

**IMPACT OF COVID-19 PANDEMIC ON THE TEACHING AND ASSESSMENT  
OF CHEMISTRY PRACTICAL IN SECONDARY SCHOOLS IN ENUGU STATE**  
**Keziah Chetachukwu BENETH & Anthony Odinaka UKEJE**

**Abstract**

*The study assessed the impact of COVID-19 pandemic on the teaching and assessment of chemistry practical. A descriptive survey design was adopted for the study. All chemistry teachers in Nsukka, Enugu State, Nigeria made up the population of the study. The sample was chosen using convenience sampling technique. A questionnaire titled "Impact of COVID-19 Pandemic on Teaching and Assessment of Chemistry Practical Questionnaire (ICTACPQ)" was used to collect data. The instrument was face and content validated by three experts, two from the field of measurement and evaluation and one from chemistry education, all from science education department, University of Nigeria, Nsukka. The instrument was trial tested on a group of 20 respondents and a reliability estimate of 0.93 was obtained. Mean, standard deviation and independent t-test were used to present the data collected. The findings showed that COVID-19 pandemic greatly influenced the method of teaching and assessing chemistry practical ( $\bar{X}=3.23$ ,  $S.D = 0.46$ ). It was also found that both urban and rural chemistry teachers had the same perception of the extent of impact of the pandemic on the teaching and assessment of the chemistry practical [Urban ( $\bar{X}=3.24$ ,  $S.D= 0.46$ ); Rural ( $\bar{X}=3.20$ ,  $S.D=0.46$ )]. It was recommended that ICT media, such as video conferencing, and Google classroom, should be adopted in teaching and assessing chemistry practical.*

**Keywords:** Chemistry practical, teaching, assessment, COVID-19 pandemic

**Introduction**

Every nation needs science in all her institutions of learning due to its vital role in national development. This is because it equips the individual with the necessary skills, knowledge, attitudes and behaviours through the manipulation of materials in the laboratory. Yamper, (2007) affirms that science generally involves the manipulation of materials through the practical application of ideas leading to new discoveries. Skills acquired when learning science enable students to solve daily life problems and improve the nation (Abungu, Okere & Wachanga, 2014). The teaching and learning of science includes both theoretical and practical aspects. According to Achimugu (2014), experiments in science are best understood by using hands- and minds-on activities. Theories, laws and principles are best understood when taught and verified experimentally. These enhance students' interest and capability to learn. According to West African Examination Council syllabus 2019/2020, learning of science by secondary school students' entails the connection between science and everyday life, acquiring science skills, understanding basic concepts in science and improvement of reasoning skills. Secondary school science is made up of subjects like chemistry, biology, physics, mathematics, and agriculture (Emendu, 2014). This study will focus on chemistry.

Oxford Advanced Dictionary (2020) defines chemistry as an aspect of science that forms new substances after the study of matters' component, properties and reactions. The main goal of chemistry education is to enable students explain, evaluate, and communicate everyday phenomena on the basis of their chemical contents (Fechner, 2009). Instructions in chemistry are through practical and theory work. Chemistry practical involves students interacting with or manipulating matter to observe and understand the natural world. Teaching and assessment of chemistry practical were interrupted by the outbreak of COVID-19 as many countries closed down schools in order to curtail the spread of the virus. This disrupted academic activities (Onyema, Eucheria, Obafemi, Sen, Atonye, Sharma, & Alsayed, 2020). Prior to the pandemic, chemistry was taught through facial interaction between the teacher and the learner in the classroom while the practical was held in the laboratory. During practical lessons, students were guided by the teacher or the lab attendant. This gives the teacher the opportunity to interact with, monitor and assess each child. These have been hampered by the COVID-19 pandemic.

Covid-19 is a viral disease which started in China in 2019 spread widely across the world. The virus can easily be spread through bodily contact, hence social distancing was made mandatory. Governments globally have introduced series of steps aimed at curbing its spread. Some of these measures include lockdown of schools and businesses, self-isolation, social distancing, reduced public gathering, restrictions in movement and working from home (Gostin & Wiley, 2020). These measures have affected almost all sectors of the economy negatively (Pragholapati, 2020).

The education sector resorted to online teaching and learning, especially in higher institutions (Sahu, 2020; Yamin, 2020). Students used devices like smart phone, laptop and personal computer to access online materials (Mahdy, 2020). These made it impossible for teachers and students to interact face to face, and for students to manipulate equipment in the laboratory together. Armando (2020) asserts that chemistry, mostly analytical and organic, can be taught with the use of slide show presentation, and videos demonstrating the mixing and separation of chemicals during online teaching. UNESCO (2020) affirmed that many students had no access to online teaching because they lack the needed electronic gadgets. Mahdy (2020) observed that some of the problems encountered during online teaching and learning include unavailability of internet in provincial and rural areas, the speed and cost of internet, lack of face-to-face interaction between students and teachers, lack of application of the clinical setting, and the challenges of carrying out experimental lessons online.

This study is anchored on "Technological Adoption Model (TAM)" developed by Davis in (1980). The model states that external variables such as perceived usefulness and ease of use influence the behavioural intention of an individual. This, in turn, determines the "actual system usage". Therefore, external variables, attitude, behavioural intention, actual use, perceived usefulness and ease of use are all the constituents of this model.

The study will also be anchored on Moore's (1997) transactional distance theory (TDT) which states that distance education is more of a psychological than a geographical separation. The psychological separation, also called transactional distance, varies from one learner and teacher to another. However, the extent of transactional distance is a function of three sets of variables: dialogue, structure and learner autonomy.

Dialogue is a constructive and purposeful interaction between learners and teachers during the course of instruction. The medium of communication determines the extent of dialogue. For instance, a dialogue can be significantly influenced by the personalities of the teacher and learners, the content of knowledge, and environmental factors. Some of the factors are effective medium of communication, learning style, and selection of instructors. Structure is how educational objectives, teaching strategies and evaluation are articulated (flexible or rigid). It is the degree to which an educational programme accommodates learners' individual needs. The less flexible the structure, the higher the transaction and the lower the interaction, while the more flexible the structure, the lower the transaction and the higher the interaction or dialogue. Lastly, learner autonomy is the ability of learners to learn more on their own. Therefore, it is the extent to which the learner determines the goals and learning experiences of a lesson. This theory is relevant to the present study, in that, learning using video conferencing during COVID-19 pandemic permits learners to develop autonomy by making presentation to classes online which enhances motivation, and self-confidence.

Onyema et al. (2020) noted that COVID-19 had adverse effects on education in terms of decreased access to education and research facilities, job losses, and learning disruption. These can only be curtailed by the adoption of technology in education. Consequently (Armando, 2020) observed that online teaching can be as effective as traditional teaching and even more if students participate fully in training to get used to the new pattern especially since COVID-19 has put everyone under pressure to accept and integrate recent technologies to surmount the challenges posed by the pandemic.

Ahmed, Jafri, Majid, Khan, Ghani, and Siddiqui (2020) further added that preparation is needed for adaptation in the current pandemic so as to make our environment habitable and comfortable. Sintema (2020) revealed that if COVID-19 pandemic is not managed on time, it may reduce the performance of students in the upcoming examination. Mahdy (2020) reported that students' performance was affected by the covid-19 lockdown in such a way that they can only cope with receiving theoretical lectures online but still feel incompetent and incomplete learning practical courses online.

Prior to the breakout of the pandemic, chemistry practical had been taught and assessed using the face-to-face method which still left teachers with some challenges. The teachers were forced to change to online teaching because of the breakout of COVID-19. This study assessed the impact of COVID-19 pandemic on teaching and assessment of chemistry practical.

The specific objectives of this study are:

1. To determine the extent to which covid-19 pandemic influenced teaching and assessment of chemistry practical.

2. To determine the extent of covid-19 pandemic influence on teaching and assessment with respect to location.

### **Research Questions**

1. To what extent does covid-19 pandemic influence the teaching and assessment of chemistry practical?
2. To what extent does covid-19 pandemic influence the teaching and assessment of chemistry practical with respect to location?

### **Hypothesis**

**H<sub>01</sub>:** There is no significant difference between the mean responses of urban and rural teachers on the influence of covid-19 pandemic in teaching and assessment of chemistry practical.

### **Method**

The study used descriptive survey design to assess chemistry teachers' opinion on the impact of COVID-19 pandemic on teaching and assessment of chemistry practical. Respondents in the study were 62 chemistry teachers from Nsukka, Enugu State, Nigeria. Convenience sampling technique was used to select the sample.

A researcher-made Google form questionnaire titled "Impact of COVID-19 Pandemic on Teaching and Assessment of Chemistry Practical Questionnaire (ICTACPQ)" was used to collect the data. The instrument has two sections. Section A elicited information on the respondents' location and age range, while section B has two clusters. The first cluster elicited information on teaching of chemistry practical, while the second cluster elicited information on assessment of chemistry practical. The instrument was a four-point Likert scale of; Strongly Agree (SA) – 4 points, Agree (A) – 3 points, Disagree (D) – 2 points, Strongly Disagree (SD) – 1 point. The criterion mean of  $(\bar{X}) = \frac{4+3+2+1}{4} = \frac{10}{4} = 2.50$  produced 2.50 as the benchmark for the study. This implies that any item that has a value of 2.50 and above was rated "Agree", while items with values below 2.50 were rated "Disagree".

Face and content validation were done by three experts, two from measurement and evaluation unit and the other from chemistry education unit, *science education department*, University of Nigeria, Nsukka (UNN). After validation, corrections were made and 21 were retained out of 24 items. The instrument was distributed to twenty (20) respondents in a different area which had similar characteristics with the sample of the study. A reliability index of 0.93 was estimated, using split-half reliability method with Cronbach's alpha technique. This indicated that the instrument was reliable. Mean, standard deviation and independent t-tests were used to analyse the data collected at 5% level of significance.

### **Results**

The results of the analysed data are presented as follows:

**Research Question 1:** To what extent does covid-19 pandemic influence teaching and assessment of chemistry practical?

---

**Table1:** Extent of the impact of COVID-19 pandemic on teaching and assessment  
N= 62

S/N	Items	Mean	S.D	Remark
	<b>Impact of Covid-19 pandemic on teaching of chemistry practical</b>			
1	Covid-19 pandemic has changed the methods and techniques of teaching chemistry practical	3.15	0.81	Agree
2	Online teaching is the only reliable method for teaching chemistry practical during Covid-19 pandemic	2.98	0.89	Agree
3	Covid-19 pandemic has changed the teaching of chemistry practical from face-to-face instructions to online platform	3.09	0.86	Agree
4	Covid-19 pandemic has disrupted the normal activities of teaching of chemistry practical	3.44	0.69	Agree
5	Teaching chemistry practical during this Covid-19 pandemic is a difficult task	3.37	0.68	Agree
6	Covid-19 pandemic has affected the quality of teaching chemistry practical, as it now appears very abstract to students	3.37	0.68	Agree
7	Remote teaching, virtual teaching, blended teaching are now the recent methods used in teaching chemistry practical	3.06	0.65	Agree
8	Good connectivity, stable power source and online resources or platforms are now compulsory in order to teach chemistry practical	3.24	0.76	Agree
9	Digital skills is now a necessity for chemistry teachers to develop for teaching chemistry practical	3.31	0.71	Agree
10	Chemistry teachers now have to be well trained to effectively use online platform to teach chemistry practical	3.42	0.69	Agree
11	Chemistry teachers now have to develop the dexterity of drawing structures using various computer software for teaching chemistry practical	3.32	0.62	Agree
12	Chemistry practical now have to be taught using audio and video platforms, as well as recorded videos for offline practice	3.24	0.80	Agree
13	Discussion and demonstration for chemistry practical are now carried out mainly through synchronous ICT media platforms e.g. video conferencing	2.98	0.88	Agree
	<b>Impact of Covid-19 pandemic on assessment of chemistry practical</b>			
14	Google classroom is now needed for submission of assignment or class work for assessment.	3.23	0.61	Agree
15	Zoom and WhatsApp and other online platforms are now needed for both virtual presentation, demonstration and discussion of practical procedure and skills for assessment.	3.32	0.62	Agree

16	Chemistry teachers now need to create more time for students to demonstrate and explain mechanism via Zoom for assessment, which in turn develops their oral communication.	3.24	0.76	Agree
17	Chemistry teachers now have to assess students through video conferencing where each student are given the opportunity to demonstrate their new learned science process skills.	3.06	0.69	Agree
18	Chemistry teachers now have to create more time to set test and assignments for each goggle classroom to answer and send back for assessment.	3.11	0.70	Agree
19	Online platforms are now needed to be created to answer students' questions, as well as correct their mistakes after assessment.	3.29	0.69	Agree
20	Students' scores and data or information can now be best stored, retrieved and circulated to teachers, parents and principals via online platforms for further cumulating of assessment scores	3.27	0.66	Agree
21	Chemistry teachers now need to create a platform where students are rated and given feedback at same time, so as to better assess their practical skills	3.39	0.61	Agree
$\Sigma\Sigma$	<b>Grand Total</b>	<b>3.23</b>	<b>0.46</b>	<b>Agree</b>

**Agree  $\geq 2.50$ ; Disagree  $\leq 2.50$**

Table 1 indicated that all chemistry teachers agreed that COVID-19 pandemic has a great impact on the teaching and assessment of chemistry practical. This was shown by the mean responses which were all above the average mean of 2.50. The mean ranges from 2.98 to 3.44 and standard deviation of 0.89 and 0.69. The grand mean of chemistry teachers' responses is 3.23 with a standard deviation of 0.46. The overall result indicates that COVID-19 pandemic has greatly affected the method of teaching chemistry practical, and method of assessing students. Online platforms are now the major media of teaching using devices such as audio-visuals, radio and smart phones.

**Research Question 2:** To what extent does covid-19 pandemic influence teaching and assessment of chemistry practical with respect to location?

**Table 2: Mean and standard deviation of urban and rural chemistry teachers' responses**

Location	N	Mean	S.D
Urban	48	3.24	0.46
Rural	14	3.20	0.46

Results in Table 2 show the mean response of urban chemistry teachers to be 3.24 with a standard deviation of 0.46 while rural chemistry teachers have a mean response of 3.20 with a standard deviation of 0.46 on the extent of impact of COVID-19 pandemic on teaching and assessment of chemistry practical. The result indicates that both urban and rural

chemistry teachers have almost the same responses to the impact of the pandemic on teaching and assessment of practical.

**Hypothesis:** There is no significant difference between the mean responses of urban and rural teachers on the influence of covid-19 pandemic in teaching and assessment of chemistry practical.

**Table 3: Independent t-test of the Difference between Urban and Rural Chemistry Teachers' Responses.**

Location	N	Mean	S.D	Df	t-cal	Sig.(2-tailed)	Decision
Urban	48	3.24	0.46	60	0.28	0.78	NS
Rural	14	3.20	0.46				

The result in Table 3 shows a significant t-cal of 0.28 and probability value of 0.78. The result showed that a significant P-value of 0.78 is greater than 0.05 level of significance of the study. Therefore, the null hypothesis which states that there is no significant difference between the mean responses of urban and rural teachers on the influence of covid-19 pandemic on teaching and assessment of chemistry practical is not rejected but retained.

### **Discussion**

The study revealed that COVID-19 pandemic greatly influenced the method of teaching and assessment of chemistry practical. The pandemic has greatly disrupted the normal way of teaching chemistry practical and forced teachers to make use of other platforms like zoom, video conferencing and WhatsApp to teach practical chemistry. This finding is similar to that of Onyema et al. (2020) which stated that COVID-19 has an adverse effect on education and can be managed by the adoption of technology in education. This is also in agreement with Armando (2020), who stated that online teaching can be effective if everyone participates in training to get used to the new pattern of teaching. COVID-19

In addition, chemistry teachers in both urban and rural areas had same responses on the extent of impact of COVID-19 pandemic on the teaching and assessment of chemistry practical. They all agreed that the pandemic has greatly influenced the method of teaching chemistry practical and its assessment. This finding agrees with Sintema (2020) that if COVID-19 pandemic is not controlled, it may negatively influence the performance of students, especially in the upcoming examination. This is also supported by Ahmed, Jafri, Majid, Khan, Ghani, and Siddiqui (2020) who revealed that preparation is needed for adaptation in the current pandemic so as to make the environment habitable and comfortable for everyone. This agreement can be due to the global influence of COVID-19the pandemic on both rural and urban dwellers.

Finally, the difference between the mean responses of urban and rural teachers is not significant on the impact of covid-19 pandemic on teaching and assessment of chemistry practical. This finding is in line with Mahdy (2020) who stated that the academic performance of most students was affected by the COVID-19 pandemic and they have only coped with receiving lectures online. This agreement may be due to the diverse impact of COVIDcovid-19 pandemic on all departments in institutions.

## **Conclusion**

From the findings in this study, it was concluded that COVID-19 pandemic has greatly impacted or influenced the method of teaching and assessing chemistry practical both in urban and rural areas.

## **Implication**

ICT media, such as video conferencing, zoom, and Goggle classroom should be used to teach and assess chemistry practical in both urban and rural schools

## **Recommendation**

The following recommendations were made on the basis of the findings:

1. Chemistry teachers should be well trained to effectively use online platform to teach and assess chemistry practical, so as to acclimatize with the changes covid-19 has brought.
2. Simple and non-harmful laboratory equipment should be provided for each chemistry student in their various homes while being taught online by their teachers.
3. ICT media, such as zoom, video conferencing should be adopted in teaching and assessing chemistry practical.
4. Computer, video projectors, and other necessary equipment should be made available for easy integration of ICT in teaching chemistry practical.

## **References**

- Abungu, H. E., Okere, M. I., & Wachanga, S. W. (2014). The effect of science process skills teaching approach on secondary school students' achievement in chemistry in Nyando District, Kenya. *Journal of Educational and Social Research*, 4(6), 359-359.
- Achimugu, L. (2014). Strategies for effective conduct of practical chemistry works in senior secondary schools in Nigeria. *Journal of Science Teachers Association of Nigeria*, 47(1), 126-136.
- Ahmed, S., Jafri, L., Majid, H., Khan, A. H., Ghani, F., & Siddiqui, I. (2020). Challenges amid COVID-19 times - Review of the changing practices in a clinical chemistry laboratory from a developing country. *Annals of Medicine and Surgery*, 55(2020), 300–304.
- Armando, M. G. (2020). Teaching college chemistry in the time of COVID-19 pandemic: A personal account of teaching in the old normal vs. the new normal. *Kimika*, 31(1), 70-75.
- Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340.
- Emendu, N. B. (2014). The role of chemistry education in national development. *International Journal of Engineering and Science (IJES)*, 3(3).
- Fechner, S. (2009). *Effects of Context-oriented Learning on Student Interest and Achievement in Chemistry Education* (Vol. 95). Logos Verlag Berlin GmbH.
- Formplus, B. (2020). Descriptive research designs: types, examples & methods. Retrieved from: <https://www.formpl.us/blog/amp/descriptive-research>



- Gostin, L.O., & Wiley, L.F. (2020). Governmental public health powers during the COVID-19 pandemic: Stay-at-home orders, business closures, and travel restrictions.
- Mahdy, M. A. A. (2020). The Impact of COVID-19 pandemic on the academic performance of Veterinary medical students. Not Peer-Reviewed. Posted: 11 June 2020. doi:10.20944/preprints202006.0130.v1
- Moore, M. (1997). *Theory of Transactional Distance*. Keegan, D., ed. Routledge, pp. 22-38.
- Onyema, E. M., Eucheria, C. N., Obafemi, F. A., Sen, S., Atonye, G. F., Sharma, A., & Alsayed, A. O. (2020). Impact of corona virus pandemic on education. *Journal of Education and Practice*, 11(13), 108-121.
- Paital, B., Das, K., & Parida, S.K. (2020). Inter nation social lockdown versus medical care against covid-19, a mild environmental insight with special reference to India. Science of the Total Environment.
- Pragholapati, A. (2020). DOI : 10.17605/OSF.IO/NUYJ9. <https://edarxiv.org/895ed/>
- Sahu, P. (2020). Closure of universities due to Corona virus Disease 2019 (COVID-19): Impact on education and mental health of students and academic staff. *Cureus*. 12.
- Sintema, E. J. (2020). Effect of COVID-19 on the performance of grade 12 students: Implications for STEM education. *Journal of Mathematics, Science and Technology Education*, 16(7), 2-6.
- Soanes, C., & Stevenson, A. (2020). Concise Oxford English Dictionary (11st ed). Oxford University Press.7
- UNESCO. (2020). Universities tackle the impact of COVID-19 on disadvantaged students; <https://en.unesco.org/news/universities-tackle-impact-covid-19disadvantaged-students>.
- WHO. (2020). Q&A on corona viruses (COVID-19). Retrieved from <https://www.ecdc.europa.eu/en/geographical-distribution-2019-ncov-cases> and <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/question-and-answers-hub/q-a-detail/q-a-coronaviruses> Last accessed 12 September 2020.
- Yamin, M. (2020). Counting the cost of COVID-19. *International Journal of Information Technology: an official Journal of Bharati Vidyapeeth's Institute of Computer Applications and Management*.
- Yamper, J. (2007). *Teaching Science in the Primary Classroom: 2nd edition*. TJ International. Padstow, England. UK.