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Impact of Factors Affecting Teachers' Utilization of Practical Periods on Achievement in Qualitative Analysis among Secondary Schools Students in Dawakin-Kudu Educational Zone, Kano-Nigeria

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Abstract

This study investigated the factors affecting teachers' utilization of practical period and its impact on achievement in qualitative analysis among secondary schools Students in Dawakin-kudu educational zone of Kano-Nigeria. The study adopted an ex-post facto research design. The population of this study comprised the entire science senior secondary schools offering chemistry under Dawakin Kudu Educational zone of Kano state, with total number of thirty-two (32) schools, with 7607 SS III students. The sample of the study comprised of 370 students selected using stratified sampling and simple random techniques method. The instrument used for data collection was Students practical chemistry qualitative analysis achievement test (SPCQAAT) with reliability coefficient of 0.606 determined using Pearson Product Moment-Correlation Coefficient (PPMCC). ANOVA F-test and Scheffe test at 0.05 levels of significance where used to test hypotheses using Statistical Package for Social Sciences (SPSS) version 23. It was found that there was significant impact between each of the predictor variables and the outcome variable. The predictor variables considered in this study include Time allocated for chemistry practical (TAP) and Class size for chemistry practical (CSP). Each of these variables has significant impact on the outcome variable. Based on the findings it was recommended that enough time should be given for practical in qualitative analysis. It's also recommended that

more classes should be constructed, and more science teachers be employed to take care of the teaming population in qualitative analysis practical chemistry.

Keywords: Class-Size, Practical-Period, Chemistry, Performance, Utilization.

Introduction

Science education is discipline that introduces learner to the content as well as methodology of getting scientific knowledge (Babajide, 2015). It also involves teaching of sciences subject (chemistry, biology, physics, Agriculture, mathematics and soon.) and their appropriate methodology of imparting it (Okeke, 2007). Science education is a field of study that deal with scientific content and materials chosen to be taught or learned, which inculcates scientific knowledge, skills, attitudes and values necessary for the learner to acquire. It deals with teaching of scientific concepts and addressing the learners' misconceptions. Therefore, science education is a well strategize activities of acquiring science through an effective process involving both teacher and student called science teaching. Science teaching involves; well planned activities that will lead to acquisition of cognitive skills (knowledge domain), well develop learning activities that inculcate the spirit of enquiry like observations, testing etc. and learning strategies that aimed to stimulate the creativity, critical thinking, curiosity, open-mindedness of the learner, etc. (National Open University 2012).

Science teaching subject includes; biology, physics, mathematics and chemistry. Chemistry is the branch of science that deals with study of chemical composition of matter and their transformation from one form to another. According to Omiko (2015), Chemistry is a branch of science which tries to make people understand the nature, composition and usefulness of natural things and those materials made by human beings. Chemistry is viewed as central of science because it is considered as a prerequisite to further study in all science and its related disciplines such as Engineering, Medicine and others (Aderonke & Victoria, 2013). The life process of all organisms involves chemical changes and many activities centres on the study of chemistry, as a result chemistry plays vital role in the development of drugs, which helps to prevent, cure and alleviate diseases and prolong lifespan and Chemists are involved in the fields like biotechnology, pharmacy, genetic engineering and they are forefront of many developing fields (Ababio, 2013; Emendu, 2014).

Despite the application of chemistry in industries, medicine, pharmacy and other related disciplines many research

findings revealed that chemistry students find chemistry concepts difficult and performed poorly in an examination (Okeke, 2011). The major problems found in teaching of Chemistry in Nigerian secondary school and tertiary institutions is that, science is presented dogmatically which students find it difficult to relate to real world of work (Muhammad, 2014). Neji (2011), reported that laboratory facilities in Nigerian science secondary schools were inadequate for teaching and learning of Chemistry. In addition Achimugu, (2016) reported that the implementation of chemistry in Nigeria is yet to achieve the expected standard due to ineffectiveness in the implementation of the subject curriculum as a result of inadequate funding, poor teachers motivation, incomplete curriculum coverage and lack of standard laboratories. Ezeudu (2013) reported that the students' academic achievement in chemistry at internal and external examination has remained considerably poor despite the applications of chemistry. Some of the contributing factors includes; poor competency as some teachers used inappropriate teaching method (STAN, 2003), lack of resources for teaching and learning, time management, deficiency in content knowledge, students' inability to understand the lessons taught, inability of teachers to complete the syllabus among others.

Chemistry is one of the practical's base science subject that require adequate time planning for greater student understanding. Chemistry is a science subject that is based on observation and experimentation. It aims at providing the students with skills to perform experimentation, observe, record, calculate precisely and make intelligent inferences. Chemistry is generally divided in to two part I.e. theory and practical. Practical chemistry deals with experimentations mainly inside laboratory and are also divided in two i.e. Qualitative and Quantitative analysis.

Quantitative analysis deals with determining the quantity of the composition elements present in a particular compound, and it mainly involve determining volume, mass (g), number of moles (mol), molar mass (g/mol), concentration in mol/dm3, and concentration in g/dm3 while Qualitative chemistry analysis is the systematic identification of an unknown salt though a series of chemical tests. It involves a series of ten steps divide in to three stages, these are; Preliminary tests, Test in solution and Confirmatory tests. Qualitative analysis is usually laboratory teaching concept of chemistry. Johnson (2011) emphasized that good laboratories influence effective teaching of chemistry. This due to the fact that laboratory experience shoulders distinctive importance for assisting students / learners to think through chemical concept and enlightenments (Robinson 2005).

According to STAN 2003, a school laboratory is a forum where both science teachers and their students interact with materials under controlled conditions as they investigate the nature in seeking answers to many problems and finding facts or information. Abdulsalam (2017) referred science laboratory to "anywhere science can

be taught or learnt:" laboratory is a place where experiments in science are carried out. The experiments involve chemicals, specimens, materials and equipment. Science laboratory was also defined as a setting in which students can work supportively in small groups to investigate scientific occurrences (Aina, 2012). According to Omiko (2007), laboratory is a room, or building or a special period of time equipped and set apart for practical or experimental studies to take place, and laboratory is the heart of a good scientific programme which allows students in the school to have experience consistently with the goals of scientific literacy. This implies that science teaching and learning cannot be completely done in a secondary school where there is no equipped laboratory. Ufondu (2009) observed that the laboratory is an indispensable organ of the school if effective teaching and learning of the science subjects are to be achieved. Omiko (2007) mentioned concept of mastery, development of cognitive abilities, critical thinking, problem solving, application, analysis, and synthesis as some of the objectives achieved through proper use of science laboratory in chemistry teaching and learning. Akani (2015), revealed that the use of laboratory in science teaching and learning helps to; develop scientific attitudes in the students towards learning chemistry especially practical. In addition, Omiko (2015), observed that the use of the laboratory in science teaching and learning helps students to learn better about nature of science and foster their intellectual understanding. However, despite the role of laboratory in teaching and learning of chemistry many chemistry teachers do not utilize it during practical periods as it's usually given in the timetable for teaching chemistry concepts, especially qualitative analysis, hence students perform poorly in qualitative analysis external examination (Ngozi and Salisu 2015).

Copriady, (2014) stated that the goals of science education can be achieved if educational laws which is related to educational curriculum, competency of teachers, educational infrastructures, organization of learning activities and educational assessment are all available. Science education curriculum contain plan of activities to be carryout by the ministry of education, schools, teachers, and students. It contains both science teaching subjects and their contents. However, the science curriculum is usually achieved and be brought to the student through time-allocation using time-table which contains the learning periods. A timetable is the means by which all the school resources are utilized to provide the greatest possible educational opportunities, timetable also specify time allocated to each subject and the lesson duration, and the number of periods allotted to each subject depends on the importance attached to the subject, hence decision expressed by the timetable affect the entire school population and reflect the education programme and philosophy of the school. Dimpka and David (2011) defines learning period as the number or the amount of days or hours students are required to attend school. He also identifies two types of learning periods as; instructional and non-instructional learning periods.

Instructional time; is the amount of time during which learners receive instruction from a classroom teacher in a school or a virtual context. However, instructional time does not include holidays or teacher's professional development days when learners are not expected to be in the in a school e.g. breaks during school the schools' days, or time spent on learning outside of school. (International Bureau of Education, 2013). According to Palm-Beach study-time learning theory 1864, academic achievement is a function or proportional to the study-time (learning time, learning period or instructional time) spend on a learning task needed to be completed. While the theory advocates the important of study-time in predicting and controlling the learning outcomes, many teachers in majority of public science senior secondary schools usually do not starts practical in qualitative analysis in time and usually performed few number of practical and usually few days to eternal examination and therefore the amount of instruction usually given will be insufficient to enriched the students with required knowledge, and this affect the performance of students in qualitative analysis. According to Nigeria national policy of education (2004), the ratio of teacher to students is 1:40 in a usual class and 1:20 for practical work. Okeke (2011) observed that the students' achievement is dependent on several factors among which is learning environment. However, in many public science senior secondary schools, the number of students to perform practical are usually larger and teachers may find it difficult to manage and control the class size for practical class and this affect students' performance in qualitative analysis (Olayinka, Ajibade & Adebola 2017)

According WAEC, (2020), chemistry exams comprise of three sections namely; paper1, paper2, and paper3. Papers 1 and 2 is combined in a composite paper to be taken at one sitting while paper 3 is taken separately. Paper 3 is 2hours practical test for school candidates or 1hour 30minutes alternative to practical works test for private candidates. Each version of the paper contains three compulsory questions and carry 50 marks. The questions are based on the following aspect of syllabus: one question on quantitative analysis, one questions on qualitative analysis and the third questions shall test candidates' familiarity with practical activities suggested in the syllabus, (WAEC, 2020). However, evidence from WAEC chief examiners report right from 2015 to 2020 has continuously mentioned aspect of qualitative analysis as one of weakness of the students during external practical examination, hence the presence research is aimed at investigating the factors affecting teachers' utilization of practical period and its impact on achievement in qualitative analysis among secondary schools Students in Dawakin-kudu Educational zone of Kano-Nigeria.

Statement of the Problem

Despite teachers' knowledge that qualitative analysis is a practical base concept of chemistry and been one of the three compulsory components of paper 3 external

extermination, many teachers in public science senior secondary schools do not utilize practical periods given in the school time-table, and usually perform few practical and usually few days to external examination in qualitative analysis, as such many students perform poorly. Source pointed out in the WAEC chief examiners report of 2015, 2016, 2017, 2018, 2019 and 2020 has continuously stated aspects of Qualitative analysis as among the weaknesses of the students, which includes; Poor observation ability, unable to carry out required test, Poor knowledge of identification of cations and anions in the solution, inability to draw logical inference from observations made, demonstrate inadequate exposure to practical work, performance not encouraging as some candidates do not adhere to the to the instruction given in the question. (WAEC chief examiners report 2015-2020). In view of the problems highlighted the researcher aims at investigating the factors affecting teachers' utilization of practical period and its impact on achievement in qualitative analysis among secondary schools Students in Dawakin-kudu Educational zone of Kano-Nigeria.

Research Objectives

The aims of the study are to determine the factors affecting teachers' utilization of practical periods in qualitative analysis from the teachers' perspectives with following objectives;

1. To determine the impact of Time allocated for practical on qualitative analysis achievement among secondary schools students in Dawakin-Kudu Educational zone of Kano state, Nigeria.
2. To find out the impact of class size on qualitative analysis achievement among secondary schools students in Dawakin-Kudu Educational zone of Kano state, Nigeria.

Research Hypotheses

The following research hypotheses are formulated by the researcher to guide the study

Ho1. Time allocated for practical has no significant impact on qualitative analysis achievement among secondary schools students in Dawakin-Kudu Educational zone of Kano state, Nigeria.

Ho2. Class size has no significant impact on qualitative analysis achievement among secondary schools students in Dawakin-Kudu Educational zone of Kano state, Nigeria.

METHODOLOGY

The research design for this study is ex – post facto research. This is because the researcher was not attempted to manipulate the variables since they have already occurred (Cohen, Mansion & Morison, 2010). The choice of this design is due to the

fact that this study involved on-the-spot observation of the behaviour of participants i.e. the representatives of the target population that could not be manipulated ,also the study attempt to explored cause and effects relationships where cause already exist and cannot be manipulated. Therefore the researcher uses what already existed and looks backward to explain why. Hence the researcher studied the phenomena on its natural forms, by exploring factors affecting teachers' utilization of practical periods and its impact on students' qualitative analysis performance.

The population for this study comprised of seven thousand six hundred and seven (7607) Senior Secondary Class 3 students (SS3) from the entire senior secondary schools offering Chemistry under Dawakin kudu Educational zone of Kano state. Hence, a sample size of 370 were selected from the large population to represent the entire population for the purpose of survey study, (Research advisors 2006). Student's practical chemistry qualitative analysis achievement test (SPCQAAT) was used to collect data for the study. The SPCQAAT instrument was adopted from 2019 chemistry paper 3 WASSCE for private candidate and contains fill in the blank to be filled by the students. The total number of the blanks are eighteen (18) and each blank carries equal mark of 1mark making a total marks of eighteen (18) for the instrument.

RESULTS

H_{01} Time allocated for chemistry practical has no significant impact on qualitative analysis achievement among secondary school students in Dawakin-Kudu Educational zone of Kano state, Nigeria.

Table 1: Analysis of Variance for the Impact of Time Allocated for Chemistry Practical on Qualitative Analysis Achievement among Secondary school students' in Dawakin-Kudu Educational Zone of Kano State, Nigeria

Source	Sum of Squares	df	Mean Square	F	Sig.	Decision
Between Groups	1340.915	2	670.457	127.466	.000	Significant
Within Groups	1930.385	367	5.260			
Total	3271.300	369				

From Table 1, the difference in the impact of time allocated for chemistry practical on qualitative analysis achievement among secondary school students in Dawakin-Kudu Educational zone of Kano state, Nigeria was $F_{(2, 367)} = 127.466, p = .000$. Now since the p-value (.000) was less than the alpha value (.05), the null hypothesis was rejected

and the alternate hypothesis was adopted. This simply means that, there was significant difference among the students in their qualitative analysis achievement based on the time allocated for chemistry practical. Therefore, the researcher concluded that time allocated for chemistry practical has significant impact on qualitative analysis achievement among secondary school students in Dawakin-Kudu Educational zone of Kano state, Nigeria.

H_{02} Class size for chemistry practical has no significant impact on qualitative analysis achievement among secondary school students in Dawakin-Kudu Educational zone of Kano state, Nigeria.

Table 2: Analysis of Variance for the Impact of Class Size for Chemistry Practical on Qualitative Analysis Achievement among Secondary school students' in Dawakin-Kudu Educational Zone of Kano State, Nigeria

Source	Sum of Squares	df	Mean Square	F	Sig.	Decision
Between Groups	3280.694	2	1640.457	350.573	.000	Significant
Within Groups	1717.209	367	4.679			
Total	4997.903	369				

From Table 2, the difference in the impact of class size for chemistry practical on qualitative analysis achievement among secondary school students in Dawakin-Kudu Educational zone of Kano state, Nigeria was $F_{(2, 367)} = 350.573, p = .000$. Now since the p-value (.000) was less than the alpha value (.05), the null hypothesis was rejected and the alternate hypothesis was adopted. This simply means that, there was significant difference among the students in their qualitative analysis achievement based on the class size for chemistry practical. Therefore, the researcher concluded that class size for chemistry practical has significant impact on qualitative analysis achievement among secondary school students in Dawakin-Kudu Educational zone of Kano state, Nigeria.

Discussion of the Results

From the results, it was found that there was significant impact between each of the predictor variables and the outcome variable. The predictor variables considered in this study include Time allocated for chemistry practical (TAP) and Class size for chemistry practical (CSP). Each of these variables has significant impact on the outcome variable, which is qualitative analysis achievement (QAA) among secondary school students in Dawakin-Kudu Educational zone of Kano state, Nigeria. Although, these findings are not in line with that of Surajo and Musa (2019), but they are fully in

line with that of Hassan, Salum, Kassim, Elmoge and Amour (2015), Peter and Adewale (2015), Ojukwu (2016), Anza, Bibiso, Mohammad and Kuma (2016). In all these studies, it was found that time allocated for lessons and class size have significant impact on students' academic achievement.

It was maintained by Adebisi and Ajayi (2015) that, if science is to be learned efficiently, it must be experienced and close to the students through practical activities. This is because, the use of laboratory in science teaching and learning helps to develop scientific skills for problem solving in students as well as scientific attitudes in the students towards learning chemistry especially practical aspect such as qualitative analysis. Qualitative analysis is the systematic identification of an unknown salt through a series of chemical tests. It is the determination of the chemical composition of a sample, it can tell you whether an atom, ion, functional group, or compound is present or absent in a sample. As a result of this, it requires adequate time, standard class, competent teachers, as well as available and adequate practical materials for better understanding.

The first finding of the study was based on hypothesis stated that time allocated for chemistry practical has no significant impact on qualitative analysis achievement among secondary school students in Dawakin-Kudu Educational zone of Kano state, Nigeria. The null hypothesis was rejected, and the alternate hypothesis was adopted. This simply means that, time allocated for chemistry practical predicts qualitative analysis achievement significantly. This implies that time allocated for chemistry practical has significant impact on qualitative analysis achievement among secondary school students in Dawakin-Kudu Educational zone of Kano state, Nigeria. The finding disagrees with Temple and Muhammad (2021).

However, this finding agrees with the findings of the following studies (Dimkpa and David 2015; Jez and Wassmer 2015). It was observed by the researcher that many teachers in public science senior secondary schools rarely teach qualitative analysis using the limited time allocated. This might be one of the reasons why many students fail chemistry of which qualitative analysis is an integral aspect, and based on this finding, students' academic achievement in qualitative analysis is predicted by the time allocated for practical. The more periods given for practical, the better the performance.

The second finding of the study was based on hypothesis stated that class size for chemistry practical has no significant impact on qualitative analysis achievement among secondary school students in Dawakin-Kudu Educational zone of Kano state, Nigeria. The null hypothesis was rejected, and the alternate hypothesis was adopted. This simply means that, class size for chemistry practical predicts qualitative analysis achievement significantly. This implies that class size for chemistry practical has significant impact on qualitative analysis achievement among secondary school

students in Dawakin-Kudu Educational zone of Kano state, Nigeria. Although the finding is not in line with Musa (2019).

However, this finding agrees with Victor, Tanko and Ehi (2017), Yusuf, Onifade and Bello in (2019), Kusi and Manful (2019), Afolabi, Wakili, Afolabi, Onwuegbunum and Ademuwagun (2020) and Mathias, Bahati and Abedi (2020). According to National Policy of Education (2004) dictated the ratio of teacher to students as 1:40 in a usual class and 1:20 for practical work, but many of our public secondary schools in Nigeria are overpopulated in terms of students' enrolment. Even in science classes, the average one can find is 60 to 70. This makes practical sessions out of control, as the teacher in charge cannot take adequate care of the teaming population. This study however discovered that class size is inversely related to students' achievement in qualitative analysis, which is a practical aspect of chemistry. The implication of this finding is that, in as much as students' achievement in qualitative analysis need to be improved, science classes should be reduced to a manageable size that can be controlled by the teacher in charge. This will enable the students to concentrate more on the lesson and gain better understanding of the concepts being learnt.

CONCLUSION

Based on the results presented, it can be concluded that;

1. Time allocated for chemistry practical in qualitative analysis has significant impact on qualitative analysis achievement among secondary school students in Dawakin-Kudu Educational zone of Kano state, Nigeria.
2. Class size for chemistry practical in qualitative analysis has significant impact on qualitative analysis achievement among secondary school students in Dawakin-Kudu Educational zone of Kano state, Nigeria.

Recommendations

The following are hereby recommended based on the findings of this study;

1. It's recommended that enough time should be given for practical in qualitative analysis and all science subjects in secondary schools in Kano state. This is to enable science teachers conduct enough practicals so as to demonstrate science processes for better understanding.
2. Its recommended that more classes should be constructed, and more science teachers be employed to take care of the teaming population in qualitative analysis practical chemistry. This will reduce overcrowded classrooms in secondary schools in the state, and in turn, enable teachers to have class control and proper class management.

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