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ANALYSIS OF THE COMMON ERRORS MADE IN QUALITATIVE ANALYSIS BY STUDENTS OFFERING CHEMISTRY IN SENIOR SECONDARY SCHOOLS IN SHENDAM LOCAL GOVERNMENT OF PLATEAU STATE, NIGERIA

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Abstract

This study determined the common errors committed by senior secondary school students in qualitative analysis in chemistry practical in Plateau state. The study adopted a descriptive research survey design. One hundred students were randomly sampled from a population of one thousand two hundred and thirty-four students for the study. One instrument Pre-determined Common Errors Committed by Chemistry Students Qualitative Analysis (PCECCSQA) was used to gather data from the respondents. The internal consistency of the (PCECCSQA) was determined using Kuder Richardson K-20 formula which yielded a reliability coefficient of 0.78. Data collected were analyzed using mean, frequency and percentage count. The result of the findings revealed that chemistry students committed common errors such as reporting, confirmatory test, identifications of gases among others. The study concluded that poor reporting, students' inability to identified gases released during qualitative chemistry practical are major reasons for underachievement is chemistry. The study recommended that chemistry teachers should be more concerned about students' practical report and encourage them to developed more sense of smelling during qualitative analysis.

Keywords: Chemistry, chemistry practical, qualitative analysis, errors

Introduction

Chemistry is a core science subject in Nigeria senior secondary schools. It deals with the study of matter and their interactions (Heys,1978). It is basically a practical oriented subject. (Kumar et al., 2016) posits that no course in chemistry can be considered as complete without including some practical work in it. Chemistry is a practically oriented discipline. According to Ayodele (1999), one of the objectives of teaching science in schools is to

communicate the spirit of science and to ensure that students acquire the practical skills of science. This cannot be effectively achieved unless students are exposed sufficiently to practical work and laboratory experiment. The importance of chemistry in the technological advancement of any nation cannot be over stressed, hence its inclusion in the senior secondary school curriculum is justified taking into cognizance its relevance in the fields of agricultural science, biochemistry, engineering, pharmacy, medicine, science education, and a host of other related science fields of endeavor. No wonder, in considering the importance of sciences, Otor (2014) maintains that indeed, chemistry is central to human's ways of life. Chemical analysis is the practical application of the three components of chemistry (physical, inorganic and organic chemistry) designed deliberately to verify the existing laws, theories, principles and hypotheses in the subject. The chemical analysis is divided in two at the senior secondary school level as qualitative and quantitative analyses. Thus, during the Senior Secondary School Examination (SSCE) students take chemistry practical as paper 1 in WASCE/NECO/NABTEB. Qualitative analysis practical at SSCE level focuses on the determination and establishing the presence of the components of a given mixture or compound without any reference to their amount or quantities (Osuide, 1998). Most investigations conducted by researchers in chemistry identified factors responsible for low achievement without actually finding out the aspect of chemistry that poses problems to students (Ezeliora, 1997; Olayemi, 2000; Nwosu, 2000 & Jimoh, 2001). It must be admitted that there are a number of factors accounting for the poor performance of chemistry students in our senior secondary schools like poor laboratory equipment /apparatus/reagents, lack of textbooks, large class size, ineffective teaching strategies adopted by chemistry teachers, among many other variables. Lack of sufficient resources in addition to poor teaching affected the learning outcome in terms of students' participation in examinations and participation in innovative (practical) chemistry activities (Osaki, 2007). Buttressing this fact Akinola (2006) maintained that among factors contributing to students' poor performance were inadequate learning facilities in the secondary schools which include science equipment and laboratories, shortage of qualified and devoted instructors (teachers), lack of the students' ability to do well in practical and teaching methodology used by teachers. Furthermore, studies are fraught with reasons ranging from chemistry being challenging, boring and abstract (Eddy,

2000); chemistry contains too many calculations (Cox, 2019); syllabus too wide (Uchegbu, et al., 2016) to the use of defective teaching method. Beyond these already established impediments, this study hitherto, sought to unearth the common errors in qualitative analysis practical that tend to pose problems to chemistry students hoping to mitigate the declining standard in terms of the students in external examinations.

Statement of Problem

It is obvious that no nation can develop scientifically and technologically if her citizenry are not properly guided. The Nigerian education system is more certificate centered and therefore, skills acquisition is not properly taken care of with more emphasis placed on certification not minding the source.

Qualitative analysis in chemistry is an aspect of chemical analysis that emphasized skills (process skills) of observations, smelling, identification, critical thinking, analytical skills among others which are some of the necessary skills require by secondary schools' students before graduation. However, this important aspect of chemistry is impeded by several factors ranging from students' factor to teachers' factor. During qualitative analysis, students committed several errors which could have been avoided when identified early enough to improve their performance and encourage skill development. The question that come to mind is could the identification of errors committed by chemistry students in qualitative chemical analysis be per of solution to students' poor performance? This is the focus of this study. The study sort to identified some of the common error's students offering chemistry committed during qualitative chemical analysis on one hand and find out which one could have higher mean effect on students' performance in chemistry.

Purpose of the Study.

The study investigates some of the factors that inhibit students' poor performance in qualitative analysis. Specifically, the objective of the study sought to;

i. Find out the nature of errors often made by students while conducting qualitative analysis.
ii. To ascertain the percentage error committed by students offering chemistry in quantitative analysis

Research Questions

The study was guided by the following research questions

i. What is the mean score of the common errors committed by students during qualitative analysis?

ii. What is the percentage score of the errors committed by chemistry students in qualitative analysis?

Methodology

The study adopted a descriptive survey research design. This design was considered appropriate for the study as it's allowed the researcher to gather information on some of the common errors committed by chemistry students in qualitative analysis. According to Emaiku (2012) descriptive survey research is that which does not require the testing of hypothesis but concerns with a systematic description of events. The study involves all 1,234 (one thousand two hundred and thirty-four final year Senior Secondary III (SSIII) students in all the 12 senior secondary school students in Shendam local government Area council of Plateau state. 100 (0ne hundred) students were randomly sampled from a purposively sample five senior secondary schools in Shendam area council for the study.

One instrument of instrument Pre-determined Common Errors Committed by Chemistry Students Qualitative Analysis (PCECCSQA). The (PCECCSQA) consisted of 12 structured items which evaluate some common errors students could make during qualitative analysis and its includes observing changes in color, smell, litmus change, parallax error, identification of gases, heating of mixtures, description of substances, drawing inferences, and as well recording of result. Evaluators were requested to record the frequency of errors committed by each respondent while conducting qualitative analysis test. The students were scored 3 points for each error made. The weighted mean scores were calculated for each student were rate as negligible and grievous errors. Thus, for a weighted mean of below between0.10-0.39 was rated grievous, while for a weighted mean of between0.40-0.69 was rated as moderately grievous error and for a weighted mean score between 0.70-above was rated highly grievous. The frequency and percentage of each error was then computer to determine which error students committed most during qualitative analysis in chemistry practical.

The PCECCSQA was validated by two experts in chemistry education drawn from University of Jos. They were as to determine the content and face validity and as well the construct validity of the PCECCSQA. Their constructive advice was used in developing the final instrument which as used.in order to determine the internal consistency of the instrument a pilot test was conducted in two senior secondary schools in Shendam Local Government Area who were part of the population but do not formed part of the sample for the study. Data collected was

used to computed the reliability of the PCECCSQA using Kuder Richardson K-20 formula which yielded an internal consistency of 0.78, this was considered adequate (Pollant, 2001) Five research assistants were trained as evaluators on the use of PCECCSQA for two weeks. They were trained on how to rate students' error without biases and to accurately monitor the practical periods. They were advised to pay attention to the twenty students selected in each of the chosen schools for the study.

Results.

The result gather was tabulated to answer the research questions stated

Research Question one: What is the mean score of the common errors committed by students during qualitative analysis?

Table 1: Mean and Frequency Scores of the Common Errors by Students in Qualitative Analysis in Chemistry

S/NO	Items	Frequency	Mean
1.	Parallax error.	28	0.78
2.	Description of substances.	20	0.56
3.	Identification of colour changes.	16	0.44
4.	Use of indicators.	20	0.56
5.	Identification of gases.	28	0.78
6.	Handling of reagents.	32	0.89
7.	Heating of reagents.	24	0.67
8.	Separation of mixtures	20	0.56
9.	correct observation	32	0.89
10.	Correct inference.	37	1.03
11.	Confirmation test	36	1.00
12.	Report.	32	0.89

Table 1 reveals the frequency count and mean of some common errors chemistry students made in qualitative analysis. The table revealed that moderately grievous errors committed by students were description of substances, identification of gases, use of indicators, heating of reagents, separation of mixtures, with a weighted mean score below between 0.40-0.69. However, it was revealed on Table 1 that chemistry students committed very grievous errors in chemistry qualitative analysis in handling reagents, correct observation, drawing correct inferences, identification of gases, parallax, confirmation test, and report with a weighted mean scores between0.70-above. it was concluded that chemistry students commit grievous errors during qualitative analysis in writing correct inferences, confirmatory test and reporting practical with mean scores of 1.03 and 1.00 respectively.

Research Question Two: What is the percentage score of the errors committed by chemistry students in qualitative analysis?

Table 2: Mean and Percentage Scores of some Common Errors by Students in Qualitative Analysis in Chemistry

S/NO	Items	Mean	Percentage
1.	Parallax error.	0.78	26.00
2.	Description of substances.	0.56	18.67
3.	Identification of colour changes.	0.44	14.67
4.	Use of indicators.	0.56	18.67
5.	Identification of gases.	0.78	26.00
6.	Handling of reagents.	0.89	29.67
7.	Heating of reagents.	0.67	22.33
8.	Separation of mixtures	0.56	18.67
9.	correct observation	0.89	29.67
10.	Correct inference.	1.03	34.33
11.	Confirmation test	1.00	36.00
12.	Report.	0.89	29.67

Table 2 reveals the mean and percentage count of some common errors chemistry students made in qualitative analysis. The table revealed that some of the highly grievous errors committed by students includes errors such as description of

substances, identification of gases, use of indicators, heating of reagents, separation of mixtures, with a percentage count of between 14.00% to 22.90%. However, it was revealed on Table 2 that chemistry students committed highly grievous errors in chemistry qualitative analysis such as handling reagents, correct observation, drawing correct inferences, confirmation test, parallax, identification of gases, and report with a percentage count of between 23.00-36.00%. It was concluded that chemistry students commit much more grievous errors during qualitative analysis in writing correct inferences, confirmatory test and reporting practical as shown in their percentage count of 34%,3% and 29.67% respectively

Discussion

The findings revealed that there exist common errors that students commit during qualitative analysis and that the purported errors can be confirmed as factors contributing to the prevailing low performance in chemistry in external examinations at the senior secondary school level. This is in conformity with the findings of Olayemi (2000), Ezeliora (2001), Nwosu (2000) and Jimoh (2001) whose study reported that most investigations in chemistry identified factors responsible for low achievement without actually finding out the aspects of chemistry that poses problems to students during chemistry practical. These findings agree with Ayodele (1999) who reiterated the fact that the process skills of science could be achieved only when science students are exposed to sufficient practical work and laboratory experiments because common errors exposed in these findings causing students` low performance in qualitative analysis can be addressed when students are exposed to more practical periods as the saying goes that ``practice makes perfect``.

Conclusion

It is therefore concluded that students actually commit certain errors/mistakes during qualitative analysis and that the errors committed are in varying degrees of intensity. Chemistry students in plateau state senior secondary schools face challenges in qualitative analysis practical. Furthermore, this could contribute to the reasons for the low performance in chemistry at WAEC/NECO/NABTEB, examinations respectively.

Recommendation

1. Chemistry teachers should actively guide students, monitor their practical work and correcting common errors throughout the experimentation process.
2. School authorities should allocate additional practical periods in the

timetable to enhance students' exposure to hands-on experiments, reinforcing the notion that practice contributes to proficiency.

3. Government support is crucial; periodic provision of apparatus and reagents to schools will encourage more practical learning, fostering a conducive environment for effective science education.
4. Chemistry teachers should be more concerned about students' practical report and encourage them to developed more sense of smelling during qualitative analysis

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