PERSONAL VARIABLES AND BIOLOGY TEACHERS' USAGE OF ICT IN SECONDARY SCHOOLS IN CALABAR METROPOLIS

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Abstract

The study assessed personal variables and Biology Teachers' Usage of ICT in Secondary Schools in Calabar Metropolis, using 63 sciences purposively drawn from a population of 168. Three research questions were stated and three corresponding hypotheses were raised. A 17-itemed structured questionnaire termed, "Biology Teachers' ICT Usage Questionnaire", (BIOTEAICTUQ), with a Cronbach alpha reliability coefficient of 0.84 was used for data collection. Mean, Standard Deviation, Independent t-test and Analysis of Variance, (ANOVA), were statistical tools used. Hypotheses were tested at 0.05 level of significance. Results indicated that while Gender and Age did not significantly influence Secondary School Biology Teachers' ICT Usage, there was a no significant influence of Working Experience on Secondary Schools' Biology Teachers' ICT Usage in Calabar Metropolis. It was thus recommended amongst others that intense efforts be made to provide adequate in-service training and support for professional development of Biology teachers in ICT for Secondary Schools in Calabar Metropolis.

Key Words: ICT, Biology, Secondary Schools, Teachers, Personal Variables

Introduction

Instructional delivery is the methods and strategies used by educators to convey content and facilitate learning in both formal and informal educational settings. It has evolved significantly, moving from traditional teacher-centered to more learner-centered technologically integrated methods. Contemporary approaches increasingly emphasize active learning, critical thinking, collaboration and the use of real-world problem -solving contexts, Beshel, (2024). To be effective, instructional delivery must accommodate diverse learners' needs, promote equity, and leverage appropriate technologies. The integration of digital tools, such as learning management systems, virtual reality and artificial intelligence, AI, has reshaped how instructor plan and deliver instruction, (Zawacki-Richter et.al, (2019). Assessment practices are also integral to instructional delivery (Ita, 2025).

Information and Communication Technologies, (ICT), has emerged as a dominant force, significantly influencing various aspects of human activities and every discipline,

including Education., from teaching and learning to assessment and evaluation. Its profound impact has brought a revolution in the method of teaching and learning, fundamentally altering the way people engage in education, work and leisure, Yasin, et.al., (2023) and Ukpoma, (2019). ICT tools such as computers and computer animations, visual experiments, internet, multimedia and multimedia presentations, online quizzes, google soft wares such as google meet, google spread sheet, etc, can be used by biology teachers for lesson preparation, administration, real-time data analysis, research, communication, to facilitate collaboration between student and teacher through online platforms, multimedia presentations to help students to: visualize biological processes, understand complex biological processes , improve understanding, develop critical thinking skills and engagements , access large amount of data etc. They also help teachers to create hands-on lessons and avoid over emphasis on rote learning, Fanthana, and Khan, (2024). As education systems strive for equity, inclusivity, and excellence, educators must continuously refine their instructional delivery to meet the evolving demands of the 21st Century learners (Asim & Ita, 2024; Ita et.al., 2024 a; Ita et.al., 2024 b; Antai et. al, 2025; Effiong. & Agbade, 2018; Olofu et. al 2024).

Biology, the study of living organisms and their interaction with their environment and also that of the interaction of these living organisms and their environment, is a very broad subject. It covers various complex processes and organisms described in books but not seen by the naked eye. It is difficult for both the teacher to teach these complex processes to the students' understanding through the traditional class lecture or the students to understand by reading textbooks and rote memorization, Bobojane, & Thulhukilr, (2022). Practical classes are very vital for clarifying theoretical aspects of biology, but due to financial constraints, it is very demanding to maintain a biology laboratory, especially in the public-school system. Learning becomes very interesting, collaborative, lively and engaging through the use of ICT tools in the classroom and boost active participation and engagement of learners during the learning process, thus improving performance (Akeh et. al 2026; Inyang et. al 2022; Igyu et. al, Obi et. al 2020; Adie et. al, 2026; Ekoro et.al., 2023). This is especially important in Biology as a computer can present the information visually through a well- prepared picture, three dimensional models, animation, interactive environment (Nwosha, 2023; Meremikwu et. al 2022).

The integration of ICT tools in biology instruction has been shown to positively affect student's engagement and performance. Ogunode et.al, (2022), have revealed a significant correlation between the use of ICT and improved academic performance among biology students. The study also noted gender differences, with male and female students benefiting, while male students benefiting more than female students. Danko, et.al., (2020), have equally shown a significant gap, with men generally reporting higher levels of access and proficiency compared to women. However, previous studies have shown that female teachers are less likely to using computers personally than their male counterparts, www.researchgate.net-age-and-it-tbl, though recent studies have shown that male and female teachers do not appear to differ greatly in their extent of pedagogical use of ICT (Nduwayezu, et.al. 2022; Agbade et. al 2018; Effiong & Agbade, 2016).

Research has consistently shown a strong correlation between age and ICT usage with younger individuals generally demonstrating significantly higher level of digital engagement compared to older adults, often referred to as the "digital divide". This means that older people are less likely to use ICT, potentially leading to social exclusion in an increasingly digital society, (Casado & Lez eamo, (2018), Macedo et.al., 2018; Olofu et. al 2022; Opara et. al 2020; Agbade et. al 2018; Usua et. al 2023; Agbor et. al 2026). In spite of the evidence above, age-related digital divide is reducing due to the significant increase in the use of new technologies among older people, Sixsmith et.al., (2022). This is also as shown in Ita, (2025).

Almareta and Paidi (2021), have revealed that the level of ICT knowledge of teachers is not dependent on years of teaching experience and also that the longer teacher teaching experience does not provide good teacher ICT knowledge, rather, younger teachers have great potentials. Ugbaja and Okeke, (2020), have affirmed that years of experience of secondary school biology teachers do not significantly influence their use of ICT,

Problem Statement

Teachers' quality and their continuing professional education and training remain central to the achievement of quality education. It was in this understanding that the Cross-River State Government, in the year, 2012, provided primary and secondary school teachers with computers at a subsidized rate through the T-CAP programme, (Teacher – Computer Acquisition Programme), in two phases. The first phase took place from September to October 2012, followed by the second phase in June 2013. In the same vein, the Head of Service of the Government of Cross River State in 2014, provided computers to all categories of civil servants in the state. Through this same programme, secondary schools were equipped with computer laboratories for teaching and learning for both students and teachers in the three education zones of the state. Teachers play a vital role in the adoption and implementation of new technology in education. Their perception is an important aspect that influences their adoption of ICT in teaching and learning (ta, 2025; Asim & Ita, 2024; Ita, et.al., 2024 a; Mutah, et.al., 2023; Patrick et. al, 2025; Patrick et. al, 2025; Patrick et. al, 2026). Thus, biology cannot flourish in the current day without an informational and communicative edge, nor can secondarily school biology teachers be internationally competitive without having been instilled with ICT abilities. To this end, the researcher seeks to assessed personal variables and Biology Teachers' Usage of ICT in Secondary Schools in Calabar Metropolis

Objectives of the study

The main objective of this study was to assess personal variables and Biology Teachers' Usage of ICT in Secondary Schools in Calabar Metropolis in teaching and learning processes but specifically, the study aims:

1. To find out whether gender of secondary school biology teachers influence their ICT usage in Calabar Metropolis.
2. To ascertain whether age of secondary school biology teachers influence their ICT usage in Calabar Metropolis.
3. To find out whether working experience of secondary school biology teachers influence their ICT usage in Calabar Metropolis.

Research Questions

The following questions will be answered in this study:

1. To what extent does gender of secondary school biology teachers influence their ICT usage in Calabar Metropolis.
2. How does age of secondary school biology teachers influence their ICT usage in Calabar Metropolis.
3. To what extent does working experience of secondary school biology teachers influence their ICT usage in Calabar Metropolis.

Statements of Hypotheses

The following hypotheses were raised to guide the study:

1. There is no significant influence of gender on secondary school biology teachers' ICT usage in Calabar Metropolis.

2. Age of secondary school biology teachers does no significantly influence their ICT usage in Calabar Metropolis.
3. Working experience of secondary school biology teachers does no significantly influence their ICT usage in Calabar Metropolis.

Methodology

The study purposively sampled 63 science teachers from a population of 168 science teachers in Calabar Metropolis. Science teachers were used instead of biology teachers because it is very scarce to have enough teachers for a particular science subject as some schools may have just one science teacher per subject or even worst for the entire sciences. The BIOTEAICTUQ instrument, made up of two parts, Respondents Personal information and 17 structured questions was used to assess secondary school biology teachers' ICT usage on a four- point modified Likert scale, with a Cronbach alpha reliability coefficient of 0.84. A mean score of 2.50 was used as hypotheses were tested at 0.05 level of significance, using the Mean, Standard Deviation, Independent t-test and Analysis of Variance, (ANOVA). Hypotheses were tested at 0.05 level of significance.

Presentation of results

Table 1: General description of variables

	N	Minimum	Maximum	Mean	Std. Deviation
Access to computer	63	7.00	15.00	11.6984	2.15253
Knowledge of ICT	63	5.00	18.00	10.9524	3.39083
Use in teaching	63	2.00	6.00	3.9365	1.17601
Challenges	63	18.00	24.00	21.6825	1.89928
Overall usage	63	36.00	62.00	48.2698	5.26157
Valid N (listwise)	63				

Hypotheses one: There is no significant influence of gender on secondary school biology teachers' ICT usage in Calabar Metropolis. The independent variable in this hypothesis is gender which categorized into two (male and female), while the dependent variable is secondary school biology teachers' ICT usage in terms of (access to ICT, knowledge of ICT, use in teaching, challenges, while using ICT and overall usage). Independent t-test analysis was used to test this hypothesis. The result is presented in Table 2.

Table 2

	Gender	N	Mean	Std. Deviation	t-value	p-value
Access to computer	Male	29	11.6897	2.10617	-.030	.976
	Female	34	11.7059	2.22288		.976
Knowledge of ICT	Male	29	10.2069	2.93232	-1.633	.108
	Female	34	11.5882	3.66075		.102
Use in teaching	Male	29	3.8966	1.17549	-.247	.806
	Female	34	3.9706	1.19304		.805
Challenges	Male	29	21.5517	1.86291	-.502	.618
	Female	34	21.7941	1.95059		.616
Overall usage	Male	29	47.3448	5.05877	-1.296	.200
	Female	34	49.0588	5.37639		.198

The result in Table 2 revealed the calculated t-value of access to ICT (-.030), knowledge of ICT (-1.633), use in teaching (-.247), challenges while using ICT (-.502) and Overall usage (-1.296). The t-values for all the five instances of ICT usage were less than the p-value of .000 at .05 level of significance. With this result the null hypothesis that There is no significant influence of gender on secondary school biology teachers' ICT usage in Calabar Metropolis was retained. This implies that gender does not significantly influence secondary school biology teachers' ICT usage in Calabar Metropolis.

Hypotheses two: Age of secondary school biology teachers does no significantly influence their ICT usage in Calabar Metropolis. The independent variable in this hypothesis is age which is classified into three (Below 30 years, 31-50years and 51 and above years), while the dependent variable is secondary school biology teachers' ICT usage in terms of (access to ICT, knowledge of ICT, use in teaching, challenges, while using ICT and overall usage. One-way analysis of variance (ANOVA) was deployed to test this hypothesis. The results of the analysis are presented in Table 3

Table 3

One-Way Analysis (ANOVA) of the influence of age of secondary school biology teachers does no significantly influence their ICT usage in Calabar Metropolis

		N	Mean	Std. Deviation
Access to computer	Below 30 years	11	11.3636	2.33550
	31-50years	40	11.9250	2.14102
	51 and above years	12	11.2500	2.09436
	Total	63	11.6984	2.15253
Knowledge of ICT	Below 30 years	11	11.4545	2.46429
	31-50years	40	11.0750	3.85897
	51 and above years	12	10.0833	2.31432
	Total	63	10.9524	3.39083
Use in teaching	Below 30 years	11	4.1818	1.53741
	31-50years	40	4.0500	1.08486
	51 and above years	12	3.3333	.98473
	Total	63	3.9365	1.17601
Challenges	Below 30 years	11	22.6364	1.62928
	31-50years	40	21.4750	1.90798
	51 and above years	12	21.5000	1.97714
	Total	63	21.6825	1.89928
Overall usage	Below 30 years	11	49.6364	4.88411
	31-50years	40	48.5250	5.80003
	51 and above years	12	46.1667	2.85509
	Total	63	48.2698	5.26157

		Sum of Squares	Df	Mean Square	F	Sig.
Access to computer	Between Groups	5.699	2	2.850	.607	.548
	Within Groups	281.570	60	4.693		
	Total	287.270	62			
Knowledge of ICT	Between Groups	12.438	2	6.219	.533	.590

	Within Groups	700.419	60	11.674		
	Total	712.857	62			
Use in teaching	Between Groups	5.543	2	2.772	2.073	.135
	Within Groups	80.203	60	1.337		
	Total	85.746	62			
Challenges	Between Groups	12.130	2	6.065	1.720	.188
	Within Groups	211.520	60	3.525		
	Total	223.651	62			
Overall usage	Between Groups	76.226	2	38.113	1.394	.256
	Within Groups	1640.187	60	27.336		
	Total	1716.413	62			

Table 3 shows the descriptive statistics of means and SD for the three groups of respondents based on the levels of their age and the actual results of ANOVA that compared the five group mean values. The comparison yielded F-ratios for access to ICT (.607), knowledge of ICT (.533), use in teaching (2.073), challenges while using ICT (1.720) and Overall usage (1.394). are respectively lower than the p -value of .000 at .05 level of significance with 2 and 60 degrees of freedom. With these results, the null hypothesis is retained in each of the five instances of access to ICT, knowledge of ICT, use in teaching, challenges, while using ICT and overall usage. This implies that there is no significant influence of age on secondary school biology teachers' ICT usage in terms of access to ICT, knowledge of ICT, use in teaching, challenges, while using ICT and overall usage.

Hypotheses three: Working experience of secondary school biology teachers does not significantly influence their ICT usage in Calabar Metropolis. The independent variable in this hypothesis is working experience which is classified into three (1-10 years, 11-20 years and 21 and above year), while the dependent variable is secondary school biology teachers' ICT usage in terms of (access to ICT, knowledge of ICT, use in teaching, challenges, while using ICT and overall usage. One-way analysis of variance (ANOVA) was deployed to test this hypothesis. The results of the analysis are presented in Table 4.

Table 4

One-Way Analysis (ANOVA) of the influence of working experience of secondary school biology teacher's ICT usage in Calabar Metropolis

		N	Mean	Std. Deviation
Access to computer	1-10 years	30	11.4667	2.47377
	11-20 years	24	12.1250	1.82525
	21 and above years	9	11.3333	1.80278
	Total	63	11.6984	2.15253
Knowledge of ICT	1-10 years	30	10.8000	3.34664
	11-20 years	24	11.6250	3.41114
	21 and above years	9	9.6667	3.42783
	Total	63	10.9524	3.39083
Use in teaching	1-10 years	30	3.8333	1.34121
	11-20 years	24	3.9583	.99909

	21 and above years	9	4.2222	1.09291
	Total	63	3.9365	1.17601
Challenges	1-10 years	30	22.2667	1.76036
	11-20 years	24	21.5833	1.74248
	21 and above years	9	20.0000	1.87083
	Total	63	21.6825	1.89928
Overall usage	1-10 years	30	48.3667	5.22252
	11-20 years	24	49.2917	5.71405
	21 and above years	9	45.2222	2.86259
	Total	63	48.2698	5.26157

		Sum of Squares	Df	Mean Square	F	Sig.
Access to computer	Between Groups	7.178	2	3.589	.769	.468
	Within Groups	280.092	60	4.668		
	Total	287.270	62			
Knowledge of ICT	Between Groups	26.432	2	13.216	1.155	.322
	Within Groups	686.425	60	11.440		
	Total	712.857	62			
Use in teaching	Between Groups	1.065	2	.533	.377	.687
	Within Groups	84.681	60	1.411		
	Total	85.746	62			
Challenges	Between Groups	35.951	2	17.975	5.746	.005
	Within Groups	187.700	60	3.128		
	Total	223.651	62			
Overall usage	Between Groups	108.932	2	54.466	2.033	.140
	Within Groups	1607.481	60	26.791		
	Total	1716.413	62			

Table 4 shows the descriptive statistics of means and SD for the three groups of respondents based on the levels of their working experience and the actual results of ANOVA that compared the five group mean values. The comparison yielded F-ratios for access to ICT (.769), knowledge of ICT (1.155), use in teaching (.377), challenges while using ICT (5.746) and Overall usage (2.033) respectively. The F-ratios for challenges while using ICT was higher than the p -value of .000 at .05 level of significance with 2 and 60 degrees of freedom. With these results, the null hypothesis is retained in each of the four instances of access to ICT, knowledge of ICT, use in teaching and overall usage but rejected for challenges, while using ICT. This implies that there is no significant influence of working experience on secondary school biology teachers' ICT usage in terms of access to ICT, knowledge of ICT, while using ICT and overall usage, but there is a significant influence of working experience on secondary school biology teachers' ICT usage in terms of challenges, while using ICT. In order to understand the pattern of the significant influence of secondary school biology teachers' ICT usage a post hoc multiple comparison analysis was carried out using Fisher's least significant difference (LSD) test. The results of these analyses are presented in Table 5

Table 5
Fisher's least significant difference (LSD) test. of the influence of working experience on secondary school biology teachers' ICT usage in terms of challenges while using ICT

Multiple Comparisons
LSD

Dependent Variable	(I) Experience	(J) Experience	Mean Difference (I-J)	Std. Error	Sig.
Challenges	1-10 years	11-20 years	.68333	.48438	.163
		21 and above years	2.26667(*)	.67221	.001
	11-20 years	1-10 years	-.68333	.48438	.163
		21 and above years	1.58333(*)	.69133	.026
	21 and above years	1-10 years	-2.26667(*)	.67221	.001
		11-20 years	-1.58333(*)	.69133	.026

* The mean difference is significant at the .05 level.

The results of Fisher's multiple comparison analysis presented in Table 5 have shown that teachers' whose working experience is 1-10 years are significantly different in their ICT usage in terms of challenges while using ICT) from those whose working experience is either 11-20 years or 21 and above year. Also, teacher' whose working experience is 11-20 years are significantly different in their ICT usage from those whose working experience is 21 and above year.

Discussion of findings
Hypothesis one: The null hypothesis was retained. This finding corroborates with the work of Almeareta & Paidi, (2021), Oguode et.al.,(2022), in their respective studies showed that female and male teachers in secondary schools do not differ greatly in the extent of their pedagogical use of ICT.

Hypothesis two: The null hypothesis was retained. This result though not in agreement with Casado & Lez eamo, (2018), Macedo, (2018), however, in spite of the evidence above, age-related digital divide is reducing due to the significant increase in the use of new technologies among older people Sixsmith et.al, (2022) Thus, this evidence is in agreement with the findings of this hypothesis.

Hypothesis Three: This hypothesis was retained. Years of experience and secondary school biology teachers do not significantly influence their use of ICT. However, teachers can improve their ICT skills through professional development, and also through their beliefs and perceptions (Ita, 2025, Ugbaja & Okeke, 2020). The result which showed a significant influence of working experience on secondary school biology teachers' ICT usage in terms of challenges, while using ICT, implies that years of experience is a challenge to the use of ICT by biology teacher. Teachers with lengthy teaching experience have lower ICT knowledge because the age of the teacher and habits of the teacher are already comfortable with

conventional teaching so they are less interested in ICT, as evidenced in the post hoc result, see table 5. This disparity can be remedied through professional development.

Conclusion

The result of this research shows that gender and age do not significantly influence secondary school biology teachers' ICT usage in Calabar Metropolis in terms of access to ICT, knowledge of ICT, use in teaching, challenges while using ICT and overall usage. while there is no significant influence of working experience in terms of access to ICT, knowledge of ICT, while using ICT and overall usage, there is a significant influence of working experience on secondary school biology teachers' ICT usage in terms of challenges, It was thus recommended among others that intense effort be made urgently, to provide in-service training and technical support on ICT for secondary school teacher in Calabar Metropolis for professional development.

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