EXPLORING THE POTENTIALS OF SMART PHONES FOR TEACHING AND LEARNING CHEMISTRY IN SECONDARY SCHOOLS

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Abstract

The difficulties which accompany smart phones-integration in school education have given birth to research into educational change management, teachers' knowledge requirements and impacts on student learning but exploring the potentials of smart phones for teaching and learning chemistry in secondary schools has not been properly researched into especially in Nigeria. Random sampling technique was used to select five public schools from Atiba Local Government, Oyo. The total of 200 students and 5 teachers were randomly selected for the sample. 40 for each school. Student's questionnaire S.S.S 2-20 and S.S.S 3-20 and 1 questionnaire for the teacher in each school. In this study, majority of students were observed to be using smart phones to improve their learning because they have information at the tip of their fingers with just the click of a button using smart phone while only very few teachers use smart phones to support chemistry teaching in order to access up-to-date information and read materials online.

Keywords: Smart phones, Chemistry, Teaching, Learning, Secondary School

Introduction

The incorporation and advantage of smart phones use in school education continues to be a focal point for educators, governments and researchers. Teachers' practice and students' learning are affected by this smart phone incorporation. Government discourse in the forms of policy statements, government-funded initiatives and government-defined curricula that explicitly aim to integrate smart phones into schools reflects the broader societal role of ICTs in economic productivity, industry advancement and globalisation (ACARA, 2012; AICTEC, 2009; MCEETYA, 2008).

The difficulties which accompany smart phones-integration in school education have given birth to research into educational change management, teachers' knowledge requirements and impacts on student learning. Effective smart phones-integration is known to be complex and multifaceted for all levels of schooling. According to Hayes (2003); Lindberg & Sahlin (2011), factors affecting smart phones-integration include leadership, organisational issues associated with new infrastructure, specialist support staff and scheduling (Hayes, 2003; Tanaka-Ellis, 2010), the types and quantities of ICTs available (Chang, 2001; Crawford, 2009; Solhaug, 2009; van Rooy, 2012), external factors such as national ICT education policy (Tearle, 2003; Tondeur, van Braak, & Valcke, 2007), the context within which teachers are working (Harris, Mishra, and Koehler, 2009), inclusion or omission of smart phones-related outcomes in prescribed curricula (Handal, Cavanagh, Wood & Petocz, 2011), teachers' capacity and beliefs (Handal, 2011; Hayes, 2003; Prestridge, 2008) and learners' dispositions and ICT skills (Bonvallet & De Luce, 2001; Tanaka-Ellis, 2010). Specific challenges, such as tightly prescribed curriculum and high-stakes assessments also make integrating smart phones into senior secondary school difficult.

Mobile learning (m-learning), according to Rodríguez-Arancón, Arús & Calle (2013), is defined as using mobile technologies for educational purposes. The resonance of smart phones, no doubt, currently gives numerous opportunities for students to utilise mobile applications in supporting learning activities (Wendeson, Fatimah, Ahmad & Nazleeni, 2010). A research conducted by Gaskell & Mills (2010) in this area proved that smart phones play a very vital role in education by providing a major opportunity which enhances access to learning resources. This affords many institutions, especially in higher education, chances to develop learner support as well as learning opportunities in ways which would build on present methods. Shuler (2009), noted that smart phones offer students opportunities to gather, access, and process information outside the classroom as well as support learning in a real-world context. He also pointed out that smart phones allow collaboration, communication (as these are considered vital for 21st century academic success) and can also facilitate instruction that is adaptable to individual and diverse learners.

Indeed, understanding science learning can be quite challenging and demanding, since it's about knowledge creation on abstract and complex concepts; consequently, there is need for knowledge and ideas collaboration and co-construction, which stresses on change in educational practices (Khoo, Williams, Otrel-Cass, Cutler, Ballard & Critchley, 2012). This is important to allow students learn using mobile learning devices such as the smart phone.

It is indeed pertinent that students realise many possibilities that these tools can have on their learning as these technologies can support learning by increasing student participation and collaboration in the learning process (Khoo *et al*, 2012). In the Western world especially, science educationists have become more informed of the vast potential impacts of smart phones on teaching and learning science. Therefore, these technologies could show a new dimension to science education which includes content and scientific processes that are presently considered as difficult (Taber, 2005). Among young people in Ghana, one of the mostly owned mobile technologies used is the smart phone. The smart phone can afford students an appropriate learning environment as there are a many mobile applications students can access to support their learning experiences in science.

According to Vavoula, Sharples, Rudman, Lonsdale & Meek (2007), learning is modified and simplified for students in institutions of higher learning when engaged in real-world activities which bring the abstract concepts they learn to life. This is especially key for science learning, because it involves making several complicated abstract concepts clear, thereby, significantly building a relationship between students' formal knowledge and their personal experiences (Vavoula*et al*, 2007). Waycott & Kennedy (2009) noted that students are hopeful when they reflect their technology-aided learning and consider its relation to the world around them as mobile phone technologies also assist science students to construct a connection between learning science in the classroom and their personal experiences in the outside world.

Smart phones can be used in presenting documents, writing notes, playing educational games, listening to audio recordings and other sound files, viewing pictures and watching video clips, plus taking photographs (Trinder, 2005). Smart phone is now used in some universities to store information and Journal of Education and Practice and to retrieve information such as e-books, courseware and timetables (Twum, 2017). The results from a study that focused on the use of smart phones in secondary schools' classrooms revealed that smart phones had numerous benefits to support learning in and out of class (Hartnell-Young and Heym, 2008).

Statement of the Problem

The attainment of proficiency in Chemistry has remained the crucial goal of many students, parents and the society at large. However, the performance of students in secondary schools has been below average over the years. Even with the global technology evolution, the traditional method of teaching in which the teacher is the repertoire of knowledge is still the order of the day. Although, the benefits of using smart phones for enriching learning are well known, they are not well tapped in Nigeria.

Science educationists are already becoming more aware of the enormous prospects that smart phones can have in science education in the developed countries. But, as far as literature review is concerned, there has not been much empirical study done in Nigeria. Therefore, it is necessary that one looks at exploring the full potential of smart phones in science learning.

Objective of the Study

This study is aimed at exposing the possibilities of improved performance in chemistry by senior secondary school students through the integration of smart phone in its teaching and learning and determining the readiness of the students and teachers to embrace it.

Research Questions

The following research questions were raised and answered

- What is the perception of students about smart phone use?
- To what extent does smart phone impact students' learning?
- What benefits will the students derive in using smart phones for learning chemistry in class room?
- To what extent does the teacher use smart phones do sift out materials in teaching Chemistry?

Methodology

Research Design

The study adopted descriptive survey design. This design was considered appropriate for the study because the researcher would not manipulate any variable in the study. Survey instrument was designed to integrate the use of smart phones into teaching and learning chemistry at senior secondary school level.

Population of the Study

The population of this study comprises chemistry teachers and students in senior secondary schools of Atiba Local Government, Oyo. The target population for the study was chemistry teachers and students of five (5) public senior secondary schools two and three in Atiba Local Government, Oyo.

Sample and Sampling Technique

Random sampling technique was used to select five public schools from Atiba Local Government, Oyo. The total of 200 students and 5 teachers were randomly selected for the sample. 40 questionnaires for students (i.e., S.S.S 2 – 20 and S.S.S 3 – 20) and 1 questionnaire for the teacher in each school.

Research Instruments

The instruments used for data collection were questionnaires constructed by the researcher for face and content validation. The questionnaire has two parts, A and B. Part A centred on the demographic data of the respondents. This included information on data such as sex, age, class and version of social network account. For students, part B was broken into six (6) subtitles, while for teachers, into three (3) subtitles. The study questionnaire was made up of the four constructs of technology readiness index (TRI) and three constructs from the technology acceptance model (TAM) as introduced by TRI was a multi-item scale comprising 34 technology belief statements, both positive and negative, related to the four technologies readiness dimensions. Each

item was rated on a 5-point scale from 1 = strongly agree, 2 = Agree, 3 = Uncertain, 4 = Disagree and 5 = Strongly Disagree. Perceived usefulness, perceived ease of use and actual usage were constructs from TAM. Each of the constructs has ten items. Actual usage is related on a 5-point scale from 1=five times a day to 5 not used. Both TRI and TAM items were reported on a 5-pointlike scale; from Strongly Agree SA, to Strongly Disagree SD.

Validity and Reliability of Research Instruments

The questionnaire was designed and the validity of the content was determined by experts in educational technology who examined the instrument to determine the its adequacy, relative to students' knowledge and adaptation use of smart phones in teaching and learning chemistry. The reliability of instrument was affirmed using Cronbach's alpha at 0.84. Thus, it shows that the instrument was reliable.

Procedure for Data Collection

After the approval of the research instrument, the researcher visited the schools to keep them informed about the purpose of the study and ensure the questionnaires were administered to the respondents (teachers and students) who were assured of the confidentially of their responses.

Method for Data Analysis

The data collected were analysed using frequency count, simple percentage, mean for descriptive statistics to answer the research questions that test the readiness of students to use smart phones is integrate in teaching and learning chemistry.

Results and Discussion

Demographic Data

Table 1: Gender Distribution of the Study

Gender	Frequency	Percentage
Male	107	53.5
Female	93	46.5
Total	**200**	**100.0**

Table 1 showed that 200 students participated in the study, out of which 54% are male, 47%are female. This implies that the students of both genders were fairly represented.

Table 2: Age Specification

Age	Frequency	Percentage
Below 15	62	31.0
16 – 18	116	58.0
19 – 21	19	9.5
22 – 24	1	0.5
25 – 26	2	1.0
Total	**200**	**100.0**

Table 2 shows that 200 students participated in the study, and the age range, out of which 31% were below 15years, 58% were 16-18years, 10% were 19-21 years, 5% were 22-24years and 1% were 24-26years.

Table 3: Class specialisation

Class	Frequency	Percentage
S.S.S. 2	97	48.5
S.S.S. 3	92	46.0
No Indication	11	5.5
Total	**200**	**100.0**

Table 3 shows that 200 students fully participated in the study, out of which 49% were in S. S. S 2, 46% where in S. S. S 3, 6% failed to indicate their specialisation. This implies that students of all class specialisations were fairly represented.

RQ1: What are the levels of students using smart phones?

Table 4: Level of students using smart phones

S/N	Items	SA	A	U	D	SD	MEAN	St.d
1	The smart phone helps me with my chemistry assignment	100	73	13	10	04	1.73	.94
		50.0	36.5	6.5	5.0	2.0		
2	Smart phone increases my interaction with chemistry	60	70	31	24	15	2.32	1.23
		30.0	35.5	15.5	12	7.5		
3	Smart phone helps me increase access to learning materials and educational resources	54	79	38	14	15	2.29	1.16
		27	39.5	19.0	7.0	7.5		
4	I prefer chatting with smart phones to studying online	39	52	39	40	40	2.85	1.35
		19.5	26	19.5	20	15		
5	Using smart phone makes my work easy and comfortable	57	89	27	20.7	28	2.16	1.06
		5.0	44.5	13.5	10.0	3.5		
	WEIGHED AVERAGE				**2.27**		**45.30%**	

Table 4 revealed that the student agreed with the following: Smart phone helps me increase access to learning materials and educational resources mean = 2.29; I prefer chatting with smart phone to studying online mean = 2.85. But the students disagreed with the following: that smart phone helps them in their chemistry assignment mean = 1.73: that it increases their interaction with Chemistry subjects mean = 2.32. This may be one of reasons they did not want to use these technologies in supporting teaching. It is vital that lecturers play their role in supporting education by utilizing smart phones in teaching and learning science (Daniel, 2008). The weighted average is 2.27 which can be rated as 45.30%. This implies that the levels of students using smart phones for learning is low.

RQ 2: To what extent does smart phone impact students' learning?

Table 5: Extent to which smart phone impacts students' learning

SN		SA	A	U	D	SD	MEAN	St.d
1	Smart phone makes it easier for me to communicate with my classmates	69	78	28	20	05	2.07	1.054
		34.5	39.0	14.0	10.0	2.5		
2	Smart phone provides enhancement materials to supplement the textbook.	43	87	30	31	09	2.38	1.119
		21.5	43.5	15.0	15.5	10.5		

3	I find it easy to represent my thought using smart phones signs and symbols or practical.	49	64	46	28	13	2.46	1.190
		34.5	32	23	14	6.5		
4	I feel bored while solving assignments on my smart phone	45	77	27	30	21	2.53	1.280
		22.5	38.5	13.5	15	10.5		
	WEIGHED AVERAGE	**2.36**	**54.23%**					

Table 5 reveals that the students agreed with the following: that smart phone provides enhancement materials to supplement the textbook, mean 2.38: I find it easy to represent my thought using smart phones signs and symbols or practical, mean = 2.46: I feel bored while solving assignment on my smart phone, mean = 2.53. But the students disagreed with the following: smart phones make it easier for me to communicate with my classmates, mean=2.07. The weighted average is 2.36 which can be rated as 54.23%. This implies that the extent of students having access to smart phones for learning Chemistry is high, i.e., above average.

RQ 3: What are the levels of students' interest in using smart phones for learning Chemistry in the class room?

Table 6: The levels of students' interest in using smart phones in learning Chemistry in the classroom

SN		SA	A	U	D	SD	MEAN	St.d
1	Smart phone increases my creativity	54	80	33	19	14	2.30	1.17
		27	40	16.5	9.5	7.0		
2	Smart phone increases my motivation to learning chemistry	57	74	39	15	15	2.29	1.18
		28.5	37	19.5	7.5	7.5		
3	I think smart phone will benefit us if it is allowed in school	64	50	37	30	19	2.45	1.33
		32	25	18.5	15	19.5		
4	I like the idea of doing my studies via smart phone because I would not be limited to regular school hours.	41	47	48	40	24	2.80	1.30
		2.5	23.5	24	20	12		
5	I also do not find it convenient to use smart phone at home	27	49	34	63	27	3.07	1.28
		13.5	24.5	17	31.5	13.5		
	WEIGHED AVERAGE	**2.58**	**68.91%**					

Table 6 reveals that the students agreed with the following: smart phone increases my motivation to learning Chemistry, mean = 2.29: Smart phone increases my creativity, mean = 2.30: I think smart phone will benefit us if it is allowed in school, mean = 2.45. However, the students were uncertain that they like the idea of doing their studies via smart phone because I would not be limited to regular school hours, mean = 2.80: that the students disagree with the following: that do not find it convenient to use smart phone at home mean = 3.07. That levels of students' interest in using smart phones in learning Chemistry in the classroom. The weighted average is 2.58 which can be related as 68.2. This implies that the discomfort of students to use smart phones for learning is high, that is, above average.

RQ 4: To what extent does the teacher use smart phones do sift out materials in teaching Chemistry?

Table 7: Extent the teacher uses smart phones to sift out materials in teaching Chemistry

SN		SA	A	U	D	SD	MEAN	Std.D
1	Use smart phones has been a pleasant experience	60 3.0	40 2.0				1.40	.548
2	I often view chemistry related films, videos and programmes	60 3.0	40 2.0				1.40	.548
3	Multimedia facilities are available for teaching chemistry	80 4.0	20 1.0				1.40	.548
4	I send emails to my Chemistry students to discuss subject content and attach other important information from my phone.	60 3.0	40 2.0				1.20	.447
5	I use smart phones to contact my students for important information	60 3.0	40 2.0				1.40	.548
6	I access and download textual materials, audio and video clips for my class in teaching	40 2.0	60 3.0				1.20	.548
7	I seldom use smart phones applications in teaching chemistry	40 2.0	60 3.0				1.20	.548
8	I download materials into my smart phones to store up-to date information for my students	60 3.0	40 2.0				1.60	.548

9	The students are more skilled at using the smart phones	80 4.0	20 1.0		1.20	.447
10	I use online science dictionaries on my smart phones to get definitions for my class.	80 4.0	20 1.0		1.20	.447
11	Use of smart phones makes me more effective as a chemistry teacher.	80 4.0	20 1.0		1.20	.447
12	I recommend using smart phones to make teaching Chemistry more effective	80 4.0	20 1.0		1.20	.447
	WEIGHTED AVERAGE			**1.417**	**58.2%**	

Table 7 reveals that the teachers agreed with the following: that use smart phones has been a pleasant experience, mean = 1.40: That they often view Chemistry related films, videos and programmers mean = 1.40: That multimedia facilities are available for teaching Chemistry, mean = 1.40: That sending emails to my Chemistry students to discuss subject content and attach other important information from my phone, mean = 1.20: that the use smart phones makes it easier to contact my students for important information, mean = 1.40: That access and download textual materials, audio and video clips for my class in teaching, mean = 1.60: That seldom use smart phones applications in teaching Chemistry, mean = 1.20: that I download materials into my smart phones to store up-to-date information for my students, mean = 1.20: That the students are more skilled at using the smart phones, mean = 1.20: That use of smart phones make me more effective as a chemistry teacher, mean = 1.20: That they recommend using smart phones to make teaching chemistry more effective, mean = 1.20. Weighted average is 1.42 and 58.2%. This implies that the level of teacher interest in using smart phone to teach Chemistry is high and above average.

Conclusion and Recommendations

Conclusion

Based on the findings of the study, the following conclusions were made:

a. Majority of students were observed to be using smart phones to improve their learning. This could be because this technology made it easier to have access to information that can be read every time and everywhere. Therefore, students have information at the tip of their fingers with just the click of a button.

b. Secondly, some teachers use smart phones to support chemistry teaching in order to access up-to-date information and read materials online. Only a few lecturers were aware of the instructional importance of the smart phones. Most teachers were not aware of the numerous possibilities that smart phones have on education.

Therefore, this research gave a better understanding of students' practice and perception towards learning through smart phones and therefore will help to enhance educational activities and aid in engaging students to contribute to their learning.

Recommendations

Based on the results and conclusions of the study, the following recommendations were made.

Students should be aware and take an interest in using smart phones to support their learning experiences. Chemistry students should be more encouraged by their teachers to use chat room, such as viber and whatsapp for group discussions, share images through Bluetooth for explaining scientific concepts and processes, read eBooks and download scientific materials from the internet. Therefore, there should be seminars for students as to make them more aware of the full potentials the smart phone has to enhance their learning.

Teachers are encouraged to design activities that allow students to appropriately use their smart phones during lesson (through a secondary mobile policy- such as rules around usage and etiquette). These technologies can provoke the interest of the students and make chemistry learning more interactive. As a result, chemistry teachers should explore different ways mobile phone technologies can be used to support learning. Teachers can also formulate automatic alerts to their students on important information, such as quiz dates, additional required readings as well as links to helpful websites. Therefore, there should be seminars for teachers to be made more aware on how effectively the smart phone could be used to enhance or support teaching chemistry.

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