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Perceived Effects of ICT Integration on Teaching and Learning in Ghanaian Senior High Schools: A Mixed-Methods Study

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Abstract
Integrating Information and Communication Technology (ICT) in education is not just a trend, but a transformative force that is reshaping traditional teaching and learning methodologies. This mixed-methods study delves into the potential effects of ICT integration on teaching and learning in Ghanaian senior high schools, with a specific focus on educators' perspectives. Data were collected from 90 teachers across various categories of schools in the Greater Accra Region, employing both quantitative surveys and qualitative interviews. The findings reveal that ICT positively influences teaching and learning outcomes, enhancing student engagement, promoting critical thinking, and facilitating personalised learning experiences. These personalised learning experiences, enabled by ICT, allow students to learn at their own pace, focus on their individual learning needs, and receive immediate feedback. Notably, female teachers reported a higher perceived impact of ICT on their teaching practices than their male counterparts. Despite these positive perceptions, the study identifies significant challenges, including inadequate infrastructure, limited access to technology, and insufficient training for educators, which hinder effective ICT integration. This research underscores the need for targeted support, such as regular professional development workshops and mentorship programmes, and equitable access to ICT resources, including ensuring all schools have a minimum standard of technology and internet connectivity. These recommendations align with the national curriculum's goals of fostering student digital literacy and innovation. By highlighting these dynamics, the study contributes to the broader discourse on educational technology in Ghana, providing essential insights for policymakers and stakeholders seeking to optimize ICT integration in the educational landscape.

Keywords: Educational Technology, Ghana, ICT Integration, Senior High Schools, Teaching and Learning

1. Introduction

Incorporating Information and Communication Technology (ICT) has transformed the approach to teaching and learning in different academic domains. ICT encompasses a range of technologies that facilitate information collection, storage, editing, and dissemination (Wordu et al., 2021). With ICT being a critical component of the national curriculum, it is now extensively used as a management, assessment, diagnostic, and statistical tool (Mugaya, 2020). In addition to traditional lesson preparation, interactive computer applications and simulation exercises have also been adopted to enhance the learning experience (Rowe et al., 2015). Furthermore, instead of just teaching students to use technology, teaching them through technology has been identified as a critical strategy in preparing them for the future (Pardede, 2020). The educational expertise of teachers and students can be used to assess the effectiveness of ICT in education (Mwenda, 2017).

Numerous studies have investigated factors that can optimise the effectiveness of learning technology, such as motivation, feedback, reinforcement, social interaction, readiness level, and pacing (Ananga, 2020). The integration of ICT in education offers considerable potential for enhancing educational outcomes. Nonetheless, addressing challenges such as infrastructure, teacher training, and access is crucial for its efficient utilisation. For instance, this study builds on previous research that demonstrates how internet access can improve academic performance in Ghanaian Senior High Schools. It examines what teachers think about using ICT to enhance lessons and activities (Amponsah, et al., 2022). Similarly, this study aims to investigate teachers' perceptions of using ICT in the classroom to enhance the overall learning experience in Ghanaian Senior High Schools. This investigation is like how teachers feel about the government's Wi-Fi technology programme and its impact on their teaching (Asomah et al., 2024).

The integration of ICT into the educational system in Ghana, particularly at the Senior High School (SHS) level, is crucial for achieving objective and root-based learning. The Ghanaian government recognises the significance of ICT in stimulating critical thinking, innovation, creativity, and digital literacy to tackle the problems of the twenty-first century (Gunu et al., 2022). As such, the integration of ICT into SHS curricula has been met with great enthusiasm (Gyasi-Mensah & Osman, 2022). Studies indicate that the inclusion of ICT in educational curricula has a favourable effect on teachers' and learners' competencies and knowledge (Mwendwa, 2017). This holds particular importance given the recent implementation of a new curriculum by the National Council for Curriculum and Assessment (NaCCA), which strongly emphasises the acquisition of skills and competency-based learning. According to NaCCA (2018), learners' daily activities should naturally incorporate the usage of ICT for them to be empowered and transformed into digital citizens who are creative designers, computational thinkers, global collaborators, and capable of creative communication. However, assessing the perceived influence of ICT integration on learning process is crucial for ensuring the effective implementation of the new curriculum.

Numerous studies have explored the efficacy of ICT as an educational tool (Baah-Duodu et al., 2020). There is a widely held belief that ICT has the potential to revolutionise conventional teaching and learning methods by empowering teachers and students to enhance higher-order thinking skills, problem-solving capabilities, creativity, and communication skills; nonetheless, there is no adequate empirical evidence to substantiate this claim. Notwithstanding, it is generally recognised that ICT can encourage transformation and facilitate the cultivation of 21st-century competencies in educators and learners (Mohamed et al., 2021). In education, this transformative power of ICT can extend to addressing the challenge of promoting intrinsic motivation in students. Teachers, lecturers, and researchers may need to seek practical ways to leverage ICT tools and strategies to enhance intrinsic motivation, leading to better engagement in the learning process (Arkorful et al., 2021). By integrating technology into pedagogy, educators can create interactive and stimulating learning environments (Arkorful et al., 2021) that tap into students' natural curiosity and enthusiasm, fostering a genuine interest in acquiring knowledge and skills.

The incorporation of ICT in high schools is a topic that has garnered significant attention in research. For instance, Arkorful et al. (2021) discovered that educators' favourable attitudes toward incorporating ICT in their pedagogy corresponded with the inventive use of ICTs in teaching, leading to increased student engagement in the learning process. Similarly, Awuor and Okono (2022) observed that students cooperated to solve problems arising from using ICT, forming academic discourse communities, and working together across different schools. This

highlights the global importance of technology in educational activities, as emphasised by teachers (Gyasi-Mensah & Osman, 2022).

Incorporating ICT in education piques academic curiosity and fosters a sense of fulfilment by enabling students to transition from passive knowledge recipients to active information creators. It is essential to recognise, however, that despite the potential advantages of integrating ICT into education, obstacles must be overcome. For example, Biasi et al. (2021) found that conventional examination conditions may impede the successful incorporation of ICT in schools. Restrictions on using ICT gadgets during examinations can demotivate teachers and students who have been using ICT as part of their learning and teaching. Consequently, this study explores educators' perspectives on the influence of ICT integration on teaching and learning, with a specific focus on grades 10 to 12.

1.1. Statement of the problem

ICT integration in education has become a worldwide phenomenon. Some studies (Bento & Martins, 2018; Gil-Flores et al., 2017) demonstrated that ICT integration in education can improve teaching and learning and boost learner involvement and motivation. Consequently, the Ghanaian government has tried to incorporate ICT into the educational system because it acknowledges the capacity of ICT to raise educational standards (Asante & Osei-Kwasi, 2019; Oduro, 2019). Despite these efforts, more studies need to examine the perspectives of senior high school teachers on the impact of ICT integration on educational activities in Ghana.

The effective integration of ICT in education hinges on the dual foundation of teachers' active support and involvement, as Ertmer Ottenbreit-Leftwich (2010) emphasized. This support is connected to teachers' attitudes and perceptions, a sentiment echoed in the research by Arkorful et al. (2021). Essentially, teachers' positive shaped by their perceptions, attitudes toward ICT, are vital determinants influencing their willingness to actively engage with and support the use of ICT in educational settings. Therefore, fostering a positive environment where teachers endorse and actively participate in using ICT is crucial for its successful implementation and impact on education. To determine possible obstacles and enablers to its delivery, it is crucial to be abreast of teachers' views at SHS on incorporating ICT in the classroom. Consequently, this research aims to investigate how Ghanaian senior high school teachers perceive the impact of ICT integration on teaching and learning activities. The study aims to determine possible obstacles and enablers to Ghana's effective adoption of ICT at the senior high school level.

1.2. Objective of the study

This study aimed to ascertain the perceived effects of ICT integration on senior high school teaching and learning, as well as the extent to which educators employ ICT resources during instruction. The broad objective is further broken down into specific and achievable objectives:

1. To determine the effect of incorporating ICT on the teaching and learning process.
2. To explore the perceived effects of ICT utilization in teaching and learning by educators of both genders.
3. To investigate the differences in the utilization of ICT in teaching and learning among educators from three categories of schools
4. To determine teachers' views on using ICT in teaching and learning across different school categories.

1.3. *Research Questions*

The study addresses several key questions related to the integration of Information and Communication Technology (ICT) in education, particularly in Ghanaian senior high schools:

1. How do teachers perceive the impact of incorporating ICT into the teaching and learning process in Ghanaian senior high schools?
2. What is the perceived influence of ICT incorporation on teaching and learning among male and female teachers in Ghanaian senior high schools?

3. What are the differences in the use of ICT in teaching and learning among educators from various school categories (Category A, B, and C)?
4. What are teachers' views on using ICT in teaching and learning across different school categories?

These questions aim to explore the effectiveness, challenges, and perceptions of ICT integration in the educational system.

2. Literature Review

2.1. Theoretical Framework

The Technology Acceptance Model (TAM) was used in this study to explore and predict users' behaviour toward information technology. The TAM has been widely used to explain how individuals accept technology and is based on four primary concepts: perceived ease of use, perceived usefulness, attitude towards using, and behavioural intentions. Davis first proposed the model in 1986, which various researchers have modified and refined. Perceived ease of use and perceived usefulness refer to the degree to which people believe that utilising a specific system will save them physical and mental effort and enhance their job performance, respectively. In this study, perceived usefulness and perceived ease of use were examined for e-learning opportunities to improve learning outcomes. The TAM is essential for assessing technology acceptance (Adarkwa, 2018).

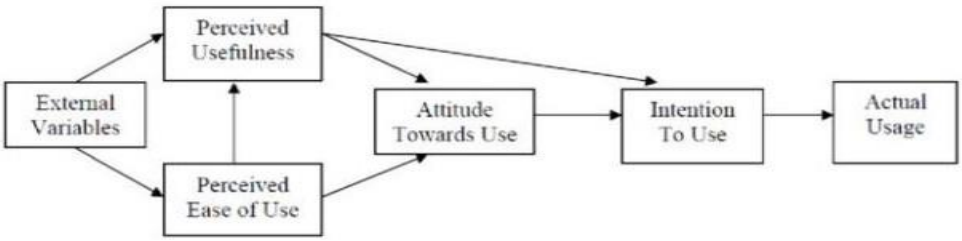

Figure 1: Technology Acceptance Model (Source: Adopted from Park, (2009)

2.2. Enhancing Teaching and Learning Through the Effective Integration of ICT

The integration of ICT as a teaching tool in classrooms has been shown to enhance cognitive knowledge and promote effective learning in schools (Yermekkyzy, 2022). To achieve this, it is essential for teachers to understand ICT and incorporate it into their teaching methods. This approach can help stimulate and improve student abilities, promote better learning outcomes, and cultivate lifelong learning skills (Prasad et al., 2021). Although Prempeh (2020) discovered in their study that students and teachers prefer using ICT for general studies and entertainment purposes such as streaming videos, watching movies, and playing games, Moyo (2019) asserted that the primary motivation for incorporating ICT in education is to enhance the quality of teaching and learning beyond the traditional methods. Moyo's position has been affirmed by Prempeh (2020), who found that integrating ICT in second-cycle institutions increases accessibility, efficiency, and overall quality of education.

Incorporating ICT into the traditional teaching and learning approach involves using various modes of instruction while maintaining the same learning objectives (De Koster et al., 2017). De Koster et al suggest that teachers can now use a projector and PowerPoint application instead of writing on the board, utilising technology effectively without compromising the learning outcomes (Wilson, 2020). According to Awang et al. (2019), secondary schools need an ICT plan aligned with their vision to achieve full integration of ICT in education.

However, Gülen (2019) claims that an ICT plan demands quality and reliability in numerous areas. First, the ICT system's hardware and software must be high-quality for reliable functioning. This includes ensuring that servers and network equipment are high-quality and can handle the organisation's workload. Second, ICT plan implementers must be qualified, and system trained. IT professionals and end-users will utilise the system daily. Ensuring everyone has the right skills and knowledge will help the system run smoothly. The ICT plan must match

the company's business strategy and goals. The ICT system should support fundamental business processes and help the corporation achieve its goals. The ICT system must understand the organisation's demands before establishing and implementing the ICT plan. Fourth, the ICT system must scale and adapt to business needs. The ICT system should expand with the company. Monitoring and maintenance are needed to keep the system running smoothly.

Finally, a solid ICT support system is necessary to resolve concerns. This comprises a quick-response help desk or support crew. Sabiri (2020) suggests categorising ICT integration in education into three areas: ICT as a learning resource, ICT for lesson preparation, and ICT for teaching, as each school's approach may differ. Incorporating ICT into teaching effectively requires ICT proficiency that considers appropriate hardware and software and the ability to manage various computer programmes for different purposes (Gil-Flores et al., 2017). Turugare et al. (2020) propose that teachers can use projectors to present lessons, leading to efficient and effective interaction with students and promoting the successful integration of ICT into teaching and learning.

2.3. Empirical Framework

2.3.1. Effect of Incorporating ICT on the Teaching and Learning Process

The integration of ICT into education has been widely regarded as a transformative force in the teaching and learning process. Numerous studies highlight the positive impact of ICT on enhancing pedagogical strategies, student engagement, and overall educational outcomes. Anderson and Dexter (2005) state that ICT tools, such as interactive multimedia, simulations, and online resources, offer diverse modalities for delivering instructional content. These modalities cater to various learning styles, providing students with a more personalised and interactive learning experience. Furthermore, Hattie et al. (2017) emphasises the role of feedback in effective teaching, and ICT facilitates timely and constructive feedback mechanisms. Incorporating learning management systems and online assessment tools allows educators to track individual student progress, identify learning gaps, and tailor interventions accordingly. This supports a formative assessment approach and fosters a dynamic and responsive teaching environment.

2.3.2. Perceived Effects of ICT Utilisation in Teaching and Learning by Educators of Both Genders

Research on educators' perceptions, irrespective of gender, towards using ICT in teaching and learning reveals a generally positive outlook. Ertmer et al. (2012) note that educators recognise ICT to enhance pedagogical practices, making lessons more engaging and relevant. Integrating multimedia resources and interactive platforms caters to diverse learning styles and promotes inclusivity in the classroom. Additionally, Ghavifekr et al. (2017) argue that both male and female educators acknowledge the role of ICT in developing students' 21st-century skills, including critical thinking and digital literacy. The perceived benefits of ICT utilisation extend beyond the immediate classroom setting, as educators recognise the importance of preparing students for the technologically driven future.

2.3.3. Differences in the Utilisation of ICT in Teaching and Learning Among Educators in Secondary Schools

While the overall perception of ICT is positive, variances in its utilisation among educators in secondary schools are evident. Research by Chigona and Chigona (2010) indicates that differences in technological proficiency, access to resources, and institutional support contribute to divergent practices. Educators in well-resourced schools might have greater access to ICT tools and training, leading to more extensive integration into their teaching practices. Moreover, a study by Selwyn (2011) suggests that variations in subject disciplines also affect the extent of ICT integration. For instance, science and mathematics teachers may use simulations and modelling tools more extensively than those in humanities, reflecting subject-specific pedagogical preferences.

2.3.4. Teachers' Views on the Usage of ICT in Teaching and Learning Across Different School Categories

Teachers' perspectives on using ICT in teaching and learning vary across different categories of schools, namely public, private, and religious institutions. According to Anderson (2017), educators in private schools may express

more favourable views due to better access to technology resources and professional development opportunities. Conversely, teachers in public schools may need help with infrastructure limitations and insufficient training. Furthermore, a study by Quayson and Halm (2020) reveals that teachers in religious schools may integrate ICT tools to align with specific educational values or religious teachings. This emphasises the contextual nature of ICT utilisation, with educators adapting their practices based on the mission and vision of the educational institution. In conclusion, exploring the literature on the influence of ICT integration in teaching and learning among Ghanaian Senior High School teachers reveals a complex interplay of factors that shape perceptions, practices, and variations in the educational landscape. The positive impact of ICT is evident, but challenges (Asad et al., 2021) and discrepancies highlight the need for targeted support and equitable access across different school contexts.

3. Materials and Methods

3.1. Research Design

The data for this study were collected from 90 mathematics teachers of grades 10 to 12 in Greater Accra Region using an explanatory sequential mixed methods design (Hollstein, 2014). The design was chosen for complementarity and triangulation; the qualitative method brought meaning and interpretation to the statistical results given by the quantitative method. A survey questionnaire was used to gather quantitative information and conducted semi-structured interviews to gain qualitative insights. The collected quantitative data were analysed using both descriptive and inferential statistics and the qualitative data thematically.

The study examined the effect of ICT integration on teaching and learning processes and differences (if any) in perceptions between male and female teachers regarding ICT integration and among teachers from the three categories of senior high schools. The qualitative data were analysed thematically to identify challenges faced during integration, and the significance of ICT integration. The chosen research design for this study was non-experimental, as it aimed to report the current situation regarding the integration of ICT in senior high schools within the Greater Accra Region of Ghana without manipulating the existing teaching and learning environment. This design was deemed appropriate by the researchers based on the work of Cohen et al. (2000) and Topping (2023), who highlight the advantages of non-experimental designs in providing a snapshot of a particular phenomenon.

3.2. Population of the Study

The study targeted senior high school teachers in the Greater Accra region of Ghana, as the aim was to gain insight into the phenomenon from the perspectives of the various SHS's systemic categorisation by the Ghana Education Service (GES, 2022). Most teachers (n = 74, 82.2%) were male, while only 16 (17.8%) were female. Table 1 presents a comprehensive overview of the demographic information of the participants involved in the study. The sample included 50 (55.5%) teachers from Category A schools, 24 (26.7%) from Category B schools, and 16 (17.8%) from Category C schools. The age range of the teachers varied, with 12.2% for 20–30 years, 54.4% aged between 30 and 40 years, 24.4% for 40–50 years, and only 8.9% within the age range of 50–60 years. Regarding subjects taught, 53.3% of the teachers taught General Science courses, 18.9% taught ICT, and Agriculture, General Arts, Business, and Technical skills were taught by 8.9, 8.9, 3.3, and 4.4 percent, respectively, while only 2.2% taught Home Economics.

Table 1: A comprehensive overview of the demographic information of the participants in the Senior High Level

Demographic Variable	**Categories**	**Frequency**	**Percentage (%)**
Gender	Male	74	82.2
	Female	16	17.8
Category of School	Category A	50	55.5
	Category B	24	26.7
	Category C	16	17.8

3.3. Sample Size and Sampling Technique

In this study, a multi-stage sampling technique was used to gather data. Initially, a stratified random sampling approach was implemented to select two senior high schools, each from urban, semi-urban, and rural areas in the Greater Accra Region. Secondly, a convenience sampling technique was used to select the participating teachers from the selected schools. According to Babbie (2017), convenient sampling entails selecting individuals who are easy to come by and readily available to the researcher.

The schools selected were readily available within the study's region. Finally, twenty teachers with more than five years of experience in teaching were purposefully selected from each participating school, allowing them to make informed decisions about the items on the questionnaire. In total, 90 teachers participated in the study.

3.4. Instrument

The research team adopted a self-report questionnaire and designed the interview guide based on teachers' responses to the questionnaire to collect data from teachers from six selected senior high schools. The questionnaire consists of two sections (Sections A and B) intended to gather respondents' demographics and opinions on the phenomenon under investigation. A five-point Likert scale, which included options ranging from strongly agree to disagree strongly, was used to assess the participants' level of agreement with the statements on the questionnaire. The questionnaire items were internally consistent, with a high reliability estimate of Cronbach alpha ranging from 0.78 to 0.88. The Likert scale of 1-5 was utilised in the structured questions to determine the degree of agreement with the items.

3.5. Data Analysis

The analysis of the quantitative data in this study involved a two-step process. The initial step involved using descriptive statistics, such as frequencies, percentages, means, and standard deviation, to examine the participants' personal data and background information. The second step focused on applying inferential statistics, such as independent sample t-tests and a one-way between-groups ANOVA.

4. Results

4.1. Research Question One: How do teachers perceive the impact of incorporating ICT into the teaching and learning process in Ghanaian senior high schools?

The effects of incorporating ICT into the instruction in senior high schools were examined in this study, and the findings are presented in Table 2. The minimum and maximum scores, on the other hand, were 32.5 and 97.5, respectively. Table 2 presents the mean and standard deviation of teachers' perceptions of the impact of incorporating ICT into teaching and learning.

Table 2: Mean and Standard deviation on the Teachers Perceptions of the Impact of Incorporating ICT into Teaching and Learning

Variable	Mean	SD	Min	Max.	Skewness	Kurtosis	Alpha
ICT Integration for Teachers	76.00	13.15	32.50	97.50	-1.17	2.48	.78

This suggests that the mean score is closer to the highest score, indicating it is negatively skewed. This means that most teachers highly perceive the impact of integrating technology into teaching and learning exercises. The perceived effect of integrating ICT into teaching and learning, as perceived by teachers, is buttressed by an average

score of 76%. Thus, integrating ICT positively impacts teaching and learning, according to the teachers' perceptions.

4.2. Research Question Two: What is the perceived influence of ICT incorporation on teaching and learning among male and female teachers in Ghanaian senior high schools?

Table 3 illustrates the outcomes of comparing ICT usage among the genders of educators about teaching and learning. The data indicates a substantial statistical difference in the mean scores of male and female educators concerning their perceived influence of ICT incorporation on the teaching and learning process [t (73.94) = -2.69, $p < .05$].

Table 3: The ICT Incorporation in Teaching and Learning among Male and Female Teachers

	Independent Samples t-test			Comparing male and female		
Gender	N	M	SD	df	t	P
Male	74	75.03	14.18	73.94	-2.69	.009
Female	16	80.47	4.67			

The study found that female teachers perceived ICT integration to impact teaching and learning than their male counterparts significantly. Specifically, the mean rating of the perceived effect of ICT integration on learning and teaching was higher for female teachers (M = 80.47, SD = 4.67) than for male teachers (M = 75.03, SD =14.18), indicating a statistically significant difference [t (73.94) = -2.69, $p < .05$]. The results suggest that, on average, female teachers rated the impact of ICT integration on teaching and learning at 80.47%, while male teachers rated it at 75.03%.

4.3. Research Question Three: What are the differences in the use of ICT in teaching and learning among educators from various school categories (Category A, B, and C)?

A one-way ANOVA was conducted to investigate the differences in the adoption of ICT among teachers from different categories of schools, and the results are presented in Table 4. According to the results presented in Table 4, no significant difference was observed between teachers from categories A, B, and C schools in terms of their utilisation of ICT in teaching and learning.

Table 4: One-way ANOVA test comparing teachers in the three categories of schools on ICT integration

Categories of Schools	N	M	SD	df	F	p
Category A	50	76.40	10.51	3.86	1.01	.39
Category B	24	73.85	16.42			
Category C	16	73.89	18.88			

The analysis of variance using a one-way between-groups design was carried out to determine if there were any significant differences in the impact of ICT integration on teaching and learning among educators from the three categories of schools. The results in Table 5 indicate that no statistically significant differences were found [F (3, 86) = 1.008, $p = .393$]. Therefore, there are no significant disparities in the perception of the impact of ICT integration on teaching and learning across the three categories of schools.

4.4. Research Question Four: What are teachers' views on using ICT in teaching and learning across different school categories?

This question aims to explore and compare the perceptions and attitudes of teachers towards the use of Information and Communication Technology (ICT) in their teaching practices. Specifically, it seeks to understand the perceived benefits, challenges and barriers, usage patterns, support and resources, and their views on the overall impact of ICT on student engagement and learning outcomes across different school categories. This is meant to provide

meaning and understanding to the statistical results generated by the quantitative method, and to triangulate the findings. Interviews were conducted involving six (6) teachers (two from each of the categories of schools). This is because interviews allow for multiple sensory channels, including spoken, non-spoken, auditory, and visual; interviews are a versatile technique for gathering data (Cohen et al., 2005). Guest et al. (2006) found that basic elements of metathemes emerged as early as six interviews, which influenced the choice of conducting six interviews in this study. A semi-structured format was employed to make sure the interview was controlled but still allowed for some spontaneity. The interview guides gathered more detailed information through a more flexible, in-depth dialogue with teachers. The interview also allowed the teacher to express their views regarding how ICT integration enables or hinders their teaching activities. The 90 teachers were arranged in ascending order using their means on the self-report questionnaire. The first 10 teachers at the top and the first 10 at the bottom of the table were shortlisted. Similarly, 10 teachers from the middle of the continuum (i.e., 41st to 50th positions) were likewise shortlisted. The 30 shortlisted teachers cut across all three categories of schools. Volunteers for the interviews were solicited from the shortlisted teachers from all three categories of schools. Out of the four teachers who volunteered for category A, only two were selected—one male and one female. The same approach was used to shortlist interviewees for categories B and C. This was to maintain gender balance among the participants. Common themes were used to analyse the data gathered in response to the question.

The interview data revealed different benefits from the perspective of teachers for integrating ICT into teaching and learning practices. Some of the teachers' opinions are presented as excerpts. The researchers coded the interviewees, starting from the low-achieving schools. For the coding, TrC_1 means "teacher from Category C school 1", TrC_2 means "teacher from Category C school 2". TrB_1 means "teacher from Category B school 1", TrB_2 means "teacher from Category B school 2". TrA_1 means "teacher from Category A school 1", TrA_2 means "teacher from Category A school 2".

The interview responses reveal several key themes related to the integration of ICT into teaching and learning in Ghanaian senior high schools. Three themes, in all, were highlighted: benefits of ICT integration, challenges of ICT integration, and resource disparities.

4.5. Benefits of ICT Integration

All six teachers from the three categories of schools attest to the fact that the integration of ICT promotes learning. Although their expressions may differ, the opinions all converge at the same point. For example, TrC_1 indicated that:

> *Sir, it enhances student engagement. ICT can make learning more interactive and engaging. Students can use digital tools to collaborate, research, and create content, which can improve their motivation to learn. My students claim it helps them understand the content better.*

In this expression, engagement, collaboration, and motivation on the part of the students were emphasised. The teacher from Category C School 2, TrC_2, expressed a similar sentiment:

> *"It enables personalized learning: With ICT, teachers can provide differentiated instruction to cater to individual learning styles and abilities. For instance, they can use educational software and online resources to tailor learning activities and assessments."*

Similarly, TrC_2, highlights the benefit of incorporating ICT in teaching and learning activities by focusing on the advantages of ICT to teachers while preparing their lessons and assessments. The fact that it helps teachers provide differentiated instruction that promotes learning aligns with the views of TrC_1.

Furthermore, TrB_1 considered the general benefit of incorporating ICT for both the teachers and the students by emphasising up-to-date access to data and information. That is:

> *"It facilitates access to information. The internet and other digital resources provide a wealth of information that can be used to support teaching and learning. With ICT, students can access up-to-date and diverse information from various sources."*

Moreover, TrB_2 indicated that ICT is beneficial as it provides an avenue for acquiring skills that can lead to the development of digital entrepreneurs.

> *It helps to develop digital literacy. ICT integration can help students develop digital literacy skills such as searching for and evaluating online information, creating digital content, and using digital tools for communication and collaboration.*

The opinion expressed by TrB_2 goes beyond the immediate usage of ICT in classroom activities. The teacher sees ICT as a tool for providing life-long learning opportunities for the students.
Similarly, TrA_1 approached the benefits of the incorporation of ICT as providing students with critical thinking and problem-solving skills. This position echoed TrB_2's stance:

> *It promotes critical thinking. ICT can foster critical thinking and problem-solving skills. For instance, students can use digital tools to analyse data, conduct research, and create multimedia presentations.*

Finally, TrA_2 is of the opinion that integrating ICT into classroom activities has the potential to transform the entire educational system for the better. TrA_2 argues that "*ICT incorporation helps teachers teach without stress, and learners also learn without tears. It is the magic box of the 21st century*."

In summary, integrating ICT in teaching and learning in high school has the potential to improve student engagement, enable personalised learning, provide easy access to information, foster digital literacy skills, and encourage critical thinking. The opinions of the teachers regarding the incorporation of ICT into classroom activities are similar, irrespective of whether the teacher is in Category A, B, or C school.

4.6. Challenges of ICT Integration

Integrating ICT in teaching and learning can benefit high school students and teachers. However, it can also present some challenges. There are numerous challenges mentioned by the teachers. Common challenges include limited access to technology, outdated equipment, technical issues, insufficient training, resistance to change among teachers, student distraction, and concerns about privacy and security.

4.7. Resource Disparities

Differences in resources and support available to teachers in different school categories (low-achieving, medium-achieving, and high-achieving) were noted, affecting the extent and effectiveness of ICT integration. Schools in the same category highlighted similar challenges, as observed. For example, in low-achieving category schools, TrC_1 bemoaned the inadequacy or scarcity of some of the modern technological tools. According to TrC_1:

> *We have limited access to technology. Some high schools may need more adequate access to technology or may have outdated equipment. This can limit teachers' ability to incorporate ICT into their lessons effectively. The cost of using ICT in Ghana is very high and unaffordable for most schools.*

Similarly, the teacher in the second low-achieving category school, TrC_1, expressed frustration at the malfunctioning of the technological tools that are available in their school. The excerpt from TrC_1 highlights pain and agony:

> *We have technological issues. Technical issues such as connectivity problems, software glitches, and hardware malfunctions can disrupt lessons and create frustration for teachers and students. I am in a rural area, and the connectivity could be better. This affects internet use in the classroom, and it is very frustrating. I sometimes climb trees or put my phone on a long pole to enable me to have connectivity for my ICT integration in the classroom.*

In addition, medium achieving schools' problems are alike. In one situation, lack of training was the issue, while in another situation, it was the resistance of the teachers to adapt to the new demands and approach to teaching. The excerpts are presented accordingly:

TrB_1 indicated:

> *There needs to be more training. Many high school teachers may still need to receive adequate training on effectively integrating ICT into their teaching practice. This can lead to a lack of confidence and skills to use technology effectively in the classroom.*

TrB_2 claimed:

> *Some of us are afraid to change. Some teachers may resist change and hesitate to incorporate new technology into their teaching practice. This can be due to a lack of familiarity with technology, a preference for traditional teaching methods, or concerns about the potential disruption to their teaching routine.*

The high-achieving schools have their challenges as well. Although they have the necessary technological tools and resources, they are either faced with classroom management, ethical, or privacy issues. One of the teachers (TrA_1) lamented:

> *…we experience student distraction. The use of ICT in the classroom can also lead to student distraction and a lack of focus on the lesson content. Teachers need to be mindful of this and ensure that technology is used to support learning and engagement. I have observed that when I use it virtually, students join the class and leave at will. This is worrying because I see that some of the students pretend to be online, but they are not present.*

The second teacher, TrA_2, expressed worries over the safety of the students:

> *… privacy and security are my concerns. The use of technology in the classroom raises issues around privacy and security, such as the protection of student data and the risk of cyberbullying. Some people engage in online activities that involve stealing other people's data. I always advise my students to protect their personal information online, such as by using strong passwords, being cautious about the websites they visit and the emails they open and keeping their software and security tools up to date."*

Overall, teachers from various school categories expressed positive views on the potential of ICT to transform education, despite the challenges faced. They emphasised the need for adequate infrastructure, training, and support to maximise the benefits of ICT in education. The interview data suggest that there may be differences in the resources and support available to teachers in different schools. Thus, integrating ICT in teaching and learning in high schools can bring significant benefits. However, teachers, head teachers, and other stakeholders need to be aware of the challenges involved and take steps to address them effectively. This may include providing training and support, ensuring access to adequate technology, and adopting a mindful approach to using technology in the classroom.

5. Discussion

The integration of Information and Communication Technology (ICT) in senior high schools in Ghana has shown significant potential to enhance teaching and learning processes. The quantitative data from this study reveal that teachers perceive ICT integration as having a positive impact, with a mean score of 76% indicating high levels of approval. This aligns with previous research by Anderson and Dexter (2005), which highlights the diverse modalities ICT offers for delivering instructional content, catering to various learning styles, and providing a more personalised learning experience.

Gender-based differences were evident, with female teachers perceiving a greater impact of ICT on teaching and learning than their male counterparts. This finding is consistent with the work of Liu and Wang (2018), who noted

similar gender disparities in ICT integration. Addressing these differences through targeted training and support could ensure more equitable ICT adoption across genders.

Qualitative data from interviews further support these findings. Teachers emphasised the benefits of ICT in enhancing student engagement, enabling personalised learning, and providing access to up-to-date information. For instance, one teacher noted, "ICT can make learning more interactive and engaging" (TrC_1), while another highlighted that "ICT integration can help students develop digital literacy skills" (TrB_2). These insights echo the sentiments of Ertmer et al. (2012), who found that educators recognise ICT's role in enhancing pedagogical practices and developing 21st-century skills.

However, challenges such as inadequate infrastructure, limited access to technology, and insufficient training persist. Teachers from low-achieving schools particularly highlighted these issues, with one teacher lamenting, "We have limited access to technology… the cost of using ICT in Ghana is very high and unaffordable for most schools" (TrC_1). This is consistent with the findings of Oduro (2019), who noted similar barriers to ICT integration in Ghanaian schools.

In conclusion, while ICT integration holds promise for enhancing education in Ghanaian senior high schools, addressing infrastructure and training challenges is crucial for maximizing its benefits. By providing adequate resources and support, policymakers and educational stakeholders can ensure the effective integration of ICT, ultimately leading to improved educational outcomes and preparing students for the demands of the 21st century.

6. Conclusion

The integration of Information and Communication Technology (ICT) in education has been widely recognized as a transformative force, particularly in enhancing pedagogical strategies, student engagement, and overall educational outcomes. This study investigated the perceived effects of ICT integration on teaching and learning among senior high school teachers in the Greater Accra Region of Ghana. The findings reveal several key insights that contribute to our understanding of the impact of ICT in educational settings. Firstly, the study found that the majority of teachers perceive ICT integration as having a positive impact on teaching and learning. The mean score of 76% indicates that teachers highly value the role of ICT in enhancing instructional practices. This positive perception is crucial as it underscores the potential of ICT to revolutionise traditional teaching methods and foster a more interactive and engaging learning environment. Teachers' recognition of the benefits of ICT is a significant step towards its successful implementation in schools. Secondly, the study highlighted gender-based disparities in the use of ICT for educational purposes. The study revealed a statistically significant difference in the mean rating of female teachers (80.47%) compared to their male counterparts (75.03%). This finding suggests that female teachers may be more inclined to embrace ICT tools and integrate them into their teaching practices. Understanding these gender-based differences is essential for developing targeted interventions that can support both male and female teachers in effectively utilising ICT. Thirdly, the study investigated the differences in ICT utilisation among educators from various school categories. The results indicated no significant differences in the perception of ICT integration across Category A, B, and C schools. This finding suggests that regardless of the school's category, teachers generally hold similar views on the impact of ICT on teaching and learning. However, it is important to note that while perceptions may be similar, the actual access to and availability of ICT resources can vary significantly between schools, potentially influencing the extent of ICT integration. The study also identified several challenges that hinder the effective integration of ICT in education. These challenges include inadequate infrastructure, limited access to ICT resources, and insufficient training for teachers. Addressing these challenges is crucial for maximising the benefits of ICT in education. Providing adequate infrastructure, ensuring equitable access to ICT resources, and offering comprehensive training programs for teachers can significantly enhance the successful integration of ICT in schools. In conclusion, the findings of this study underscore the positive impact of ICT integration on teaching and learning in senior high schools in the Greater Accra Region of Ghana. Teachers' perceptions of ICT as a valuable tool for enhancing instructional practices highlight the potential of technology to transform education. However, addressing the challenges related to infrastructure, access, and training is essential for realising the full benefits of ICT. By fostering a supportive environment and providing the

necessary resources, policymakers and educational stakeholders can ensure the effective integration of ICT, ultimately leading to improved educational outcomes and preparing students for the demands of the 21st century.

7. Recommendations

The government and educational institutions should invest in robust ICT infrastructure. This includes high-quality hardware and software, reliable internet connectivity, and maintenance services to ensure the smooth operation of ICT tools in schools. Continuous professional development programs should be established to equip teachers with the necessary skills and knowledge to effectively integrate ICT into their teaching practices. This training should cover both technical skills and pedagogical strategies for using ICT to enhance learning. All subjects should seamlessly integrate ICT into their curriculum. This involves developing lesson plans that incorporate ICT tools and resources, promoting interactive and engaging learning experiences for students. Educational policies should support ICT integration in schools. This includes providing adequate funding, creating supportive policies, and establishing a help desk or support team to assist teachers and students with ICT-related issues. Schools should foster a collaborative environment where teachers can share best practices and resources related to ICT integration. This can be achieved through professional learning communities, workshops, and online forums.

8. Limitations of the Study

The study has several shortcomings that may limit the findings' generalisability to other regions and educational contexts in Ghana. The study depended on self-reported data from teachers, that could be biased by social desirability. This could affect the validity of the findings. The fact that data were captured at a single point may limit its reliability. This may limit the ability to draw conclusions about the long-term impact of ICT integration on teaching and learning. The study primarily focused on teachers' perceptions of ICT integration. It did not include the perspectives of students, administrators, or other stakeholders, which could provide a more comprehensive understanding of the impact of ICT in education. Addressing these limitations in future research could provide a more holistic view of ICT integration in education and its effects on teaching and learning outcomes.

9. Implication for practice

The integration of ICT in education, particularly at the senior high school (SHS) level in Ghana, has several practical implications. Continuous professional development programmes are essential to equip teachers with the necessary skills and knowledge to effectively integrate ICT into their teaching practices. This includes training on how to use various ICT tools and platforms, as well as strategies for incorporating technology into lesson plans. Schools need to invest in reliable ICT infrastructure, including high-quality hardware and software, to support the effective use of technology in the classroom. This also involves ensuring that there is adequate technical support to maintain and troubleshoot ICT systems. Therefore, we should design the curriculum to integrate ICT in a manner that enhances learning outcomes. This includes integrating ICT into various subjects and creating opportunities for students to use technology in meaningful ways, such as through project-based learning and collaborative activities. There may be a need to adapt traditional assessment methods to accommodate the use of ICT in education. This could involve developing new assessment tools that measure students' digital literacy and their ability to use technology to solve problems and create content.

10. Suggestions for future research

There is a need to conduct longitudinal studies to track the long-term impact of ICT integration on student learning outcomes and teacher practices. This would provide valuable insights into the sustainability and effectiveness of ICT initiatives over time. It may be necessary to compare the effectiveness of ICT integration in different educational contexts, such as urban vs. rural schools or public vs. private schools. This would help identify best practices and potential challenges unique to different settings. Furthermore, investigating and understanding the gender differences in the use and perception of ICT in education can inform targeted interventions to ensure equitable access and utilisation of technology for all students. In addition, explore innovative pedagogical

approaches that leverage ICT to enhance teaching and learning. This could include research on the use of virtual reality, gamification, and other emerging technologies in the classroom. Finally, examining teachers' attitudes and beliefs about ICT integration and how they influence their teaching practices has the potential to identify factors that motivate or hinder teachers from effectively using technology in their classrooms.

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