# SMALL SCALE EXPERIMENT AND STUDENTS' ACHIEVEMENT AND RETENTION IN PRACTICAL CHEMISTRY

**BY**

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***Abstract:***
*This paper considered the Effect of Small Scale Experiment on Students' Retention and Achievement in Chemistry. Chemistry as a practical-oriented subject requires laboratory materials for its effective teaching, learning, and retention. These much needed materials are often in short supply in many secondary schools. The results are that some topics are skipped, some practical topics are taught theoretically instead and or the skills involved are just demonstrated. Demonstration with its merits cannot replace the experience students will have in hands-on-activities. Small scale experiment can be used to teach practical chemistry with small quantity of laboratory chemicals. The sample is 100 senior secondary (SS) II chemistry students drawn from three senior secondary schools in the study area, Enugu North L. G. A. of Enugu State. Two research questions guided the study. Mean and standard deviation were used to answer the research questions. The findings revealed that the experimental group achieved and retained more than the control group.*
***Keyword:*** *small scale, experiment, students, achievement, retention and chemistry.*

## Introduction:

Science is very important in national development. The knowledge of science has influence human development in areas of health, communication, transportation, industrialization, food production, education and others. Chemistry, as one of the core science subjects taught in secondary school, is the study of nature and properties of all forms matter and various changes they undergo. Chemistry is an experimental science that relies primarily on practical work. According to Mbajiorgu and Reid (2004), it is not a subject that can only be taught by theory lesson but a partner in the development of concepts and understanding. Laboratory work (practical lessons) therefore, should be used for problem solving (concretize abstract concepts) and development of concepts and so inculcate into the students, the desired scientific process skills and attitudes needed for effective learning and retention of chemistry. Lots of laboratory materials chemicals and equipment needed for effective teaching and learning of chemistry are at times inadequately provided in many schools and so, deprive the students the chance of learning chemistry concepts and skills as and when due before external examinations where the test for them will be done. Inadequacy of materials made some resourceful teachers to demonstrate the skills under

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Students' ability to remember or retain can only be enhanced through hands-on-activities (practical lesson) which are rarely embarked upon in our secondary schools due to insufficiency of laboratory materials. To involve every student on hand–on–activities, to ensure effective teaching, learning and intention of chemistry, small scale experiment (SSE) which requires only small quantity of chemicals may be adopted. The question now arises; would the use of small scale experiment enhance students' level of achievement and retention in chemistry?

Therefore, the study is designed to find out how SSE affect students' achievement and retention in practical chemistry.

**Research Questions:**

1. What is the mean achievement score of SS II students taught

was titration of Hydrochloric acid, $HCl_{(aq)}$ against base, Sodium hydroxide ($NaOH_{(aq)}$). The instrument was a 30 item multiple choice test on the contents, qualitative and quantitative analyses – identification of ions: ($Fe^{2+}$, $Fe^{3+}$ and $SO_4^{2-}$) and calculations of end point, concentration of acid and base in moles/dm3 and in grams/dm3 and percentage purity. The instrument was validated and its reliability coefficient was found to be 0.76 using KR–20. The instrument (Pre–test) was administered to the subjects before the treatment commenced. After the treatment the pre-test was reshuffled and administered as a post-test to the subjects. Delayed post-test was further reshuffled and administered to the subjects two weeks after the treatment. Each of the test items were scored 1 marked. The scores were collated and used for data analysis.

The data collected with the instrument, were analyzed using mean and standard deviation.

**Result and Discussion**

**Students' Achievement in Chemistry**

**Table 1: Mean Score of Students' Achievement in Chemistry due to SSE and DM**

| Group | Mean (?) Score | SD | N |
|---|---|---|---|
| Treatment Group SSE | 25.48 | 3.22 | 50 |
| Control Group (DM) | 15.66 | 3.09 | 50 |

From Table 1 the two groups, treatment (SSE) and control (DM) groups have different mean scores of 25.48 and 15.66 respectively. The difference in mean scores depicts that SSE has positive effect on the students' achievement in chemistry. Considering the standard deviation (SD) of the treatment (3.22) and control (15.66) groups, the small scores showed that the SD is closer to the observation of the mean, and that the scores are homogeneous and meaningful.

**Table 2: Mean Retention Score of Students taught Chemistry (Quantitative and Qualitative Analysis) with SSE.**

| Group | Pre-Test | | Post-Test | | Retention Test | | N |
|---|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD | |
| Treatment (SSE) | 11.00 | 2.24 | 25.48 | 3.22 | 26.80 | 2.24 | 50 |
| Control Group (DM) | 12.00 | 3.10 | 15.66 | 3.09 | 15.54 | 3.11 | 50 |

**Table 2** revealed that the two groups retained what they were taught to some extent. The experimental group taught with SSE has mean post achievement test score of 25.48 and retention score of 26.80 implying that the group retained better that the control group taught with DM whose post achievement and retention scores were 15.66 and 15.54 respectively. The observed difference in the retention scores of the two groups must be due to SSE which afforded every student the opportunity to practice chemistry skills with their hands. SSE exposed the student to realities of the concepts they learnt, help remove misconceptions and confusion, and so make deep impressions on them (learners) (Ezeano 2008). The finding of this work agreed with the work of Barak and Dori (2000) on enhancing undergraduate students' chemistry understanding through project base learning which also proved that there is a significant difference in the retention of students of the two groups (experimental and control) in favour of the experimental group. The finding also tallied with the work of Tompson and Soyibo (2002) who found that the practical experience enhances students' attitude and achievement in science.

**Discussion and Conclusion**

Results of data analysis in table 1 revealed that SS II students taught qualitative and quantitative analysis using small scale experiment (SSE) achieve better (with higher mean scale) than those taught the same topics with demonstration method (DM). With SSE every student was afforded the opportunity to participate in the practical lessons. The higher mean score for SSE could stem from the novelty of the method and the participation of every student in the practical chemistry lessons. This is relates to the view of Akinkiye (1987) in Ezeano (2008) who opined that students seem to understand better when they are made to work on their own than when the work is done for them. Students' participation in practical chemistry instill confidence in them, enhance science process skills development, stimulate their interest and bridge the gap between theory and practice (Ezeano, 2012).

The result also showed that a difference existed in the mean retention score of students taught with SSE. The SS II chemistry students taught with SSE have higher retention score than those taught with DM (Control Group) (Table 2). SSE therefore, made positive effect on the experimental group.

Since SSE, which gave every students the chance to conduct practical, led to higher retention of chemistry concepts, it therefore implies that it has more meaningful effect on the students. The results also agreed with Thompson and Soyibo (2002) who found that the attitude and achievement of the students at the end of treatment were in favour of the experimental group. Practical work is important for good understanding, achievement and retention of chemistry, Ezeano (2008).

The implication of the finding of this study to chemistry teachers, science educators and curriculum planners is based on the fact that SSE allows the use of small quantity of chemicals and has positive effect in learning practical chemistry, there is need to adopt SSE as a teaching method in our secondary schools. This is very necessary because it is a method that encourages practical chemistry lessons when the laboratory materials are insufficiently supplied.

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