Faculty of Natural and Applied Sciences Journal of Mathematics and Science Education
Print ISSN: 2814-0885 e-ISSN: 2814-0931
www.fnasjournals.com
Volume 6; Issue 2; March 2025; Page No. 93-101.

Impact of Information and Communication Technology on Physics Education Among Senior Secondary School Students in Ahoada, Nigeria

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Abstract
This research examined the influence of Information and Communication Technology (ICT) on the teaching and learning of physics among senior secondary school students in Ahoada, Nigeria. The research used a descriptive survey approach. Stratified random sampling and census sampling methods were used to get 200 students and 12 teachers, respectively. The data collection tool for this research was a questionnaire entitled "Impact of Information and Communication Technology (ICT) in the Teaching and Learning of Physics Questionnaire (IICTTLPQ)." A reliability coefficient of 0.80 was established for this study. The acquired data were analysed using mean and standard deviation to address the study questions, while a t-test was used to evaluate the hypotheses at a 0.05 level of significance. The research indicated a substantial disparity between students and teachers on the influence of ICT on teaching and learning. It was determined that there is no major disparity in the challenges encountered by physics teachers and students in utilising ICT for teaching and learning. It was ultimately determined that there was no substantial difference between instructors' and students' attitudes on the use of ICT. The researchers advised, among other recommendations, that secondary school teachers and students should engage in the utilisation of ICT for teaching and learning. Additionally, ICT resources should be insured to facilitate their replacement in the event of vandalism, ensuring continuous availability for classroom instruction. Furthermore, both government and non-governmental organisations should enhance their efforts through funding to provide well-equipped ICT classrooms.

Keywords: ICT, Physics Education, Senior Secondary School Students, Ahoada, Nigeria

Introduction

The teaching of physics over time has always been the use of traditional methods for students' learning of subject matter. These traditional methods of teaching include the lecture, demonstration, discussion, laboratory, questioning, project, field trip, and inquiry, among others. Nonetheless, these methods have their limitations. For instance, the lecture method is teacher-centred, thereby making students passive learners, even though it is preferable when it comes to teaching large class sizes. Also, the lecture method makes the teacher the final authority or the only custodian of knowledge, and this ought not to be so. The laboratory method has issues of non-availability of equipment, inadequate equipment for large class size, insufficient time for the practical, paucity of laboratory technicians, incompetent use of the equipment on the part of some teachers, etc.. The demonstration method is not left out, does not encourage independent work, thereby making students passive learners. The discussion method also has its limitations. Alamina (2006) noted that some discussions get pointless, the better students feel their time is being wasted, and the dull students feel frustrated because they have no contribution to make. Aside from that, it doesn't favour the introverts who find it difficult to express themselves. What about the project method? There are issues of hazards and financial constraints. There is therefore a need for teachers in our nation, Nigeria, to accommodate alternative teaching methods to address these challenges mentioned above.

According to Briones (2018), Isa et al. (2020) and Josiah et al. (2022), several scholars argued in their investigations that instructors' methods presumably reveal students' academic performance. Akpokiniovo's (2022) study reported that the performance of physics students in the last 20 years is exasperating. The

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conventional teaching techniques should be held accountable, since educators have used them for education from ancient times. Agreeing with that, Uwizeyimana et al. (2018) revealed that obstacles to successful physics learning and instruction are associated with conventional teacher-centred methodologies prevalent in secondary school physics classrooms. Merja and Maarika (2018) asserted that pedagogical improvement is crucial due to the fast evolution of conceptions related to learning, necessary knowledge, education, and the world. Teachers are urged to keep pace.

A teacher is a pivotal character in the educational process, since they are the instrument through which the curriculum, embodying the ideals of a country, is executed. Transferring knowledge necessitates that educators use the most suitable methods and pedagogical approaches tailored to the student and aligned with the goals and expected results. Physics educators must use innovative teaching methods that enhance engagement and enjoyment, in response to current advancements in educational technology, to address the prevalent issue of inadequate performance. Shedrack (2022) stated that various pedagogical approaches might favourably or adversely influence students' attitudes or interest in a topic, ultimately impacting their performance outcomes. In conclusion, Sukarmin et al. (2017) argue that defining a teaching method that takes into account learners' misdirection in the organisation of the subject's rules, targets, and transportation is premature. Moving forward, learning can adapt to various data sets, as evidenced by this. The characteristics of organised Data and Communication Advanced (ICT) signs that can change over cinema, sound, and change into advanced plans, giving acclimate and understanding data (Ezenduka & Achufusi, 2013), without a fixed address, make student engagement. Streamlined understudy censure in the lore, especially in stand up to bits of data, is initial when there is a sense of integrity to integrity interested in the point or course. Suleiman (2022) suggested that information and communication technology (ICT) could be used to correctly misplace and amplify effective instruction and appreciation of bits of data, especially in the face of challenges. Adeyemo (2010) says that the use of motorised devices in all aspects of teaching is being proposed as part of the education information and communication change. According to Kamaludeen et al. (2021), information and communication technology (ICT) is generally and then passed on as an essential tool for considering and showing up over over over up data, conducting tests, and communicating disclosures.

According to Shehu et al. (2021), information and communication technology (ICT) includes all forms of communication, such as radio, television, portable phones, computers, organised get amped, satisfying frameworks, and joined rates confederations such as tape recording, conferencing and clear capability. According to Simin et al. (2015), in the motorised age, the use of ICT in teacher settings is superior for providing students with the opportunity to secure and execute 21st-century skills. According to Sharma et al. (2011), the sensible use of ICT may reevaluate the cement used to run the look up over and capability shapes, resulting in a paradigm shift in both the substance and rules organisation. The incorporation of information and communication technology (ICT) would, in the opinion of Simin et al. (2015), assist in encouraging the world's bears to replace conventional search engine optimisation techniques with adaptive instruction. During the conflict, this would be of assistance. In a general sense, Etukakpan et al. (2021) point by point in their research demonstrate that society is undergoing acclimatisation as a result of the rapid expansion and duplication of ICT across all spheres of life. Mentoring and education approaches have been impacted by this advancement, which has, in a sense, influenced the educators' organisation. Madubuchi (2021) set that 21st-century unfaltering instruction ought to prioritise the figure of styles and courses of improvement to address challenges, emphasising the centrality of satisfying and driving rates in speedy ways. This could be accomplished by revealing how ICTs are being used in education.

The fact that a student from a family can enrol in traditional classes that primarily emphasise the use of blended media supports the use of ICT in education, according to Kamar et al. (2016). According to Merja and Maarika (2018), chief runs appear to permit free online courses that are open to everyone at private institutions, indicating that competition in the online education sector is increasing worldwide. The integration of web inner parts parts Information and Communication Enhancement energises clean learning and the sharing of instrument resources in comparison to conventional instrument systems, which require an increase in interactions between instruments and students. Kamar et al. (2016) observed that e-learning, mobile learning, remote learning, and ubiquitous learning, all of which comply with ICT standards, have grown prevalent, since contemporary education is no longer confined to traditional classroom settings and note-taking. Chukwunenye (2015) noted that the emergence of ICT has facilitated several instances of computer-simulated experiments that may be conducted utilising educational software packages. Virtual labs that use software are not feasible without ICT.

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The advantages of the virtual laboratory include the capacity to conduct hazardous experiments in physics, addressing the issue of insufficient laboratory equipment, and providing multiple opportunities to review specific experiments. This repetition fosters mastery, serving as a remedy for the limited time available in traditional laboratory classes, as virtual laboratories can be accessed at any time, with the duration of use dictated by the user, among other benefits.

Despite the number of students selected for a course, it energises learning at any time and location, highlighting the benefits of ICT and addressing the issue of large class sizes. ICT educator advancements have the potential to improve surface science instruction throughout the instructors' modules, astonish students, provide visual instruction to clarify speculative concepts, foster compelling communication between students, and develop important thinking skills and other skills necessary for working in an ICT-rich environment (Eddahby et al., 2021). Awuor and Okono (2022) also found that ICT-integrated energised learning improves students' educational outcomes, such as captivated, engagement, and retention, as well as their engagement in the classroom, in comparison to traditional classroom methods. Nwambela et al. (2020) on an especially fundamental level found in their study that the integration of ICT in the run the show up up and learning of surface science improves students' academic performance. ICT in the form of videos and activities serves as a crucial back and a sensible elective to see at office get organized that certain schools may require, allowing understudies to observe operational shapes (Mwanaszumbah & Magoma, 2016) in addition to advancing students' enthusiasm for surface science and facilitating their comprehension of inquisitive concepts. These unanswered clarifications regarding the incorporation of ICT into instruction have the potential to secure surface science instruction and comprehension. Amaebite and Adiele (2021) are well known that a few countries are realigning their teaching targets to address the progressing educational demands of the 21st century, particularly creative advancements in course and learning.

In any case, incorporating ICT into education presents obstacles. Even though instruments play a crucial role in integrating ICT into education and putting it into practice, some people think this is because they are required to have certain knowledge and skills (Yadev, 2015). According to Suleiman (2018), a few attendees at the conference who do not have access to ICT are more likely to avoid using the instrument in the classroom due to anxiety over disappointment. He confirms that this shift in response to the idea that some instruments, who believe they are required to utilise ICT, are afraid of using it for the first time in recent classes with students who might have more knowledge. According to Dano et al. (2019), the majority of the practical implementation of ICT-integrated run the appearance up and learning is surprising in terms of the teacher's competence. Briones (2018) conducted a study that found a correlation between students' surface science performance and instructors' ICT proficiency. In the 21st century, instruments must not only demonstrate proficiency in their use but also contribute basic effort in recognising appropriate instructional materials. So other than, Hussaini et al. (2023) combat that instructors' capacity with ICT noncompliance was the crucial factor in choosing the commonsense utilize of ICT contraptions to movement course and learning surface science.

An inadequate control supply, burglary as a result of organization leaders' passion for the security of ICT change, the restrictive effects of ICT resistance, an organized student-to-tool degree, teachers' organized approach to utilizing ICT assets in instruction, and teachers' loss in utilizing these assets sensibly are all challenges that Aina (2013) acknowledges. Shedrack's (2022) comprehensive inquiry confirmed that ICT resources are neither open nor utilised in classrooms. Briones (2018) identified the obstacles to the use of information and communication technology (ICT) in education, such as the student-computer and teacher-computer ratios, a lack of planning for ICT integration, the need for ICT expertise and certainty, a lack of specialised gear, and the obligation to access ICT resources. Yunusa et al. (2019) noted that the integration of ICT as a supplementary resistance for running the appear up and learning surface science is lost in the Nigerian instrument framework. According to Khalid et al. (2016), one of the first obstacles to incorporating new changes is the possibility that their insignificant application will enhance education. They say that the development of knowledge is not guaranteed, but it could be surprising if unused technology is used. In addition, there is concern regarding instructors' and students' attitudes toward ICT usage. Way insinuates the inclination for a certain challenge. People are pulled into what they respect and seek to clear themselves from what they really, truly, genuinely abhor. A favourable disposition towards ICT among teachers and students routinely locks in their utilize of ICT for instrument purposes. This suggests that the conversation will take place if their assumptions regarding ICT are negative. Agyei and Agyei (2019) are stunned that teachers' demeanours and sees around the utilize of ICT in surface science instruction are vital, as these components may in a common

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sense influence the effectiveness of any ICT progress and execution handle. Suleiman (2018) certified that instrument analysts and analysts have pointed up that a teacher's way is a central component in the clarification of unused prompts in classroom run the classroom. According to him, ICT trends have an impact not only on how teachers use computers in the classroom but also on their ability to get a kick out of organising. He stated that the cement up to of offer help provided by school organisations may influence teachers' views regarding the integration of ICT in classrooms. Given up boundless unimaginably loathe toward the as of by and by said issues, it is fundamental to emphasise that unless ICT is sensibly integrated into our teaching framework, the idealised benefits of instruction would be truant in our society, especially in Africa. Africa must initially play a significant role in the development of its landmass. In the field of education, one ought to discuss whether an overhaul is something that should be noted. To this question, Bao and Koenig (2019) provided charming responses. They insist that instrument goals be adaptable to the demands of an evolving global scene, ensuring that education is the primary benefit provided by society to organise the following workforce. The goals of instruction have advanced to prioritise the overhaul of central "21st Century aptitudes" in learners. According to the National Inquiry into Board, 2012, which is cited in Bao & Koenig, 2019, these capacities propose the information and qualities necessary for compelling change in the workforce and the global economy of the twenty-first century. According to Suleiman and Yahya (2016), expanding STEM (Science, Technology, Engineering, and Mathematics) education by the end of ICT is a sensible strategy for addressing Africa's creative and financial underdevelopment. These, by and by, appeared to compel the specialists to examine the effect of ICT on the teaching and learning of physics in secondary schools in Ahoada West Local Government Area in Nigeria.

Objectives of the Study

Specifically, the objectives of the study are to:

1. identify the impact of ICT on teachers and students in the teaching and learning of physics in secondary schools.
2. identify the problems faced by physics teachers and students in the use of ICT tools for teaching and learning in secondary schools.
3. Identify the attitude of teachers and students towards the use of ICT tools in the teaching and learning of physics in secondary schools.

Research Questions

1. What are the impacts of ICT tools on teachers and students in the teaching and learning of physics in secondary schools?
2. What are the problems faced by teachers and students in their use of ICT tools for teaching and learning physics in secondary schools?
3. What is the attitude of teachers and students towards the use of ICT tools in the teaching and learning of physics in secondary schools?

Hypotheses

$H0_1$: The impact of ICT on teachers and students in the teaching and learning of Physics does not differ significantly.

$H0_2$: The problems faced by teachers and students in their use of ICT tools for teaching and learning physics do not differ significantly.

$H0_3$: The attitude of teachers and students towards ICT tools for teaching and learning physics does not differ significantly.

Methodology

This research utilised a descriptive survey design. In Ahoada West Local Government Area of Rivers State, twelve physics teachers were selected through a census sampling method, while 200 Senior Secondary 2 (SS2) physics students were chosen via a stratified random sampling technique. Data collection was carried out using a structured questionnaire titled "Impact of Information and Communication Technology (ICT) in Physics Education Questionnaire (IICTTLPQ)." Responses were measured on a 4-point Likert scale, categorised as "Strongly Agree" (SA), "Agree" (A), "Strongly Disagree" (SD), and "Disagree" (D). The reliability of the instrument was confirmed with a reliability coefficient index (r) of 0.80. The researchers personally distributed the questionnaires and retrieved them immediately after participants provided their responses. Mean and

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standard deviation were applied to analyse the research questions, while a t-test was used to assess the hypotheses at a 0.05 level of significance.

Results

Table 1: Mean and standard deviation showing the impact of ICT in teaching and learning physics

	Students				Teachers			
Items	**N**	**$\bar{X}$**	**SD**	**Remark**	**N**	**$\bar{X}$**	**SD**	**Remark**
ICT makes teaching and learning interesting	200	3.22	.749	A	12	3.67	.651	A
ICT makes teaching and learning lively	200	2.95	1.157	A	12	3.17	.835	A
ICT makes teaching and learning exciting	200	1.79	.761	D	12	2.58	.793	A
ICT Improves performance	200	2.85	1.146	A	12	2.75	1.215	A
It makes teaching and learning look real.	200	3.10	1.190	A	12	3.08	1.084	A
ICT makes teaching and learning possible anytime and anywhere	200	2.79	1.222	A	12	3.00	.853	A
ICT motivates teaching and learning	200	2.63	1.118	A	12	2.83	1.030	A
Grand mean (GM)		**2.761**				**3.01**		

From table 1 above, the criterion mean value for students and teachers are 2.76 and 3.01 respectively which are both above the criterion cutoff point of 2.50 i.e. students and teachers agreed that ICT has impact on the teaching and learning of physics.

Table 2: Mean and standard deviation showing the problem of physics teachers and students towards the use of ICT

	Students				Teachers			
Item	**N**	**$\bar{X}$**	**SD**	**Remark**	**N**	**$\bar{X}$**	**SD**	**Remark**
Slow internet	200	2.67	1.833	A	12	3.50	.522	A
Irregular power supply	200	2.65	1.337	A	12	3.00	1.044	A
Inadequate ICT tools for several students	200	2.23	1.917	A	12	1.50	.522	D
Virus threat associated with computers	200	2.91	1.101	A	12	3.00	1.267	A
Lack of ICT time	200	2.79	1.137	A	12	3.17	1.267	A
Lack of access to a network	200	2.70	1.334	A	12	2.83	1.26	A
Incompetence of teachers and students in the use of ICT tools	200	2.22	1.028	A	12	2.83	1.115	A`
Grand Mean		**2.59**				**3.23**		

From the table 2 above, the criterion mean value for students and teachers are 2.59 and 3.23 respectively which are both above the criterion cutoff point of 2.50 i.e. students and teachers agreed to all the items in the table on problems towards the use of ICT.

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Table 3: Mean and standard deviation showing the attitude of Physics teachers and students towards the use of ICT

Item	Students N	$\underline{X}$	SD	Remark	Teachers N	$\underline{X}$	SD	Remark
I enjoy teaching and learning with ICT tools	200	3.55	.499	A	12	3.58	.515	A
I dislike teaching and learning with ICT tools.	200	2.95	1.001	A	12	2.85	1.030	A
Teaching and learning with ICT tools makes me bored	200	1.48	.501	D	12	1.42	.515	D
I like teaching and learning with ICT.	200	2.74	1.109	A	12	3.08	1.084	A
Teaching and learning with ICT tools make learning lively	200	3.26	1.179	A	12	3.17	1.267	A
ICT makes teaching and learning interesting	200	2.81	1.166	A	12	2.83	1.231	A
I don't get stressed when teaching and learning with ICT tools	200	2.73	1.112	A		2.67		A
Grand Mean (GM)		**2.79**				**2.79**		

From table 3 above, the criterion mean value for both students and teachers are 2.79 which is above the criterion cutoff point of 2.50 i.e. students and teachers agreed to all the items in the table on attitude towards the use of ICT.

Table 4: t-test of the mean difference between students and teachers' impact of using ICT

Category	N	$\overline{X}$	SD	df	t	Sig	Decision
Students	200	19.32	2.968				
				210	2.030	0.044	Sig
Teachers	12	21.08	2.151				

Table 4 above shows that the calculated t-value (2.030) for students and teachers is significant at 0.05 level of a significance. Therefore, the null hypothesis is rejected implying that the impact of using ICT tools on teachers and students for the teaching and learning of physics among secondary schools differ significantly.

Table 5: t-test of the mean difference between the problems faced by physics students and teachers in using ICT

Category	N	$\overline{X}$	SD	df	t	Sig	Decision
Students	200	18.16	3.361				
				210	4.480	.000	Sig.
Teachers	12	22.67	3.846				

Referring to Table 5, the derived t-value of 4.480 for both educators and learners is statistically significant at the 0.05 threshold. Consequently, the null hypothesis is invalidated, indicating that the obstacles encountered by teachers and students in integrating ICT tools for physics education in secondary schools show notable differences.

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Table 6: t-test of the Mean difference between the attitudes of Physics Teachers and Students towards the use of ICT

Category	N	$\overline{X}$	SD	df	t	Sig	Decision
Student	200	19.50	2.628				
				210	-.106	-916	Not Sig.
Teachers	12	19.58	2.99				

As shown in Table 6, the calculated t-value of -0.106 for both educators and learners is not significant at the 0.05 threshold. Consequently, the null hypothesis is accepted, indicating that there is no substantial difference in the perspectives of teachers and students regarding the application of ICT tools in teaching and learning physics in secondary schools.

Discussion

As demonstrated in Table 4, Hypothesis 1 reveals that the influence of ICT on both teachers and students in physics education differs significantly. However, both groups acknowledged that ICT enhances physics performance. This conclusion aligns with the studies of Adeyemo (2010) and Mwambela et al. (2020), which also established that incorporating ICT into physics instruction positively impacts students' academic success. Likewise, this research supports the findings of Briones (2018), who reported that ICT integration in classrooms improved students' comprehension of scientific concepts, heightened their interest in the subject, facilitated lesson management, and provided teachers with greater flexibility in lesson preparation. Additionally, the outcomes of this study correspond with those of Hussaini et al. (2023), who arrived at a similar conclusion regarding the crucial role of ICT in teaching and learning physics.

As indicated in Table 5, the results of Hypothesis 2 show that the difficulties encountered by teachers and students in utilising ICT tools for physics education in secondary schools differ considerably. Nevertheless, both groups face challenges related to ICT usage. These findings align with Makanda (2015), who identified low ICT adoption in lesson delivery due to constraints such as inadequate infrastructure, limited computer access, and a lack of ICT proficiency. Furthermore, Makanda (2015) noted that only a small number of teachers integrated ICT into their teaching, attributing this to insufficient training, limited time for ICT use, and inadequate facilities. However, regarding ICT competence, this study contradicts Makanda's findings. While Makanda (2015) observed that physics teachers demonstrated relatively high ICT proficiency, frequently using word processing and the internet, this study found that many physics teachers lacked ICT skills. Additionally, these results contrast with Briones (2018), who discovered that Grade 8 physics teachers had a high level of ICT competency. Nevertheless, Briones (2018) agreed with this study in identifying challenges such as unreliable or insufficient internet access, a lack of ICT training workshops, limited technical assistance, inadequate time for lesson planning with ICT, and a shortage of suitable software and hardware. Moreover, this study aligns with Suleiman (2018), who also highlighted the challenge of insufficient time for effective ICT integration in classrooms. Finally, it concurs with Hussaini et al. (2023), who pointed out that the availability of ICT resources is insufficient compared to the number of students and the instructional time allocated for ICT-based lessons.

Table 6 supports Hypothesis 3, which asserts that there is no significant difference in the attitudes of secondary school teachers and students toward ICT use in physics education. Both groups exhibit a positive perception of ICT in the classroom, likely due to its benefits, such as flexible learning opportunities. These findings are consistent with Makanda (2015), who also reported that teachers and students maintained a favourable outlook on ICT integration in education. Similarly, this study aligns with the research of Khalid et al. (2016) and Agyei and Agyei (2019), which concluded that educators generally hold a positive perspective regarding the application of ICT in teaching and learning.

Conclusion

Emphasising the role of ICT in education while upholding academic honesty is crucial, particularly in scientific disciplines like physics. The adoption of ICT has greatly transformed the approach to teaching and learning physics. A country's technological development is closely tied to its achievements in physics, which heavily depend on the effectiveness of modern teaching tools. As a result, developing nations such as Nigeria should prioritise increasing their investments in ICT to improve education, especially in the field of physics.

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Recommendations

The following recommendations were made:

1. More money should be allocated by government and non- governmental organizations to build up ICT centers with all the necessary equipment.
2. Orientation programs should be organised for teachers to ensure they have the knowledge and experience to use ICT effectively in the classroom.
3. In order to be competent, secondary school teachers and students should continuously get training on how to utilize government-sponsored ICT instruments.
4. Inadequate power supply—the main obstacle—need to be fully addressed, as information and communication technology (ICT) instruments are useless without electricity.
5. ICT resources should be insured by relevant authorities which will allow for easy replacement in the event of damage.

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Cite this article as:
Shedrack, T., Godpower-Echie, G., & Chinda, W. (2025). Impact of Information and Communication Technology on Physics Education Among Senior Secondary School Students in Ahoada, Nigeria.*FNAS Journal of Mathematics and Science Education, 6*(2), 93-101.