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Challenges of E-Learning on Chemistry Students during the First Wave of 2019/2020 Covid-19 Lock Down: Implications on Sustainable Stem Education

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ABSTRACT

This study discussed the challenges of e-learning by Chemistry students during the first wave of 2019/2020 COVID-19 lockdown in Nigeria: implications on sustainable STEM education. The study concentrated in Awka South Local Government Area of Anambra State, Nigeria. A descriptive survey research design was used to carry out the study. The population sample of the study comprised of 114 Chemistry students (44 males and 70 female) that participated in e-learning during the first wave of 2019/2020 COVID-19 lockdown in Nigeria. Two research questions and one hypothesis were formulated for the study. The instrument used was developed by the researchers known as E-Learning Challenges by Chemistry Students (ECCS) with reliability of .75. The ECCS was distributed by the researchers to the students. Mean and standard deviation were used to answer the research questions while t-test was used to test the null hypotheses. The findings showed a statistical significance difference between the mean responses of male and female Chemistry students to ECCS in favour of female students. Based on these findings, conclusions and recommendations towards implication on sustainable STEM education were made.

KEYWORDS: *STEM, Chemistry, e- learning and COVID-19*

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INTRODUCTION

STEM stands for science, technology, engineering and mathematics education. The aim of STEM education is to give people skills that make them more employable and ready to meet the current labour demand. Yeping et al (2020) noted that Chemistry is one of areas in STEM education, it's essential in solving various problems along with the ever evolving technology in the world. Lisa (2022) opined that Chemistry is one of the school subjects that is volatile to retain, thus requires constant rehearsal. Due to COVID-19 pandemic, contacts with people was restricted including attending classes for lectures. As a result schools, institutions resort to e-learning in teaching the subject due to its advantages.

Advantages of e-learning for sustainable STEM education includes; Ability to link the various resources in several varying formats and ability to delivering courses online (Clover, 2017; Ezeliora & Obikezie, 2017). Furthermore, e-learning help in academic achievement, interest, retention among young students' in the areas of improving students' perceptions, communication, quality of education, critical thinking and self-learning (Shahzad et al 2020). Edeh et al (2020) noted that e-learning help to show greater knowledge among secondary and higher education students not minding their gender and location. Amith et al,(2022) asserted that in as much as e-learning has the ability of helping in long distance learning and maintaining Chemistry knowledge during the COVID-19 lockdown does not mean that it has no constraints against sustainable STEM education.

According to Lisa (2022) constraints of e-learning that work against sustainable STEM education are; Most of the e- learning assessments are limited to questions that are only objective in nature, there is

also the problem of the extent of security of e-learning programs, the authenticity of a particular student's work is also a problem as e- learning just about anyone can do a project rather than the actual student itself and the assessments that are computer marked generally have a tendency of being only knowledge-based and not necessarily practicality-based (Amith et al, 2022). Despite these constraints, the advantages seems to be more useful especially in developing countries of the world during 2019/2020 COVID-19 lockdown which has helped in sustainable STEM education in the period if properly used (Amith et al, 2022).

Shahzad et al (2020) asserted that if properly used female participant in north Malaysia shows greater percentage in achievement, interest and retention than their male counterpart when taught science subjects like Chemistry using e-learning. The researchers further asserted that female students experienced less challenges in use of e-learning in science subjects than their male counterparts. Egbo et al (2011) opined that female business students in University of Nigeria Nsukka showed more interest and achieve better than their male counterparts when taught business studies with e-learning. In contrary Ramirez et al (2015) observed that if properly used, gender has no effect in achievement, interest and retention when taught Chemistry with e- learning unless a particular gender is given more attention. These researchers maintained that students showed great achievement, interest and retention in e- learning provided they are computer literate, being time conscious and have inward motivation. Elema et al (2022) and Guillermo et al (2022) maintained that female students have good responds than their male counterparts in e- learning Chemistry and Physics studies during COVID-19 era; this resulted to knowledge of STEM education among the female students. Amith et al (2022) opined that gender and location is not an issue in e- learning during pandemic, so knowledge of STEM education depends on the individual. The authors further asserted that provided that genders and locations are giving with equal opportunity, they encountered the same problems and challenges in any e- project based learning. Furthermore, Kumar (2015) outlined some challenges that students faced in e-learning during holiday and distance learning as thus: Adaptability struggle, Technical Issues differences, Computer literacy, Time management and Self-motivation

Thus, these study wishes to find out the extent the above issues were challenges of Chemistry students during first wave of 2019/2020 COVID-19 lockdown in Awka South Local Government Area of Anambra State, Nigeria: implications on sustainable STEM education.

Research Questions

Three research questions guided the study

1. To what extent do male and female Chemistry students encounter the same challenges during e-learning in first wave of 2019/2020 COVID-19 lockdown in Nigeria?
2. How has location impacted on the challenges encountered by Chemistry students during e-learning in the first wave of 2019/2020 COVID-19 lockdown in Nigeria

Hypothesis

Two hypothesis were formulated to guide the study

1. There is no significant difference in the challenges encountered by male and female Chemistry students in e-learning during first wave of 2019/2020 COVID-19 lockdown in Nigeria.

Methodology

The design of the study is descriptive survey research design. It is suitable for this study because the study only sort the opinion of secondary school Chemistry students on the challenges of e-learning during the first wave of 2019/2020 COVID-19 lockdown: implications on sustainable STEM education. The study was carried out in Awka South Local Government Area of Anambra State, Nigeria. 150 secondary school Chemistry students were randomly chosen from 5 co-educational schools in the local government. Three schools from urban areas of the local government while two schools from the rural areas. Out of 150 questionnaires distributed to the students, 114 were collected 36 were rejected due to manipulations in responds by the students. 44 male and 70 female Chemistry students were used for the study. The instrument use for data collection is a questionnaire developed by the researchers named E-learning Challenges of Chemistry Students (ECCS). ECCS has section A which sought information on the bio data of the students while the rest of the questionnaire is grouped into adaptability struggle extent, technical issues, computer literacy, time management and Self-motivation. A four point rating scales of strongly agree (SA) = 4 point, Agree (A) = 3 point, Disagree (D) = 2 point and strongly disagree (SD) = 1 point were provided for response by the students in section B. The instrument was face validated by two experts with reliability value of .75 using Cronbach Alpha. Mean and standard deviation were used to answer the research questions while t-test was used to test the hypotheses. Mean value equal to and above 2.5 was accepted while mean value below 2.5 was disagree.

Results

Research Question 1: To what extent do male and female Chemistry students encounter the same challenges during E- learning in first wave of 2019/2020 COVID-19 lockdown in Nigeria?

Table 2 Mean and Standard Deviation Responses of Male and Female Chemistry Students on Challenges Encountered in E-Learning During First Wave of 2019/2020 COVID-19 Lockdown in Nigeria

ADAPTABILIY STRUGGLE EXTENT	GENDER	SA	A	D	SD	STD DEV	X	DECISION
1. I have not been involved in any e-learning	M	4	12	10	18	1.4	2.1	D
before first wave of 2019/2020 COVID-19	F	10	28	16	16	1.6	2.5	A
lockdown.								
2. I am comfortable with e-learning chemistry	M	6	6	22	10	1.5	2.2	D
Studies.	F	16	24	24	6	1.6	2.7	A
TECHNICAL ISSUES								
3. I have access to computer for e-learning	M	4	6	22	12	1.4	2.0	D
during the period of 2019/2020 COVID-19	F	34	10	16	10	1.7	3.0	A
lockdown.								
4. There is always power supply during	M	4	10	20	10	1.4	2.2	D
e- learning.	F	16	20	20	14	1.6	2.5	A
COMPUTER LITERACY								
5. I have computer knowledge before the first	M	6	6	22	10	1.5	2.2	D
wave of 2019/2020 COVID-19 lockdown.	F	26	12	36	0	1.7	3.0	A
6. I have knowledge of CD storage system in	M	6	8	18	12	1.5	2.2	D
Chemistry before the first wave of 2019/2020	F	14	26	26	4	1.6	2.7	A
COVID-19.								
TIME MANAGEMENT								
7. I am always online with my e-instructor	M	4	4	22	14	1.4	2.0	A
during first wave of 2019/2020 COVID-19	F	28	18	6	6	1.7	3.0	A
lockdown.								
8. I mange my time well whenever I am M	M	10	22	12	0	1.7	2.9	A
tested during first wave of 2019/2020	F	32	26	10	2	1.8	3.3	A
COVID-19 lockdown e- learning.								
SELF MOTIVATION								
9. I learn more Chemistry concepts with M	M	4	10	18	12	1.4	2.1	D
e-learning.	F	20	24	22	4	1.7	2.9	A
10. I always complete my task during the	M	12	14	14	4	1.7	2.8	A
first wave of 2019/2020 COVID-19 lockdown.	F	16	40	12	2	1.7	3.0	A

Result of table 2 show those male Chemistry students during the first wave of 2019/2020 COVID-19 lockdown in Awka south local government area of Anambra State Nigeria disagreed in six items out of ten items with mean responses below 2.5 but their female counterpart agreed in all the items

RESEARCH QUESTION 2 how has location impacted on the challenges encountered by Chemistry students during E- learning in the first wave of 2019/2020 COVID-19 lockdown in Nigeria

Table 3 Mean and Standard Deviation Responses of Rural and Urban Chemistry students that participated in E- learning during the first wave of 2019/2020 COVID-19 lockdown in Nigeria

ADAPTABILIY STRUGGLE EXTENT	GENDER	SA	A	D	SD	STD DEV	X	DECISION
1. I have not been involved in any e-learning	R	4	12	10	18	1.4	2.1	D
before first wave of 2019/2020 COVID-19	U	10	28	16	16	1.6	2.5	A
lockdown.								
2. I am comfortable with e-learning chemistry	R	6	6	22	10	1.5	2.2	D
Studies.	U	16	24	24	6	1.6	2.7	
ATECHNICAL ISSUES								
3. I have access to computer for e-learning	R	4	6	22	12	1.4	2.0	D
during the period of 2019/2020 COVID-19	U	34	10	16	10	1.7	3.0	A
lockdown.								
4. There is always power supply during	R	4	10	20	10	1.4	2.2	D
e- learning.	U	16	20	20	14	1.6	2.5	
ACOMPUTER LITERACY								
5. I have computer knowledge before the first	R	6	6	22	10	1.5	2.2	D
wave of 2019/2020 COVID-19 lockdown.	U	26	12	36	0	1.7	3.0	A
6. I have knowledge of CD storage system in	R	6	8	18	12	1.5	2.2	D
Chemistry before the first wave of 2019/2020	U	14	26	26	4	1.6	2.7	A
COVID-19.								
TIME MANAGEMENT								
7. I am always online with my e-instructor	R	4	4	22	14	1.4	2.0	A
during first wave of 2019/2020 COVID-19	U	28	18	6	6	1.7	3.0	A
lockdown.								
8. I mange my time well whenever I am	R	10	22	12	0	1.7	2.9	A
tested during first wave of 2019/2020	U	32	26	10	2	1.8	3.3	A
COVID-19 lockdown e- learning .								**SELF**
MOTIVATION								
9. I learn more Chemistry concepts with	R	4	10	18	12	1.4	2.1	D
e-learning.	U	20	24	22	4	1.7	2.9	A
10. I always complete my task during the	R	12	14	14	4	1.7	2.8	A
first wave of 2019/2020 COVID-19 lockdown.	U	16	40	12	2	1.7	3.0	A

Result of table 3 above show that rural Chemistry students during the first wave of 2019/2020 COVID -19 lockdown in Awka south local government area of Anambra State Nigeria disagreed with most items with below mean responses of 2.5 but urban agreed in all.

H_{O1} There is no significant difference in the challenges encountered by male and female Chemistry students in E-learning during first wave of 2019/2020 COVID-19 lockdown in Nigeria.

Table 3: T- test analysis of male and female students' response to ECCS

	Test Value = 0					
	T	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
FEMALE	4.087	3	.026	524.00000	115.9927	932.0073
MALE	6.239	3	.008	330.00000	161.6609	498.3391

In table number 3, is two tailed t test showed that female Chemistry students have .026 and that of male is .008. This however is an indication that female Chemistry students have higher percentage of mean value than their male counterpart show a significant difference in the table

Therefore, null hypothesis is rejected alternative hypothesis accepted which uphold that there is a significant difference in challenges encountered by male and female Chemistry students in E-learning during first wave of 2019/2020 COVID-19 lockdown in Awka South Local Government Area Nigeria in favour of female Chemistry students.

Discussion

The results of the findings are discussed under the following:

Whether male and female Chemistry students encounter the same challenges during E- learning in first wave of 2019/2020 COVID-19 lockdown.

From the finding, it was observed that male Chemistry students encountered more challenges than their female counterpart during the period. The finding is contrary with Ramirez et al (2015) who observed that gender has no effect in achievement, interest and retention when taught Chemistry with e-learning. Secondly, the finding is in consonances with Shahzad et al (2020) and Elema et al (2022) who asserted that if properly used female participant in north Malaysia shows greater percentage in achievement, interest and retention than their male counterpart when taught science subjects using e-learning. The result is also in line with Egbo et al (2011) who opined that female business students in University of Nigeria Nsukka show more interest and achieve better than their male counterparts when taught business studies with e-learning. This result could be as a result of keen interest of female students in internet facilities or it could be as a result of female Chemistry students being more exposed to STEM education related activities and STEM education knowledge than their male counterpart.

Conclusion

From the findings of this study, the following conclusions were drawn; The research show there were a significant difference in challenges encountered by male and female Chemistry students in E-learning during the first wave of 2019/2020 COVID-19 lockdown in favour of female students

Recommendations

From the findings to this study, the following recommendations were made

1. For efficient sustainable STEM education, Chemistry students should be exposed to e-learning at least once or twice while in a term especially males students and generally the rural students not minding their gender.

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