

Efficacy of Reflective Questioning Instructional Strategy on Students' Achievement in Gas Laws Contents of Secondary Schools Chemistry

Anthonia Ebere Onah

Department of Science Education, University of Nigeria Nsukka, Enugu, Nigeria
anthonia.nnadi@unn.edu.ng

Eunice Odugo Chukwunwogor*

Department of Science Education, University of Nigeria Nsukka, Enugu, Nigeria
Corresponding Author: eunice.chukwunwogor@unn.edu.ng

StellaMaris Amalachukwu Nwankwo

Department of Science Education, University of Nigeria Nsukka, Enugu, Nigeria

Clara O. Dike

Department of Science Education, University of Nigeria Nsukka, Enugu, Nigeria

Priscilla Okwuchukwu Dave-Ugwu

Department of Science Education, University of Nigeria Nsukka, Enugu, Nigeria

Bukar Alhaji Umate

Department of Science Education, University of Nigeria Nsukka, Enugu, Nigeria

David Nwoye Ezeh

Department of Science Education, University of Nigeria Nsukka, Enugu, Nigeria
david.ezeh@unn.edu.ng

Cliff I. Okebanama

Department of Science Education, University of Nigeria Nsukka, Enugu, Nigeria

Evangelista C. Oguguo

Department of Business Education, Imo State College of Education, Ihethe-Uboma, Nigeria

Edith Ngozi Onah

Department of Science Education, University of Nigeria Nsukka, Enugu, Nigeria

Valentina .C. Agugu

Department of Science Education, University of Nigeria, Nsukka, Enugu, Nigeria

Abstract—This study investigated the efficacy of reflective questioning instructional strategy on students' achievement in gas laws contents of secondary schools Chemistry. A pre-test-post-test, control group quasi-experimental research design was adopted in the study. The participants were 129 students (72 females and 57 males) of four intact classes sampled from two government owned secondary schools in Nigeria using multi-stage sampling procedure. Two intact classes each were assigned to experimental and control groups respectively. Data collection was done using a 25-item gas laws achievement test (GLAT). Data collected were analyzed using mean, standard deviation and analysis of covariance (ANCOVA). The result showed that there was a significant difference between the experimental and control groups indicating that reflective questioning instructional strategy enhances students' achievement in gas laws. Also, there was no significant influence of gender on the mean achievement scores of students in gas laws and there was no significant interaction effect of questioning instructional strategies and gender on students' achievement in gas laws. Chemistry teachers and pre-service teachers should be trained on how to adopt reflective questioning instructional strategy in the classroom instructions..

Keywords-Academic achievement; chemistry education; gas Laws; reflective Questioning

I. INTRODUCTION

Sound knowledge of Chemistry at the secondary school level helps students in developing basic skills and competence required for problem solving in the environment. It also helps students that will go further in their studies to be able to do well in Chemistry courses and Chemistry related courses in higher institutions for individual and national development. Chemistry is the science that systematically studies the composition, properties, and activity of organic and inorganic substances and various elementary forms of matter (Helmenstine, 2019). The study of Chemistry plays a very significant role in the development of the individual and the entire nation at large. Chemistry addresses the need of the society through its relevance and functionality in content, practice and application. Therefore, students need good background knowledge in Chemistry especially in secondary

schools where the foundation is laid. Unfortunately, reports show that students have faulty foundations in Chemistry in secondary schools (Nkiko, 2021) and there has been poor achievement of students in the subject over the years (Njeri, 2022; Chief Examiner's Reports, 2015-2019). Academic achievement refers to the educational accomplishment by the students at school (Ajayi, 2017). Achievement measures the amount of academic content a student learns in a determined amount of time. Reports from researches indicate that students' achievement in Chemistry is not encouraging (Ademola, et al., 2013, Aniodoh & Egbo, 2014, Njeri, 2022). Apart from these reports, the records of analysis of students' results conducted by West African Examination Council, (WAEC) 2015-2019 indicated poor achievement of students in Chemistry as shown in the table below:

Year	Mean Score	Standard Deviation
May/June 2015	36	15.62
May/June 2016	43	15.36
May/June 2017	47	16.00
May/June 2018	27	13.78
May/June 2019	40	14.76

Source: Chief Examiner's Report 2015-2019

Apart from the poor achievement, even the few students that have good results in Chemistry do not have good knowledge of Chemistry as Chikendu and Ejesi (2021) reported that many university students (who have passed Chemistry in secondary schools) experience difficulty with the fundamental ideas in Chemistry. This indicates lack of good knowledge of Chemistry among secondary school students.

The students' poor knowledge and achievement in Chemistry has been attributed to so many factors. The poor achievement of students in Chemistry is as a result of the difficulties of some topics in the secondary school Chemistry curriculum (Uchegbu, et al., 2016). One of such difficult areas in Chemistry according to Hammer (2013) and Uchegbu et al. (2016) is gas laws. The gas laws are a group of physical laws modeling the behavior of gases developed from experimental observations (Chandan & Marco, 2022). These laws are necessary in calculations requiring the number of moles of a given reagent when either product or reactant in a Chemistry reaction involves gases. According to Kariper, (2013), gas law concepts seem to be too abstract for the students. Understanding the relationships between volume, temperature, and pressure is difficult for the students (Leslie & Bearden (2023). The WAEC chief examiner's reports (2017) also revealed that students find it difficult to show understanding of basic concepts in Chemistry such as the mole concepts and sketching of graphs. According to the report, the aspect of Chemistry involving graph work and calculations (gas laws) were generally poor.

To make students understand the gas laws concepts and improve on their achievement, it will be required of teachers to use effective questioning strategies as Edeh and

Vikoo, (2013); Opeteye, (2020); Shanmugavelu, et al., (2020) reported that students' poor achievement in Chemistry is as a result of poor questioning strategies in the classrooms. Teacher's questioning strategy play a central role in the processes of teaching and learning because students' learning, thinking, participation and their level of engagement depend on the kind of questions teachers formulate and use in the classroom (Olaniran & Akorede, 2018). The questioning strategy usually employed by Chemistry teachers is based on initiation, response and evaluation pattern of discourse (Opeteye, 2020). Khan and Inamullah (2011) reported that the majority of questions teachers ask depend only on factual information and often requires only one correct answer. This does not give the students the needed wait time which increases students' thoughtfulness and engagement. TeacherVission Staff (2019) reported that questioning strategies used by teachers are mostly knowledge-based questions which focus on testing students' knowledge and understanding rather than on how students are learning.

Also, the way teachers pose their questions does not target the individual student rather the target is on the general class. When teachers ask questions and few students answer the questions correctly, they will assume that the class has understood what was taught. But this may not be the case as many of the students who did not answer the question may not have understood what the teacher taught. Teachers need professional development in learning how to develop their questioning techniques in the classroom for instructional and assessment purposes (Agbowuro, et al., 2019). According to Patzer (2023), teachers should use their questions to create positive learning culture among the students. There is need for teachers to use questions to encourage students to think, help

students learn from each other and also help students develop active approach to learning (Arslan, 2006). Therefore, teachers should develop questioning strategies which target an individual student and which will help students in articulating their thoughts. Questions that require the individual student to think critically about the subject and how to learn the subject. To give students such opportunity demands reflective questioning.

The main target of reflective questioning strategy is on students' learning process rather than learning outcome. Reflective questioning is the use of questions that prompt learners to reflect on their learning (Kershaw, 2023). It help the students to critically examine their learning progress. These questions focus majorly on how students are engaged and participate in the learning process and so can help the students to be active in their learning. To use reflective questioning strategy, the teacher, will first state the objectives of the lesson and then engages the students in questions to ascertain what the students know about the topic, do not know and will do to help them learn the ones they do not know. The students' responses will guide the teacher in teaching. After teaching, the teacher will then engage the students in questions to know what they have learnt, what they are yet to learn and the reason why they have not learnt them. To answer the questions, the students will use think-pair-share/write-pair-share method (Center for Teaching Innovation (2023), which gives every student in the classroom opportunity to answer the questions. In think-pair-share/write-pair-share method, each of the students will first think and write down his/her answers to the questions, then the students will discuss their answers with a small group of other students and then come up with collective questions on the areas they did not understand and share with the teacher. This gives every student opportunity to express his/her views, state areas of difficulties and challenges, and also learn from other students which can help catch students' attention towards learning.

Reflective questioning instructional strategy targets students' learning process and thus may have effect on students' learning behaviors and outcome. In particular, its specific effect on achievement of male and female students in gas laws content of secondary school Chemistry is not known yet hence this study to investigate the efficacy of reflective questioning instructional strategy on students' achievement in gas laws contents of secondary schools Chemistry. The study aimed at determining the effect of reflective questioning instructional strategy on students' mean achievement scores in gas laws. The study addressed the following issues;

1. What are the mean achievement scores of students taught gas laws using reflective questioning strategy?
2. What are the mean achievement scores of male and female students in gas laws?
3. What is the interaction effect of questioning instructional strategy and gender on students' achievement in gas laws.

II. METHODS

The study adopted non-equivalent control group quasi-experimental research design. The area of the study was

Obollo-Afor Education Zone of Enugu State, Nigeria. The population of the study comprised of 2383 senior secondary one (SS1) Chemistry students of 49 co-educational government owned secondary schools in Obollo-Afor Education Zone. Co-educational schools were used as gender is a moderating variable in the study. The sample size for this study consisted of one hundred and twenty-nine (129) SS1 Chemistry students (57 male and 72 female students) drawn from four intact classes from two co-educational government owned secondary schools. Simple random sampling technique using lucky dip was used to sample two Local Government Areas from Obollo-Afor Education Zone. From each of the sampled Local Government Areas, purposive sampling technique was used to sample one co-educational government owned secondary schools (since gender is a moderating variable in the study). In each of the sampled schools, two SS1 intact classes were sampled. One class was assigned the experimental group while the other was assigned control group.

The instrument used for data collection is Gas Laws Achievement Test (GLAT) The GLAT comprised of 25 multiple choice items which were developed by the researcher. Each of the multiple-choice test items has four options (A – D) as possible answers to the questions. For each item only one of the four options is the correct answer. The instrument was subjected to face and content validation by three experts from Chemistry and Measurement and Evaluation Units, University of Nigeria, Nsukka. The items were corrected and modified on the basis of suggestions and recommendations of the experts. The instrument was trial- tested using twenty-five (25) SSI Chemistry students from secondary school which was not used for the study. Kuder-Richardson Formular 20 (K-R 20) was used to estimate the reliability index of GLAT to be 0.84

The regular Chemistry teachers of the sampled schools taught the students during the experiment. Before the commencement of the treatment, the GLAT was administered to the research subjects for pretest. After the pretest, teaching commenced, the experimental group was subjected to reflective questioning strategy during lesson activities while the control group was subjected to conventional questioning strategy during lesson activities. The teaching exercise lasted for four weeks. At the end of the teaching exercise, the GLAS was administered to the students both in the experimental and control group for post-test. After two weeks, the GLAT was reshuffled and administered to the research subjects again to measure students' retention of the lessons taught. The scores of the two groups on pretest, posttest and retention test were computed by the researcher and analyzed. Mean and standard deviation were used to answer the research questions while the hypotheses were tested at 0.05 level of significance using ANCOVA.

III. RESULTS

The results in Table 1 shows that the students who were taught gas laws using reflective questioning strategy had mean achievement score (\bar{x}) of 15.67 and standard deviation (SD) of 3.14 at the posttest. Similarly, the students who were taught gas laws using conventional questioning strategy had mean achievement score (\bar{x}) of 11.89 and standard deviation (SD) of 2.94 at the posttest. The adjusted means of 15.30 and 12.41 for the students of the reflective questioning and conventional questioning strategies respectively indicate that the students

who were taught using reflective questioning had higher posttest mean achievement score than the students taught using the conventional questioning strategy. In order words, the

experimental group achieved better than those taught using conventional questioning strategies.

Table 1

Mean achievement scores of students taught gas laws using reflective questioning strategy

Group	N	Pretest		Posttest		Adjusted Mean
		\bar{x}	SD	\bar{x}	SD	
Reflective questioning strategy	67	11.57	5.46	15.67	3.14	15.30
Conventional questioning strategy	62	5.77	2.38	11.89	2.94	12.41

N = Number of Respondents, \bar{x} = Mean, SD = Standard Deviation

Table 2 shows that an F-ratio of $F(1, 124) = 13.912, p = 0.000$ was obtained. The significant value obtained ($p = 0.000$) is less than 0.05 at which the study is being tested. Thus, the null hypothesis one (H_{01}) is rejected. This implies that there is a

significant difference in the mean achievement scores of students taught gas laws using reflective questioning strategy and those taught using conventional questioning strategy in favour of the students taught using reflective questioning strategy.

Table 2

Analysis of covariance for the effect of questioning strategy on students' achievement in gas laws

Source	Type III Sum of Squares	df	Mean Squared	F	Sig.	Partial Eta Squared	Decision
Corrected Model	485.476 ^a	4	121.369	13.078	.000		
Intercept	1614.716	1	1614.716	173.999	.000		
Pretest	23.000	1	23.000	2.478	.118		
Treatment	129.102	1	129.102	13.912	.000	.000	.101
Gender	13.812	1	13.812	1.488	.225	.225	.012
Treatment * Gender	6.348	1	6.384	.684	.410	.410	.005
Error	1150.726	124	9.280				
Total	26391.000	129					
Corrected Total	1636.202	128					

S = Significant, NS = Not Significant, = =

Table 3 indicates that the male students had mean achievement score (\bar{x}) of 13.86 and standard deviation (SD) of 3.50 at the posttest. Similarly, the female students had mean achievement score (\bar{x}) of 13.85 and standard deviation (SD) of 3.66 at the posttest. The adjusted means of 14.32 and 13.40

for the male and female students respectively indicate that the male students had higher posttest mean achievement score than the female students.

Table 3

Mean analysis of the achievement scores of male and female students in gas laws

Group	N	Pretest		Posttest		Adjusted Mean
		\bar{x}	SD	\bar{x}	SD	
Male	57	5.89	2.10	13.87	3.50	14.32
Female	72	11.07	5.68	13.85	3.66	14.40

N = Number of Respondents, \bar{x} = Mean, SD = Standard Deviation

Table 2 shows that an F-ratio of $F(1, 128) = 0.684, p = 0.410$ was obtained for the interaction effect of questioning instructional strategy and gender on students' achievement in gas laws. The associated significant value obtained ($p = 0.410$) is greater than 0.05 at which the study is being tested. Thus, the null hypothesis seven (H_{03}) was not rejected. This by

implication means that students' achievement in gas laws due to their exposure to different questioning strategies is not dependent on their gender.

IV. DISCUSSIONS

We discovered that students taught gas laws using reflective questioning instructional strategy achieved higher than students taught with the use of conventional questioning strategy. This implies that reflective questioning strategy improves students' understanding of gas laws. The higher achievement of students taught using reflective questioning strategy could be because the strategy enables the students to view questioning as part of learning and as such participate actively in answering questions in the classroom which facilitates meaningful learning in the students. The findings of this study agree with the findings of Onah, et al. (2020) and Bond (2013). These studies revealed that reflective strategies bring about students' higher achievement. The research carried out by Bond (2013), revealed that students who practiced reflective assessment achieved significantly higher than the students who did not practice reflective assessment. Also, the finding of this study is in line with the report of YuekMing and Latifah (2014) who observed that students' reflective writing improves students' achievement. When reflective practice is part of learning, meaning and relevancy is created, which initiates growth and change (Dewey, 1933). Reflective questioning instructional strategy being a learner-centered approach of learning which makes the students view questioning time as opportunity to learn and in which all the students participate in answering questions in the classroom, could have accounted for the students' high achievement in gas laws unlike the conventional questioning strategy which make the students view questioning time as moment of just obtaining grades or answering questions and only few of the students partake in answering questions in the class.

The finding also showed that male students had slightly higher mean retention score than female students in gas laws. The different socialization processes of male and female students may have given the male students an edge over the females. However, the result indicated that no significant difference existed in the mean achievement scores of male and female students in gas laws. The finding agrees with the studies of Rivera and Sanchez (2020) and Adewumi and Olorundare (2017) who found that gender of the subjects did not significantly affect students' performance in gas laws. The findings of this study however differ from the report of Arsaythamby, et al. (2015) who reported that male students obtained significantly high achievement than female students in Chemistry. On the other hand, Aniodoh and Egbo (2014) reported that female students achieve significantly higher than male students in Chemistry.

The result further showed no significant interaction effect of questioning instructional strategy and gender on students' achievement in gas laws. The finding is similar to the findings of Onah et al. (2020) who found out that there was no interaction effect of assessment method and gender in Chemistry. This finding is also in agreement with the findings of Okonkwo (2016) who reported that there is no significant interaction between metacognitive learning cycle and gender on students' achievement in Basic Science. The absence of interactive effect of questioning instructional strategy and gender on the students' achievement in this study could be attributed to the fact that reflective questioning instructional strategy provided opportunity for all students irrespective of gender to be actively involved in learning situations, hence all students benefitted equally from the strategy.

V. CONCLUSIONS

The study therefore concludes that reflective questioning instructional strategy enhances students' achievement in gas laws, male students do not achieve significantly higher than the female students in gas laws and there is no significant interaction effect of questioning instructional strategies and gender on students' achievement in gas laws. The researchers recommends that Ministry of Education in Nigeria should organize seminars, workshops and conferences for Chemistry teachers to enable the teachers update their knowledge and skills on the innovative questioning strategies such as reflective questioning instructional strategy. Chemistry teachers should endeavour to use active instructional strategies such as reflective questioning instructional strategy in teaching. Teachers' training institutions like Universities and Colleges of Education should incorporate the use of reflective questioning instructional strategy in the training of pre-service teachers.

REFERENCES

1. Ademola, A.S., Olufunke, B. O. & Amoke, M. (2013). Trends in students' achievement in senior school certificate examination (SSCE) in chemistry between 2008 –2012. *International Journal of science and research (IJSR)*; 2(6), 373-395. Retrieved from, www.ijer.net>archive>IJSROFF2013284
2. Adewumi, P. R. & Olorundare, A. S. (2017). The Use of Problem-Based Instruction Strategy (PBIS) in Gas Laws Class: A Gender Academic Performance Difference. *International Journal of Trend in Scientific Research and Development*, 1(4): 458-464. Retrieved from, <https://www.ijtsrd.com/papers/ijtsrd171.pdf>
3. Agbowuro, C., Nanso, M. D., Maigoro, I. L., Mauchin, M. L. & Oche, A. J. (2019). Effects of
4. socratic questioning teaching strategy on the achievement of public secondary schools biology students in Langan North, Plateau State, Nigeria. *European Journal of Training and Development Studies*, 6 (1), 13-28.
5. Ajayi, O. V. (2017). Effect of Hands-On Activities on Senior Secondary Chemistry on Students Achievement and Retention in Stoichiometry in Zone C of Benue State. *SSRN Electronic Journal*, 2(2), 54–59. Retrieved from, <https://doi.org/10.2139/ssrn.2992803>
6. Aniodoh, H. C. O. & Egbo, J. J. (2014). Effect of gender on students' achievement in chemistry using inquiry role instructional model. *International Journal of Social Sciences & Education*, 4 (2), 185-196.
7. Arsaythamby, V., Lee, H. H. & Lee, S. C. (2015). Gender and ethnicity differences manifested in chemistry achievement and self-regulatory learning. *International Education Studies*, 8 (8). Retrieved from, <http://dx.doi.org/10.5539/ies.v8n8p1>
8. Arslan, M. (2006). The role of questioning in the classroom. *Hasan Ali Yücel Eğitim Fakültesi Dergisi Sayı 2* (1), 81-103. Retrieved from, <https://hayefjournal.org/Content/files/sayilar/103/81.pdf>
9. Bastiaens, E. & Heymann, P. (2023). Reflections on establishing an effective and sustainable community

- of practice for a strategic objective within a higher education institution. Retrieved from, <https://onlinelibrary.wiley.com/doi/full/10.1002/kpm.1747>
10. Bond, J. B. and Ellis, A. K. (2013). Effects of Metacognitive Reflective Assessment on Fifth and Sixth Graders' Mathematics Achievement. *School Science and Mathematics*, 113(5), 227–234. doi: 10.1111/ssm.12021
 11. Chandan, G. & Marco C. (2022). Gas Laws and Clinical Application. Retrieved from, <https://www.ncbi.nlm.nih.gov/books/NBK546592/>
 12. Chief Examiner's Report (2015-2019). West African Examination Council (WAEC) Annual Report. Retrieved from, <file:///C:/Users/USER/Downloads/WAECCHIEF EXAMINERS REPORT.html>
 13. Chief Examiner's Report (2017). West African Examination Council (WAEC) Annual Report. Retrieved from, <file:///C:/Users/USER/Downloads/Chief-Examiners-Report-May-June-2017-Examinations.pdf>
 14. Chief Examiner's Report (2018). West African Examination Council (WAEC) Annual Report. Retrieved from, Retrieved from, <C:/Users/USER/Downloads/WAECCHIEF EXAMINERS REPORT.html>
 15. Chikendu, R. E. & Ejesi, N. (2021). Causes of ineffective learning of Chemistry in Private Secondary Schools in Enugu State. *African Journal of Educational Management, Teaching and Entrepreneurship Studies, AJEMATES*, 2(1): 157-171.
 16. Clio, S. (2021). Reflection questions: definition and examples. Retrieved from, <http://study.com/academy/lesson/reflection-questions-definition-and-examples.html>
 17. Dewey, J. (1933). *How We Think: A Restatement of the Relation of Reflective Thinking to the Educative Process*. Boston, MA: D.C. Heath & Co Publishers. Retrieved from <https://www.studocu.com/en-gb/document/cardiff-university/global-problems-and-legal-theory/reflective-theories-and-legal-theories/22894055>
 18. Edeh, I. E. & Vikoo, B. (2013). Some factors affecting the performance of secondary school students in chemistry, a Kolokuma/Opokuma study. *Journal of Education and Practice*, 4(7), 66-78
 19. Hammer, M. (2013). Teaching the gas properties and gas laws: an inquiry unit with alternative assessment. Retrieved from, <https://digitalcommons.mtu.edu/cgi/viewcontent.cgi?article=1695&context=etds>
 20. Helmenstine, A. M. (02 July, 2019). What Is Chemistry? Definition and Description. Retrieved from, <https://www.thoughtco.com/what-is-chemistry-602019>.
 21. Kariper, I.A. (2013). Primary science teacher candidates' misconceptions on gases. *Journal of European Education*, 3(1), 33-35
 22. Khan, W., & Inamullah, H. (2011). A study of lower-order and higher-order questions at secondary level. *Asian Social Science*, 7(9), 149-157. doi:10.5539/ass.v7n9p149
 23. Leslie, L. and Bearden, H. (2023) Employing Context-Based Learning to Bolster Conceptual Understanding of Gas Law Relationships in General Chemistry. *Open Journal of Social Sciences*, 11 (1), 1-10. doi: [10.4236/jss.2023.117001](https://doi.org/10.4236/jss.2023.117001).
 24. Njeri, M. (2022). Principals' perception of factors contribution to students poor performance in chemistry in public secondary schools in Wajir County, Kenya. *International Journal of Chemistry*, 1 (1), 46-58. Retrieved from, <file:///C:/Users/USER/Downloads/1099-Article%20Text-4072-1-10-20220630.pdf>
 25. Nkiko, M. O. (2021). Interrogating the teaching and learning of Chemistry in Nigerian Private Universities: Matters arising. *Journal of Education and Learning*, 10 (3), 132-139.
 26. Okonkwo, M. O. S. (2016). Effect of metacognitive learning cycle (MLC) on students' achievement and interest in Basic Science. Unpublished Master's Degree thesis of the Department of Science Education, University off Nigeria, Nsukka.
 27. Olaniran, N. & Akorede, S. F. (2018). Influence of Lecturers' Classroom Questioning Effectiveness on University Students' Achievement in Economics in South-West Nigeria. *International Association of African Researchers and Reviewer*, 12(2), 87-100.
 28. Onah, A. E. & Ezeh D. N. (2021). Reflective assessment strategy and students' retention in Chemistry. *Journal of Curriculum Organization of Nigeria (CON)*, 28 (2), 82-93.
 29. Onah, A. E., Ezeh, D. N. & Agugu, C. V. (2020). Efficacy of metacognitive reflective assessment instructional strategy on students' achievement in secondary school Chemistry. *African Journal of Theory and Practice of Educational Research (AJTPER)*, 8 (1), 98-107.
 30. Opeteye, J. (2020). Effectiveness classroom questioning wait time on senior secondary school students' performance and reflective reasoning in Chemistry. *Nigerian Journal of Educational Research and Evaluation*, 18(2), 59-73.
 31. Patzer, R. (March 7, 2023). Questioning in the classroom: how to improve your skills. Retrieved from, <https://blog.irisconnect.com/uk/how-to-improve-questioning-skills>.
 32. Rivera, D. G. & Sanchez, J. M. P. (2020). Use of Contextualized Instructional Materials: The Case of Teaching Gas Laws in a Public Uptown High School. *Orbital. The Electronic Journal of Chemistry* 12(4):276-281. Retrieved from, https://www.researchgate.net/publication/348087544_Use_of_Contextualized_Instructional_Materials_The_Case_of_Teaching_Gas_Laws_in_a_Public_Uptown_High_School. DOI:10.17807/orbital.v12i4.1526
 33. Shanmugavelu, G., Ariffin, K. V. V., Mahayudin, Z. and Sundaram, M. A. R. K. (2020). Questioning Techniques and Teachers' Role in the Classroom. *Shanlax International Journal of Education*, 8(4), 45-49. Retrieved from, <https://files.eric.ed.gov/fulltext/EJ1268029.pdf>

34. Teacher Vision Staff (2019). Levels of questions in Bloom's taxonomy. Retrieved from, <https://www.teachervision.com/teaching-strategies/levels-questions-blooms-taxonomy>
35. Tienken, C. H., Goldberg, S., & DiRocco, D. (2010). Questioning the questions. *Education Digest*, 75(9), 28-32.
36. Uchegbu, R. I., Oguoma C. C., Elenwoke, U. E., Obiaku E. & Ogbuagu, O. E. (2016). Perception of difficult topics in chemistry curriculum by senior secondary school (II) students in Imo state. *AASCIT Journal of Education*. 2(3), pp. 18-23.
37. YuekMing, H., & Latifah, A. M. (2014). Assessing learning outcomes through students' reflective thinking. *Procedia- Social Behavioral Sciences*, 152 (1), 973-977.

