

Comparative Study of Practical and Theoretical Approach in Teaching and Learning of Chemistry A Case Study of Government Technical College Kano

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Abstract: The study was a comparative study of practical and theoretical approaches to the teaching of chemistry a case study of Government Technical College Kano. The study was designed to determine the most effective teaching method between practical and theoretical learning methods. In a bid to achieve this aim, the study raised two research questions and three hypotheses. The study adopted the experimental design. The study sampled 40 students made up of 20 for the experimental group and 20 for the control group. The experimental group was taught by the researchers using the practical method while the control group was taught using the theoretical method of teaching. A pre-test was given before treatment. At the end of the treatment period, a post test was given. Results showed that students who were taught using the practical method performed better when compared with those taught using the theoretical method.

Keywords: *Practical Approach, Learning and Theoretical Approach.*

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I. INTRODUCTION

A. Background to the Study

Teaching traditionally is understood as the act of disseminating information to the learners. A close observation of the traditional classroom teaching for instance will reveal that teacher delivers the lesson while the students listen attentively, taking notes when appropriate. Theoretical method of teaching is a method of teaching that involves normal and ordinary teaching, i.e teaching conventionally without carrying out any experiments. The introduction of science education into the formal school system dates back to the time of the Christian missionaries, who brought western education to Nigeria in 1843. Science education, has its root in the primary school, where it started with the teaching of arithmetic, health education, elementary science e.t.c

Practical method of teaching refers to the act of using an experimental/scientific test carried out mainly in the laboratories to ensure proper understanding of the study that was treated theoretically Nigeria as a developing country has come to realize that science is a vital instrument of change that guides her world. She has accorded priority to the teaching and learning of science as seen in the National Policy on Education (2002) in section four which specifies that one of the aims of science is to equip students to team effectively in the modern age of science and technology. One of the objectives of science education is to develop students' interest in science and technology (Sola and Ojo, 2007).

B. Statement of the Problems

In chemistry teaching and learning process employed by teachers affect the performance of students, chemistry teaching cannot be made more effective without effective teaching, and there are so many devices for effective teaching. An effective teaching can ensure an effective learning. In most secondary schools today, theoretical method of teaching is still used as a major method of teaching; however, we need to blend this method with other ones. One therefore may ask among the method, which one will improve the performance of students in chemistry. This among practical and theoretical method can be more effective in improving the performance of students in chemistry.

C. Purpose of the Study

The main purpose of this study is to find out whether the use of practical method would be more effective than theoretical conventional method. Specifically, the study intends to achieve the following objectives;

- To find out the appropriate method to be used in teaching chemistry so as to enhance quality education.
- To develop the students' interest towards the learning of chemistry

D. Significance of the Problem

The findings from the study will benefit stake holders like chemistry educators, researchers, students, parents, school administrators, curriculum planners and ministry of education in making decisions.

Chemistry teachers who may have over the years been bothered on the teaching methods to be used to enhance students' performance in chemistry will be provided an option which they can try out to see their viability. It helps the researchers identify which of the teaching methods is most effective for further modification and research work.

The research findings will encourage as well as motivates students to be serious in studying chemistry.

In addition, it helps the curriculum planners to reappraise the teaching strategies of chemistry at secondary school level and tertiary institutions.

E. Research Questions

The following research question was answered in the study.

- What is the mean achievement score of students in pre-test for theoretical and practical learning group?
- What is the mean achievement score of students in post-test for practical learning and conventional learning groups?

F. Research Hypothesis

The null hypotheses below were tested at 0.05 level of significance.

- There are no significant differences in the pre and post-test

mean achievement score of students in the practical group.

- The performance means score of students in theoretical group will not differ significantly in the pre and post- test.
- There is no significant difference in the mean achievement score of students in practical and theoretical group.

G. Scope of the Study

This study is delimited to two topics in chemistry only: Qualitative analysis and quantitative analysis.

H. Limitations of the Study

Due to the limited time factor and lack of adequate fund, this research work is limited to one secondary i.e Government Technical College in Kano state.

I. Operational Definition of Terms

Some of the terms used in the study are defined as follows:

- Teaching: This is the act of impacting knowledge as well as instructing someone on how to do something especially in a school.
- Science: This is the intellectual and practical activity encompassing the systematic study of the structure and behaviour of the physical and natural world through observation and experiment.
- Practical (Experiment): This is a scientific procedure undertaken to make a discovery, test, hypothesis, or demonstrate a known fact. It also refers to learning about a scientific test that is carried out mainly in the laboratories in order to study what happens and gain more enlightenment.
- Theoretical method teaching: This is a learning that involves normal and ordinary teaching conventionally without carrying out experiments.
- Chemistry: This is a branch of science concerning the properties and interaction of the substance which matter can be composed. It is also the scientific study of the structure of substances on how they react when combined together

II. LITERATURE REVIEW

A. Factors Influencing Student's Achievements in Chemistry.

Several factors affecting academic achievement of students in chemistry as stated by Julie P. Noble (1994) includes:

- Instructional Materials
- Unavailability of laboratories
- Environmental factors
- Family background
- Gender

➤ *Instructional materials*

Teaching aids employed in teaching chemistry has great effect on the achievement of students. Students tend to perform better when taught using good instructional materials such as textbooks, audio-visual etc.

➤ *Environmental factors*

An environment is the total surrounding of a place where people live. The environment has a great impact on students achievement, students who learn under a conducive environment such as a less populated class, well ventilated class and good sitting arrangements has a tendency of a greater performance than students who study under non conducive environment, well ventilated class rooms and good sitting arrangements.

➤ *Unavailability of laboratories*

The use of good laboratories facilitates teaching and learning but when this is absent but when there is no laboratories the students performed below expectation.

➤ *Family background*

This has to do with the root or origin where a certain person comes from. It was believed that students who come from an educationally sound family, has a motivation and inspiration to work hard which in turn leads to higher achievement, while a child from a family that are less concern about education will have no motivation to work hard towards achieving higher performance.

➤ *Gender*

This is the condition of been either a male or female. From the researches carried out over times, male factors perform higher in chemistry and other science related courses than females and this is proven by the higher number of males students found in science related course (Busch 1995)

B. Empirical Studies on the Use of Practical and Theoretical Teaching Method

The word empirical denotes information acquired by means of observation or experimentation. A central concept in modern science and the scientific method is that all evidence must be empirical or empirically based, that is, dependent on evidence or consequences that are observable by the senses and this can also be achieved by carrying out experiments or conducting practical.

(Dalton 1950).By this, we can say learning will be more attractive if students can be allowed to practicalized their lessons in chemistry.

C. Summary of Literature Review

The term chemistry is referred to as the scientific study of the structure of substance, how they react when combined with one another and how they behave under different conditions. Chemistry has contributed immensely to the world

of human and animals surrounding him. The importance does include:

Manufacture of soap, dye stuffs, medicines, chlorine, production of disinfectants, public and house hold fire extinguishers, pesticides, fertilizers, e.t.c

The achievement of students in chemistry over the years as stated by Busch (1995), Harbor-Peters (1994) reported that female students have significantly lower self efficiency than males with respect to chemistry.

Some of the factors that influence students' achievement in chemistry includes: Instructional Materials which determine the experience of the students, Unavailability of laboratories which may result to students failure, Environmental factors which has to do with the conduciveness of the surrounding, Family background which involves the origin or root where a certain person comes from etc.

Teaching method has played a great role in facilitating chemistry instruction, these includes: Experimentation, Class discussion, Field trips, using of films etc. Under this, the teaching methods play a great role such as facilitating the students' effectiveness and efficiency in class. It also serves to measure to measure the morality of the students.

Observations or experimentation of a particular study is known as empirical study which is a central concept in modern science and that is dependent on evidence or consequences that are observable by the senses. Thomas K. (1969) said in his popular writings that if two scientists will make an observation and experiment on the same event the result obtained at the end may not be the same in respect to the type of method used. Since empirical denotes information acquired by means of observation or experimentation, it denotes that chemistry has to be practicalize by chemistry students in all aspect for the purpose of producing a qualitative student of chemistry

III. RESEARCH METHODOLOGY

This chapter deals with methodology employed in the conduct of the study which included research design, the population of the study, the sample of the study, validation of the instrument, administration of the instrument and method of data analysis.

A. Design of the Study

The study employed quasi experimental research design that is, the pre- test post- test control group design was used. This design was composed on the basis of using intact groups to avoid disruption of normal classes. The choice of this design is well informed in the study in that, the researchers used two groups comprising of experimental and control group.

B. Population of the Study

The population of the study comprises of all S.S 1 students of Government Technical College of Kano state who were sixty in number.

C. Sample of the Study

According to Agomuo (2006), Sample is a group of items, objects or subjects taken from the population for examination.

However, for the purpose of this research and in order to obtain a sufficient representation without any prejudice, respondents were randomly selected out of the population of the students. The sample used was forty students, twenty for the practical group and twenty for theoretical group.

D. Description of the Instruments Used

Teacher made achievement test (TMAT) in chemistry was developed by the researchers to measure students' performance in qualitative and quantitative analysis, both before and after treatment. The TMAT consist of ten objective questions.

E. Validation of the Instruments

The instruments was validated first by an expert in chemistry, then by another expert in measurement and evaluation

F. Administration of the Instruments

When the teacher was satisfied with the quality of the instruments, he then administered it to the group of students for whom it was constructed. After the administration, the response of the students was scored according to their performances.

G. Method of Data Analysis

Data obtained from the study was analysed using two statistical method the mean and the t-test.

➤ Research Questions

The two research questions rose for the study was analysed using mean. The mean was ideal because, it takes into consideration all scores involved in a distribution. The mean is given by the group with the highest score was taken to perform better in chemistry.

➤ Hypotheses

The two hypotheses rose for the study was tested using the t-test.

IV. PRESENTATION AND ANALYSIS OF DATA

This chapter deals with the presentation and analysis of data collected from various respondents through the research instruments used.

➤ Research Question One;

What is the mean achievement score of students in pre-test for practical and theoretical learning group?

The mean achievement scores of students in pre-test for practical and theoretical group is as shown below in table one.

Table 1: Mean achievement Scores of Pre-Test for Practical and Theoretical Groups.

Type of test	Group	N	mean score	S.D	Group mean diff	Remark
Pre-test	theoretical	20	47	27	01	There is homogeneity in the Pre-test
Practical	20	46	24.4			
Total	40					

From the table obtained above, it shows that the pre- test mean for theoretical group is 47 and the pre-test mean for the practical group is 46. Therefore there is no wide variation in the achievements of students between the practical learning group and the theoretical learning group after conducting the pre-test.

➤ Research Questions Two:

What is the mean achievement scores of students in post-test for practical and theoretical learning group?

The mean achievement scores of students in post-test for practical and theoretical learning group is as shown in table 2 below.

Table 2; Mean Achievement Scores of Students in Post-Test for Practical and Theoretical Groups.

Type of test	Group	N	mean score	S.D	Group mean diff	Remark
Post -test	practical	20	55	28.9	19	Performed better than the theoretical group
theoretical	group					
Practical	20	74	24.4			
Total	40					

From the table obtained above, it shows that the post-test mean for the theoretical group is 55, and the post- test mean for the practical group is 74. Therefore this indicates that practical group performed better than the theoretical learning group. This also shows the effectiveness of practical method over theoretical method.

➤ *Hypothesis One:*

There is no significant difference in the pre and post- test mean achievement score of students in the practical group

The -test summary of the mean achievement in the pre and post- test of the practical group is presented in table 3.

Table 3-Test Comparison of the Mean Achievement Scores of Practical Group in pre and Post -Test.

Type of test	N	mean score	S.D	diff	t-cal	t-critical	Decision
Pretest	20	46			24.4		
	38	0.05	3.6288	2.021	Ho is rejected		
Post es	20	74			24.4		
Total	40						

Table 3 shows that our calculated t value of 3.6288 is greater than critical t-value of 2.021 at 0.05 level of significance with a degree of freedom of 38, hence there is significant evidence showing that the hypothesis which states that there is no significant difference in the pre and post- test mean achievement score of students in the practical group is rejected. In conclusion there is a significant difference in the pre and post –test mean achievement score of students in the practical group.

➤ *Hypothesis Two;*

The performance mean scores of students in theoretical group will not differ significantly in pre and post -test.

The performances mean scores of students in theoretical group for the pre and post -test is as shown in table 4 below.

Table 4; The Performance Mean Scores of Students in Theoretical Group for the Pre and Post -Test.

Type of test	N	mean score	S.D	diff	t-cal	t-critical	Decision
Pre test	20	47			27		
	38	0.05	0.9029	2.021	Ho is accepted		
Post test	20	55			28.9		
Total	40						

Table 4 shows that our calculated t-value of 0.9029 is less than critical T-value of 2.021 at 0.05 level of significance with a degree of freedom of 38, hence there is significant evidence showing that the hypothesis which states that the performance mean scores of students in theoretical group will not differ significantly in pre and post -test is accepted. In conclusion, the performance mean scores of students in theoretical group will not differ significantly in pre and post-test.

V. DISCUSSION OF THE FINDING

The study was a comparative study on the effective of experience teaching methods on the performance of finding out which of the two methods is most effective in the teaching and learning of chemistry

The analysis of research question one showed that there was the two groups, that is, they were on the same level before the re introduced. Research question two shows that in the post-test for expert land theoretical learning groups, the practical group performed better. There could be that practical involves active participation of the students

Hypothesis one shows that the students perform better in the post test of practical learning group. The reason behind this is that students perform better after treatment which shows the effectiveness of practical method.

From hypothesis two, there was no significant the performance of students in practical learning group both before and after treatment this shows that theoretical method is not as effective as practical method of teaching

Chemistry teachers are therefore advised to adapt the method for effective teaching and learning and excellent performance of students in chemistry.

VI. SUMMARY, CONCLUSION AND RECOMMENDATION

It deals with the summary of the preceding chapters, conclusion of the work and recommendation based on the findings from the research work.

A. Summary of the Study or Findings

This section focuses on the entire research work, analysis, results and outcome of the whole research work.

The researchers started the first chapter of their work by explaining the motives of the research which is to compare practical method of teaching with theoretical method and determine which is the most effective in the teaching and learning of chemistry and has the potentials to boost students' performance and achievements in chemistry.

The researchers used the quasi experimental research design to enable them achieve the set aims and objectives of the study as well as answer research questions and hypothesis.

The total populations used by the researchers are the S.S.1 students of government college kano which made up a total of forty students grouped into two groups of twenty students each, one group called the practical and the other the control group. The method of sampling used is the random sampling method.

The researchers used the teacher made achievement test as an instrument for data collection. At the end of the treatment period, an achievement test in chemistry was administered to the two groups. Results were recorded; data obtained were analysed using the mean and standard deviation for the research questions and t-test for correlated samples for the three hypotheses.

➤ *Results Showed that;*

- In the pre - test for practical and theoretical groups, there was homogeneity in their performance from the calculated mean and there was little variation.
- In the post test for practical and theoretical groups, the result showed that the practical group performed better than the theoretical group.
- In the pre and post-test of practical group, there was significant difference, showing that students perform better after treatment.
- In the pre and post- test for theoretical group, there mean no significant difference in their performance showing that their scores remain the same even after treatment.

B. Conclusion

In conclusion, based on the data collected from the assessment of the students through teacher made achievement test. It was discovered that the methods used by teachers of chemistry has great effect on the performance of the students. So the chemistry teacher should always be conscious of whatever method of teaching he wants to employ in teaching a particular topic and decide how effective it will be before administering it. He can conduct an assessment either during or after the lesson to know its effectiveness and this can be done by asking the students questions, written test, quiz e.t.c.

C. Recommendations

From the findings based on the research, the following recommendations were drawn;

- The school management should ensure good and available instructional such as the laboratories, chemistry is a practical science subject and a such should be taught with as much instructional material as possible.
- The teachers should ensure proper use of teaching methods such as practical, discussion, project, fieldtrip e.t.c and try to make teaching as much fun as possible.
- The teachers should always evaluate students after each lesson so as to determine more effective teaching methods.

D. Suggestion For Further Research

The suggestions laid by the researcher's areas follow;

- When taking a further research, a mixed school should be used. That is, a school that comprises males and females in order to gauge their experience and understanding towards the learning of chemistry using same topic.
- Since there are a lot of other methods in teaching chemistry such as discussion method, project, fieldtrip, learning by doing e.t.c should be used for correlation until all the methods are tested to find out the ones most appropriate in the teaching of chemistry.
- Regarding to tertiary institutions, the course chemistry should be carried out for research on the methods that are more appropriate for its teaching so as to enhance quality education in the field.

REFERENCES

- [1]. Akinyemi, F.O (2006). A strategy for enriching science teaching in schools. A paper presented at the 41 Annual conference of science teachers Association (STAN).
- [2]. Agomuo, J.O (2006).Sources of science self-efficacy. Journal of research in Science teaching Pp 485-499.
- [3]. Alexander, B & Thomas, K (2004).Stanford encyclopedia of philosophy university of Chicago press (pp 406-412).
- [4]. Ango, M.L (1990).Basic science laboratory. Ehindero Nigeria limited pp 37-40
- [5]. Bajah, S.T (1999).The changes in science and technology in Nigeria beyond the year 2002.African Journal of education vol. 1 No 1 (pp43-44).
- [6]. Bichi, M.T (2004).Measurement and evaluation in education. Dibe so press limited.
- [7]. Buschi, J.P (1995).Gender education and Blackwell encyclopedia of sociology. Blackwell publishing In 1809.
- [8]. David, S. M & George, P. C (2005).Introduction to practice of statistics(5edition): W.H Freeman & company.
- [9]. Denghardt, M. B(2001).Education and value of knowledge. London George Allen and Unasid press pp.1-7.pp12.
- [10]. Harbor Peters(1994).An intervention study to enhance girls interest, self concept and Achievement in science. Journal of research science teaching pp 870-888.
- [11]. Julie, P. N (1994).Academic eligibility, policy and administration guidelines. Journal of applied social psychology pp 55-59.
- [12]. Kuhum, B. W. (1969). Teaching methods and institutions for colleges in career related issues. A longitudinal study. Journal of career development 29th edition.Pp251-263.
- [13]. NPE(2002).Nigeria National Policy on Education
- [14]. Obemeata, J. O (2005), Evaluation in Henry and practical Ibadan: Franco Ola printers.
- [15]. Okafor, M. D (2000), Attitude of some Nigerian science students. A paper presented at the 41t science conference of STAN.
- [16]. Smith, W .M (1991), Effect of instruction in learning motivation, Developmental psychology,42,pp70-83.
- [17]. Sola, A. O & Ojo, O. E (2007). Effects of project, inquiry and lecture demonstration, teaching methods on senior secondary students' achievement in separation of mixtures practical test. Academic journal on educational research and review, 2(6), pp 124-132,
- [18]. Tenzin, J. F (2002), Students attitude to learning. The American heritage the dictionary of 4 edition.
- [19]. Waec, (1994-1999).Results of candidates at the senior school certificate examination (SSCE)May/June in chemistry, Statistical division lagos