

# Effects of Reflective Teaching on Secondary School Students' Academic Achievement in Chemistry in Ondo State, Nigeria

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**ABSTRACT:** The study investigated the effects of reflective teaching on secondary school students' academic achievement in Chemistry in Ondo State, Nigeria. It also examined the effect of Reflective Teaching on gender of chemistry school students. The study employed the quasi-experimental pretest – posttest control group design. The subjects were randomly assigned to two groups (Experimental and control group). The sample consisted of 60 Senior Secondary School 1 Chemistry teachers and all Chemistry Students in Senior Secondary 1 (SS1) that were on ground in each of the school chosen. Two hundred and ten students were assigned to each of the experimental and control groups respectively. The instrument used to collect data was Chemistry Achievement Test (CAT). The reliability coefficient of the instrument was 0.82. The Instrument was administered on the subjects before and after the treatment. The data generated were subjected to t-test analysis, analysis of variance and analysis of covariance to test for the acceptance or rejection of the null hypotheses at 0.05 level of significance. Results of the analyses showed that Reflective teaching strategy produced better achievement in students. Based on the findings, it was recommended that teachers should be trained, conversant with and constantly use reflective teaching strategy in the teaching of Chemistry. Curriculum developers and government should see to the modality of implementing reflective teaching strategy in our various schools.

**Key Words:** Reflective, teaching, Reflective teaching, academic Achievement, secondary school.

## Introduction

In recent times, there has been a growing public anxiety about teaching and learning in Nigerian schools based on deteriorating performance of students' in internal and external examinations especially in science subjects and Chemistry in particular. Due to the observed deterioration in students academic performance, questions are continually being asked by individuals and organizations and various efforts are being made to remedy the situation but unfortunately, it appears as if these efforts have not yielded the much needed result. Besides, the practising teacher seems either to have forgotten or intentionally not paying attention to those things he/she learnt in his/her methodology courses while undergoing training. This has also affected the quality of teaching as well as the learning outcomes of students.

It is also observed by the researcher that students seem to learn very little science at school and the little they seemed to learn tends to be by rote learning. Hence, students find the learning of science to be difficult. This observation is supported by Sam (2011) who regrettably observed that academic excellence has since departed from the land because at the end of every academic year, the nation is grieved by the below average performance of thousands of students in national examinations conducted by the WAEC, NECO and the JAMB.

Saage (2009) & Derek (2007) identified some of the factors affecting the learning of science to include: poor primary school background in science, lack of incentives for test, lack of interest on the part of students, students not interested in hard work, incompetent teachers in the primary school, large classes and fear of the subject.

Science teaching in Nigerian schools has therefore been generally criticized because of the poor performance of students in science subjects when compared to their counterparts in other countries. Owoeye (2012) observed that despite the efforts being made towards ensuring that performances improved, students' academic performance in both internal and external examinations has been a mess. He therefore concluded that not all is well with the system. The researcher in her own observations noted that poor performance of secondary school students in Senior Secondary Certificate examination in science had made it difficult for majority of students to gain admission into higher institutions of learning in recent times.

The National Policy on Education of the Federal Republic of Nigeria (2007) emphasized the need to train Nigeria citizens to be able to manipulate the environment towards the development of the society, understand the world around him, acquire appropriate skill, ability and competence in all areas of human

endeavour so as to equip the individual to live comfortably within his society and contribute to the development of the society. In the light of this, the National Policy on Education (2007) recommended enrolment ratio of 60:40 in favour of science. Experience over the years showed that few students enroll for chemistry and the performance of the very few students who opted for chemistry are very low (Sansawal, 2009; Can, 2012; Otu and Avaa 2011).

Acquisition of appropriate scientific and technological skills is necessary to cope with the challenges presented by the evolving needs of modern work placed in our industries and ever growing non formal sector. Education and training systems that respond adequately to these demands will therefore, contribute to the efforts to overcome the growing unemployment and marginalizing of majority of the populace. Such systems will provide access to appropriate learning experience designed to broaden skills and knowledge that can increase productivity and significantly improve the fortunes of the unemployed, thereby reducing poverty and unemployment amongst the youth.

The contemporary world is driven by science and technology and the two are interrelated. Whereas science probes into the question "Why", technology probes into the "How" aspect. From the onset of the scientific age to date, society has been relying on science to help solve the mesh in technology. Science has become such an indispensable tool that no nation, developed or developing, wishing to progress in the socio-economic sphere, will afford to relegate its learning in her schools to the background. Science and technology therefore has become the hallmark for sustainable development in any national economy.

Research evidences have proved that the contributions of Chemistry to quality of life and nation building are worthwhile in all aspects. Any nation aspiring to be scientifically and technologically developed must have adequate level of Chemistry education (Eke, 2008). The role of Chemistry in the development of the scientific base of a country cannot be over emphasized. Chemistry occupies a pivotal position in science and technology and is needed by everybody and in every aspect of human endeavour (Olayemi, 2009).

Chemistry education occupies a central position to all science disciplines and has been identified to be one of the major bedrock for the transformation of the nation's economy. The role of science in the development of modern technological innovations is far reaching in every sphere of man's life. If Nigeria is to build an organized, self-reliant, and technologically compliant society, much emphasis has to be continually made in science and technology in our school system.

Teaching is the systematic process of imparting desirable knowledge, values and skills to learners (Filani, 2010). A teacher with training is more mature and confident to perform his task more efficiently. The quality of our human capital depends on the quality of our teachers. What students learn is directly related to what, and how teachers teach, and what, and how teachers teach depends on their knowledge, skills and commitments.

The need to improve the quality of science teaching and learning for citizens so that they develop scientific literacy to cope with the demands of science and technology growth has been the yearning of every nation in the 21<sup>st</sup> century. Adediwura and Bada (2007) and Ehindero and Ajibade (2000) supports good methods of teaching that would make the learners develop and have sound education. The methods that are meant to train the child to become a whole being, helping his mind and personality to grow (Osakinle, Onijigbin, & Falana, 2010). It is therefore, imperative to create room for further search for instructional tool that could appeal and arouse learners' interest and at the same time help to achieve the objectives of science education

To achieve the desired educational goals, teachers need to reflect on their teaching from the planning stage to the last process of their teaching in the classroom. This process will, according to Clarke (2003), allow the teachers to clarify their knowledge base, content and their students' learning styles and as well, crystallize the pedagogy to be implemented.

Methodology is very vital in any teaching- learning situation. The method adopted by the teacher may promote or hinder learning. It may sharpen mental activities which are the basis of social power or may discourage initiatives and curiosity, thus making self reliance and survival difficult. (Ameh and Dantani, 2012). Teaching is not just standing in front of a class talking. The best teachers contemplate the manner in which they all present a topic and have a wide variety of instructional strategies at their disposal.

Reflective teaching orientates teachers towards self-focus and self-evaluation. It involves the transformation of professional values and actions of the teachers and that of others who he/she interact with. Reflective teaching means looking at what you do in the classroom, thinking about why you do it and thinking about if it works or not. It is a process of self-observation and self-evaluation in which strength and weaknesses are identified and then adjust to re-plan for better performance. It is a means of professional development which begins in the classroom. It is paying critical attention to the practical values and

theories which inform everyday action by examining practice relatively and reflexively (Bolton, 2010). Reflective teaching is in three phases: planning, teaching and debriefing.

Reflective teaching has to do with deliberate examination of how we teach and learn (Gatumu, 2006). It is more towards critical thinking of how we teach and learn. It is a kind of teaching strategy which has to be viewed in terms of what the teacher can do for himself and his students to ascertain productivity in his teaching and in his students' learning. Hence reflective teaching is a call to let the teacher combine theory and practice to maintain and sustain his teaching profession (Ige and Olayode, 2012).

Reflective teaching is also about a skilled teaching of knowing what to do. In this manner reflective teaching is a professional alternative to action research. It is a personal means of conducting one's own ongoing professional life by solving problems in a systematic manner (Gatumu, 2006). Pollard and Tann (2006) regard reflective teaching as a cyclic process by which teacher interprets his/her classroom practice. Reflective teaching enables teacher to form the known to the unknown by making use of recalled experiences in a critical manner. Reflective teaching is a deliberate move to allow the teacher think critically of his/her teaching, so that his/her students can maximize their learning. Reflective teaching is a mark of a concerned teacher who is skilled enough to examine his/her beliefs, values and assumptions behind the teaching practice (Ige and Olayode, 2012).

Maarof (2007) examined the reflective journal entries of 42 trainee teachers who underwent teaching practicum in schools in Malaysia. The study investigated the types of reflections, strategies, and perceptions of the trainees toward reflective journal/diary writing. The findings of the study indicated that 77% of the trainee stated that the task assisted them in evaluation their teaching methods, strengths, weaknesses, and problems in the teaching.

Ahmed and Al-Khalili (2014) examined the impact of reflective teaching approach on teaching skills of primary science student teachers. Data analysis revealed that the approach was effective on developing the overall teaching skills of elementary education student lesson, planning, introduction, use of new materials classroom management and evaluating their teaching and learning process, furthermore students involved indicated that the approach helps them in identifying strengths and weakness in teaching. They also indicated that it assists them in discovering means of correcting and improving their teaching.

This study also reminds teachers of the strength of experiential learning which is learning through reflection on doing which is often contrasted with rote or didactic learning. Experiential learning focuses on the learning process of an individual student. Learning by doing, if inculcated through the teacher into the student activities in teaching and learning, will give the student meaningful understanding of what they are taught and this will lead to brilliant achievement in Chemistry.

Osborne, Collins and Simon (2003) noted that positive attitudes towards school science appear to peak at or before the age of eleven and decline thereafter by quite significant amount, especially for girls. Furthermore, Barba & Cardina (2001) asserted that girls' interest in science was found to decline as they progress through school, at a much higher rate than that of boys. This correlates with a greater drop in self esteem for girls since boys' externalized difficulties in mathematics and science by seeing the subject as important. There is a wide spread of classroom gender bias and that teachers seem to communicate with boys than with girls. Hudson (2013) reported that male students achieve higher scores in chemistry than the female students.

## Purpose of the Study

The purpose of this study was to investigate the effect of reflective teaching on secondary school students' academic achievement in Chemistry in Ondo State Nigeria. It examined the effect of the processes of reflection before, during and after teaching. It also investigated the effects of gender on reflective teaching.

## Research Hypotheses

The following hypotheses were generated and tested at 0.05 level of significance:

**H<sub>o</sub><sub>1</sub>:** There is no significant difference in the academic achievement mean scores of students in the experimental and control groups before the treatment.

**H<sub>o</sub><sub>2</sub>:** There is no significant difference in the academic achievement mean scores of male and female students in the experimental and control groups before the treatment.

**H<sub>o</sub><sub>3</sub>:** There is no significant difference in the academic achievement mean scores of male and female students in the experimental and control groups after the treatment.

## Research Method

The study is a pre-test, post-test quasi-experimental control group design. The target population of this study consisted of all Senior Secondary Class 1 (SS 1) Chemistry students in all the public senior secondary schools in Ondo state, Nigeria. The population of chemistry teachers presently in the state as of the time of this study is 410. The decision to use SS Class 1 students for the study is based on the assumptions that reflective teaching will fully integrate them into Chemistry class and that SS 1 students are considered knowledgeable enough to be able to read and understand the language of the questionnaire and be more responsive to a new strategy and able to have good interpretation while teaching them through reflective teaching.

The sample for this study comprised 60 Senior Secondary 1 (SS 1) Chemistry Teachers and all chemistry students on ground in one arm of Senior Secondary Class 1 in each of the schools selected as the experimental and control groups respectively. The sample was selected using multistage sampling technique.

The first stage was the selection of 12 Local Governments (four from each of the three senatorial districts) using stratified random sampling. The second stage was the selection of five schools from each of the selected local governments (to give a total of 60 schools). The third stage was to select SSS I Chemistry students, to cater for gender. The use of stratified random sampling technique was used. The participants were randomly assigned to the experimental and control groups respectively.

The instruments used for the study was Chemistry Achievement Test (CAT). The Chemistry Achievement Test constituted the pre-test and post-test instrument for the students. The CAT was drawn by selecting questions relating to the topics that were covered by this study from the past questions of Senior School Certificate Examinations conducted by both West African Examinations Council (WAEC) and National Examinations Council (NECO). The research instrument designed for the study i.e. Chemistry Achievement Test (CAT) was validated by the experts. A field test was carried out which involved thirty (30) Senior Secondary School (SS 1) students offering Chemistry randomly selected. The students were drawn from two local government areas of Ondo State which were not part of the Local Government Areas selected for the study so as to avoid interactive effect of respondents. The mean score and standard deviation were obtained. Reliability was determined using Kuder Richardson-21 and found to be 0.82 and 0.88 at 0.05 level of significance which was considered reliable enough for use.

## Instructional Package for Reflective Teaching

The package consisted of scheme of work and lesson notes on selected topics in Chemistry. The topics in the schools scheme of work prescribed for the period of this study by the Ministry of Education will be used. The package was prepared on weekly basis according to the scheme of work for Senior Secondary School Chemistry. The outline for the lesson have date, period, topic, instructional objectives of the lesson (stated in behavioural terms) entry behaviour, instructional materials and the teachers' activities. Teacher's self -reflective rating package will be given to the selected teachers to be completed by them first and then, the research assistants completed their own to provide a fuller understanding of the achievements of the participating teachers as well as areas they may need to continue working on. This was done weekly so that the teacher will readjust if need be. Audio recording was done at least once in each of the schools in the experimental group. Individual teacher had a diary of his/her written account of his/her lessons which were analysed and discussed by the teacher and the research assistants at least weekly. Steps to reflection as explained in this work were used by the mentor teacher and the teacher in the experimental group as part of the reflective package.

## Experimental Procedure

The research was in stages; the first stage is the training of the research assistant which lasted for one week, the second stage was the administration of pre-test to all the students participating in the study, this lasted for one week. The next stage was the treatment stage and this also lasted for four weeks while the last stage was the administration of post-test. Altogether, seven weeks were used for the study. The researcher personally visited the participant teachers. Each of the teachers was provided with the scheme of work and the lesson plans meant for the study. These lesson plans were studied and discussed with the teachers for proper lesson delivery.

## Data Analysis

The data collected were tested using t-test, Analysis of Variance (ANOVA) and Analysis of Co Variance (ANCOVA) at 0.05 level of significance.

## Results and Discussion

### Hypothesis 1

**Ho<sub>1</sub>:** There is no significant difference in the achievement mean scores of students in the experimental and control groups before the treatment.

**Table 1:** t-test of students achievement mean scores in experimental and control groups before treatment.

Group	N	Mean	Standard Deviation	df	t-cal	t-table
Experimental Control	210	11.67	3.47	418	1.525	1.960
	210	12.07	1.55			

P>0.05

Table 1 shows that the experimental group has 210 students and same with the control group. The experimental group has a mean value score of 11.67 with standard deviation of 3.47 while the control group has a mean score of 12.07 with standard deviation of 1.55. t-calculated (1.525) is less than t-table (1.960) at 0.05 level of significance. The null hypothesis is accepted. This implies that there is no significant difference in the achievement mean scores of students in the experimental and control group before the treatment.

### Hypothesis 2

**Ho<sub>2</sub>:** There is no significant difference in the achievement mean scores of male and female students in the experimental and control group before the treatment.

**Table 2: 2 x 2 ANOVA of students' achievement by gender and treatment.**

Source	SS	df	Ms	F <sub>cal</sub>	F <sub>tab</sub>	P
Corrected Model	21.122	3	7.041	0.972	2.60	.906
Gender	0.002	1	0.002	0.000	3.84	.987
Group	16.290	1	16.290	2.248	3.84	.135
Gender * Group	4.320	1	4.320	0.596	3.84	.135
Error	3013.935	416	7.245			
Corrected Total	3035.935	419				
Total	62226.000	420				

P>0.05

Table 2 shows that F<sub>cal</sub> (0.596) is less than F<sub>tab</sub> (3.84) at 0.05 level of significance. The null hypothesis is accepted. This implies that there is no significant difference in the achievement mean scores of male and female students in the experimental and control groups before the treatment. Similarly the main effect of gender (F = 0.000, P>0.05) and treatment (F = 2.248, P>0.05) on students' achievement before the treatment is not statistically significant at 0.05 level in each case.

### Hypothesis 3

**Ho<sub>3</sub>:** There is no significant difference in the achievement mean scores of male and female students in the experimental and control groups after the treatment.

**Table 3: 2 x 2 ANCOVA Summary of Students' achievement mean scores by gender and treatment.**

Source	SS	df	MS	F <sub>cal</sub>	F <sub>table</sub>	P
Corrected Model	8025.546	4	2006.386	259.264	2.37	.000
Covariate (pretest)	82.442	1	82.442	10.653	3.84	.001
Gender	4.240	1	4.240	0.548	3.84	.460
Group	7996.542	1	7996.542	1033.310	3.84	.000
Gender * Group	0.520	1	0.520	0.067	3.84	.000
Error	3211.588	415	7.739			
Corrected Total	11237.133	419				
Total	115644.000	420				

P>0.05

Table 3 reveals that  $f_{cal}$  (0.067) is less than  $F_{table}$  (3.84) at 0.05 level of significance. The null hypothesis is accepted. This implies that there is no significant difference in the achievement mean scores of male and female students in the experimental and control groups after treatment. Treat had significant effect on students' achievement in Chemistry. ( $F = 1033.310$ ,  $P < 0.05$ ) while the effect of gender on students' achievement in Chemistry is not statistically significant at 0.05 level ( $F = 0.548$ ,  $p > 0.05$ ).

## **Discussion**

Findings from this study revealed that there was virtually little variation in the mean scores of students in the experimental and control groups before the treatment but a significant difference in the achievement mean scores of the experimental and the control groups after the experiment, a glance on the performance of the groups, it was obvious that the experimental group performed better. It was clear that the introduction of reflective teaching strategy which was the treatment enhanced the achievement of the experimental group tremendously. This implies that the reflective teaching strategy was superior to the conventional method of instruction as it produced more effective learning than the conventional method.

Considering the numerous steps involved in reflective teaching compared to the conventional method. The reflective teaching strategy is a seven step instructional action process comprising planning, observation, description, evaluation, analysis, conclusion and final action plan, in addition these process are followed by the debriefing phase where the teacher makes decisions on what to do next if he/she come across such or similar situation he had encountered or observed. A process of self observation and self evaluation of his/her teaching. This will undoubtedly had given the students a good foundation in the subject hence the brilliant performance.

The finding also supported the findings of Derek (2007) who reviewed the seriousness of the deplorable performance of secondary school students in science subjects and identified persisted use of the traditional mode of instruction as one of the major shortcoming affecting the teaching and higher achievement in science subjects. He also concluded that Chemistry as a science subject is bulky in nature hence an attempt to adopt lecture method in teaching is an attempt to rush over the topics within the stipulated time which do not give room for proper understanding of the subject.

Based on these results, it could be inferred that reflective teaching strategy is far effective for the teaching of Chemistry in the secondary schools because a closer look at the result after treatment showed that its more superior to the conventional method. The finding is supported by the submission of Ameh and Dantanai (2012) that the method adopted by the teacher may promote or hinder learning, sharpen mental activities which are the basis of social, power or discourage initiatives and curiosity thus making self-reliance and survival difficult.

The finding is also supported by the submission of Maarof (2007) that efficient and effective teachers who are professionally and academically qualified must be produced to promote Chemistry learning in schools.

The finding of this study corroborate that of Odunusi (1984) in Jegede (2003) who found out that sex of students is not a factor which significantly influences on attitude towards science, he therefore concluded that attitude is developed in the school since it can be argued that majority of students come to school with no particular interest in any subject.

On the other hand, this study negates the findings of some other studies, as some of the studies associate better performance with boys while the others associate it with girls. Hudson (2013) in an experimental study showed that male students achieve higher scores in Chemistry than the female students, whereas Anaso and Anaso (2006) in a similar study indicated that students in boys' schools perform better than those from girls school while Okwo and Otuba (2007) in a similar study noted that female students perform significantly better than their male counterparts. Thus far gender was exposed to the same treatment but treatment had significant effect on students' achievement in chemistry. Research effort to link gender differences and achievement in science remain inconclusive but they have been able to reveal one interesting fact, that gender seems not to be as important in students' achievement as their innate ability. And instead of resolving this controversy, the findings of this present study in respect of gender related differences would appear to be strengthening the controversy. This may not be real but rather can be explained in terms of gender by content – area interaction on science Achievement (Adeyemi, 2002).

## **Conclusion**

The findings of this study revealed that reflective teaching produced a better performance in students than the conventional model of instruction (the lecture method). the findings also supported Gibbs

belief that the reflective cycle encourages the teacher to think systematically about phases of an experience or activity. Gibbs is clear and precise allowing for, description, analysis and evaluation of the experience helping the reflective practitioner to make sense of experiences and examine his/her practice. Gibb's prompts the practitioner to formulate an Action Plan if the situation arises again. The reflective teaching strategy borne out of the fact that different situations, teaching topics, learner's cognitive readiness, concepts being taught, skills intended to be developed in learners demand for different strategies to be used. Therefore a teacher who is not aware of a variety of such strategies can either attempt to neither use them in the first place nor use them adequately. It also encourages students to engage in activities that encourages skill's development and cognitive reasoning.

These findings have implications for the design of instruction in Chemistry. Chemistry teachers should always follow the steps to reflection that is the planning stage, teaching stage and debriefing stage of his/her teaching in addition to the seven Action model. If the teacher is efficient and effective, that is well grounded especially in the areas of reflective teaching before going ahead to teach the desired concept. This will definitely give the students a stronger footing. It is only when students have a meaningful understanding of what they are taught and not just rote learning that they can rightly apply that knowledge to solve real life problems as they come their ways.

## **Recommendations**

Based on the findings of this study, the following recommendations were made:

1. Teachers should use reflective teaching strategy in teaching Chemistry as this will enhance students understanding of the content knowledge. Chemistry teachers should change their approach and method of teaching Chemistry in schools.
2. Workshop/seminars should be organised constantly for secondary school Chemistry teachers to adequately prepare them for their professional roles as teachers and that such skills as planning decision making, team work, collaboration problem solving and help seeking which are critical for survival in the twenty first century work setting.
3. Government should enact a policy that will encourage the use of reflective teaching in our schools
4. School management should give room for time and space for the practice of reflective teaching in our schools and also organised seminars at regular intervals in their schools. They should have objectives and goals favouring reflective teaching in our schools
5. School authority should serve as facilitator who is considered an essential part of the learning setting in which teachers will understand the nature of reflection and its relation to the learning traits.
6. Curriculum experts in pre-service teacher's education should ensure utilization of reflective teaching programmes for the pre service teachers

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