



DIGITALIZATION OF TEACHING AND LEARNING OF CHEMISTRY EDUCATION IN SECONDARY SCHOOLS IN ANAMBRA STATE: FOCUS ON IMMIGRANT TEACHERS

Achugbu, Chinwe N.J.

Department of Science Education , Nnamdi Azikiwe University, Awka, Anambra State

Eke, Joy Anulika

Department of Science Education , Nnamdi Azikiwe University, Awka, Anambra State

ABSTRACT

The aim of this study was to examine the impact of digitization in teaching and learning chemistry in secondary schools in Anambra State. A descriptive survey research design was adopted. This approach was chosen because the researcher wants to study the impact of digitization in teaching and learning chemistry in secondary schools in Anambra State. The study population consisted of 6,342 teachers in six educational zones of the state. The sample included 634 science teachers in public secondary schools in Anambra state with 393 male and 241 female teachers. This represented 10% of teachers in public secondary schools in the six education zones of Anambra state. The data collection tool was a questionnaire developed by the researcher entitled: Digitizing Chemistry Teaching and Learning in Secondary Schools in the Anambra State Questionnaire (DCTLSSASQ). The results of the study showed that several digital devices required for teaching and learning chemistry in secondary schools in Anambra State were either unavailable or misused, as the results showed. The study recommended, among other things, the following: Teachers should be trained and retrained. As we are in the technological age, teachers should receive extensive training and retraining in the use, servicing and maintaining computers and other computing devices related to teaching. They should also receive adequate information on new techno-pedagogies and other teaching methods, as well as the latest innovations in ICT.

KEYWORDS: Digitalization, Electronic Learning, Innovation, Teaching, Chemistry

INTRODUCTION

Educational institutions have been in a constant state of change just like the society whose need these institutions seek to fulfill. In recent years, there has been various developments and innovations in educational policies that have had decisive influence in the Nigerian educational system. These changes can be seen in the form of introduction of new media, new

pedagogy, learning theories or the inclusion of techno-pedagogy. Today, we have come to experience another innovation coming to the fore in the educational landscape which is digitalization. Digital media is an integral part of the daily routine of most people. As a result, tablets, smartphones, laptops and the internet have become increasingly important in schools. Teaching with advanced approaches and digital devices



is one of the most viable strategies for simplifying concepts and promoting student performance and retention. Therefore, digitization is crucial for data processing, storage and transmission, as information of all kinds can be efficiently transmitted, compacted and integrated. For this reason, it is an ideal way to get information for many organizations around the world, including educational institutions. By deploying, using and supporting digitalization in teaching and learning, teachers and learners should benefit from greater convenience, convenience, portability, sustainability, security and accountability. However, they could also be limited by restrictions on teachers and learners. Human resources, finance, energy, security, location, connectivity, information to be digitized, hardware and software requirements, etc. In the Nigerian school system, Chemistry has been approved and accepted by the Nigerian government as a subject of study in the school curriculum and learning of Chemistry is beneficial to students at all levels of their academic pursuit. The Federal Republic of Nigeria National Policy on Education (2014) stated the main objectives of science subjects in secondary school curriculum as follows:

- i. Stimulation of interest and motivation of learners in advancing the study of science beyond secondary school level.
- ii. Achievement of competence and independency in students' learning of science.
- iii. Discover the place of science in career choice and development in science and technology as it relates to life.
- iv. Efficiency and resource conservation in their profession.
- v. Building of the required skills at the secondary school level in order to widen their knowledge of science.

For these objectives to be achieved, the teaching of Chemistry must be made more attractive and interesting to students, and one of the ways of achieving this is to digitize the teaching processes and strategies where learners can have access to materials that can help them explore the learning content so as to improve academic performance. Students are co-creators of knowledge no doubt, but more is expected of teachers who are guides on the side to be acquainted with the use various digital media required. In reality, today's teachers are digital immigrant, hence a lot is required to fully acquired the competencies and skills required to function effectively in a digitized classroom. Chemistry is a branch of physical science which deals with structure, properties and changes of

matter. Chemistry encompasses topics such as the properties of individual atoms, how atoms form chemical bonds to form chemical compounds, the interactions of substances through intermolecular forces that give matter its general properties, and the interactions between them substances through chemical reaction to form a to form other substance. Conceptually, the definition of Chemistry kept changing over the years due to researches, innovations and new approaches in teaching and learning of the subject. Eilks and Hofstein (2013) noted that the history of Chemistry education is a culture of dynamic innovation characterized by new approaches cum knowledge and skills. This of course included new methods, strategies and techniques of teaching. Colgoni and Eyles (2010) conceptualized science subjects in general and Chemistry in particular as broad based interdisciplinary programmes that need a range of integrated approaches. In this context Chemistry is regarded as an essential basis for many facts of our everyday lives, and has many unforeseen potential benefits for our future. Proper understanding of Chemistry enables us to explain the world around us.

The innovative approaches in teaching science also encapsulate digital techniques Chemistry. For example, a teacher can use video project to teach global warming for students to benefit maximally from the knowledge and skills. Eilks et al. (2009) noted the importance of the following digital techniques in teaching Chemistry: Video games, Team games, Role playing, question games, Puzzles, Discussion, Table top games, lets imagine games and Quizzes, these techniques can be digitalized and enhanced teaching Chemistry. Different types of technology can be used in the digital era to teach in the classroom. In this regard, Karehka (2012) noted that use of computer assisted learning in the classroom, smart interactive, white board, online media and online study tools are very effective in teaching various subjects.

STATEMENT OF THE PROBLEM

The relevance of the knowledge of Chemistry to the sustainable development of any society is immeasurable. Chemistry has undeniably affected the entire human race in such a way that in order to survive, one needs adequate knowledge of Chemistry. The methods and facilities used by science teachers to teach science subjects especially Chemistry in senior secondary school are very important for the smooth, effective, growth and development of a humane society and the acquisition of scientific skills. Proper understanding of Chemistry enables one to explain the



world around us. This describes the basic necessity to teach and learn Chemistry which knowledge and skills remain dynamic in the face of the changing nature of the society. Accordingly, the approaches, methods, competencies and techniques of teaching Chemistry keep on changing. This calls for the need to employ innovative approaches in teaching Chemistry in the digital era which can be conceptualized in terms of information age within a period in human history characterized by the shift from traditional to digital revolution. Teachers' poor ICT competence and lack of confidence in using new technologies in teaching are two very significant determinants of their levels of engagement in ICT. Ironically, most teachers of Chemistry do not possess these required digital skills to function effectively in digital classroom owing to the fact that they were trained without these digital skills. The need to determine the extent to which teachers have adequate digital skills and the impact of digitization on the teaching and learning of chemistry is therefore central to this study.

AIM AND OBJECTIVES OF THE STUDY

This study is aimed at examining the impact of digitization in the teaching and learning of Chemistry in secondary schools in Anambra state. Specifically, the study sought to;

1. Identify the digital devices utilized in teaching and learning of Chemistry in secondary schools in Anambra state
2. Examine the impact of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state
3. Examine the extent of digital competencies of teachers in teaching Chemistry in secondary school in Anambra state
4. Determine the perceptions of teachers on digitalization of teaching and learning of Chemistry in secondary school in Anambra state
5. Identify the challenges of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state
6. Examine the prospects of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state.

RESEARCH QUESTIONS

The following research questions in line with the objectives of the study were raised to guide the conduct of this study:

1. What are the various digital devices utilized in teaching and learning of Chemistry in secondary schools in Anambra state?
2. To what extent is the impact of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state?
3. What is the extent of digital competencies of teachers in teaching Chemistry in secondary school in Anambra state?
4. What is the perception of teachers on digitalization of teaching and learning of Chemistry in secondary school in Anambra state?
5. What are the challenges of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state?
6. What are the prospects of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state?

HYPOTHESES

The following research hypotheses were formulated to guide this study and were tested at 0.05 level of significance:

H₀₁: There is no significant difference between the mean response scores of male and female teachers on the various digital devices utilized in teaching and learning of Chemistry in secondary schools in Anambra state

H₀₂: Significant difference does not exist between the mean response scores of male and female teachers on the impact of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state

H₀₃: There is no significant difference between the mean response of male and female teachers on the extent of digital competencies possessed by teachers in teaching Chemistry in secondary school in Anambra state

H₀₄: There is no significant difference between the mean response scores of male and female teachers on the perception of teachers on digitalization of teaching and learning of Chemistry in secondary school in Anambra state

H₀₅: There is no significant difference between the mean response scores of male and female teachers on the challenges of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state

H₀₆: Significant difference does not exist between the mean response scores of male and female teachers on the prospects of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state.

**METHODOLOGY**

This study adopted a descriptive research design. This approach was adopted because the researcher intends to examine the impact of digitization in the teaching and learning of Chemistry in secondary schools in Anambra state. The population of the study consisted of 6,342 secondary school teachers in six education zones of the state. This comprised 830 teachers from Aguata, 1,694 teachers from Awka, 937 teachers from Nnewi, 989 teachers from Ogidi, 1,394 teachers from Onitsha and 498 teachers from Otuocha education zones respectively. The sample for the study comprised 634 public secondary school science teachers in Anambra state which consisted of 393 male teachers and 241 female teachers. This represented 10% of public secondary school teachers in the six education zones of Anambra state. The instrument for data collection was a researcher-developed questionnaire titled: Digitizing Chemistry Teaching and Learning in Secondary Schools in the Anambra State Questionnaire (DCTLSSASQ). The instrument was validated by three experts: two from the Department of

Curriculum Studies and Educational Technology (Science Education option) while one expert was from the Department of Educational Foundations (Measurement and Evaluation unit). These experts are lecturers in the Faculty of Education, University of Port Harcourt. A reliability coefficient of 0.88 was obtained for the instrument using Cronbach Alpha through the test retest method. The researcher administered the instrument directly to the respondents with the help of six research assistants. The research questions were answered using mean, standard deviation and rank order while the null hypotheses were tested at 0.05 level of significance using the z-test statistics. Tables were constructed in respect of the demands of the respective research questions, hypotheses and a criterion mean of 2.50 was used.

RESULTS

Research Question One: What are the various digital devices utilized in teaching and learning of Chemistry in secondary schools in Anambra state?

Table 1: Mean, Standard deviation and rank order of the various digital devices utilized in teaching and learning of Chemistry in secondary schools in Anambra state

S/N	ITEMS	Male \bar{X}	Female \bar{X}	\bar{XX}	SD	Rank	Decision
1	Projected lessons	2.30	2.34	2.32	0.21	13th	Disagreed
2	Video lessons	2.33	2.45	2.39	0.18	11th	Disagreed
3	Internet	2.50	2.51	2.51	0.12	8th	Agreed
4	Digital Whiteboard	2.10	2.12	2.11	0.21	19th	Disagreed
5	Desktop Computer	2.51	2.49	2.50	0.31	9th	Agreed
6	Personal Laptop	2.72	2.61	2.67	0.23	6th	Agreed
7	Multimedia Projector	2.48	2.49	2.49	0.17	10th	Disagreed
8	Video Camera	2.30	2.41	2.36	0.23	12th	Disagreed
9	Scanner	2.60	2.76	2.68	0.14	5th	Agreed
10	Clock Machine	2.10	2.31	2.21	0.18	16th	Disagreed
11	Printer	2.67	2.87	2.77	0.12	2nd	Agreed
12	Flash Memory	2.89	2.78	2.84	0.17	1st	Agreed
13	Modem	2.50	2.47	2.49	0.18	10th	Disagreed
14	Satellite Receiver	2.10	2.20	2.15	0.24	18th	Disagreed
15	Audio Tapes	2.30	2.22	2.26	0.21	15th	Disagreed
16	Software packages	2.72	2.81	2.77	0.12	2nd	Agreed
17	Visual Board	2.67	2.43	2.55	0.19	7th	Agreed
18	Local Area Network (LAN)	2.10	2.10	2.10	0.31	20th	Disagreed
19	Wide Area Network (WAN)	2.00	2.10	2.05	0.23	22nd	Disagreed
20	Internet services	2.60	2.73	2.67	0.18	6th	Agreed



21	ICT Laboratories	2.70	2.76	2.73	0.12	4th	Agreed
22	Satellite Receiver	2.10	2.04	2.07	0.23	21st	Disagreed
23	Zoom	2.40	2.24	2.32	0.34	13th	Disagreed
24	Google Classroom	2.22	2.10	2.16	0.28	17th	Disagreed
25	Coggle	2.00	2.01	2.05	0.36	22nd	Disagreed
	Grand Mean	2.40	2.41	2.41	0.21		Disagreed

Table 1 showed that the average mean score of respondents was 2.41 with a standard deviation of 0.21. Judging by the result, table 1 revealed that few items were excepted and overall mean fell short of the criterion mean of 2.5. Thus, respondents disagreed on the various digital devices utilized in teaching and learning of Chemistry in secondary schools in Anambra state. By implication, it is obvious from the result

obtained above that digital tools and devices required for the digitalization of the teaching and learning of Chemistry are either not available or utilized by teachers in secondary schools in Anambra state.

Research Question Two: To what extent is the impact of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state?

Table 2: Mean, Standard deviation and rank order of the impact of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state

S/N	ITEMS	Male \bar{X}	Female \bar{X}	\bar{XX}	SD	Rank	Decision
26	The online learning/teaching is effective for learning all aspects of Chemistry	2.76	2.60	2.68	0.13	5th	High Extent
27	Digitalization develops student's analytical skills in Chemistry	2.87	2.68	2.78	0.10	1st	High extent
28	Digitalization raises students' motivation as well as helps them not to guess too much	2.56	2.78	2.67	0.14	6th	High Extent
29	Learning with digitized material supports the achievement of the learning goals	2.56	2.51	2.54	0.19	10th	Moderate Extent
30	Computer Based Test displays all diagrams and signs accurately in Chemistry	2.71	2.74	2.73	0.21	4th	High Extent
31	Digitalization provides students an infinite access to unlimited information of varying degrees	2.83	2.67	2.75	0.16	3rd	High Extent
32	It helps students study contents in a way that shows connection between subjects	2.55	2.58	2.57	0.21	8th	Moderate Extent
33	It allows students to use various kinds of technology to conduct research, communicate and create knowledge	2.77	2.74	2.76	0.20	2nd	High Extent
34	It enables students to collaborate with their peers and teachers	2.67	2.66	2.67	0.19	5th	High Extent
35	It makes a classroom environment resemble a work place	2.48	2.53	2.51	0.23	11th	Moderate Extent
36	It encourages very high and critical thinking	2.55	2.77	2.66	0.21	7th	High Extent
37	Enables teachers and students share accountability for learning and achievements	2.54	2.56	2.55	0.23	9th	Moderate Extent
	Grand Mean	2.65	2.67	2.65	0.18		High Extent

Table 2 revealed that the average mean set scores of male and female respondents' ranges between 2.51 (SD= 0.23) and 2.78 (SD= 0.10). The table also showed that all the items had mean above the criterion mean of 2.5. with item number 27 ranking the highest. Thus, respondents were in agreement that to a high

extent, digitalization impacts the teaching and learning of Chemistry in secondary schools in Anambra state.

Research Question Three: What is the extent of digital competencies of teachers in teaching Chemistry in secondary school in Anambra state?

**Table 3: Mean, Standard deviation and rank order on the extent of digital competencies of teachers in teaching Chemistry in secondary school in Anambra state**

S/N	ITEMS	Male \bar{X}	Female \bar{X}	\bar{XX}	SD	Rank	Decision
38	Teachers communicate information and express themselves through different mediational means	2.56	2.51	2.54	0.25	1st	Moderate Extent
39	Teachers are able to open software, sort out and save information on the computer, and other simple skills in using the computer and software	2.30	2.22	2.26	0.23	4th	Low Extent
40	They are able to download different information types from the Internet	2.51	2.53	2.52	0.20	2nd	Moderate Extent
41	Teachers organize information according to a certain classification scheme or genre	2.36	2.41	2.39	0.21	3rd	Low Extent
42	Teachers compare and put together different types of information related to multimodal texts	2.20	2.32	2.26	0.34	4th	Low Extent
43	Teachers take part in net-based interactions of learning, and take advantage of digital technology to cooperate and take part in networks	2.14	2.11	2.13	0.31	6th	Low Extent
44	Teachers develop something new by using specific tools and software. Remixing different existing texts into something new	2.01	2.16	2.09	0.34	7th	Low Extent
	Grand Mean	2.30	2.32	2.31	0.27		Low Extent

Table 3 revealed that the digital competencies of teachers in teaching Chemistry in secondary school in Anambra state was at a low extent. The data presented in Table 3 revealed the grand mean score of respondents to all items was 2.31 (SD= 0.27) which was below the criterion mean of 2.50. This clearly shows that science teachers especially those teaching Chemistry lack the digital competence, skills and

expertise to digitalize the teaching and learning of Chemistry.

Research Question Four: What is the perception of teachers on digitalization of teaching and learning of Chemistry in secondary school in Anambra state?

Table 4: Mean, Standard deviation and rank order on the perception of teachers on digitalization of teaching and learning of Chemistry in secondary school in Anambra state

S/N	ITEMS	Male \bar{X}	Female \bar{X}	\bar{XX}	SD	Rank	Decision
45	Digitalization makes teaching of Chemistry effective, efficient and easier	2.56	2.61	2.59	0.13	7th	Agreed
46	It introduces technological skills in permeating and practical ways that increases teachers' productivity	2.71	2.55	2.63	0.21	6th	Agreed
47	It further develops teachers' technological skills	2.88	3.00	2.94	0.11	2nd	Agreed
48	Digitalization improves teachers' teaching skills and fosters productivity	3.11	3.02	3.07	0.09	1st	Agreed
49	Delivery contents electronically helps to bring out the best from both teachers and	2.99	2.87	2.93	0.12	3rd	Agreed



	students							
50	Digitalization enables teachers to get the full attention of students	2.78	2.67	2.73	0.14	5th	Agreed	
51	Digitalization provides an opportunity for teachers and students to communicate at all times	2.87	2.68	2.78	0.16	4th	Agreed	
	Grand Mean	2.84	2.77	2.81	0.14		Agreed	

The data presented in Table 4 above revealed the mean response scores of the respondents to all items analyzed ranging from 2.59 (SD=0.13) to 3.07 (SD=0.09) which showed that the respondents accepted all the items. By implication, the results showed teachers have positive perception and awareness on the

digitalization of teaching and learning of Chemistry in secondary school in Anambra state.

Research Question Five: What are the challenges of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state?

Table 5: Mean, Standard deviation and rank order on the challenges of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state

S/N	ITEMS	Male \bar{X}	Female \bar{X}	\bar{XX}	SD	Rank	Decision
52	Digital devices are expensive to maintain	3.00	2.88	2.94	0.15	3rd	Agreed
53	Digital devices are expensive to acquire	2.81	2.99	2.90	0.18	4th	Agreed
54	The cost of internet subscription is not an impediment	3.10	3.02	3.06	0.11	2nd	Agreed
55	Software packages for drawing and labeling poses a challenge	2.70	2.67	2.69	0.21	6th	Agreed
56	Laboratory digital devices are readily available and affordable	2.10	2.11	2.11	0.32	7th	Disagreed
57	Lack of devices for accessing the internet	2.81	2.65	2.73	0.22	5th	Agreed
58	Power supply is not inadequate	3.11	3.20	3.16	0.11	1st	Agreed
	Grand Mean	2.80	2.79	2.80	0.19		Agreed

With respect to items in Table 5 which sought to find out from the respondents the challenges of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state, the grand mean score for all items which stood at 2.80 (0.19) exceeded the criterion mean of 2.50. Thus, respondents agreed to all the items as the challenges of digitalization to the teaching and learning of Chemistry except item number

56. Also, respondents ranked inadequate power supply as the most challenging factor to digitalization.

Research Question Six: What are the prospects of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state?



Table 6: Mean, Standard deviation and rank order on the prospects of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state

S/N	ITEMS	Male \bar{X}	Female \bar{X}	\bar{XX}	SD	Rank	Decision
59	Digital learning increases students' performance in Chemistry	2.55	2.70	2.63	0.22	5th	Agreed
60	Digitalization of the teaching and learning of Chemistry makes students self-motivated and more accountable	3.02	2.99	3.01	0.18	1st	Agreed
61	Digital learning tools involve educators and parents to a deeper extent	2.78	2.67	2.73	0.20	4th	Agreed
62	Digitalization of the teaching and learning of Chemistry is far more interactive and memorable than voluminous textbooks or one-sided lessons	3.01	2.75	2.88	0.17	3rd	Agreed
63	Digital learning tools and technology is rapidly increasing information sharing in the teaching and learning of Chemistry	2.56	2.67	2.62	0.22	7th	Agreed
64	Increasing students' employability with digital learning tools and technology	2.50	2.42	2.46	0.24	8th	Disagreed
65	Digital learning tools and technology enable educators to rapidly share information with other educators in real-time	2.87	2.90	2.89	0.12	2nd	Agreed
66	Digital learning tools and technology fill the gaps where traditional classroom teaching falls behind in the teaching and learning of Chemistry	2.53	2.72	2.63	0.30	5th	Agreed
Grand Mean		2.74	2.73	2.73	0.21		Agreed

The data presented in Table 6 revealed the grand mean response score of the respondents to all items analyzed was 2.73 (0.21) which showed that the respondents accepted most of the items except item number 64. Thus, respondents were in agreement to the prospects and benefits derivable from the digitalization

of teaching and learning of Chemistry in secondary schools in Anambra state.

Hypothesis One: There is no significant difference between the mean response scores of male and female teachers on the various digital devices utilized in teaching and learning of Chemistry in secondary schools in Anambra state

Table 7: Summary of z test on difference in mean response scores of male and female teachers on the various digital devices utilized in teaching and learning of Chemistry in secondary schools in Anambra state

Categories	n	\bar{X}	SD	df	z-cal	z-crit	p	Decision
Male	393	2.40	0.21	632	0.60	1.96	0.05	H ₀ ₁
Female	241	2.41	0.20					Retained

Table 7 above showed that the z calculated value of 0.60 is less than the z critical value of 1.96 at 0.05 level of significance with the degree of freedom of 632. The null hypothesis was retained. This means that

significant difference does not exist between the mean scores of male and female respondents on the various digital devices utilized in teaching and learning of Chemistry in secondary schools in Anambra state.



Hypothesis Two: Significant difference does not exist between the mean response scores of male and female teachers on the impact of digitalization in

teaching and learning of Chemistry in secondary schools in Anambra state

Table 8: Summary of z test on difference in mean response scores of male and female teachers on the impact of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state

Categories	n	\bar{X}	SD	df	z-cal	z-crit	p	Decision
Male	393	2.65	0.18	632	1.26	1.96	0.05	H ₀ Retained
Female	241	2.67	0.20					

Table 8 above showed that the z calculated value of 1.26 is less than the z critical value of 1.96 at 0.05 level of significance with the degree of freedom of 632. The null hypothesis was retained. Hence, Significant impact does not exist between the mean response scores of male and female teachers on the

impact of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state.

Hypothesis Three: There is no significant difference between the mean response of male and female teachers on the extent of digital competencies possessed by teachers in teaching Chemistry in secondary school in Anambra state

Table 9: Summary of z test on difference in mean response scores of male and female teachers on the extent of digital competencies possessed by teachers in teaching Chemistry in secondary school in Anambra state

Categories	n	\bar{X}	SD	df	z-cal	z-crit	p	Decision
Male	393	2.30	0.27	632	0.87	1.96	0.05	H ₀ Retained
Female	241	2.32	0.29					

Table 9 presented above showed that the z calculated value of 0.87 is less than the z critical value of 1.96 at 0.05 level of significance with the degree of freedom of 632. The null hypothesis was accepted. This means that significant difference does not exist between the mean response scores of male and female teachers on the extent of digital competencies

possessed by teachers in teaching Chemistry in secondary school in Anambra state.

Hypothesis Four: There is no significant difference between the mean response scores of male and female teachers on the perception of teachers on digitalization of teaching and learning of Chemistry in secondary school in Anambra state

Table 10: Summary of z test on difference in mean response scores of male and female teachers on the perception of teachers on digitalization of teaching and learning of Chemistry in secondary school in Anambra state

Categories	n	\bar{X}	SD	df	z-cal	z-crit	p	Decision
Male	393	2.84	0.14	632	5.83	1.96	0.05	H ₀ Rejected
Female	241	2.77	0.15					

Table 10 above showed that the z calculated value of 5.83 is greater than the z critical value of 1.96 at 0.05 level of significance with the degree of freedom of 632. The null hypothesis was rejected. Hence, Significant difference does exist between the perception of male and female teachers on digitalization of teaching and learning of Chemistry in secondary school in Anambra state

Hypothesis Five: There is no significant difference between the mean response scores of male and female teachers on the challenges of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state

**Table 11: Summary of z test on difference in mean response scores of male and female teachers on the challenges of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state**

Categories	n	\bar{X}	SD	df	z-cal	z-crit	p	Decision
Male	393	2.80	0.19	632	0.67	1.96	0.05	H₀₅ Retained
Female	241	2.79	0.17					

Table 11 presented above showed that the z calculated value of 0.67 is less than the z critical value of 1.96 at 0.05 level of significance with the degree of freedom of 632. The null hypothesis was retained. This means that significant difference does not exist between the mean response scores of male and female teachers on the challenges of digitalization in teaching

and learning of Chemistry in secondary schools in Anambra state.

Hypothesis Six: Significant difference does not exist between the mean response scores of male and female teachers on the prospects of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state

Table 12: Summary of z test on difference in mean response scores of male and female teachers on the prospects of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state

Categories	n	\bar{X}	SD	df	z-cal	z-crit	p	Decision
Male	393	2.74	0.21	632	0.24	1.96	0.05	H₀₆ Retained
Female	241	2.73	0.20					

Table 12 presented above showed that the z calculated value of 0.24 is less than the z critical value of 1.96 at 0.05 level of significance with the degree of freedom of 632. The null hypothesis was retained. This means that the mean response scores of male and female teachers on the prospects of digitalization in teaching and learning of Chemistry in secondary schools in Anambra state does not have significant difference.

technology skills and techniques, it appears that they are often reluctant to avail themselves of the opportunity to increase in their competence due to digital anxiety or phobia to master certain devices.

The impact of digitalization in teaching and learning cannot be over-emphasized. Digitalization entails processes where the teacher or learner uses digital equipment to improve their knowledge and skills. The findings of this study showed that respondents were in agreement that to a high extent, digitalization impacts teaching and learning. This finding is in line with Karehka (2012) who noted that use of computer assisted learning in the classroom, smart interactive, white board, online media and online study tools are very effective in teaching various subjects. This study further revealed that the digital competencies of teachers were generally at a low extent. This is attributed to the fact that secondary school teachers are not highly technologically skilled as these competences were lacking when entered the teaching profession.

Also, the results obtained from this study showed that teachers have positive perception and awareness towards the digitalization of teaching and learning. This finding proved that digitization generally goes a long way in having positive impacts in teaching and learning of Chemistry.

Furthermore, the findings deduced from this study revealed that respondents were in agreement on

DISCUSSION OF FINDING

Considering that Chemistry is one the core science subjects taught in secondary school, it is imperative to digitalize its teaching approaches and methods by utilizing various digital devices. The findings of this study revealed that various digital devices utilized in teaching and learning of Chemistry in secondary schools in Anambra state were either not available or poorly utilized as evidenced in the results displayed above. It is obvious that technology in education is a comparatively new phenomenon and most teachers regarded as "digital immigrants" are not technologically skilled when they entered the teaching profession. Yet to effectively expand the range of instructional opportunities that can be offered to students, teachers must reach and maintain a certain degree of technological competence but when these teachers are provided the opportunity to learn new



the various challenges militating against the digitalization of the teaching and learning of Chemistry. A myriad of factors was identified with inadequate power supply appearing the most prominent amongst others.

Finally, it is revealed from the results of this study that the prospects of digitalizing the teaching and learning of Chemistry is enormous. This finding buttresses the fact that the more the application of digitization, the more effective the teaching and learning of Chemistry would be in secondary schools in Anambra State.

CONCLUSION

Digitalization a relatively new phenomenon in education yet its application has expanded a wide range of possibilities and affordances to teaching and learning. Digitization is crucially important to data processing, storage and transmission, because it allows information of all kinds to be carried with efficiency, compactness and to be integrated. This is why it is an ideal way of preserving information for many organizations around the world and educational institutions inclusive. Digitalization makes teachers aware of the available technology and most teachers are already taking initiatives to implement them, some hitches no doubt could be encountered yet the benefits far out-weighs challenges.

RECOMMENDATIONS

Based on the findings and conclusion of this study, the following recommendations are thus made:

1. Regular training of all teachers: Teachers should be trained and retrained in digital education.
2. As we are in the technological age, teachers should receive extensive training and retraining in troubleshooting, maintenance, and servicing of computers and other related teaching equipment. They should also be given adequate information on new techno-pedagogy and other teaching methods and recent ICT innovations.
3. Provision of adequate teaching materials, digital facilities and support services to ensure their relevance to the Nigerian situation.
4. Chemistry teachers should be encouraged towards the acquisition digitization tools and frequent exposure to modern improvements.
5. Secondary school administrators should partner with the government to remedy the issue of epileptic power supply in schools.

This is important because the ICT facilities and digital devices require power for their operation.

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