

*Full Length Research Paper*

# An investigation into students' study habit in volumetric analysis in the senior secondary provision: A case study in Ondo State, Nigeria

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An investigation was carried out on students' study habit in volumetric analysis at the senior secondary school level in Ondo State. A descriptive research design was adopted in the study. Questionnaire on study habit inventory was adapted and used to collect information from the respondents at various sampled schools. The sample comprised 240 senior secondary II chemistry students drawn from six schools in Akure South Local Government Area of Ondo State. The hypotheses investigated with respect to students' study habit problems such as home work/ assignment, reading and note-taking, students' concentration, time allocation, teachers' consultation as human variables were analyzed using chi-square statistics at 0.05 level of significance. The results indicated that the main sources of students' study problems have strong influence on students' study habit which is causally related to the performance and consequently the efficiency of the students during the practical lesson in volumetric analysis. Based on the findings of this study, it was recommended that chemistry teachers need proper exposure and orientation to some psychological study problems in order to understand students' developmental and intellectual progress so as to improved learners' performances. Hence, there is a need for workshops and seminar for teachers where the importance of effective study habit behavioural pattern would be stressed.

**Key words:** Volumetric analysis, volumetric titration, study habit, practical activities.

## INTRODUCTION

One of the goals of chemistry education is to develop students' learning skills in chemistry. The goal of helping students to acquire scientific knowledge and the required skills may not have been achieved due to poor study and irregular habits and ineffective practical lesson among senior secondary school students in chemistry. Chemistry is essentially a practical oriented subject which demands proper exhibition of good study behaviour for effective interpretation of existing phenomena (Njelita, 2008). Students are rarely exposed to practical work; hence, Akpan (1999) observed that lack of practical activities by chemistry students has resulted in poor communication and observational skills. The absence of these skills gave

rise to students' poor performance in chemistry especially in volumetric analysis.

Individual's studying pattern/behaviour affect the amount of information which such individual add into his long term memory. Study habits refer to whether students study at the same time each day, whether they shut off radio, television while reading and whether they paraphrase and write down what they have read during the practical instructions. Study habit also describes some external activities which serve to activate and facilitate the internal process of learning as defined by Rothkopf (1982).

Many studies have been carried out which make available today an important catalogue on study habit (Ogunmakin, 2001; Kumar, 2002; Gbore, 2006). They argued that study habit have strong relationship with academic performance of students while other researchers (Owolabi, 1996; Whihite and D' Onofrio,

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1993) concluded that it was the combination of the study habits and other factors that could explain students' academic performance in any course of study. Adeyemo (2005) opined that study habit was a pattern of activity that went beyond merely reading for pleasure. According to him, it is a well planned and deliberate form of consistency on the part of the student towards the understanding academic subjects. Bakare (1977) in his study habit inventory pointed out eight key sources of poor academic achievement. Study habit problems associated with student's response to home work and assignments; reading and note taking; time allocation; study period procedure; student's concentration; towards examination and teachers' consultation.

The inability to utilize effectively and positively these sources of study problems may stand in the way of effective study and good performance among the chemistry students. The practice, in most senior secondary schools in Nigeria, allows the students to perform experiment in a 'cook-book' fashion whereby students only follow direct instructions. By this practice, the students get the impression that only the final results and calculations based on them matter (Alam, 2009a). Encouragements were not given by the teachers to the students to ask 'why' during the experiment. These could be ascribed to low abilities and poor academic standard of students as problems that necessitated this research (Alam, 2009b). This study attempt to find out the extent, to which training in study or study habit behaviour could solve the achievement problem in chemistry especially in volumetric analysis.

## RESEARCH AIM AND RESEARCH QUESTIONS

The purpose of this study is to investigate students' study habit towards the learning of volumetric analysis with a view to minimizing some difficulties and increase the probability of learner's involvement in the instructional process in volumetric analysis. In order to achieve this aim, following five research questions will be answered: Is there any significant influence on student's reading habit towards the learning of volumetric analysis? Do the psychological problems have any significant influence on students' study habit towards the learning of volumetric analysis? Does time management have any significant influence on students' study habit during practical activities in chemistry? Does assigned homework have any significant influence on students' study habit towards the learning of volumetric analysis? Does teachers' consultation have any significant impact on students' study habit during chemistry practical lesson?

## LITERATURE REVIEW

Definition of volumetric analysis Volumetric analysis was first introduced by Jean Baptiste Andre Dumas, a French chemist (Stillwater, 1999; Encyclopedia Britannica). He used it to determine the composition of nitrogen combined with other elements in organic compounds. Dumas burned a sample of a compound with known weight in a furnace under conditions that ensured the conversion of all nitrogen into elemental nitrogen gas. The nitrogen is carried from the furnace in a stream of carbon dioxide that is passed into a

strong alkali solution, which absorbs the carbon dioxide and allows the nitrogen to accumulate in a graduated tube. The mass of the nitrogen can be calculated from the volume it occupies under known conditions of temperature and pressure, and therefore the proportion of nitrogen in the sample can be determined. From then volumetric has been used widely in chemistry and industrial laboratories

Volumetric analysis is a method of quantitative analysis using measurement of volumes. For gases, the main technique is in reacting or absorbing gases in graduated containers over mercury, and measuring the volume changes. For liquids, it involves titration. It can also be said to be a method of determining chemical differences and principles of redox (reduction- oxidation) reactions between molecules. Chemicals under this topic are classified based on the results obtained from titration. The process of creating a balance chemical equation '*in vitro*' is called titration. It typically uses a volumetric flask, hence, called volumetric titration. There are three types of volumetric titration, which are classified based on the rate of their reaction. Direct titration method (DTM) is a one-step titration process. Indirect method (ITM) involves a two-step titration process. Back titration method (BTM) uses a three-step titration process.

## The importance of volumetric analysis

The quantitative relationship between two reacting solutions is important to the chemists. Up to some point in chemical analysis involving solutions, solid precipitates of chemical reactions between such solutions were dried, separated and massed. The technique is called gravimetric analysis. It is used in quantitative experiments to determine mass relationships. The technique is useful but it is not always practically efficient. It is difficult and in many cases a waste of efforts and materials to separate and measure mass of products of a reaction while they are in solutions. Volumetric analysis looks a better and faster technique, especially if the substances involved are acids and bases. They can be titrated against one another for better quantitative results.

Volumetric analysis is used in high school and college chemistry laboratories to determine concentrations of unknown substances. The titrant (the known solution) is added to a known quantity of analyte (unknown solution) and a reaction takes place. Knowing the volume of the titrant allows the student to determine the concentration of the unknown substance (Nelson and Kemp, 1997). Medical laboratories and hospitals use automated titration equipment for basically the same purpose. Beside these, the process has found ample use in analytical laboratories and industries. Industries like ones that manufacture drugs, fine chemicals, petrochemicals, beverages and food processing benefit immensely by the application of this process. For example, in biodiesel industry, it is used to determine the acidity of a sample of vegetable oil. By knowing the precise amount of base that is needed to neutralize a sample of vegetable oil, scientists know how much base to add to neutralize the entire amount.

Volumetric analysis has also been used in space science in determining the presence of volatile component in the ejecta flow of crater cavity volume (Ackerman, 2005), in ecological study to determine the relationship between brain structure and sensory ecology of aquatic animals – teleost fishes (Lisney et al., 2007), in specialty metal application (Dulski, 1989) and in several other area of scientific endeavors. It is an area of science that man can not do without as long as he wants to live a healthy and good life.

## Correlation between habit and volumetric analysis

Titration is a very common procedure held in secondary education to assess a chemistry student's practical aptitudes (Basic

Chemistry Lab, <http://basicchemistrylab-.blogspot.com/2009-/10/particular-uses-of-titration-and.html>). The unit comes under several labels such as quantitative analysis, mass-volume relationships and volumetric practical work. It is an integral and compulsory unit for all high school chemistry students and for undergraduates studying chemistry, biology, physics and other applied sciences like biochemistry, microbiology, biotechnology, agricultural science, medicine, nursing and pharmacy. These groups of students must possess the foundational experience from the secondary level. Several factors have been found to account for students' performance in chemistry.

Okebukola (1988) identified twelve of them. These factors according to Okebukola (1988) accounted for 64% of the variance of students' score in practical chemistry when stepwise multiple regression analysis was applied on data collected. Students' participation in laboratory activities made the greatest independent contribution to variance in performance, followed by students' attitudes to chemistry as a subject. Other related factors are teachers' attitude to chemistry laboratory work and availability of chemistry laboratory materials.

It can be seen that the work cited that a lot of factors could be responsible for students' performance, high or poor. As far as habits or attitudes are concerned, whatever students' dispositions that enhance their performance could be determined by the level of interest they show towards every activity embedded in the course. Hofstein and Lunetta (1982, 2002) just as corroborated by Derek (2007) suggest that laboratory activities have potential to enhance cognitive growth, positive attitudes as well as social relationships among peers. A few studies have revealed students' positive attitudes towards practical work including volumetric analysis (Regan and Childs 2003; Derek, 2007). Derek (2007) male sample showed a decline in attitude as they advance in grade, but no such decline was noticed in females.

On the other hand, there are studies that revealed students' boredom (Cashell, 1999; Reid and Skryabina, 2002). These changes in attitudes were in turn traced to teachers' dispositions towards helping and motivating the students and also to availability of laboratory facilities (Regan and Childs, 2003). Regan and Childs (2003) observed that when students were regularly engaged in practical activities they tend to have enhanced interest, but as the frequency slowed down to no laboratory activities for weeks, the interest also went down. Reasons why students could not be engaged regularly in laboratory activities were included in Okebukola (1986) twelve factors. Morgil et al. (2007) also submit that activities in many laboratories centered on verification of what is already known (titration in particular) rather than helping students to develop process skills that could motivate them to stay longer at task. According to Morgil et al. (2009) "Drill and practice" is applied to train students to pass practical examination. Teachers and students place great emphasis on obtaining the correctness of the answers and the mastery of process skills is normally left to chance. Experientially, this suggests why many students just work to already given answer without concentrating much on the titrations just as teachers themselves teach to test (World Bank, 2007). Such students will have nothing much to fall back on as home assignment. The result is poor study habit noticed in many students.

## RESEARCH DESIGN

As suggested by Usher (1996), Pring (2000) and Smith (1999), to investigate an issue related to the perception of individuals, the methods of data collection needed were both either quantitative or empirical data survey. Hence, we chose quantitative methods for the people allowing them to express their views in a prescribed way (Strauss and Corbin, 1990; Pratt and Loizos 1992). A descriptive research design was adopted in the study. Study habit inventory was adapted and used to collect information from the respondents at various sampled schools. The population of this study comprised

all class two (SSII) chemistry students in the public senior secondary schools in Ondo State. The choice of SSII students is considered appropriate because the students have been exposed to some basic chemistry concept in volumetric analysis.

## Data analysis

Before examining my findings, we will seek to demonstrate the significance of the data we collected by analysing it. "The basic skills required of the researcher to analyse qualitative or symbolic material involve collecting, classifying, ordering, synthesising, evaluating and interpreting. At the basis of all these acts lies sound professional judgement." (Cohen and Manion, 1997). This statement adequately describes my work processes during the analytic stage of the findings. A total number of two hundred and forty (240) senior secondary class II chemistry students were randomly selected from six senior secondary schools in Akure South Local Government Area of Ondo State. The researcher adapted the study habit inventory prepared by Bakare (1977) with a reliability coefficient of 0.83 for his study. The SHQ consisted section A and B respectively. Section A which deals with the personal data of the subjects while section B has five parts. Each of the parts contained items that deal with the main sources of students' study habit problems toward the learning of volumetric analysis in chemistry. The responses to each of the item were described as follows; Never (N), Sometimes (S), Usually (U) Always (A). In an attempt to establish the validity of the adapted study habit inventory, experts who were researchers in this area scrutinized the contents of the instruments. They gave their expert advice in respect of the language level, the appropriateness and the overall face validity of the instrument. The adapted study habits inventory was administered twice on forty five (45) SSII chemistry students which were outside the study location within an interval of two weeks. The two set of scores were correlated using Pearson's Product Moment Correlation formula. The calculated reliability coefficient of 0.64 was obtained. This was considered reliable enough for the study. After the validation of the questionnaire had been ascertained, fresh copies of the questionnaire were administered by the researcher on the sampled respondents and the completed questionnaire were collated by researcher for the purpose of data analysis. The data collected were analyzed using frequency counts and chi-square. The five hypotheses raised were tested at 0.05 level of significance.

## LIMITATION OF THE METHODOLOGY

The authors wish to acknowledge the limitation of the instrument employed in this study. Though the coefficient of reliability obtained was a bit low; experts in test and measurement (Kaplan, 2001; Nunnely, 1978) agree that such value indicate positive correlation and is acceptable for research purposes.

## FINDINGS

### Answers for research questions

The results of the study were presented in tables as follows:

#### Research issue 1

Significant influence on students' reading habit towards the learning of volumetric analysis. Table 1 shows that,

**Table 1.** Summary of students' responses with respect to reading habit in volumetric analysis.

S/N	ITEM	N	S	U	AL	$X^2_{cal}$	$X^2_{table}$
1.	During practical lesson, do you take time to read chemistry practical manual?	24	46	118	52		
2.	In reading chemistry text, do you tend to write things which later turn out to be important?	26	44	112	58		
3.	After reading the chemistry practical manual, do you find the concept of titration easy to understand and remember what you have just read	16	88	80	56	63.45	1.75
4	Do you go back and recite to yourself the material read/ studied, rechecking any points you find doubtful?	22	28	130	60		
5	Are you able to read the level of meniscus (initial and final reading) during titration?	28	50	88	74		

P < 0.05

**Table 2.** Responses of the students towards the learning of volumetric analysis with respect to their psychological problems.

S/N	ITEM	N	S	U	AL	$X^2_{cal}$	$X^2_{table}$
1.	Do you have problem in sight-reading?	120	60	50	10		
2.	Do broken homes, stress or hardship or inability to buy science materials causes you to neglect your practical work?	84	74	52	30		
3.	Do you get nervous and confused when pouring acid into the given burette?	112	96	18	14	79.10	1.88
4.	Do you have problem of expressing what you see or hear or smell during the individual practical work?	54	120	48	18		

P < 0.05

reading habit has a significant influence on students' behaviour towards practical lesson in chemistry. This is so, because the  $X^2_{cal}$  (63.45) is greater than  $X^2_{table}$  value (1.75) at 0.05 level of significance. Thus, it suggests that the reading habit of the students in chemistry texts may have significant influence on students' study behaviour towards the learning of volumetric analysis.

### Research issue 2

Influence of psychological problem on students' study habit during practical lesson.

Table 2 shows that the chi-square calculated value (79.10) is greater than the table value (1.88). This implies that psychological problems experience by the subjects like effects of broken homes, stress, or hardship and inability to see or hear or smell during individual practical work has a significance impact on students' study behaviour towards the learning of volumetric analysis

### Research issue 3

Influence of time management on students' study habit in practical activities in chemistry. Table 3 show that, time management has a significant influence on students'

study habit. This is so because the  $X^2_{cal}$  (78.22) is greater than  $X^2_{table}$  value (1.75) at 0.05 level of significance. Thus, this suggests that proper time management in learning scientific concepts could generate students' interest and good orientation towards the learning of volumetric analysis.

### Research issue 4

Influence of assigned homework does on students' study habit towards the learning of volumetric analysis. The result in Table 4 shows that the chi-square calculated value (78.22) is greater than the table value (1.88) at 0.05 level of significance. Thus, it could be seen from the students' responses that assigned homework has significant influence on students study habit.

### Research issue 5

Impact teachers' consultation on students' study habit during practical lesson in chemistry. The Table 5 shows that teachers' consultation has a significant impact when students were exposed to practical activities in chemistry. This is so because the chi-square calculated value (128.31) is greater than the table value of (2.10). Hence,

**Table 3.** Summary of the students' responses with respect to time management in the learning of volumetric analysis.

S/N	ITEM	N	S	U	AL	$X^2_{cal}$	$X^2_{table}$
1.	Do you have much time for yourself to study operational procedures and precautions during titration?	2	30	92	116		
2.	Do you plan your work so that you will make the best use of your time?	8	58	120	54		
3.	Do you spend too much time on chemistry practical work and little on other subjects?	12	64	104	50	78.22	1.75
4.	Do you study for at least three hours each week after teacher discussion in the laboratory?	6	54	96	84		
5.	Are you able to finish the practical work within the time allowed during the practical period?	30	70	80	60		

P < 0.05.

**Table 4.** Summary of the students' responses on the influence of assignment and homework on students learning habit in practical chemistry.

S/N	ITEM	N	S	U	AL	$X^2_{cal}$	$X^2_{table}$
1.	Do you begin your assignment as soon as the teacher gives them to you not allow them to pile up?	4	60	122	54		
2.	When your assigned home work is too long and hard, do you stick to it until is completed?	5	70	115	50	78.22	1.88
3.	Do you correct errors on your practical note book which your teacher have marked and returned to you?	10	50	80	100		
4.	If you have to be absent from practical work, do you make up missed lessons and assignment immediately?	18	24	96	102		

P < 0.05

**Table 5.** Summary of students' responses to teacher consultation during practical lesson.

S/N	ITEM	N	S	U	AL	$X^2_{cal}$	$X^2_{table}$
1.	When you are having problem in acid-base titration, do you try to discuss it with the teacher?	20	60	104	56		
2.	Do you hesitate to ask your teacher for further explanation on the points that are not clear to you?	5	30	130	75	128.31	2.10
3.	Do you teacher criticize your written work for being hurriedly written?	70	50	80	40		

P < 0.05

hypothesis 4 is rejected. It suggests that teacher could be an active mentor during the instructional process.

## DISCUSSION

The findings of this study have demonstrated clear pattern of reading habit on students' study behaviour towards the learning of volumetric analysis. The result in Table 1 obtained indicated that reading skill has significant influence on students' study behaviour in chemistry. The results agreed with the findings of Seweje and Idiga (2003) who reported that achievement of students in

science depended on the student's personal efforts toward the reading of scientific concept meaningfully. This could also be attributed to the fact that students might have masters and be able to read some chemical languages effectively. This is so because students might have probably understood basic operation in titration and took part in laboratory discussion and activities. It could be seen from the overall results of this study that the main sources of study problems were students' responses to assigned homework, time allocation, studied period, note-taking and teachers' consultation.

The results obtained in Tables 2 to 4 show that there is significant influence of these study problems on the study

habit of students toward the learning of volumetric analysis in chemistry. However, this finding is in line with Ogunmakin (2001) and Bassey (2002) who argued that study habits could influence academic performance of learners. De Escobar (2009) and Riaz et al. (2002) equally agree that good study habits and academic achievement walk hand in hand. This could also be linked with one or a few of the twelve factors of Okebukola (1986). The subjects of this study might have gone through series of long periods of practical lesson in volumetric analysis.

## Conclusion

Based on the findings, one could conclude that the students' study habit as related to the learning of volumetric concept could generate students' interest, attitude and ultimate success in the learning of chemistry. Chemistry teachers need proper exposure and orientation to some basic psychological study problems of students in order to understand student's developmental and intellectual progress in learning enterprise. Hence, there is a need for workshops and seminars for teachers where the relevance of study habits behavior towards practical activities would be stressed.

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