Chemistry Education Amidst a Global Pandemic: Insights from Federal University Otuoke

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Abstract— This study investigated the impact of the COVID-19 pandemic on the teaching and learning of Chemistry at Federal University Otuoke, Bayelsa State, Nigeria. A survey design was adopted, with a sample of 120 students at different levels of their study and 10 lecturers selected through random sampling. Data was gathered through a structured questionnaire and examined using descriptive statistics. The findings revealed that COVID-19 disrupted academic activities, reduced student interest in school, affected academic performance, and limited access to learning resources. Based on these findings, it is recommended that institutions invest and engage staff in sustainable digital infrastructure to support blended learning and mitigate future disruptions.

Keywords— COVID-19, Chemistry Education, Pandemic Disruption, Educational Challenges, E-learning Access, Remote Teaching.

I. INTRODUCTION

In late 2019, a virus apparently closely related to severe acute respiratory syndrome (SARS) coronavirus emerged in Wuhan, China. The virus, which was eventually identified as severe acute respiratory syndrome coronavirus 2 (SARS-COV-2), caused a disease called COVID-19 that resembled SARS and was primarily characterized by fever and respiratory symptoms. The term "coronavirus" refers to a vast family of viruses that can cause a range of diseases, from the common cold to serious respiratory tract infections. The most frequently mentioned symptoms of COVID-19 are a new persistent cough, fever, and a loss of taste and/or smell (NHS, 2023). However, the infected individual may also experience other respiratory symptoms. The world health organization declared it a public emergency of international concern in January 2020 (World Health Organization (WHO,2020). The closure of schools and campuses impacted over one billion students in over 100 nations, according to UNESCO reports (Nazif-Muñoz et al., 2021). The COVID-19 pandemic caused the greatest disruption to the educational system in human history, impacting nearly every student, including those studying chemistry.

The COVID-19 pandemic exposed the many inadequacies and inequalities in our educational system from access to the broadband internet and computers needed for online education, the supportive environments needed to focus on learning, up to the misalignment between resources and needs (Eze *et al.*, 2021)). Different countries engaged various measures to implement physical distancing to curb the spread of COVID-19 such as complete closure of the economy, including educational institutions (Nicola *et al.*, 2020; UNESCO, 2020). The pandemic had an impact on every facet of the educational system, from higher education to preschool. The lockdowns in response to COVID-19 pandemic interrupted conventional schooling with nationwide school closures. Throughout the COVID-19 pandemic, the educational community worked together to preserve learning continuity; however, pupils had to rely increasingly on their own resources to continue their remote education via radio, television, or the internet. Teachers also had to adapt to new pedagogical concepts and modes of delivery of teaching for which they may not have been trained (Al-Samarrai *et al.*, 2020). Understanding how the teaching and learning of chemistry may operate during the global pandemic and post COVID-19 is imperative to implementing new measures to better support students in their academic journey. Previous research has shown that students from lower socioeconomic backgrounds are more likely to withdraw from their studies (Smith and Naylor, 2005). The world has never seen this scale of education disruption until COVID-19 pandemic. In previous decades, major disruptions of education mainly involved natural disasters, armed conflicts or epidemics in individual countries or sometimes regions. Therefore, a lot of researchers conducted research on the impact of COVID-19 globally (Pokhrel and Chhetri, 2021). This study tries to assess the Impact of COVID-19 pandemic on Teaching and Learning of Chemistry in Federal University Otuoke, Bayelsa State, Nigeria. Education has been hit particularly hard by the COVID-19 pandemic with 1.52 billion learners out of school and 165 country-wide school closures, impacting 87.1% of the world's total enrolled learners ("COVID-19 and Education in Emergencies | Education Cannot Wait"). However, when school closures take longer, teaching and learning chemistry are affected.

The general purpose of the study is to assess the impact of COVID-19 pandemic on teaching and learning of chemistry in Federal University Otuoke, Bayelsa state, Nigeria while the specific purposes are as follows:
1) To determine the impact of COVID-19 pandemic on teaching and learning of chemistry in Federal University Otuoke, Bayelsa state, Nigeria.
2) To evaluate the value of COVID-19 pandemic on the teaching and learning of chemistry in Federal University Otuoke, Bayelsa state, Nigeria.
3) To identify the challenges militating against the teaching and learning of chemistry during COVID-19 pandemic in federal university Otuoke, Bayelsa state, Nigeria.

II. MATERIALS AND METHODS

A. Design of the Study

The research design in this study is survey research design in which a group of people or items are studied by collecting data from only a few people or items considered being representative of the entire group.

B. Population of the Study

The population of the study consists of all 200 level, 300 level, and 400 level chemistry and chemistry education students and lecturers in Federal University Otuoke, Nigeria.

TABLE 1: Study Population

Department	200 level	300 level	400 level
Chemistry	59	76	88
Chemistry Education	70	85	53

C. Sample and Sampling Techniques

Simple random sampling techniques was used to randomly select sixty (60) chemistry students and sixty (60) chemistry education student, and ten (10) lecturers in Federal University Otuoke.

TABLE 2: Sample of the Study

Department	200level	300level	400level	Total
Chemistry	20 students	20 students	20 students	60 students
chemistry Education	20 students	20 students	20 students	60 students
Total	40 students	40 students	40 students	120 students

D. Instruments for Data Collection

A questionnaire was used as the research instrument to gather data for this study. It was preceded by a covering letter, introducing the researcher, explaining the purpose of the research and soliciting assistance in providing the required information. The title of the questionnaire is "The Impact of COVID-19 Pandemic on Teaching and Learning of Chemistry in Federal University Otuoke, Bayelsa State". The questionnaire contained two (2) sections. Section A: Dealt with the respondent's personal information such as gender and age. Section B contained eighteen (18) questions that were expected to throw light on the research questions and on a four-point Likert scale of strongly Agree – "SA", Agree – "A", Disagree – D and strongly Disagree – "SD".

E. Validity of the Instrument

Validity is the degree by which the sample of test items represents the content the test is designed to measure (Berg and Gall 1989). The research instrument was submitted to the researcher's supervisors for thorough examination and investigations, thus, the instrument was validated.

F. Reliability of the Instrument

Shanghverzy (2003) defined reliability as consistency of measurement and is frequently assessed using the test – retest reliability method. Reliability is increased by including many similar items on a measure, by testing a diverse sample of individuals and by using information testing procedures. The instrument was administered to a sample of twenty (20) students who are not part of the original sample for the study.

A second administration of the instrument was conducted after a period of two weeks. The initial scores were compared with the score of the second administration using person product correction, coefficient obtained was 0.83 which confirmed the instruments reliability for use in the study.

G. Administration of the Research Instrument

The research instrument was administered to the selected students. The respondents were implored to give full concentration on the exercise and collection was made on the spot.

H. Method of Data Collection

The data of this study was obtained from the primary source of data which is the student's and lecturer's response from the questionnaire. The questionnaires were collected on the spot and administered to the respondents in person.

I. Method of Data Analysis

Simple tables, frequency count, simple percentages and mean score statistics were adopted to answer research questions in the presentation and analysis of the data generated for the study.

The four points rating scale will give values as follows: SA – 4, A – 3, D – 2, and SD – 1. *Decision Rule:* Any score that is from 2.5 and above is accepted, while any score that is below 2.5 is rejected. Therefore, 2.5 is the critical value for decision taking under mean score statistic.

III. RESULT AND DISCUSSION

A. Result

TABLE 3: Data on Department of respondents

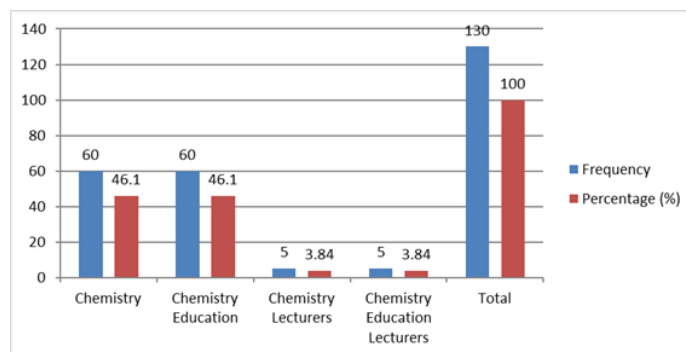| Department	Frequency	Percentage (%)
Chemistry	60	46.1
Chemistry education	60	46.1
Chemistry lecturer	5	3.84
Chemistry education Lecturers	5	3.84
Total	130	100

Fig. 1: Respondents by Department and Profession

Table 3 show that 60(46.1%) of the respondents are from chemistry and chemistry education respectively making a total of 120 students. While 5(3.84%) of the respondent are lecturers from chemistry and chemistry education respectively making a total of 10 lecturers. Students from 200,300,400, level and lecturers are involved in the research as respondents.

TABLE 4: Data on sex (gender) of respondents

Sex (gender)	Frequency	Percent (%)
Male	70	53.8
Female	60	46.1
Total	130	100

On the bases of gender, it was observed that 70 (53.8%) of the respondents were male while 60 (46.1%) were female. This eliminates any bias that could be attributed since both sex (gender) types were duly represented.

Table 5 shows that 25(19.2%) of the respondents were between the age range 16-20 years, 48(36.9%) of the respondents were between the age range 21-25 years,

42(32.3%) of the respondents were between the age range 26-30 years, while 15(11.5%) of the respondents were between the age range of 30 and below.

TABLE 5: Data on age of respondents

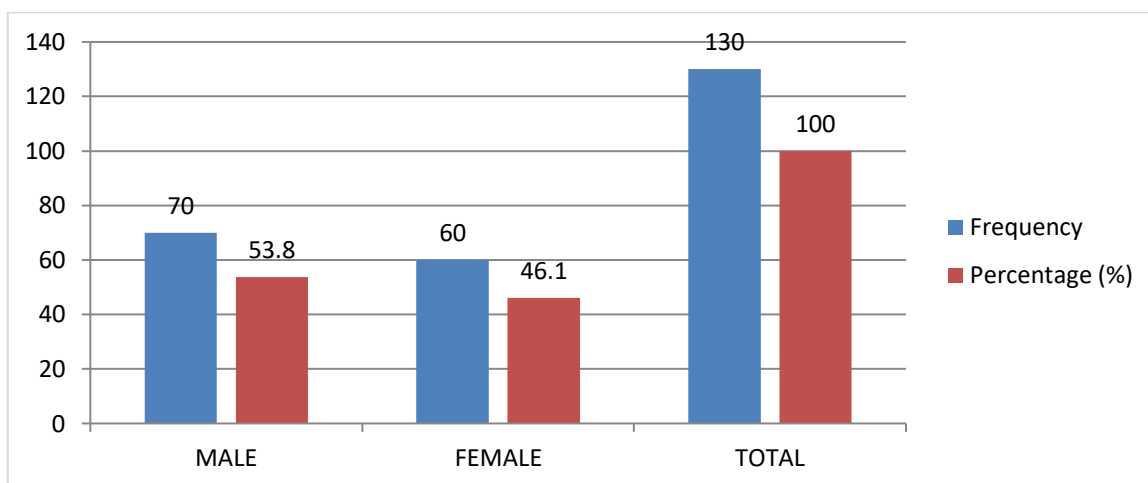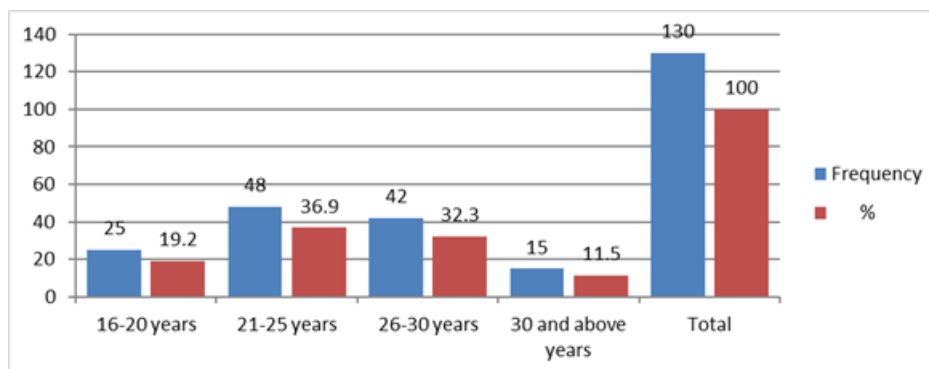| Age	Frequency	%
16-20 years	25	19.2
21-25 years	48	36.9
26-30 years	42	32.3
30 and above years	15	11.5
Total	130	100

Fig. 2: Respondents by Gender

Fig. 3: Classification of Respondents by Age

TABLE 6: Data on educational level of respondents

Educational level	Frequency	%
B.Sc	120	92.3
M.Sc	6	4.61
PhD	4	3.07
Total	130	100

Table 6 shows the educational level of respondents and it revealed that 120(92.3%) of the respondents are from B.sc level, 6(4.61%) of the respondents are from M.sc level, while 4(3.07%) are from PhD level.

B. Research Question 1

Does COVID-19 pandemic have any impact on the teaching and learning of chemistry?
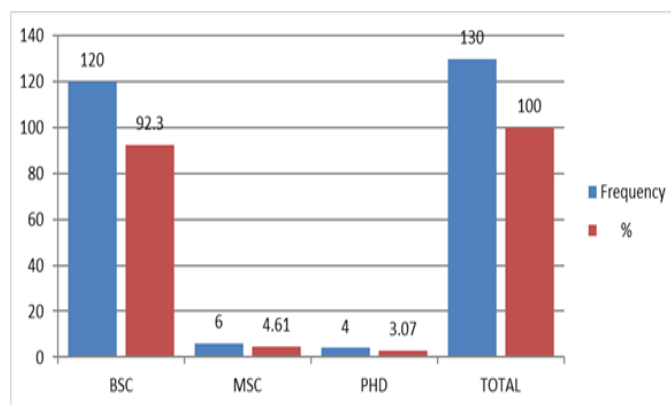

Fig. 4: Educational level of respondents

139

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Responses on statements regarding if COVID-19 pandemic has any impact on the teaching and learning of chemistry is summarized in Table 7 and Figure 5. It was noted that items 1,2,3,4,5,&6 all agreed on the various statement above. Each item had a mean score that is higher than the critical value of 2.5.it could be summated that majority of the respondents confirm that in Federal University Otuoke, COVID-19 pandemic has an impact on the teaching and learning of chemistry.

C. Research Question 2: To evaluate the value of COVID-19 pandemic on the teaching and learning of chemistry?

TABLE 7: frequency count, simple percentage and mean score statistic on the statement regarding if COVID-19 pandemic has any impact on the teaching and learning of chemistry.

| S/N	Item	SA	A	D	SD	Total	Mean	Critical Value	Remark
1	Do you think learners may lose what they have learnt before COVID-19?	76 58.5%	36 27.7%	10 7.7%	8 6.2%	130 100%	3.38	2.5	Accepted
2	After COVID-19 outbreak, most students became more interested in business than schooling?	43 33.1%	75 57.7%	6 4.6%	6 4.6%	130 100%	3.20	2.5	Accepted
3	Generally, academic performances of most students have dropped due to non-activity during the lockdown?	70 53.8%	47 36.2%	7 5.4%	6 4.6%	130 100%	3.39	2.5	Accepted
4	After COVID-19 pandemic, most students lost interest in university educational?	30 23.1%	60 46.2%	29 22.3%	11 8.4%	130 100%	2.83	2.5	Accepted
5	COVID-19 led to poor academic achievement/mass failure in external exams?	35 26.9%	52 40%	39 30%	4 3.1%	130 100%	2.90	2.5	Accepted
6	Curricular changed due to the outbreak of the COVID-19 pandemic.	36 27.7%	33 25.4%	43 33.1%	18 13.8%	130 100%	2.66	2.5	Accepted
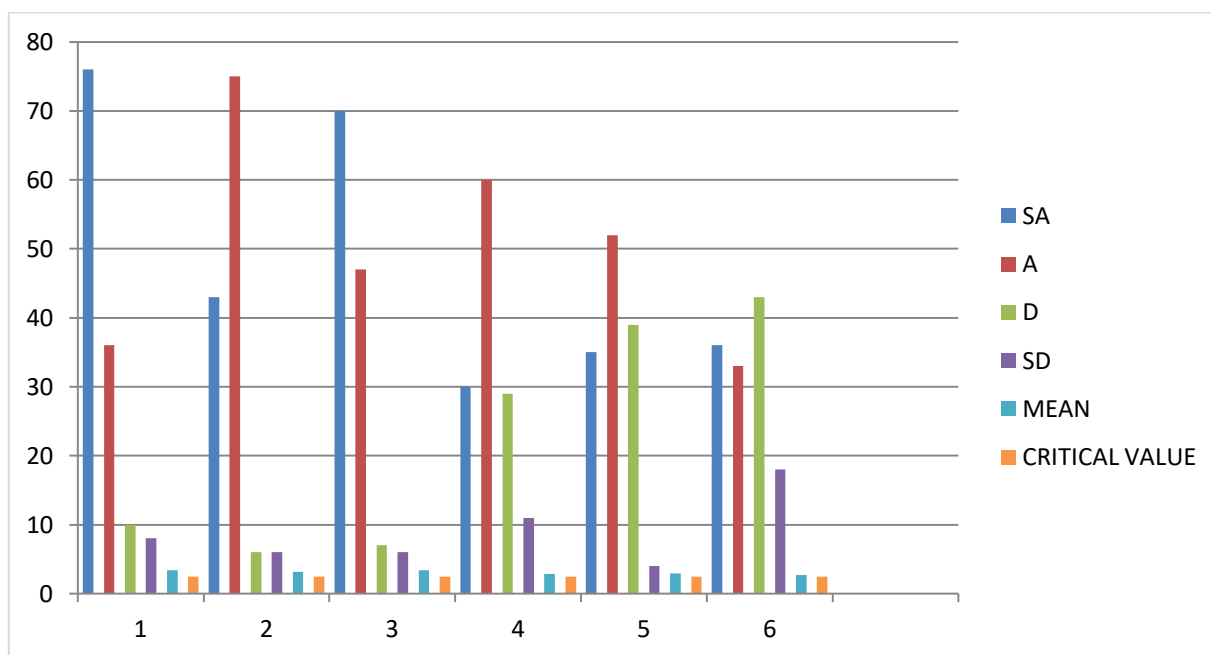
Fig. 5: Frequency count, simple percentage and mean score statistic on Research Question 1

TABLE 8: Frequency count, simple percentage and mean score statistic on statement regarding the value of COVID-19 pandemic on the teaching and learning of chemistry

| S/N	Item	SA	A	D	SD	Total	Mean	Critical Value	Remark
7	Most students experienced boredom during COVID-19 pandemic?	69 53.1%	42 32.3%	15 11.5%	4 3.1%	130 100%	3.35	2.5	Accepted
8	Loneliness among students during the pandemic has resulted to antisocial behavior such as smoking and drinking?	26 20%	78 60%	20 15.4%	6 4.6%	130 100%	2.95	2.5	Accepted
9	Students with underlying health issues are depressed due to poor access to inactivity during COVID-19	36 27.7%	69 53.1%	20 15.4%	5 3.8%	130 100%	3.04	2.5	Accepted
10	Inability to move around and or attend functions during the pandemic has led to anxiety in some students?	36 27.7%	59 45.4%	30 23.1%	5 3.8%	130 100%	2.96	2.5	Accepted
11	During the pandemic, students have little opportunity of easing out stress through sporting activities?	29 22.3%	50 38.5%	34 26.1%	17 13.1%	130 100%	2.7	2.5	Accepted
12	There is a use of digital communication infrastructure to communicate with student.	15 11.5%	46 35.4%	49 37.7%	20 15.4%	130 100%	2.43	2.5	Rejected
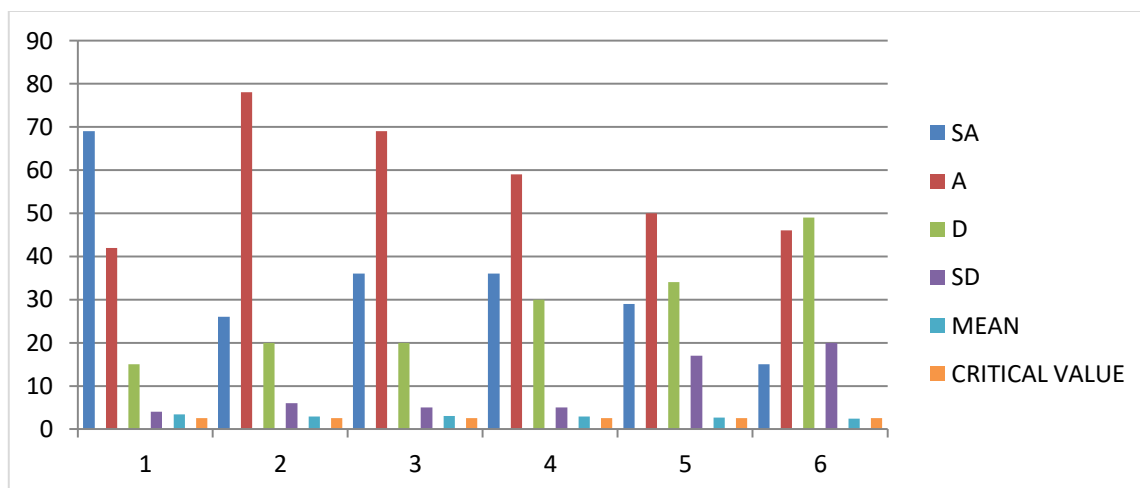
Fig. 6: frequency count, simple percentage and mean score statistic on Research Question 2

Responses on statement relating to the evaluation of the value of COVID-19 pandemic on the teaching and learning of chemistry were summarized in table 8. It was observed that items 7, 8, 9, 10, &11 all agreed while item 12 disagreed to statement on the effect of COVID-19 pandemic on the teaching and learning of chemistry. Each item had a mean score that is higher than the critical value of 2.5 except for item 12. As a result, it was shown that the COVID-19 pandemic has some value for chemistry teaching and learning.

D. *RESEARCH QUESTION 3:* What are the challenges militating against the teaching and learning of chemistry during COVID-19 pandemic?

TABLE 9: Frequency count, simple percentage and mean score statistic on the statement regarding the challenges militating against the teaching and learning of chemistry during COVID-19 Pandemic

| S	ITEM	SA	A	D	SD	TOTAL	MEAN	CRITICAL VALUE	REMARK
13	Students have no access to reading materials in the library for independent reading during the pandemic	60 46.2%	39 30%	20 15.3%	11 8.5%	130 100%	3.13	2.5	Accepted
14	Students have no access to e-learning	33 25.4%	39 30%	35 26.9%	23 17.7%	130 100%	2.63	2.5	Accepted
15	There is no room for group discussion among students during the pandemic	47 36.2%	48 36.9%	25 19.2%	10 7.7%	130 100%	3.01	2.5	Accepted
16	Students became depressed as they spent almost a year at home without any formal learning	31 23.8%	81 62.3%	11 8.5%	7 5.4%	130 100%	3.04	2.5	Accepted
17	The pandemic led to the recruitment of different skilled/skills by the teachers.	20 15.4%	22 16.9%	58 44.6%	30 23.1%	130 100%	2.24	2.5	Rejected
18	There is a new method of teaching.	23 17.7%	20 15.4%	28 21.5%	59 45.5%	130 100%	2.05	2.5	Rejected
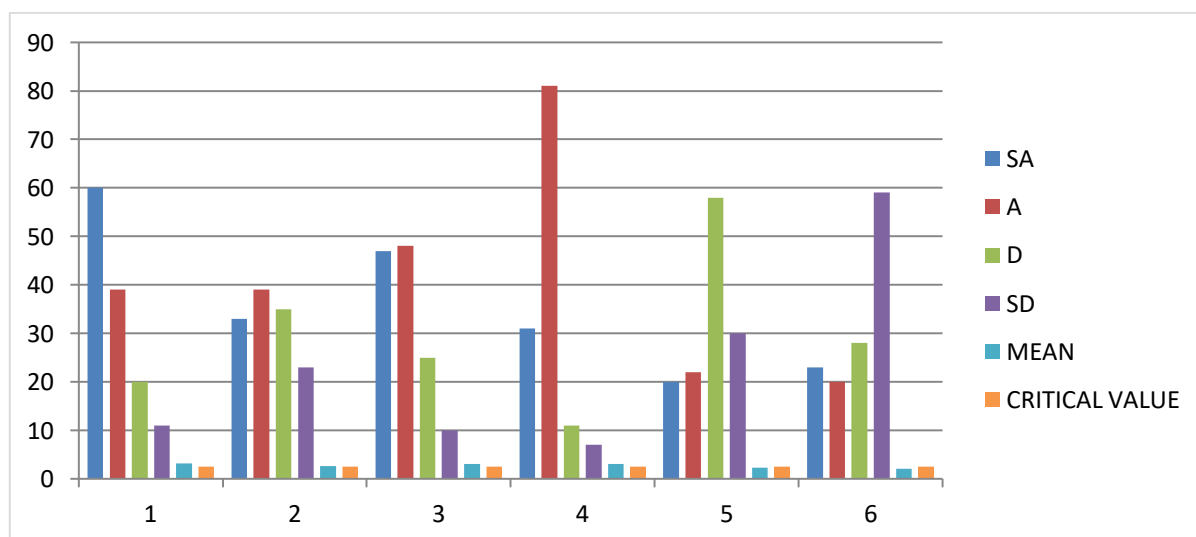
Fig. 7: frequency count, simple percentage and mean score statistic on Research Question 3

141

Responses on statements on the various challenges militating against the teaching and learning of chemistry during COVID-19 pandemic showed that items 13, 14, 15, & 16 all agreed while items 18 & 19 disagreed to the statement on the challenges militating against the teaching and learning of chemistry during COVID-19 pandemic. Each item had mean score that is higher than the critical value of 2.5 with the exception of item 17 & 18. Therefore, it was confirmed based on majority of the responses that during COVID-19 pandemic a lot of challenges militated against the teaching and learning of chemistry.

E. Discussion of Findings

The finding revealed that COVID-19 pandemic has an impact on the teaching and learning of chemistry in Federal University Otuoke, Bayelsa state as students were required to adjust to new circumstances and lifestyles and face ambiguity regarding what would happen next concerning their education and future. The transition to online learning has happened quickly and has introduced a variety of new difficulties for both students and instructors. According to Burki (2020), the use of virtual learning may continue until a satisfactory COVID-19 vaccine is available. Also, the finding on no room for group Discussion among students has affected their academic performances as some student tend to understand a given course without group discussion. The probability that students will face more frequent and severe emotions of loneliness, anxiety, and isolation is considerable, due to the sense of disconnection many may feel after departing from the university campus (Zhai and Du, 2020). Lastly, the finding revealed that, the COVID-19 has affected the academic performance of students to the extent that it led to poor achievement/mass failure in external exams. The result revealed that COVID-19 pandemic made most students of Federal University Otuoke to become depressed as they spent almost a year at home without any formal learning.

V. CONCLUSION

It was without doubt that COVID-19 had a great impact in the life of the students in Chemistry Education and Chemistry programme of Federal University Otuoke and the lecturers in their learning and teaching of chemistry respectively. The findings of this study revealed that the interaction between the students and lecturers was restricted during COVID-19 pandemic. The study therefore concluded that COVID-19 has both positive and negative impacts on the teaching and learning of chemistry in Federal University Otuoke, in Bayelsa State, Nigeria. However, due to the pandemic, the negative impacts outweigh the positive impacts as the students affirm they lost what they have learnt before COVID-19 and had no access to E-learning.

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