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STUDENTS' PERCEPTION OF THE CHALLENGES AND PROSPECTS IN THE USE OF DIGITAL DEVICES FOR CHEMISTRY LEARNING IN NIGERIAN SECONDARY SCHOOLS

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Abstract
This study examined the challenges and prospects in the use of digital devices for Chemistry learning in Secondary schools. A descriptive survey research design was adopted. The sample consisted of one hundred (100) Chemistry students randomly selected from four (4) Senior Secondary Schools in Odeda Local Government Area of Ogun State. The data collection tool was a questionnaire developed by the researcher. The data collected was analyzed using frequencycounts, simple percentages and mean. Findings of this study showed that some schools do not have adequate digital devices for classroom instruction. Even schools with some digital devices rarely made use of the devices. It was discovered that students have challenges in the use of the digital devices and solutions to the challenges were suggested. The study recommended among other things: Sufficient digital devices should be provided for students' use in schools, schools should allot enough time for Chemistry lessons, alternative power sources such as solar power should be provided for schools and workshops should be organized for Chemistry teachers to make them efficient on the use of digital devices for Chemistry teaching and learning.

Introduction

The importance of digital pedagogy to national development cannot be over-emphasized. Pedagogy refers to the method of passing information from the teacher to the students. Digital pedagogy therefore refers to the use of digital technologies in the teaching-learning process. Pedagogy is the basis of the teaching profession. A teacher can only facilitate learning when he/she has good knowledge of the subject-matter and employs suitable method of teaching to pass information to the students. Today, teachers in training now take courses in educational technology. This is in realization of the fact that no nation can develop above the quality of its teachers.

Pedagogy could be defined as the study of being a teacher and the process of teaching. Today, the global call for improved instructional delivery has led to an increased use of digital technologies (Nathaniel, Onasanya& Yusuf, 2019). The traditional system of the all-knowing, all-powerful teacher at the front of the class distilling knowledge into the empty minds of the students is no longer relevant. The use of digital technologies is capable of furthering the shift towards a more independent, student-led inquiry modes of learning. In the process, the teachers become co-collaborators or eModerators. Therefore, technology is no longer a mere tool in the classroom but something that changes how and what we learn.

According to BECTA (2008), students now use technology such as Facebook, WhatsApp, Twitter and Skype to get connected to friends, family, information and entertainment. Technology therefore enables them to connect with many people in many ways and more often. BECTA (2008) further observed that there was a seamless transition between the real and digital lives of the students. Students can now be described as being digitally expectant and there is the

need for teachers to refine their teaching and learning techniques to meet the increasing demands of their students.

It should be noted that the attitude of the secondary school students is different from those of the teachers. The secondary school teachers fall between the categories of those that have been using digital technologies to teach and those who are yet to embrace the use of technologies in teaching. These technologies are mostly learnt by the teachers on their own or through their peers. Those teachers that have been using the technologies in teaching are limited to only those technologies that they are familiar with in their home or workplace. The use of the digital technologies by such teachers may not be able to meet the expectations of their students or Chemistry curriculum. We should also realize that digital technological skillsand effective use of appropriate digital pedagogy in Chemistry lessons are two separate factors in the teaching-learning process.

The secondary school Chemistry students now expect that the teaching and learning they will experience in schools to be rich in digital technologies. When these students are out of their formal schools, they make use of digital devices like TV, radio, phones, Ipad, social networking, digital images and editing, electronic text, etc. However, as often as they use these devices outside the school, the question is "Are these students really digitally fluent across all facets of their life?". Most Chemistry educators and researchers believe that these students are digitally skillful in their lives outside school but less skillful within the school.

Chemistry teachers can use technology as a powerful tool to meet the different needs of their students. Teachers can make effective use of technology to create a more engaging, personalized and inclusive learning experience for all students. But learning in the digital era is associated with the problems of slow acceptance, availability of internet, computer laboratories, multimedia projector, digital classrooms, regular electricity, among others in the developing country such as Nigeria (Dutta & Bilbao-Osorio, 2012 cited by Nathaniel, Onasanya& Yusuf, 2019). The Senior Secondary School Certificate Examination (SSCE) results in different school subjects in Nigeria do not reflect the huge investment of the education stakeholders. This, according to Akanmu and Fajemidagba (2013) is due to slow and low acceptance of use of digital technologies for quick access to the needed information.

Statement of the problem

Chemistry is among the essential science subjects taught at the secondary school level in Nigeria's education landscape (Obaje& Eje, 2021). The National Curriculum for Senior Secondary Schools Science (1985) cited by Mohammed (2009) stated that Chemistry curriculum is aimed at:

- Facilitating a transition from secondary to tertiary level of education in the use of scientific concepts and techniques acquired in Chemistry.
- Providing the students with basic knowledge in chemical concepts and principles, through efficient selection of content and sequencing.
- Showing Chemistry in its relationship with other subjects.
- Showing Chemistry and its links with industry, everyday life, hazards and benefits.
- Providing a course which is complete for its pupils not proceeding to higher education while it is at the same time, a reasonably adequate foundation for a postsecondary course.

One of the ways to achieve the above objectives is for the teachers to make effective use of the appropriate digital pedagogy in the teaching and learning of Chemistry in secondary schools. Unfortunately, the use of the digital tools in school is faced with several challenges. It is against

this background that this study investigated the students' perception of the challenges and prospects in the use of digital devices for Chemistry learning in Nigerian secondary schools.

Research Questions

The following research questions were answered in this study:

1. What are the digital devices available for the teaching and learning of Chemistry in secondary schools?
2. How frequent do secondary school students use digital devices in the learning of Chemistry?
3. What are the benefits of using digital devices in the learning of Chemistry?
4. What are the challenges of using digital devices for Chemistry learning?
5. What are the solutions to the challenges of using digital devices for Chemistry learning in secondary schools?

Methodology

The descriptive survey was adopted through structured questionnaire for data collection. The population for this study consisted of all Senior Secondary School Chemistry students in Odeda Local Government Area of Ogun State, Nigeria. A total of one hundred (100) Chemistry students randomly selected from four (4) Senior Secondary Schools in Odeda Local Government Area of Ogun State constituted the sample size for the study. The data collected was analyzed using frequency counts, simple percentages and mean. The validation of the research instrument was done using experts in measurement and evaluation and some senior colleagues in the Department of Chemistry, Federal College of Education, Abeokuta.

Results

All the one hundred Chemistry students that participated in this study filled and returned the questionnaire. They were made up of thirty-nine males and sixty-one females.

Table 1 shows the results on research question 1: What are the digital devices available for the teaching and learning of Chemistry in secondary schools?

Table 1: Accessible digital devices

S/N	Items	Accessible	(%)	Not Accessible	(%)
1	Mobile phones	81	81	19	19
2	Recorders	34	34	66	66
3	Television sets	74	74	26	26
4	Desktop computer	56	56	44	44
5	Laptops	79	79	21	21
6	Notebooks	95	95	5	5
7	Touchscreen tablets	38	38	62	62
8	Internet facilities	62	62	38	38
9	Ipad	37	37	63	63
10	Digital camera	28	28	72	72
11	Multimedia projector	25	25	75	75
12	Multimedia podium	15	15	85	85
13	Interactive whiteboard	47	47	53	53
	Mean scores	51.6	51.6	48.4	48.4

Table 1 shows the data on digital devices accessible to Chemistry students in secondary schools. Mobile phones, television sets, Desktop computers, laptops, notebooks, internet facilities and

interactive whiteboards are accessible to more than half of the respondents. The Recorders and the Ipad were accessible to 34 and 37 % of the respondents respectively. The least accessible digital devices to the respondents are the Multimedia podium, Multimedia projector and the Digital Camera.

Table 2 shows the results on research question 2: How frequent do secondary school students use digital devices in the learning of Chemistry?

Table 2: Frequency of use of digital devices

S/N	Items	OU (%)	RU(%)
1	Mobile phones	43 43	5757
2	Recorders	1919	8181
3	Television sets	2323	7777
4	Desktop computer	3030	7070
5	Laptops	5353	4747
6	Notebooks	7979	2121
7	Touchscreen tablets	2424	7676
8	Internet facilities	42 42	58 58
9	Ipad	2424	7676
10	Digital camera	1717	8383
11	Multimedia projector	20 20	8080
12	Multimedia podium	16 16	8484
13	Interactive whiteboard	5454	4646
	Mean scores	34.234.2	65.865.8

OU : Often Used; RU : Rarely Used

The results in Table 2 shows that the respondents often used the following digital devices: laptops, notebooks and interactive whiteboard. The following digital devices were rarely used by the respondents: Recorders, mobile phones, television sets, Desktop computer, touchscreen tablets, internet facilities, Ipad, digital camera, multimedia projector and multimedia podium. The majority of the respondents,with an average mean of 65.8 % affirmed that the digital devices were rarely used for the teaching and learning of Chemistry in their schools.

Table 3 shows the data on research question 3: What are the benefits of using digital devices ,in the learning of Chemistry?

Table 3: Benefits of using digital devices for Chemistry learning

S/N	Items	SA + A (%)	SD + D (%)
1	Use of digital devices improves Chemistry learning	83 83	17 17
2	Use of digital devices promotes students' interests in learning Chemistry	77 77	23 23
3	Use of digital devices makes learning to be creative and innovative	83 83	17 17
4	Use of digital devices to learn Chemistry could make students to be self-reliant	62 62	38 38
5	Use of digital devices promotes self-study	74 74	26 26
6	Use of digital devices arouses learners' curiosity	66	34

		66	34
	Mean scores	74.2 74.2	25.8 25.8

SA : Strongly Agreed; A : Agreed; SD : Strongly Disagreed; D : Disagreed

The results in Table 3 on the benefits of using digital devices show that most of the respondents see the use of digital devices as ways to improve Chemistry learning, promote their interest in learning Chemistry, be creative and innovative, make them to be self-reliant and be curious in learning Chemistry. An average of 74.2 % of the respondents agreed that the use of digital devices is of great benefit to them.

Table 4 shows the results on research question 4: What are the challenges of using digital devices for Chemistry learning?

Table 4: Challenges in the use of digital devices for Chemistry learning

S/N	Items	SA + A (%)		SD + D (%)	
1	Inadequate time allotted to Chemistry learning	49	49	51	51
2	Shortage of digital devices in schools	65	65	35	35
3	Teachers' inefficiency in the use of digital devices	47	47	53	53
4	Insecurity	39	39	61	61
5	High cost of internet facilities	6868		32	32
6	Unstable internet services	7070		30	30
7	Unstable electricity	80	80	20	20
8	Poor computer literacy of students	50	50	50	50
9	Inability to understand the teacher's method of teaching	58	58	42	42
	Mean scores	58.458.4		41.641.6	

SA : Strongly Agreed; A : Agreed; SD : Strongly Disagreed; D : Disagreed

The results in Table 4 showed the challenges in the use of digital devices for Chemistry learning. The results showed that Chemistry students have the following challenges in the use of digital devices: inadequate time for Chemistry learning, shortage of digital devices, teacher's inefficiency in the use of digital devices, insecurity, high cost of internet facilities, unstable internet services and electricity and poor computer literacy of students. An average of 58.4 % of the respondents agreed on the challenges in the use of the digital devices.

Table 5 below shows the results on research question 5: What are the solutions to the challenges of using digital devices for Chemistry learning in secondary schools?

Table 5: Suggested solutions to the challenges in the use of digital devices for Chemistry learning

S/N	Items	SA + A (%)	SD + D (%)
1	Sufficient digital devices should be provided for students' use in schools.	89 89	11 11
2	Adequate time should be allotted to the learning of Chemistry in schools.	90 90	10 10
3	The students should be given proper orientation and training to prepare them for the use of digital devices.	9090	1010

4	Workshops should be organized for Chemistry teachers to make them efficient in the use of digital devices.	7979	2121
5	Teachers should attend workshops to update their knowledge on appropriate digital pedagogy for Chemistry lessons.	7272	2828
6	Alternative power sources such as solar power should be provided for schools for regular electricity.	76 76	2424
7	The Government should provide adequate fund for schools for the purchase and maintenance of digital devices.	80 80	20 20
8	Chemistry teachers should be encouraged to embrace digital technologies within their classroom practice.	8484	1616
9	Adequate security should be provided for schools.	78 78	22 22
	Mean scores	82 82	18 18

SA : Strongly Agreed; A : Agreed; SD : Strongly Disagreed; D : Disagreed

Table 5 shows the solutions to the challenges facing students in the use of digital devices for Chemistry learning. The respondents affirmed that sufficient digital devices and adequate time should be provided for the students, alternative power sources, adequate fund and security should be provided for schools, proper orientation and training should be given to the students to prepare them for the use of digital devices and workshops should be organized for Chemistry teachers to make them efficient in the use of digital devices. An average of 82 % of the respondents agreed that all the suggested solutions to the challenges facing the use of digital devices are capable of solving the identified problems confronting the use of digital devices for Chemistry learning.

Discussion

Chemistry is one of the key subjects offered by students in secondary schools. For effective teaching and learning of Chemistry, it is important to use digital devices in classroom instruction. The results of this study showed that some of the digital devices such as multimedia projector, multimedia podium, digital camera, ipad and recorders are not accessible to the students in some of the secondary schools. Evidence from the results obtained in this study also showed that some of the available digital materials are rarely used in some of the secondary schools. This is the case for mobile phones, recorders, television sets, desktop computers and Ipads which were rarely used in most of the secondary schools under study. These research results were in agreement with the findings of Achughu and Eke in their study on digitalization of teaching and learning of Chemistry Education in secondary schools in Anambra state.

The results of this study revealed that the use of digital devices in the teaching and learning of Chemistry has a lot of benefits. These results showed that the use of digital devices improves Chemistry learning, promotes students' interest in Chemistry learning, makes Chemistry learning to be creative and innovative, arouses learners' curiosity and could make students to be self-reliant. These findings had earlier been reported by Onasanya, Nathaniel, Sofoluwe and Onasanya (2014). This study, however, identified some impediments to the use of digital devices for Chemistry learning in secondary schools. The constraints include inadequate time allotted to Chemistry learning, shortage of digital devices, teacher's inefficiency in the use of digital devices, insecurity, high cost of internet facilities, unstable internet services and unstable

electricity. These problems were also identified by Nathaniel, Onasanya and Yusuf (2019) in their studies on engagement, learning styles and challenges of learning in the digital era among Nigerian secondary school students.

This study proffered the solutions to the challenges in the use of digital devices for Chemistry learning. Some of the solutions are: Sufficient digital devices should be provided for schools, adequate time should be allotted to Chemistry learning, workshops should be organized for Chemistry teachers and more fund should be provided for schools by the Government.

Conclusion

Any nation that intends to attain global independence and maintain a good economy must give a serious attention to its scientific and technological development. For Nigeria to be economically developed, its education must be digitalized. Chemistry with its developmental virtues could be used to drive the growth of Nigerian economy if its teaching and learning is digitalized.

Recommendations

The challenges confronting Chemistry students on the use of digital devices for Chemistry learning could be overcome by:

1. Providing sufficient digital devices for students' use in schools.
2. Allotting sufficient time for Chemistry lessons in schools.
3. Organizing workshops for Chemistry teachers to make them efficient on the use of digital devices for Chemistry teaching and learning.
4. Providing alternative power sources such as solar power for schools.
5. Giving students proper orientation and training on the use of digital devices.
6. Provision of adequate fund for schools for the purchase of digital devices by the Government.
7. Provision of adequate security for schools.

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