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TEACHER VARIABLES IN THE AWARENESS OF EMERGING ICT TOOLS IN CHILDHOOD EDUCATION

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Abstract
This study examined how teacher characteristics influence awareness of information and communication technology tools in early childhood education within primary schools in the Umuahia Educational Zone, which includes Umuahia North and Umuahia South Local Government Areas. A descriptive survey design guided the investigation, which was framed by five research questions. The population comprised all Basic Science teachers in both public and private primary schools in the zone who held qualifications in Primary Science and were currently teaching that subject. Using a purposive sampling procedure, 142 of these teachers were selected to participate. Data were gathered with a researcher-designed questionnaire on awareness of information and communication technology resource tools for Basic Science instruction. Responses were analyzed by computing arithmetic means and standard deviations, conducting independent-samples t tests, and performing one-way analysis of variance. Results showed that none of the teacher variables—educational qualification, age, gender, years of service or school type—had a statistically significant effect on their awareness of these technology tools for teaching and learning Basic Science. In light of these findings, it is recommended that curriculum specialists and teacher-education planners embed systematic exposure to emerging information and communication technology tools within Primary Science programmes so as to graduate teachers who are fully competent in integrating such tools into primary-level Basic Science instruction.

Keywords: ICT tools; childhood education; communication equipment; software

Introduction

The rapid advancement of information and communication technology (ICT) in the 21st century has transformed educational practices across all levels, including childhood education. Emerging ICT tools now play a crucial role in enhancing teaching and learning experiences. However, the effective integration of these technologies largely depends on various teacher-related variables such as knowledge, skills, attitudes, and professional development. According to Olofin et al. (2023), the millennium has been marked by an unprecedented growth of information, knowledge, and innovation driven by scientific research. In this context, the role of teachers in embracing and utilizing emerging ICT tools is critical for fostering effective and modern childhood education. Hence, Olofin, et al,(2023) further opined that the industrial and technological development of any nation depend to a large extent on the level of scientific education of her citizens including primary school teachers and children. In this study, we focus mainly on the years from 6 to 11 years old. However, we also recognize that in order to work in a holistic way, we must understand and consider the entire cycle of children's learning and development. Child development is, after all, a continuum of experiences that spans from birth through adolescence up until the transition to adulthood, with the early years being the critical foundation and launching point that influences the rest of a child's life. In general, in the domain of science and technology, there is the desire to be properly informed at all stages and all times. This is why many nations pay particular attention to the teaching and learning of science in its schools. However as important as science is, records show that the performance of science

students in Nigeria in their examination over the years has not been encouraging (Ayoade, et al 2023). Part of the reason is due to ineffectiveness of the science teacher. A competent teacher for instance would create a classroom environment which is conducive for learning. Lu (2022) noted in particular that part of what makes a science teacher effective is awareness of the emerging information and communication technology tools to be incorporated in his science lessons. By ICT in this paper, we refer to the computers and internet facilities to handle and communicate information for learning and teaching purposes.

The communication includes electronic mails, messaging and chatting, video and telephone conferencing. Information and Communication Technology (ICT) may include a sum of tools to communicate, create, disseminate, store, and manage information in learning environments. ICT always influences all aspects of life. In education, it is needed to support teaching and learning process. As observed by .Luo, et al (2021), ICT can enhance the quality of education by increasing learner's motivation and engagement, by facilitating acquisition of basic skills and by enhancing teacher training. Digital technology has been applied in various fields, including childhood education, and its study is becoming a trend along with diverse developments. Weng & Li (2023) remarked that with an array of digital art tools, children can express their creativity and imagination like never before. They can draw, animate, compose music, and even learn coding, fostering their problem-solving skills and creativity. It provides opportunities for developing enquiry, exploration and other children's interests; enables children to play roles they see in the adult world; adds to children's possibilities for being creative; can support independent learning and allows children to record their own personal view of the world, explore different areas they have an interest in, such as playing instruments, creative writing, or beginner programs related to various subjects Weng and Li (2023). Konca and Hakyemez-Paul (2021) revealed that the most noticeable benefit of technology in childhood education is that it promotes a high level of engagement with children when being used in lessons. The activities carried out through digital and interactive tools increase learner's concentration and, therefore, they assimilate concepts more quickly, enhancing learning. This type of tool involves learners in more practical learning, with the aim of reinforcing what they have taught (Vidal-Hall, et al, 2020). Children's ICT capability is vital to ensuring that in future they become proficient users of ICT in their society.

The integration of ICT into the classroom allows teachers to alter their teaching practices and content, as technologies enable the learning process to be more creative, engaging, and authentic. Oyewole and Salami (2024) are of the view that to integrate technology in childhood education, the learner should be guided to develop technological literacy and ICT capability, encouraged to create and promote digital play, guided to use ICT to search for things of interest and use it to teach literacy and numeracy. In fact, Vidal-Hall, C. et al, (2020) and Amuzu & Ibrahim (2022) revealed that it is not only the children who benefit from the use of technology though. It also provides childhood educators with unlimited access to newer and more practical and flexible approach to teaching. Kermani and Aldemir (2015) reported that more recently, the need for increased technological literacy and ICT capability amongst young children has meant that teachers now are required to learn how to support and scaffold the use of technology in childhood education to ensure that they understand the notion of using ICT as a tool for learning. Teachers can

also learn to design unique learning environments for children. Amuzu & Ibrahim (2022) reported that childhood educators are of the view that the use of digital technology, such as cameras, video games, computers, tablets, TV, ebooks, internet, smartphones, etc., had a strong influence in assisting learning.

Consequently, teachers' involvement is required for the integration of technology into learning. Educators with positive perceptions and understanding of technology use can apply it in teaching effectively (Yang and Gunn, 2020). However, those who understand but possess negative perceptions will hinder its integration into the learning process. Several countries have implemented digital technology right from early childhood education classes. For example, a quasi-experimental study by Kermani and Aldemir (2015) involving 58 children in North Carolina showed that mathematics and science skills improved by applying technologies such as Google or educational software games. Another study used a literature review by collecting 26 nresearch articles from 2012 to 2017 on applying digital technology to childhood education in several countries, including the United States, Australia, United Kingdom, South Korea, etc. (Mantilla & Edwards, 2019). However, such studies concerning Nigeria have not been adequately reported in the literature. This may be due to lack of awareness of emerging technologies in childhood education. Ipem, et al (2024) and Oyewole and Salami (2024) noted that these days, there is nothing as important in childhood learning as the learning of literacy and language. They posit that for literacy and language, computers offer a great 'print rich' learning environment for children, For instance,Word Processors have the biggest impact on classroom learning in this area as word processing is closely associated with literacy and language work at all levels, and as a consequence has a contribution to make across the early years curriculum. Slutsky, et al (2019) and Weng & Li (2023) further noted that Talking Books combine speech and words, and these can reinforce the link between written and spoken text designed to encourage reading. Other ICT tools, real or pretend, can have a major impact on a child's imaginative role playing experiences in school. Furthermore, Konca and Hakyemez-Paul (2021) believed that Multimedia programs can also play a role as an ICT tool for teachers. Software such as 2Create a Story takes a fresh and innovative approach to early writing, bringing the multimedia possibilities of new technology to children's story making. While Word banks and grids can also aid in literacy and language development in childhood.

The use of emerging technologies has become an important component in advancing childhood education, as educators seek more interactive and effective ways to support young learners' development. Studies by Zabatiero et al. (2018), Mantilla and Edwards (2019), Vidal-Hall et al. (2020), Kaynar et al. (2020), and Kara and Cagiltay (2023) identified a variety of technological tools that enhance the integration of children's curriculum and learning environments. These include communication equipment such as digital and video cameras, webcams, wireless cameras, smartphone and tablet cameras, which are employed to record activities, capture creative play, and encourage reflection. Video cameras are often used to support creative activities like filmmaking, while programmable toys such as Bee Bots provide engaging ways to teach literacy and numeracy. Other tools listed include smartboards, overhead projectors, role-play toys such as defunct mobile phones, computers, laptops, tablets like iPads, sound recorders, photocopiers, and interactive whiteboards, all contributing to dynamic learning experiences. Audio recorders, digital projectors, talking cards, and photo albums further help document and support children's learning processes.

Software applications also play a vital role in childhood education. According to these studies, computer programs like Microsoft PowerPoint are utilized to create and share learning journeys, while book-making software, art programs such as MS Paint and Paint 3D, and literacy tools like MS Word help develop children's ICT capabilities. Spreadsheets such as MS Excel are also integrated to promote numeracy development. Additionally, interactive platforms such as chat rooms and educational websites, examples include Starfall, ABC Ya, Cookie, Funbrain, Media4Math, and Scribd, facilitate real-time communication and offer diverse resources to enrich learning. These technologies have been shown to positively influence children's numeracy skills, language acquisition, cognitive development, creativity, problem-solving abilities, self-confidence, curiosity, motivation, interest in learning, and emotional and social well-being. Hence, findings from the reviewed studies confirm that emerging technologies are now closely linked to children's daily environments and present significant opportunities for classroom application. However, despite widespread acknowledgment of these benefits, it remains unclear how aware Basic/Primary Science teachers in the Umuahia Educational Zone are regarding these emerging technologies for teaching and learning purposes. This lack of clarity creates a pressing need for investigation. Therefore, the central problem of this study is to determine, given certain teacher variables, the extent to which Basic Science teachers in Umuahia Educational Zone are aware of emerging ICT tools relevant to their teaching practice. The outcomes are expected to offer insights that would inform targeted interventions to support effective technology integration in early science education.

Statement of the Problem

The integration of emerging information and communication technologies (ICT) into childhood education has become a central theme in modern educational discourse. Advancements in digital tools, interactive platforms, and educational software have created new opportunities for enhancing early learners' experiences, offering richer, more engaging, and developmentally appropriate methods of teaching and learning. Ideally, teachers, especially those handling Basic/Primary Science subjects, are expected to be fully aware of and proficient in the use of these emerging ICT tools. Their awareness and application of technologies such as digital cameras, interactive whiteboards, programmable toys, educational software, and online learning resources should facilitate creative instruction, improve cognitive development, enhance children's problem-solving abilities, and contribute to overall academic success. In a well-functioning system, every Basic/Primary Science teacher would integrate such technologies seamlessly into classroom activities, ensuring that children develop critical 21st-century skills from an early stage. However, in reality, the situation appears different, particularly in regions like the Umuahia Educational Zone. Observations suggest that many Basic/Primary Science teachers may lack adequate awareness, exposure, or training in the use of these emerging ICT tools. This gap in knowledge and skills limits the integration of technology into teaching and learning processes, thereby restricting children's access to the educational benefits that these tools offer. Despite the increasing availability and emphasis on technology in education globally, the actual use of emerging ICT resources in many primary classrooms remains limited or inconsistent. Therefore, the problem of this study is to determine the extent to which teacher variables influence the awareness of emerging ICT tools among Basic/Primary Science teachers in Umuahia Educational Zone. Specifically, the study seeks to establish how factors such as professional qualifications, years of teaching experience, exposure to ICT training, and specialization impact teachers' awareness and readiness to apply these emerging technologies in early childhood education.

Purpose of the Study

This study examined teacher variables affecting the awareness of Information Communication Technology (ICT) tools in childhood education within primary schools in the Umuahia Educational Zone, comprising Umuahia North and Umuahia South Local Government Areas. Speficially, the study seeks to:

1. determine the influence of teacher variables on Basic Science teachers' awareness of ICT resource tools used for teaching and learning Basic Science in primary schools in Umuahia Educational Zone.
2. examine how Basic Science teachers' awareness of ICT resource tools used for teaching Basic Science differs based on their educational qualification.
3. investigate how Basic Science teachers' awareness of ICT resource tools used for teaching and learning Basic Science differs based on their age.
4. explore how Basic Science teachers' awareness of ICT resource tools used for teaching and learning Basic Science differs based on their gender.
5. examine how Basic Science teachers' awareness of ICT resource tools used for teaching and learning Basic Science differs based on their years of service.
6. assess how Basic Science teachers' awareness of ICT resource tools used for teaching and learning Basic Science differs based on their type of school.

Research Question

The following research questions guided the study;

1. How does Basic Science teachers' awareness of ICT resource tools used for teaching Basic Science differ based on their educational qualification?
2. How does Basic Science teachers' awareness of ICT resource tools used for teaching/learning Basic Science differ based on their age?
3. How does Basic Science teachers' awareness of ICT resource tools used for teaching/learning Basic Science differ based on their gender?
4. How does Basic Science teachers' awareness of ICT resource tools used for teaching/learning Basic Science differ based on their years in service?
5. How does Basic Science teachers' awareness of ICT resource tools used for teaching/learning Basic Science differ based on their type of school?

Hypotheses

1. There is no significant difference in Basic Science teachers' awareness of ICT resource tools used for teaching/learning Basic Science based on their educational qualification.
2. There is no significant difference based on their gender in Basic Science teachers' awareness of ICT resource tools used for teaching/learning Basic Science.
3. There is no significant difference based on their years in service in Basic Science teachers' awareness of ICT resource tools used for teaching/learning Basic Science.
4. There is no significant difference based on their type of school in Basic Science teachers' awareness of ICT resource tools used for teaching/learning Basic Science.

Methods

The study adopted an ex-post facto research design. The population comprised all teachers in public and private primary schools in Umuahia Federal Constituency/Educational Zone. Specifically, the target population included all Basic Science teachers who possessed qualifications in Primary or Basic Science and were actively teaching Basic Science in the schools. Data obtained from the Research and Statistics Division of the Abia State Universal Basic Education Board for the 2022/2023 academic session revealed that there were 119

Basic Science teachers across 43 public schools and 23 Basic Science teachers across 8 private schools, making a total of 142 Basic Science teachers in both public and private primary schools in the Constituency. It was observed that other Basic Science teachers who lacked specialization in Primary or Basic Science were excluded from the study population. A purposive sampling technique was employed, as the entire population of qualified Basic Science teachers was used for the study. The instrument for data collection was the "Information Communication Technology Resource Tools in Basic Science Awareness Questionnaire" (ICTRTBSAQ), developed by the researcher with the assistance of experts in Measurement and Evaluation from the Department of Educational Foundations, Guidance and Counseling, as well as an expert in Primary/Basic Science education. The ICTRTBSAQ was structured into two sections: Section A obtained general information regarding the personal data of respondents, while Section B contained items designed to assess teachers' awareness of ICT resource tools relevant to Basic Science instruction. Section B utilized a four-point Likert-type scale, with response options ranging from "Very Much Aware," "Aware," "Moderately Aware," to "Not At All Aware."

To establish the instrument's validity, the ICTRTBSAQ was subjected to expert review by one specialist in Primary Science Education and two experts in Measurement and Evaluation. These experts assessed the relevance and coverage of the items to ensure that all critical domains were addressed. For reliability, the split-half technique was applied by administering the instrument to 30 Basic Science teachers from another federal constituency. The Pearson Product Moment Correlation Coefficient for the two halves, calculated using the Statistical Package for Social Sciences (SPSS), yielded a value of 0.75, which was deemed sufficiently high for the study's purposes. Following the validation and reliability testing, the questionnaire was administered to the 142 Basic Science teachers, achieving a response rate of 90%. Data collected were analyzed using mean scores, standard deviation, independent t-tests, and one-way analysis of variance (ANOVA) where appropriate, with the aid of SPSS software.

Results

Table 1: Mean and Standard Deviation Scores of Respondents' Awareness of ICT Communication Equipment for Learning Basic Science

Variable	Category	N	%	Mean	SE
Gender	Male	50	38.2	16.40	5.32
	Female	81	61.8	15.48	5.94
Age	21–30	71	54.2	16.21	5.74
	31–40	33	25.2	14.85	5.66
	41 & above	27	20.6	16.04	5.75
Educational qualification	NCE/OND	36	27.5	15.33	4.46
	First Degree/HND	41	31.3	16.56	5.67
	Masters & Above	54	41.2	15.61	6.47
Years of Service	1–10	63	48.1	16.02	5.91
	11–20	35	26.7	14.89	5.60
	21 & above	33	25.2	16.48	5.47
Type of School	Public	93	71.0	16.34	6.23
	Private	38	29.0	14.58	3.96
Total	—	131	100.0	15.83	5.71

Table 2: Mean and Standard Deviation Scores of Respondents' Awareness of ICT Software for Learning Basic Science

Variable	Category	N	%	Mean	SD
Gender	Male	50	38.2	24.20	8.61
	Female	81	61.8	26.00	10.12
Age	21–30	71	54.2	26.06	9.85
	31–40	33	25.2	23.64	9.15
	41 & above	27	20.6	25.41	9.44
Educational qualification	NCE/OND	36	27.5	23.53	6.70
	First Degree/HND	41	31.3	26.41	11.16
	Masters & Above	54	41.2	25.67	9.90
Years of Service	1–10	63	48.1	25.78	9.99
	11–20	35	26.7	27.49	9.41
	21 & above	33	25.2	22.12	8.28
Type of School	Public	93	71.0	26.31	10.54
	Private	38	29.0	22.87	6.09
Total	—	131	100.0	25.31	9.58

Table 3: Mean and Standard Deviation Scores of Respondents' Awareness of ICT Chat Rooms/Websites for Learning Basic Science

Variable	Category	N	%	Mean	SD
Gender	Male	50	38.2	19.00	7.25
	Female	81	61.8	20.17	8.66
Age	21–30	71	54.2	20.70	8.26
	31–40	33	25.2	18.15	7.28
	41 & above	27	20.6	19.78	8.13
Educational qualification	NCE/OND	36	27.5	20.31	7.91
	First Degree/HND	41	31.3	20.68	7.94
	Masters & Above	54	41.2	18.96	8.47
Years of Service	1–10	63	48.1	20.56	8.38
	11–20	35	26.7	19.40	8.18
	21 & above	33	25.2	19.06	7.71
Type of School	Public	93	71.0	20.22	8.73
	Private	38	29.0	19.03	7.71
Total	—	131	100.0	19.87	8.13

Research Question and Hypothesis One

Q_1: How does Basic Science teachers' awareness of ICT resource tools used for teaching/learning Basic Science differ based on their educational qualification?

H_{O1}: There is no significant difference in Basic Science teachers' awareness of ICT resource tools used for teaching/learning Basic Science based on their educational qualification. This hypothesis was formulated to compare teachers' awareness of ICT Communication Equipment, Softwares and Chat rooms/websites used in teaching/learning Basic Science based on their highest educational qualification. Three categories of educational qualification were identified and used for this

analysis. These were N.C.E., First Degree/HND, Masters Degree & above. To analyse the data, the One-Way Analysis of Variance (ANOVA) statistic was used. The result is as shown in Table 4.

Table 4: **Summary of One-Way Analysis of Variance of Awareness of ICT Resource Tools Used in Teaching/Learning Primary Science Based on Educational Qualification of Primary Science Teachers'**

ICT Resource Tools	Sources of Variance	SS	MS	DF	F
Communication Equipment	Between Groups	33.374	16.687	2	
	Within Groups	4 202.931	32.835	128	508
	Total	4 236.305	—	130	
Softwares	Between Groups	171.244	82.622	2	
	Within Groups	11 748.923	91.788	128	933
	Total	11 920.168	—	130	
Chat Rooms/Websites	Between Groups	58.960	39.176	2	
	Within Groups	8 535.834	66.535	128	589
	Total	**8 594.794**	**—**	**130**	

P = .05; Critical $F_{2,128}$_{2,128} = 3.00

Table 4 shows that educational qualification is not a significant factor in the differences in mean awareness scores recorded by Primary Science teachers of different categories of educational qualifications on each of the emerging ICT resource tools. Based on this finding, the null hypothesis was retained.

Research Question and Hypothesis Two

Q_2: How does Basic Science teachers' awareness of ICT resource tools used for teaching/learning Basic Science differ based on their age?

H_{02}: There is no significant difference in Basic Science teachers' awareness of ICT resource tools used for teaching/learning Basic Science based on their age. This hypothesis was formulated to compare Basic Science teachers' awareness of ICT Web Sites, Software's and Chat Rooms used in learning based on their age. Three age categories of 21-30 years, 31-40 years and 41 years and above were identified and used for this analysis. To analyse the data, the One-Way Analysis of Variance (ANOVA) statistic was used. The result is as shown in Table 5.

Table 5: Summary of One-Way Analysis of Variance of Awareness of ICT Resource Tools Used in Teaching/Learning Basic Science Based on Age of Basic Science Teachers

ICT Resource Tools	Sources of Variance	SS	MS	DF	F
Communication Equipment	Between Groups	43.269	21.634	2	
	Within Groups	4 193.036	32.758	128	0.660
	Total	4 236.305	–	130	
Softwares	Between Groups	132.238	66.119	2	
	Within Groups	11 787.930	92.093	128	0.718
	Total	11 920.168	–	130	
Chat Rooms/Websites	Between Groups	147.096	73.548	2	
	Within Groups	8 447.698	65.998	128	1.114
	Total	8 594.794	–	130	

P = .05; Critical $F_{2,128}$_{2,128} = 3.00

Table 5 shows that age of the Basic Science teachers is not a significant factor in the differences in the mean awareness scores recorded by Basic Science teachers of different

categories of educational qualifications on each of the emerging ICT resource tools. Based on this finding, the null hypothesis was accepted.

Research Question and Hypothesis Three

Q_3: How does Basic Science teachers' awareness of ICT resource tools used for teaching/learning Basic Science differ based on their gender?

H_{03}: There is no significant difference in Basic Science teachers' awareness of ICT resource tools used for teaching/learning Basic Science based on their gender. This hypothesis was formulated to compare Basic Science teachers' awareness of ICT Communication Equipment, Softwares and Chat Rooms/Websites used in teaching/learning Basic Science based on their gender. To analyse the data, the independent t-test was used. The result is as shown in Table 6.

Table 6: Summary of Independent t-test Analysis of Basic Science Teachers' Awareness of ICT Resource Tools Used in Teaching/Learning Basic Science Based on Gender

ICT Resource Tools	Gender	N	Mean	SD	t-value
Communication Equipment	Male	50	16.40	5.33	0.894
	Female	81	15.48	5.94	
Softwares	Male	50	24.20	8.61	−1.05
	Female	81	26.00	10.12	
Chat Rooms/Websites	Male	50	19.38	7.25	−0.541
	Female	**81**	**20.17**	**8.66**	

P < .05; df = 129 Critical t = 1.96

The result in Table 6, shows that gender of the Basic Science teachers is not a significant factor in the differences in the mean awareness scores recorded by Basic Science teachers of different categories of the emerging ICT resource tools. Based on this finding, the null hypothesis was accepted.

Research Question and Hypothesis Four

Q_4: How does Basic Science teachers' awareness of ICT resource tools used for teaching/learning Basic Science differ based on their years of service?

Ho_4: There is no significant difference in Basic Science teachers' awareness of ICT resource tools used for teaching/learning Basic Science based on their years of service. This hypothesis was formulated to compare Basic Science teachers' awareness of ICT Communication Equipment, Softwares and Chat Rooms/Websites used in teaching/learning Basic Science based on their number of years in service. Three categories of years of service were identified and used for this analysis. These were 1-10 years, 11-20 years and 21 years and above. To analyse the data, the One-Way Analysis of Variance (ANOVA) statistic was used. The result is as shown in Table 7.

Table 7

Summary of One-Way Analysis of Variance on Basic Science Teachers' Awareness of ICT Resource Tools Used in Teaching/Learning Basic Science Based on Their Number of Years of Service

ICT Resource Tools	Sources of Variance	SS	MS	DF	F
Communication Equipment	Between Groups	47.536	23.768	2	
	Within Groups	4 188.769	32.725	128	0.726
	Total	4 236.305	–	130	
Softwares	Between Groups	515.021	257.511	2	
	Within Groups	11 405.147	89.103	128	2.890
	Total	11 920.168	–	130	
Chat Rooms/Websites	Between Groups	58.960	29.480	2	
	Within Groups	8 535.834	66.686	128	0.442
	Total	**8 594.794**	**–**	**130**	

P = .05; Critical $F_{2,128}$_{2,128} = 3.00

From Table 7, shows that the years of teaching experience of the Basic Science teachers is not a significant factor in the differences in the mean awareness scores recorded by Basic Science teachers on each of the emerging ICT resource tools. Based on this finding, the null hypothesis was retained.

Research Question and Hypothesis Five

Q_5: How do Basic Science teachers differ on the awareness of emerging ICT resource tools used for teaching/learning Basic Science based on their type of school?

Ho_5: There is no significant difference in Basic Science teachers' awareness of emerging ICT resource tools used for teaching/learning Basic Science based on their type of school. This hypothesis was formulated to compare Basic Science teachers' awareness based on their school type of ICT Communication Equipment, Softwares and Chat Rooms/Websites used in teaching/learning Basic Science. To analyse the data, the independent t-test was used. The result is as shown in Table 8.

Table 8: Summary of Independent t-test Analysis on Basic Science Teachers' Awareness of ICT Resource Tools Used in Teaching/Learning Basic Science Based on School Type

ICT Resource Tools	School Type	N	Mean	SD	t-value
Communication Equipment	Public	93	16.34	6.23	-1.62
	Private	38	14.58	3.96	
Softwares	Public	93	26.31	10.54	-1.89
	Private	38	22.87	6.09	
Chat Rooms/Websites	Public	93	20.22	8.73	-0.858
	Private	38	19.02	6.47	

P < .05; df = 129 Critical t = 1.96

The result from Table 8, shows that the school type of the Basic Science teachers is not a significant factor in the differences in the mean awareness scores recorded by Basic Science teachers on each of the emerging ICT resource tools. Based on this finding, the null hypothesis was retained. Hence teachers' of public and private schools were not significantly different in their awareness of emerging ICT resource tools used for teaching/learning Basic Science.

Discussion

The findings of the study revealed that Basic Science teachers' highest educational qualification, age, gender, years of service, and school type did not significantly influence their awareness of ICT communication equipment, software, or chat rooms/websites used in teaching and learning Basic Science; consequently, all null hypotheses were retained. This outcome concurs with Philomina and Amutha (2016), who found that ICT integration

awareness did not vary across teachers of different qualifications. It also echoes Vidal-Hall et al. (2020), who reported that early childhood practitioners' beliefs and apprehensions about digital media were independent of teaching experience. In line with Kumar and Singh (2021), this study confirms that male and female teachers hold similar attitudes toward computer use, even though Science specialists tend to view technology more favorably than their Arts-focused peers. Finally, the absence of significant differences between public and private school teachers mirrors the findings of Amuzu and Ibrahim (2022), who observed comparable levels of ICT awareness and utilization across both sectors. Hence, this uniformity across demographic and professional groups suggests that broader contextual factors such as institutional support, access to resources, and the quality of professional development may play a more critical role in shaping teachers' ICT awareness than individual characteristics. It underscores the need for systemic, school-wide initiatives that ensure equitable access to technology and targeted training for all teachers, regardless of their background or experience.

Conclusion

The study demonstrates that Basic Science teachers' educational qualification, age, gender, years of service, and school type do not exert a statistically significant effect on their awareness of ICT resource tools for teaching and learning. This uniformity across demographic and professional profiles highlights that individual characteristics alone are insufficient to predict ICT awareness; instead, the quality and availability of institutional support, access to resources, and ongoing professional development are likely more decisive. Consequently, structured programmes such as targeted workshops, seminars, and in-school training should be implemented to raise ICT awareness uniformly among all Basic Science teachers. Enhancing teachers' familiarity and confidence with these tools is expected to foster more positive attitudes toward ICT integration, which in turn will enrich instructional practices and stimulate students' engagement and learning outcomes in Basic Science.

Recommendations

Based on the findings, the following recommendations are made:

1. Basic Science teachers should actively take advantage of workshops, seminars, conferences, and other professional development programmes aimed at enhancing ICT competencies.
2. Curriculum experts and planners in Primary Science teacher education should integrate awareness and training on emerging ICT tools into the curriculum, to produce ICT-competent graduates capable of delivering effective Basic Science instruction in primary schools.
3. Reliable internet facilities should be made available in all primary schools to promote the effective use of ICT in the teaching and learning of Basic Science.
4. ICT-equipped resource centers should be established in both public and private primary schools, to be managed by competent and disciplined computer technologists.
5. NGOs should be encouraged to invest in the provision, support, and improvisation of ICT facilities in primary schools.
6. Adequate provision for stable electricity supply, effective security measures, and availability of ICT experts should be ensured in primary schools to support the sustainability of ICT resources.
7. Government should liaise with international organizations, such as the World Bank and other relevant bodies, to secure investments for the provision of ICT resources in primary schools.

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