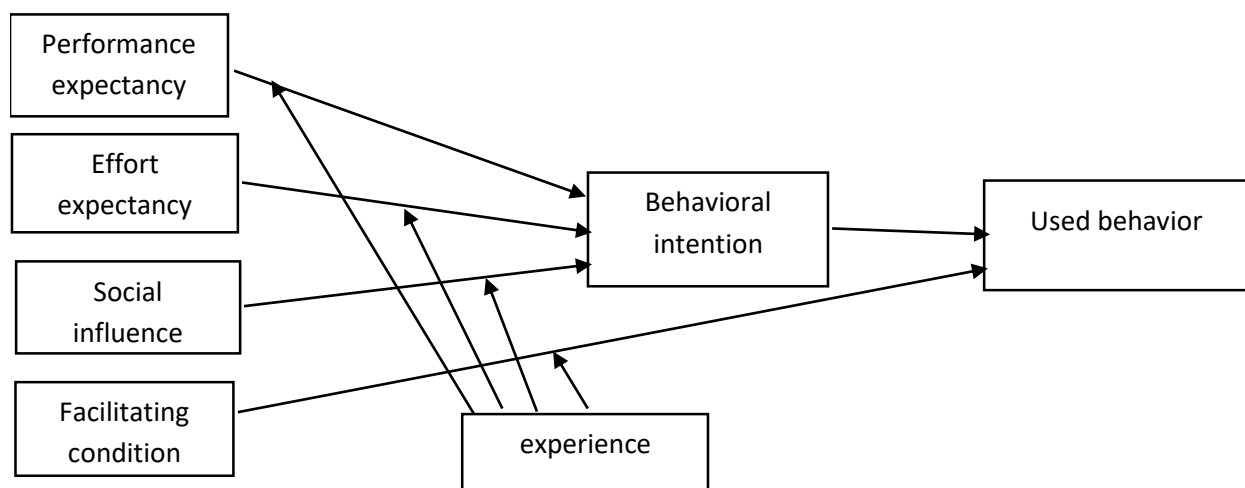


Figure 1: Unified Theory of Acceptance and Use of Technology (UTAUT)

Although the Unified Theory of Acceptance and Use of Technology (UTAUT) did not directly include self-efficacy, attitude, and anxiety as determinants of intention, it is still considered a valuable model for analysis in this study. The theory does not assume that attitude towards technology use has a direct impact on intention (Venkatesh, 2003).

Theory of planned Behavior (TPB) is a psychological theory that propose that individuals' intention to engage in a behavior are influence by their attitudes toward that behavior, subjective norms, and perceived behavioral control (Icek Ajzen, 1985). Proposed the theory. Theory of Planned Behavior (TPB) as

a supportive theoretical framework for understanding the attitudes, self-efficacy, and intentions of biology teachers towards integrating ICT in their teaching.

Through an analysis of relevant literature, this research would examine the key constructs of the Theory of planned behavior (TPB). Attitude, Subjective norm, Perceived behavioral control, and Intention in the context of ICT integration in Biology education. In the contemporary educational landscape, the integration of Information and Communication Technology (ICT) has emerged as a critical component for enhancing teaching and learning experiences across various disciplines, including Biology (Jones, 2022). ICT encompasses a wide range of tools and resources, such as computers, internet-based applications, interactive whiteboards, and educational software, which can enrich instructional delivery, facilitate student engagement, and promote active learning (Johnson & Smith 2024).

The Theory of Planned Behavior (TPB) has a significant relationship with ICT integration in education. According to TPB, an individual's intention to perform a behavior, such as integrating ICT in teaching practices, is influenced by their attitude towards the behavior, subjective norms, and perceived behavioral control. In the context of ICT integration, teachers' attitudes towards ICT, their perception of colleagues' and administrators' support, and their confidence in their ability to effectively integrate ICT all play a crucial role in determining their intention to adopt and integrate ICT. Therefore, understanding TPB can help educators identify potential barriers to ICT integration, design effective professional development programs, and develop strategies to promote positive attitudes and behaviors towards ICT integration among teachers. By addressing these factors, educators can increase the likelihood of successful ICT integration, ultimately enhancing teaching and learning outcomes.

Source: Ajzen, 1985

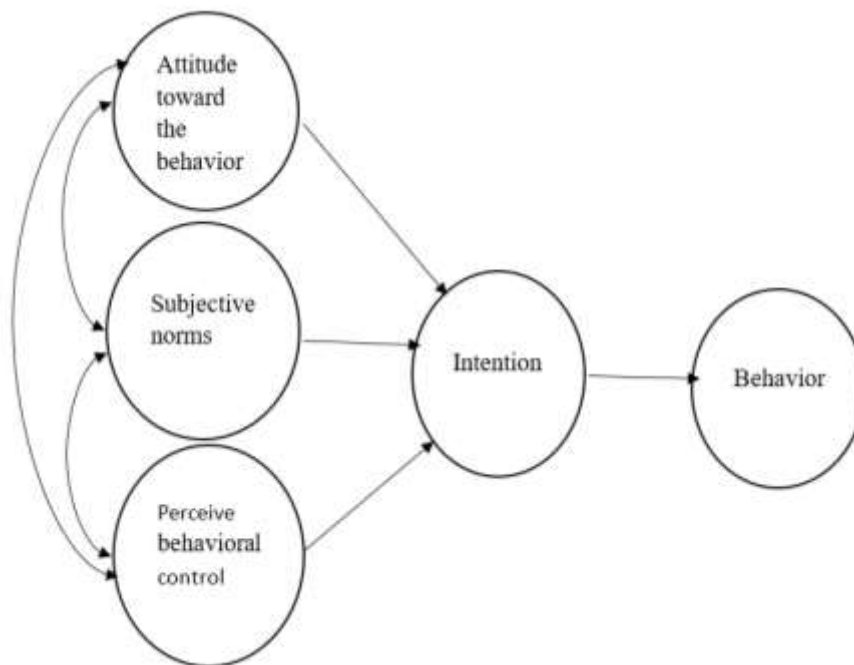


Figure 2. Theory of Planned Behavior

Understanding Biology teachers' attitudes, Self-efficacy beliefs, and intentions towards ICT integration is essential for promoting effective technology use in the classroom. By applying the constructs of the Theory of planned Behavior (TPB), the researcher will examine the factors influencing biology teachers' decisions to adopt and utilize ICT tools in their teaching practices.

**Attitudes towards ICT Integration:** Research has shown that biology teachers' attitudes towards ICT integration are shaped by various factors, including their perceptions of the relevance of technology to biology instruction, the perceived benefits of ICT for student learning outcomes, and the alignment of ICT with pedagogical goals. Positive attitudes towards ICT integration are associated with beliefs that technology can enhance students' understanding of biological concepts, facilitate inquiry-based learning, and foster active engagement in the learning process. Smith (2018) found that Biology teachers who perceived ICT as a valuable tool for promoting student-centered learning and inquiry-based instruction reported more positive attitudes towards ICT integration in their teaching practices.

**Subjective Norms and Social Influences:** The subjective norms experienced by Biology teachers play a crucial role in shaping their intentions to integrate ICT into their teaching practices. Colleague support, administrative expectations, and peer influence can either facilitate or hinder the adoption of ICT in Biology classrooms. Positive social influences, such as collaborative professional development opportunities and supportive school leadership, can encourage Biology teachers to embrace ICT integration as a normative practice within their professional communities. A study by Jones and Lee (2019), demonstrated that Biology teachers who perceived strong support from their colleagues and school administrators for ICT integration were more likely to express intentions to use technology in their instructional activities.

**Perceived Behavioral Control and Self-Efficacy:** The perceived behavioral control and self-efficacy of Biology teachers encompasses their confidence and capability in their ability to effectively use ICT tools, overcome technical challenges, and integrate technology into their existing teaching practices. Self-efficacy beliefs regarding ICT use can be influenced by factors such as prior experience with technology, access to professional development opportunities, and the availability of technical support resources. Higher levels of perceived behavioral control and self-efficacy are associated with greater intentions to integrate ICT in teaching biology. Wang and Zhang (2020) found that biology teachers who received comprehensive training in ICT integration, coupled with ongoing technical support, reported higher levels of perceived behavioral control and self-efficacy in using technology for instructional purposes.

By applying the TPB as a theoretical framework, educational stakeholders such as teachers, principals, staffs, parent teachers' association (PTA) and others can identify targeted strategies to support Biology teachers in adopting and effectively utilizing ICT tools in their instructional practices. By examining the key constructs of attitude, subjective norm, and perceived behavioral control, researchers can gain insights into the factors influencing Biology teachers' decisions to adopt and utilize ICT tools in the classroom as seen in figure 2 above. Moving forward, continued research efforts are needed to investigate the complex interplay between individual, social, and contextual factors that shape Biology teachers' experiences with ICT integration, ultimately contributing to the advancement of technology-enhanced Biology education.

According to Ghavifekr (2015), a study carried out in Malaysia on the effectiveness of ICT Integration in Schools. The research design used was descriptive survey with population of 129 teachers and sample of 93, simple random sampling techniques was used to obtained the sample. Survey questionnaire was used for data collection. The data was analyzed using descriptive and inferential analysis using SPSS package version 2.1. The findings of the study indicated that one of the major factors that influenced the success of technology-based teaching and learning was well-prepared teachers with ICT skills.

Ong'amo, Ondigi and Maundu (2015) conducted a study on integration of ICT in the teaching of Biology – A case study of Selected Secondary Schools in Mumias Sub County, Kenya. The study explored and determined the impact of ICT integration in enhancing pedagogical teaching of Biology in Secondary schools. This study was conducted through descriptive study using survey design. The target population consisted of all 49 secondary schools in Mumias Sub-county having 14,934 students, 497 teachers and 49 head teachers. Out of the schools, 45 are public schools and 4 are private schools. The sampling technique used was stratified sampling. Instrument used for data collection was questionnaire and interview. Data gathered was analyzed using descriptive and inferential statistics from the SPSS package.

Hong (2016) carried out a study on social studies teachers' views of ICT integration in Colorado, USA. Research design used was quantitative design of survey type, 23 secondary schools' social studies teachers was used as Population as while the study sample, face-face interview was used for data collection, the data was analyzed using descriptive and inferential statistics. The study revealed that teachers involved in the study had a positive attitude towards ICT as an instructional tool. They liked ICT as a pedagogical tool and as a resource bank for their teaching.

A research conducted by Hickson (2016) in South Georgia that investigated teachers' self-efficacy toward integrating technology into the curriculum, quantitative research design was used with a population of 75 and a sample of 64 teachers. convenience sampling technique was used to get the sample size. Teachers' Sense of Self-Efficacy questionnaire was used to collect the data; Pearson's Product Moment Correlation Coefficient was used to analyzed the data. The study revealed that, there is no statistically significant relationship between teacher self-efficacy and the capacity to incorporate technology into the classroom. There was also no relationship between teacher self-efficacy and the use of smartphones, the internet, social media, text messaging, or email.

Sulaiman, Hindatu and Lawal (2017) investigated teachers' awareness of the utilization of ICT for Biology teaching in secondary schools in Matazu Local Government Area, Katsina State, Nigeria. The study used a descriptive survey method, 18 Biology teachers and 5 Principals constitute the study population as well as the sample size, stratified sampling technique was used to obtained the sample and structured questionnaire was for data collection, descriptive and inferential statistics was used for data analysis. The result of the research showed that teachers were aware of the usefulness of ICT in the teaching and learning process.

Moluayonge and Innwoo (2017) carried out research on teachers' use of information and communications technology in education in Cameroon secondary schools. The study was quantitative research of descriptive survey design, the population of the study was 1,456 teachers and sample size of 120 teachers was used, the sample was obtained using stratified random sampling technique, descriptive survey questionnaire was used for data collection, descriptive and inferential statistics was used for data analysis. The result showed that low usage of ICT in teaching and learning was partly due to poor ICT infrastructure in secondary schools of Cameroon.

Teachers' attitudes, readiness and expertise in using ICT are critical in implementing ICT in the classroom. Teachers must have ample ICT skills and a high degree of trust to integrate technology in the classroom. Furthermore, to use ICT effectively in Biology teaching process, teachers need to understand its pedagogical function (Hennessy, 2021). To successfully initiate and integrate information and communication technology (ICT) in school's program depends strongly on the teachers' attitudes and support. It is believed that if teachers perceived information and communication technology programs as neither fulfilling their needs nor their students' needs, it is likely that they will not integrate the technology into their teaching and learning. Among the factors that influence successful integration of ICT into teaching are teachers' attitudes and beliefs towards information and communication technology.

Biology teachers, self-efficacy translates into a "judgment of their capabilities" to attain the proposed outcomes by involving students in learning using ICT, even when they may be difficult or unmotivated, Barni, Danioni and Benevene (2019); Biology teachers' Self-efficacy in using ICT in teaching is influenced by various factors, including pedagogical integration, technological competence, professional development, student outcomes, reflection, and

contextual considerations. Addressing these factors and providing support structures, educators can enhance teachers' self-efficacy and promote meaningful integration of technology into biology education.

Teachers' attitude, skills (self-efficacy), and intention towards ICT integration in teaching, are essential human factors involved in the integration of ICT in the classroom. An equally important finding was that appropriate equipment, technical assistance, a stable Internet connection, etc. are material factors that guarantee quality technology integration, Kawane and Sain (2015), Stephan, Markus and Glaser-Zikudam (2019).

### Aim and objectives of the study

The objective of the study was to investigate Biology teachers' attitudes, self-efficacy and intention toward integrating Information and Communication Technology (ICT) for teaching in secondary schools in Plateau State. The study was guided by the following objectives.

- i. Find out Biology teachers' level of Information and Communication Technology (ICT) integration in teaching in Plateau State
- ii. Find out the attitudes of Biology teachers toward ICT integration in teaching in secondary schools in Plateau state.
- iii. Find out Biology teachers' self-efficacy for integrating Information and Communication Technology (ICT) in teaching in secondary schools in Plateau state.
- iv. Find out the intention of Biology teachers in integrating ICT into teaching in secondary schools in Plateau state.

### Research questions

- i. What is the Biology teachers' level of ICT integration in teaching in secondary schools in Plateau State?
- ii. What is the attitude of Biology teachers toward (ICT) integration in teaching in secondary schools in Plateau state?
- iii. What is the Biology teachers' self-efficacy for integrating information and communication technology (ICT) in teaching in secondary schools in Plateau state?
- iv. What is the Biology teachers' intention in ICT integration in teaching in secondary schools in Plateau state?

### Research Hypothesis

The following hypotheses were formulated to guide the study.

- Ho<sub>1</sub>:** There is no significant relationship between Biology teachers' level of ICT integration and their attitudes in using ICT in teaching and learning.
- Ho<sub>2</sub>:** There is no significant relationship between Biology teachers' level of ICT integration and their self-efficacy toward using ICT in teaching in secondary schools.
- Ho<sub>3</sub>:** There is no significant relationship between Biology teachers' level of ICT integration and their intention toward using ICT in teaching in secondary schools

### METHODOLOGY

The study was carried out using correlational research design. The area of the study was Plateau State secondary schools. The population of the study was 235 Biology Teachers in Plateau state. 198 Biology teachers was used as sample size for the study. Proportionate stratified sampling technique was used to obtained the sample size. a questionnaire titled: 'Biology teachers level of ICT integration, attitudes, self-efficacy and intention toward integrating information and communication (ICT) in teaching in Plateau state (BTLICTIASEIICTT). The instrument was adapted from previous study by Beri and Sharma (2019). Titled Teachers' Attitude and self-efficacy towards Integrating ICT in Teacher Education-training colleges in the State of Haryana, India (TASIICTTETC). And for the intention it was adapted from a previous study by Wieland and Leye (2023) titled Understanding intention and use of digital elements in higher education teaching among mid-sized Germany university lecturers (UIUDEHETMSGUL). This was possible because a researcher can adapt an instrument from previous studies relevant to the current research (Churchill, 2019). BTLICTIASEIICTT has four (4) sections. The first section was on Biology teachers' ICT Integration level with ten (10) items. Second section was on Biology teachers' attitude toward ICT integration in teaching with ten (10) items. Third section was on Biology teachers' self-efficacy on the use of ICT in teaching with ten (10) items. Fourth was on Biology teachers' intention to integrate ICT in teaching with ten (10) items. All the sections used five (5) point Likert scale of strongly agreed (5 point), agreed (4 point), undecided (3 point), disagreed (2 point), and strongly disagreed (1 point) of the ten (10) items from each of four sections. The researcher established internal consistency using Cronbach's Alpha ( $\alpha$ ) method. The reliability index of the instrument was 0.74 which was acceptable. Research question 1-4 was answered using Descriptive statistics of mean ( $\bar{x}$ ) and standard deviation ( $\sigma$ ) and all the three (3) hypothesis were tested using Pearson product-moment correlation coefficient (PPMC) at 0.05 level of significance. The Statistical Package for Social Sciences (SPSS) version 23.0 was used for the analysis. Base on five-point scale, a mean score of 3.01-5.00 would be regarded as high integration, 2.01-3.00 would be regarded as

neutral integration and 0.01-2.00 would be regarded as low integration, the same goes to self-efficacy and intention and for attitude, a mean score of 3.01-5.00 would be regarded as positive attitude, 2.01-3.00 would be regarded as neutral attitude and 0.01-2.00 would be regarded as negative attitude.

## RESULT

**Research Question One:** What is biology teachers' level of ICT integration in teaching in secondary schools of plateau state?

Table 2: shows the Mean ( $\bar{x}$ ) and standard deviation ( $\sigma$ ) of Biology teachers' level of ICT integration. All the 10 items' mean scores are more than 3.0, this indicate that responses of teachers' level of ICT integration was high. The average mean ( $\bar{x}$ ) and SD ( $\sigma$ ) of the scores are 3.8675 and 0.52543 respectively. This revealed that Biology teachers in Plateau state have integrated ICT in teaching

Table 2: Mean and standard deviation of Biology Teachers level of ICT Integration in Teaching in Plateau State

S/N	Statements	N	Mean	SD	Decision
1	Regularly, I incorporate ICT tools such as multimedia, simulations, etc. in my biology lessons.	198	4.18	1.079	High
2	I feel confident in using ICT tools and resources in my biology lessons.	198	4.02	0.835	High
3	I can't incorporate ICT tools in teaching and learning Biology	198	3.85	1.009	High
4	ICT tools and resources are complicated to use in teaching Biology	198	3.82	0.967	High
5	I use the internet to access up-to-date biology information for lesson planning.	198	3.80	1.134	High
6	I frequently use digital platforms (e.g., online quizzes, forums, or virtual labs) to assess my students' understanding of biology concepts.	198	3.88	1.107	High
7	ICT-based biology resources (e.g., simulations, interactive videos) make complex concepts easier to present	198	3.81	1.126	High
8	I regularly receive professional development or training on how to effectively integrate ICT into my biology teaching.	198	3.77	1.147	High
9	I encounter challenges (e.g., lack of equipment, limited internet access) in integrating ICT into my biology lessons.	198	3.85	1.065	High
10	I believe that ICT integration in biology teaching helps prepare students for future scientific careers and technological advancements.	198	3.68	1.214	High
Average			3.8675	0.52543	

**Research Question Two:** What are the attitudes of secondary school Biology teachers toward integration of ICT) in teaching in secondary schools in Plateau state?

Table 3: shows the Mean ( $\bar{x}$ ) and standard deviation ( $\sigma$ ) of Biology teachers' attitude toward ICT integration into teaching. All the 10 items' mean scores are more than 3.0, an indication that response of teachers' attitude for integration of ICT was positive. The average mean ( $\bar{x}$ ) and SD ( $\sigma$ ) of the scores are 3.8200 and 0.52543 respectively. This revealed that biology teachers in plateau state have positive attitude toward ICT integration in teaching.

Table 3: Mean and standard deviation of Biology Teachers Attitude toward ICT Integration in Teaching in Plateau State

S/N	Statements	N	Mean( $\bar{x}$ )	SD( $\sigma$ )	Decision
1	ICT tools enhance the relevance of biological concepts in the classroom.	198	4.04	1.004	Positive
2	ICT integration increases student engagement with biological content.	198	4.08	0.776	Positive
3	I hardly use computer or laptop during teaching. I think traditional methods are more effective for these students	198	3.58	1.113	Positive
4	Using ICT tools enhances the effectiveness of teaching biology concepts.	198	3.85	0.861	Positive
5	ICT tools are easy for biology teachers to incorporate into their lesson plans.	198	3.75	0.943	Positive
6	ICT integration improves students' understanding of biological concepts.	198	3.91	0.875	Positive
7	Biology teachers feel adequately trained to effectively use ICT resources in teaching.	198	3.87	0.917	Positive
8	I enjoy while using ICT tools and devices and it makes permanent learning to the students as well as increases the teaching skills of the teachers.	198	3.76	0.958	Positive
9	ICT integration allows for more interactive and dynamic biology lessons.	198	3.66	1.000	Positive
10	I am open to adopting new ICT tools and methods in teaching biology.	198	3.70	1.089	Positive
Average			3.8200	0.5080	

**Research question three:** What is the Biology teachers' self-efficacy for integrating information and communication technology (ICT) in teaching in secondary schools in Plateau state?

Table 4: shows the Mean ( $\bar{x}$ ) and standard deviation ( $\sigma$ ) of Biology teachers' self-efficacy for integrating information and communication technology (ICT) in teaching. All the 10 items' mean scores are more than 3.0, this indicate that responses of teachers' self-efficacy for integrating information and communication technology (ICT) in teaching was high. The average mean ( $\bar{x}$ ) and SD ( $\sigma$ ) of the scores are 3.7600 and 0.53679 respectively. This revealed that Biology teachers in plateau state have high self-efficacy for integrating of ICT into teaching.

Table 4: Mean and standard deviation of Biology Teachers' Self-efficacy for integrating ICT in Teaching in Plateau State

S/N	Statements	N	Mean ( $\bar{x}$ )	SD( $\sigma$ )	Decision
1	I feel confident in my technical skills to effectively use ICT tools in teaching biology.	198	4.08	0.951	High
2	I believe I have the pedagogical knowledge to integrate ICT effectively into biology lessons.	198	3.82	0.867	High
3	I am able to plan biology lessons that incorporate ICT seamlessly.	198	3.74	0.915	High

4	I can efficiently manage ICT resources in the classroom to enhance biology teaching.	198	3.79	0.950	High
5	I am able to adapt ICT tools to suit different learning styles and abilities in biology classes.	198	3.89	0.966	High
6	I am effective in using ICT tools to engage students actively during biology lessons.	198	3.66	1.029	High
7	I can assess student learning effectively when using ICT tools in biology teaching.	198	3.64	1.102	High
8	I actively seek professional development opportunities to enhance my ICT skills for teaching biology.	198	3.61	1.124	High
9	I am able to collaborate with colleagues to effectively integrate ICT into biology curriculum planning.	198	3.79	1.000	High
10	Integrating ICT into biology teaching improves student learning outcomes.	198	3.58	1.113	High
Average			3.7600	0.5367	

**Research Question Four:** What is the Biology teachers' intention in ICT integration in teaching in secondary schools in Plateau state?

Table 5: shows the Mean ( $\bar{x}$ ) and standard deviation ( $\sigma$ ) of Biology teachers' intention for integrating information and communication technology (ICT) in teaching. All the 10 items' mean scores are more than 3.0, this indication means responses of teachers' intention for integrating information and communication technology (ICT) in teaching was high. The average mean ( $\bar{x}$ ) and SD ( $\sigma$ ) of the scores are 3.8330 and 0.48682 respectively. This revealed that Biology teachers in plateau state have high intention for integrating ICT into their teaching.

Table 5: Mean and standard deviation of Biology Teachers' Intention in ICT Integration in Teaching in Secondary Schools in Plateau State

S/N	Statements	N	Mean ( $\bar{x}$ )	SD( $\sigma$ )	Decision
1	I intend to actively integrate ICT tools into my biology teaching practices.	198	4.04	0.976	High
2	I am motivated to explore and incorporate new ICT resources into my biology lessons.	198	3.99	0.723	High
3	I see integrating ICT as an opportunity for professional growth and development as a biology teacher.	198	4.07	0.770	High
4	I believe integrating ICT will enhance student engagement and participation in biology lessons.	198	3.89	0.840	High



5	I expect that integrating ICT will lead to improved learning outcomes for my biology students.	198	3.79	0.975	High
6	I anticipate that using ICT tools will make my biology teaching more efficient.	198	3.97	0.865	High
7	I believe integrating ICT will enhance the relevance and effectiveness of the biology curriculum.	198	3.71	0.953	High
8	I aim to adopt a student-centered approach by integrating ICT into biology teaching.	198	3.64	1.056	High
9	I am supported by my school administration to integrate ICT into my biology teaching practices.	198	3.73	1.016	High
10	I am committed to continuously improving my use of ICT tools in teaching biology.	198	3.49	1.264	High
Average			3.8330	0.48682	

**Hypothesis one:** There is no significant relationship between Biology teachers' level of ICT integration and their attitudes in using ICT in teaching.

Table 6: shows the relationship between Biology teachers' level of ICT integration and their attitude toward using ICT in teaching in secondary schools. Based on the table, teachers' integration of ICT has positively correlated to their attitude ( $p < 0.05$ ). specifically, Biology teachers' level of ICT integration and their attitude toward using ICT in teaching in secondary schools showed weak positive correlation with R-value of 0.221 and thus the hypothesis is rejected.

Table 6: PPMC Result of Biology Teachers' level of ICT Integration and their Attitude in using ICT in Teaching

Variable	N	R	p-value	Decision
ICT Integration	198	0.221	0.001	Rejected
Attitude	198			

**Hypothesis two:** There is no significant relationship between Biology teachers' level of ICT integration and their self-efficacy toward using ICT in teaching.

Table 7: shows the relationship between Biology teachers' level of ICT integration and their self-efficacy toward using ICT in teaching in secondary schools. Based on the table, Biology teachers' level of ICT integration has positive correlation to their self-efficacy ( $p < 0.05$ ). specifically, Biology teachers' level of ICT integration and their self-efficacy toward using ICT in teaching in secondary schools showed weak positive correlation with R-value of 0.205 and thus the hypothesis is rejected.

Table 7: PPMC Result of Relationship between Biology Teachers' level of ICT Integration and their Self-efficacy toward using ICT in teaching

Variable	N	R	p-value	Decision
ICT Integration	198	0.205	0.001	Rejected
Self-efficacy	198			

**Hypothesis three:** There is no significant relationship between Biology teachers' level of ICT integration and their intention toward using ICT in teaching.

Table 8: shows the relationship between Biology teachers' level of ICT integration and their intention toward using ICT in teaching in secondary schools. Based on the table, teachers' integration of ICT has positively correlated to their intention ( $p < 0.05$ ). specifically, Biology teachers' level of ICT integration and their intention toward using ICT in teaching in secondary schools showed weak positive correlation with R-value of 0.211 and thus the hypothesis is rejected.

Table 8: PPMC Result of Biology Teachers' level of ICT Integration and their Intention toward using ICT in Teaching.

Variable	N	R	p-value	Decision
ICT Integration	198	0.211	0.001	Rejected
Intention	198			

## Discussion of Results

The result of the study revealed that Biology teachers in Plateau state have integrated ICT into teaching. This finding agrees with the finding of Ghavifekr (2015) and Orig'amo *et.al* (2015) which have found that teachers have integrated ICT into teaching because the study revealed that 70% of the teachers were frequently users of ICT in classroom teaching and this finding correlate with finding of the current study. The reason was due to the effort of Plateau state government in collaboration with non-governmental organization(NGO) such as World bank, AGILE, Parent Teachers Association (PTA) that distributed computers and other ICT tools to the public secondary schools across the seventeen (17) local government in the state since 2011. The finding is not in agreement with the findings of Gomina (2022), Mehari *et. al* (2020), Moluanyonge and Innwowa (2017), Suliaman, Hindatu and Lawal (2017) because their findings showed, there was low usage of ICT tools in teaching and learning due to poor ICT infrastructures and power failure in secondary schools

The result also revealed that Biology teachers have positive attitude for integrating ICT into teaching. This was so because, Plateau state government had made effort in motivating teachers in the state through training of teachers in ICT skills across the seventeen (17) local government of the state. This finding agrees with the finding of Muslem *et. al* (2018), their findings showed that teachers had positive attitude (perception) of the implementation of ICT in teaching and learning this was because teachers believe that ICT support them in their lessons as well as help them to find information that make their lessons delivery very easy and quick. Clipa *et.al* (2023), findings revealed that, teachers have positive attitudes toward ICT use in teaching, reason, because training, re-training and workshop on ICT use in teaching frequently organized by the ministry of education at all levels. Beri and Sharma (2019), findings from their study revealed that teacher-educators have positive attitude toward ICT, it tools, devices and usage in teacher-education process, reason because teacher-educators believe that Information and Communication Technology (ICT) provide them with first-hand information needed for teaching and learning process. Mwila (2018), his findings indicate that teachers have showed good attitude toward ICT integration because, teachers believed that as the world have become technology-based environment no sector should left behind. Hong (2016). This might be due to motivation of teachers through training and availability of ICT tools by the plateau state government.

The result further revealed that Biology teachers in plateau state have high self-efficacy (capability or confidence) for integrating ICT into teaching. This finding is in disagreement with the findings of Gbemu *et. al* (2020) who argued that teachers have low self-efficacy for integrating ICT. Also disagreed with Moluayonge and Innwo (2017) this is because their finding showed low competence and confidence to use or integrate ICT in teaching and learning due low access to available resources and insufficient ICT support tools for teachers. The finding agrees with the finding of Clipa *et. al* who found out that teacher have high self-efficacy. According to the research teachers that received basic training skills on ICT would have high self-efficacy toward it integration and this confirm with the Biology teachers on the Plateau who were trained on ICT skills which was organized by the state government in other for the teachers to incorporate it in their teaching and learning process.

The research reveal that Biology teachers have high intention for integrating ICT into teaching. The findings greed with the findings by Olugbara *et al.* (2020) who found that the intention to use e-learning has a positive effect on actual integration because teachers' willingness to integrate ICT in teaching has become necessary with the Global trend of technology-based society.

The research further revealed that Biology teachers' level of ICT integration and their attitude toward using ICT in teaching in secondary schools showed weak positive correlation. The findings agree with the findings of David *et.al* (2022) which reveal that, there is a significant difference between Biology teachers' attitudes and their level of ICT integration in teaching and learning.

The result also revealed that Biology teachers' level of ICT integration and their self-efficacy toward using ICT in teaching in secondary schools showed weak positive correlation. The finding agrees with Hickson (2016) who asserted that no statistically significant relationship between teacher self-efficacy and the ability to integrate technology within the classroom. However, it contradicts the finding from Gbemu, Sarfo, Adentwi, and Akllassu-Ganan' (2020) study that revealed the lack of belief in their ability to use ICTs to teach translated into the teacher educators not using these tools in their teaching.

Finally, the result reveal that Biology teachers' level of ICT integration and their intention toward using ICT in teaching in secondary schools showed weak positive correlation. This finding confirm with the findings by Shah & Zhongjun, (2021) in Wieland *et.al* 2023 which examine Biology teachers' intention-behavior and their level of ICT integration have partial or complete positive correlation.

## CONCLUSION AND RECOMMENDATION

This study concludes that Biology teachers in Plateau state have integrated information and communication technology (ICT) in their teaching. This is because, the findings revealed that Biology teachers have positive attitudes toward ICT integration in to their teaching and learning process, also they have high level of self-efficacy to used ICT in their teaching activities and are having high intention to integrate information and communication

technology (ICT) in their teaching line. The study recommends that, government at all level should ensure teachers are encourage to integrate ICT in their teaching by providing conducive atmospheric ICT environment, training and re-training, workshop and seminars should be a routing activities at all level of education.

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