Educational Tools in the Clouds: Assessing Chemistry Teachers' Level of Awareness

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Abstract
The study investigated chemistry teachers' level of awareness of free internet based educational tools in Calabar Education Zone of Cross River State. Five research questions guided the study. The entire population of eighty four chemistry teachers from the seventy nine public secondary schools in the educational zone constituted the sample for the study. The sample comprising forty one male and forty three female chemistry teachers successfully completed the questionnaire which was the instrument for data collection. Simple percentage was used to analyse the research questions. Results of the analysis revealed that (1) thirty eight (45.2%) of the chemistry teachers have high internet literacy level (2) most of the chemistry teachers 59 (70.2%) exhibit moderate level of internet access (3) only 17 (20.2%) have a high level of awareness of online educational tools (4) male chemistry teachers have higher awareness level than their female counterparts and (5) level of awareness decreases with increase in years of service of the chemistry teachers. Based on the results, it was recommended, among others, that seminars and workshops should be organised to sensitize chemistry teachers on availability of internet based educational tools.
Keywords: chemistry, internet, open, education, resources

Introduction

Science education is viewed seriously by many nations because it is considered a necessary foundation for meaningful national development. Chemistry as a science subject is one of the core subjects required to pursue a programme in any science-based course, including medicine, engineering, pharmacy, nursing. It is the branch of science that deals with the composition, properties and uses of matter. It is a subject that should interest students as it applies to daily lives.

Chemistry is a very interesting subject but can sometimes be challenging as some of the topics or concepts may be difficult to understand when handled only theoretically. This would involve the use of other available resources, with textbooks being the most common. However, reliance on textbooks only is fraught with danger as the teachers will always be saddled with the responsibility of looking out for current editions which may not always be readily available or affordable; even as the best textbooks have their limitations. Akani and Abonyi (2011) and Nwafor et al. (2022) evaluated chemistry books used in Nigerian secondary schools and found them to be very limited in topical coverage, learning activity coverage and readability. The advent of the internet has greatly diminished the adverse limitation of complete reliance on textbooks with the introduction and availability of free online educational resources. Indeed, the internet has transformed the ways information is shared and this has affected practices and developments in many institutions across the world.

The internet is also known as the 'cloud' and the resources are also known as 'services' or 'solutions'. The cloud services are to help manage and make immediately available useful information rather than infrastructure (Wikipedia, 2024). Therefore various cloud solutions litter the internet and they include a collection of free educational tools which the United Nations Educational, Scientific and Cultural Organisation (UNESCO) calls 'open education resources' (Bissell, 2007). The term Open Education Resources (OER), was coined and adopted in 2002 at the United Nations Educational, Scientific and Cultural Organisation (UNESCO) Forum on Open Courseware and was designated to include 'teaching, learning and research materials in any medium, digital or otherwise that reside in the public domain or have been released under open licence that permits no-cost access, use or adaptation and redistribution by others with no or limited restriction' (UNESCO, 2012: 1).

Open education resources (OER) including the free course materials, virtual laboratories, charts, among others, were designed to combat the challenges of scarce educational materials and tools for teaching and learning. They are available and free and can be accessed from anywhere and at anytime, provided the devices for internet accessibility are available and usable. OER operates under the open license which means that they can be downloaded free of charge without requesting for permission. Such materials can be modified, adopted or adapted to suit the classes to be taught. Some of these online resources not only provide teachers with additional materials and tools to learn/teach some topics but sometimes also provide pedagogical styles that can be adopted in teaching them (Sclater, 2009). Free educational materials in the cloud have many advantages. For example, updates are available for free and without restrictions or price tags. There is therefore no excuse of unavailability of current textbooks. Although the internet has been flooded with OER for at least 10 years now, research results point to the fact that teachers exhibit varying levels of awareness of the availability of these resources (OPAL, 2011; Rolfe, 2012; Akomolafe & Olajire, 2014).

The OER impact report had reported a general lack of familiarity with OERs due to low computer literacy, insufficient technological resources like computers and poor internet connections in Sub-Sahara Africa (OECD, 2006). Also, Akubuiro et al. (2014) found that although teachers access the internet, they do not visit educational sites; Ekpo-Eloma and Effiong (2013) also reported of teachers' poor knowledge of innovative tools that boost teaching and learning. However, Akomolafe and Olajire (2014), in their survey on internet access among undergraduate students at the Obafemi Awolowo University, Ile-Ife, Nigeria, revealed a high Internet access. As at the time of the study, result showed that only 10% of the students had never accessed the Internet facilities.

Nwaohiri (2021) examined the level of awareness of OER in 3 Nigerian Universities and the results showed a high level of awareness although, 55% of the respondents said they did not know of many OER repositories. Also, Wiche and Ogunbodede (2021) investigated awareness of OERs by Library and Information Science Students of Ignatius Ajuru University of Education, Rivers State, Nigeria and the findings revealed that the students have high level of awareness on the concept of open educational resources and the diverse types of OER. Itasanmi (2020) found average level of awareness of OERs among Open and Distance Learning (ODL) students in south western Nigeria, while Bhartia and Leonardo (2021) reported poor level of awareness among students and faculty communities. Apart from the poor or moderate level of awareness, Rolfe (2012) in his study also found that female staff had significantly lower awareness level (39%) than their male counterpart (76%).

Abubakar et al. (2017) assessed the accessibility of e-resources by post graduate students of Nigerian universities and found that most of the ICT facilities were not accessible to the post graduate students. On the other hand, Ememe and Modebelu (2019) investigated distance learning students on accessibility of OER in institutions of learning in Lagos state and the study revealed that although open education resources were available, students lacked the internet and digital skills to maximally access them, which led to the recommendation that students should be encouraged to acquire digital skills to enable them tap into the rich resources provided by the OER.

Oberiri and Timothy (2018) assessed university students' usage of the internet resources for research and learning in North East Nigeria. Results showed that in the frequency of internet accessibility generally, more than half the students (62%) accessed internet on a daily basis, 18% between 2-5 times a week and 9.6% at least once a week. Ogunbodele et al. (2022) and Issa et al. (2020) also revealed a statistically significant difference in the use of digital resources by gender in their study and that male students used digital resources more than female students. Ilerbare and Afemikhe (2020) also found out that younger teachers (30yrs-40yrs) were more knowledgeable than their older counterparts (>40yrs) in the use of computer and digital packages. Prensky (2010) as cited by Inyang-Abia (2014) had also noted that the younger generation described as 'digital natives' were more adaptable to using technology for

learning and information gathering than the older generation described as 'digital immigrants'.

Research questions
1. What is the level of internet literacy of chemistry teachers
2. To what extent do chemistry teachers access the internet?
3. To what extent are chemistry teachers aware of OER sites?
4. To what extent does gender influence awareness of OER?
5. To what extent do years of service influence level of awareness of OER?

Methodology
The study investigated the level of chemistry teachers' awareness of free educational tools and resources on the internet. Descriptive survey was adopted for this research and the study targeted chemistry teachers in Calabar Education Zone. The Calabar Education Zone comprises 7 local government areas namely Akamkpa, Akpabuyo, Bakassi, Biase, Calabar Municipality, Calabar South, and Odukpani with a total of seventy nine (79) public secondary schools. The population of the study consisted of the entire 84 chemistry teachers in the Education Zone (Males=41; Females=43) who successfully filled the questionnaire which was the instrument for data collection.

The instrument for data collection was titled "Chemistry Teachers' Awareness of Free Internet Educational Tools Questionnaire" (CTAFIETQ). The questionnaire had 4 sections. Section A collected respondents' bio-data while section B with 8 items elicited responses concerning level of internet literacy; it utilised a Yes/No response option. Section C contained 5 items and collected information on chemistry teachers' level of internet frequency. It utilised a 6 point Likert scale type where respondents had to choose from Almost every day to Never. Section D solicited responses on teachers' level of awareness of free educational tools and resources. It contained 15 items and utilised a 4 point Likert scale type and respondents had to choose from strongly agree to strongly disagree. The research instrument, purpose and questions were face validated by two lecturers in Test and Measurements. For reliability, the instrument underwent a trial test involving 30 (thirty) chemistry teachers in private schools spread around Calabar South and Calabar Municipality. The Relaibility coefficients were estimated using the Cronbach Alpha and the values obtained ranged from 0.81 to 0.92

Internet literacy, internet accessibility and level of awareness of educational tools on the internet was classified as high, moderate or low using the formula, mean plus or minus standard deviation ($\bar{x}\pm1\text{SD}$). Those who scored above the mean plus one SD where categorized as high. Those who scored below the mean minus SD were classified as being low while those who scored between the two groups were classified as being moderate.

Presentation of results

Research question 1: What is the level of internet literacy by chemistry teachers in Calabar Education Zone?

Table 1: Frequency distribution of the level of internet literacy among Chemistry teachers in Calabar Education Zone of Cross River State

Level of awareness	f	%
High internet literacy level	38	45.2%
Moderate internet literacy level	21	25.0%
Low internet literacy level	25	29.8%
Total	84	100%

The result shows that 38 (45.2 percent) of the chemistry teachers have high internet literacy which means they can search the internet for resources using search engines, download and save downloaded materials. Twenty five (29.8 percent) were rated as having low internet literacy level while 21 (5%) have a moderate internet literacy level.

Research question 2: To what extent do chemistry teachers access the internet?

Table 2: Frequency distribution of the level of internet access among Chemistry teachers in Calabar Education Zone of Cross River State

Level of internet access	f	%
High access level	10	11.9%
Moderate access level	59	70.2%
Low access level	15	17.9%
Total	84	100

The result shows that most of the chemistry teachers 59 (70.2%) use the internet moderately. In fact, the number of chemistry teachers that recorded high internet access is lower than the number that recorded low internet access.

Research question 3: To what extent are chemistry teachers aware of free educational sites?

Table 3: Frequency distribution of the level of awareness of Open Education Resource sites among Chemistry teachers in Calabar Education Zone of Cross River State

Level of awareness	f	%
High awareness level	17	20.2%
Moderate awareness level	54	64.3%
Low awareness level	13	15.5%
Total	84	100%

Table 3 reveals that only 17(20.2%) of the chemistry teachers have a high level of awareness on availability of free educational resources while majority 55(64.3%) are just moderately aware. However, 13(64.3%) have low level of awareness.

Research question 4: To what extent do years of teaching experience influence chemistry teachers' level of awareness of educational tools?

Table 4: Frequency distribution of the years of teaching experience and level of awareness of Open Education Resources among Chemistry teachers in Calabar Education Zone of Cross River State

Level of awareness Teaching experience	LAL f(%)	MAL f(%)	HAL f(%)	Total f(%)
0-5yrs	5 (38.5)	7 (13.0)	7 (41.2)	19 (22.6)
6-10yrs	2 (15.4)	22 (40.7)	8 (47.1)	32 (38.1)
11-15yrs	3 (23.1)	12 (22.2)	0 (0.0)	15 (17.9)
Above 15yrs	3 (21.4)	13 (24.1)	2 (11.8)	18 (21.4)
Total	13 (15.5)	54 (64.3)	17 (20.2)	84 (100)

LAL= Low awareness level; MAL= Moderate awareness level; HAL= High awareness level

The result in Table 4 reveals that teachers with fewer years of teaching service (<11years) have higher level of awareness (88.2%) and out of 33 teachers who have taught for more than 10 years, only 2 (11.8%) recorded high level of awareness.

Research question 5: To what extent does gender influence level of awareness on educational tools among chemistry teachers?

Table 5: Frequency distribution of gender and level of awareness of Open Education Resources among Chemistry teachers in Calabar Education Zone of Cross River State

Level of awareness Gender	LAL f(%)	MAL f(%)	HAL f(%)	Total f(%)
Male	9 (69.2)	19 (35.2)	13 (76.5)	41 (48.4)
Female	4 (30.8)	35 (64.8)	4 (23.5)	43 (51.2)
Total	13 (15.5)	54 (64.3)	17 (20.2)	84 (100)

LAL= Low awareness level; MAL= Moderate awareness level; HAL= High awareness level

The result on Table 5 shows that even though there are more female chemistry teachers, very few of them 4(23.5%) have a high level on awareness of these free educational tools, compared to their male counterparts with 13 (76.5%). More female chemistry teachers (35, 64.8%) however showed moderate awareness on the educational resources compared to their male counterparts (19, 35.2%). Also, more male chemistry teachers

recorded low awareness level (9, 69.2%) compared to their female counterparts (4, 30.8%).

Discussion of the findings

The major focus of this study was to investigate the extent to which chemistry teachers are aware of free educational resources in the cloud. These resources provide tools with which they can build rich lesson notes, and help teachers impart more to the students they interact with. From the findings of this study, even though more than half of the chemistry teachers recorded a high internet literacy level, the level of internet access reveals that the majority of the teachers do not access the internet very frequently. This result is in agreement with Ememe and Modebelu (2019) and Abubakar et al. (2017) whose studies revealed poor internet access; the finding however is not in agreement with the findings of Oberiri and Timothy (2018) and Akomolafe and Alajire (2014) who reported high internet access among the groups studied.

Results also show that the level of awareness of the availability of free educational resources is also very low. Perhaps, it is the poor internet usage among chemistry teachers that accounts for the poor level of awareness on the availability of these resources. The level of awareness of free educational tools is also low; and it is in agreement with Bhartia and Leonardo (2021). This finding, though very disturbing and unexpected, is in agreement with Akubuiro et al. (2014) who noted that very few teachers carry out educational exercises or activities on the internet. It is also in agreement with the OECD (2006) that reported poor awareness and utilization of OERs in sub-Sahara Africa.

This result is however not in agreement with the results obtained by Itasanmi (2020) who found average level of awareness of OERs among Open and Distance Learning (ODL) students. It is also not in agreement with Nwaohiri (2021) and Wiche and Ogunbodede (2021) who reported high level of awareness among their study groups. The difference in research results in these two environments, may be as a result of many things. First is the fact that some of the study groups are different. While this study targeted chemistry teachers, some of the other studies targeted university students. It could also be as a result of better enlightenment of the study groups on the availability of these resources. It could also be that they have higher internet literacy and better internet access to these resources than the teachers in Calabar Education Zone.

Be that as it may, the arguments of insufficient technological resources and poor internet connections perhaps explained study results in the early 2000s but definitely not now in 2024. This is because of the availability of so many smart phones which many teachers own and admit to using to access the internet, just as many teachers own personal computers. This means that chemistry teachers need to be more deliberate in searching for OERs as they surf the internet. This is why Ekpo-Eloma and Effiong (2013) assert that it is this ignorance as shown by chemistry teachers concerning

innovations to boost teaching and learning that makes Nigeria's quest for scientific breakthrough through her youths a mirage. Therefore the results obtained here may not only be a result of ignorance of free educational resources, but also the result of lack of desire or interest to spend time to explore the clouds for relevant educational resources.

This study also observed that of the 17 (20.2%) of the teachers that have high awareness level, 88.2% (15) were younger teachers, most of whom have not taught for more than 10years. No wonder Prensky (2010) as cited by Inyang-Abia (2014) calls the younger teachers the "digital natives" and the older teachers the "digital immigrants". The younger teachers or "digital natives" are described as the free born of the technological age and natural adopters of technological language and practices, while the older generation are the "digital immigrants" who have to learn the language of technology (Inyang-Abia, 2014). This result is in agreement with Ilerbare and Afemikhe (2020) who also found out that younger teachers (30yrs-40yrs) with lower years of service were more knowledgeable than their older counterparts (>40yrs) in the use of computer and digital packages. Younger teachers had more computer skills while teachers with more than 10 years teaching experience lacked computer skills and felt anxious about computers. These studies strongly confirm the fact that older teachers tend to have a phobia for change, particularly with regards to technology and ICT. The fact that the older serving teachers had almost no awareness is very important bearing in mind that most schools assign the senior examination classes to the older and more experienced teachers to teach. When older teachers, who are unwilling to embrace new innovations or are even unaware of such facilities, are still the ones taking charge of the future of students, then there can really be no change either in the results or attitude of students towards this important and beautiful subject.

The study also revealed that a very poor number of female chemistry teachers had high level of awareness. This paltry figure of 4 (23.5%) compared to their male counterpart 13 (76.5%) is incredibly low. This is sad especially seeing that the female chemistry teachers that took part in the study are more (43, 51.2%) than the male teachers (41, 48.8%). This result is in line with the findings of Rolfe (2012), Ogunbodele et al. (2022) and Issa et al. (2020), and it is a situation that is not helpful at all to the schools, students or the society, especially with all the efforts made to encourage science learning among the female students. This result calls for urgent steps to redress the situation among female chemistry teachers in Calabar Education Zone.

Students in secondary schools are at a very impressionable stage of their lives. They need role models they can positively look up to. A science teacher void of creativity, who is lack lustre and dry in lesson presentation will certainly not be a model to look up to. Part of why these tools are there is to inject creativity into science education and it is therefore necessary to get chemistry teachers interested in this cloud based resources. The future of the youths, the higher institutions, the nation and the industrial

breakthrough the nation so passionately desires will continue to elude Nigeria except teachers begin to explore the many free educational resources.

Conclusion

Internet based free educational tools are rich educational materials meant for teachers, students and all learners. They provide a rich source of intellectual materials especially with the scarcity of current edition of textbooks, poor library and poor laboratory services. From the findings of this study, although more than half of the chemistry teachers recorded a high internet literacy level, majority of the teachers do not access the internet very frequently. Results also show that the level of awareness of free educational resources is very low. It was also observed that younger teachers have higher awareness level, and fewer number of female chemistry teachers had high level awareness.

Recommendations

Chemistry should not only be taught as a subject in the classroom but also in such a way that learners are able to recognize and appreciate it in their everyday activities. Based on the conclusions of this study, the following recommendations were made:

1. Regular seminars and workshops should be organised to sensitize chemistry teachers on the availability of these invaluable educational materials in the cloud.

2. Teachers, particularly the older teachers in the service, should be trained and retrained on ICT utilization and internet literacy.

3. Chemistry teachers should be encouraged to surf the internet, search for and visit OER sites for free lesson materials.

4. Student teachers in the faculties and colleges of education should be sensitized on the availability of these free internet based resources.

5. Finally, female chemistry teachers need to stir themselves to be aware of situations, innovations and services that have been made freely available for their use.

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