



# Ameliorating Student's Performance and Attitude towards Chemistry through Chemistry Problem-Solving Techniques (CPST)

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## Abstract

This paper determined the effect of Chemistry Problem Solving Technique (CPST) on students' performance and attitude towards chemistry. The study was an experimental design that was also aimed at illuminating the claim by several authors that the methods of instructions could change students' attitude positively towards chemistry. 100 male and female senior secondary two students were randomly assigned into experiment and control groups and taught electrolysis. The control group received instruction via the traditional lecture method while the experimental group received theirs through the CPST. Two instruments, a 4-item electrolysis problem solving test (EPST) and a 23-item attitude towards chemistry problems-solving technique inventing (ATCPSI) were developed and administered to both groups after the period of instruction. Data collected were analyzed using the t-test for equality of means. The study established the usefulness of chemistry problem solving technique in motivating students towards chemistry. It also established the relative efficacy of CPST over the traditional lecture method in students' problem solving in chemistry thereby confirming the fact that acceptable methods of instructions are capable of changing students' performance and attitude towards chemistry. The study recommended that chemistry teachers be encouraged through workshops and seminars, to embrace chemistry problem solving techniques as a strategy for teaching and learning of chemistry.

**Keywords:** Students, Performance, Attitude, Chemistry, Problem-Solving, Techniques.

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## INTRODUCTION

Several studies (Eboka & Obiajulu, 2014; Agommuoh & Maryam, 2014) have acknowledged science and technology as the bedrock of national development but which cannot survive without chemistry. According to Gongden (2015), development in technology goes hand in hand with advancement in science such that any nation that lags behind in science will lag behind in technological development. Chemistry is seen as the foundation upon which science is built and hence technology. Most developed countries are at par with Nigeria because they recognized the relevance of chemistry in their national economy. Based on this, Arokoyu & Ugonwa (2012) pointed out that chemistry is one of the fundamental ingredients of technology. Chemistry education takes a central position in science and technology.

Chemistry is the study of the composition, properties, uses and structure of matter. It is the science of matter and the changes it undergoes, and attempts explaining chemical phenomenon of everyday life (Kolomuc & Tekin, 2011). Aniodoh and Eze, (2014) described it as a branch of science which enables learners to understand what happens around them, it affords its recipients the opportunity to explore their immediate environment. Chemistry education has a crucial role to play in helping to find answers to various human and socio-economic problems as well as making the society more scientifically literate. The objective of chemistry education in schools extends to the fundamental concepts of chemistry that students need to learn and understand and the chemical processes behind phenomena in life (Kolomuc & Tekin, 2011; Ifeyinwa & Nweze, 2014).

Research evidences have proved that chemistry's contribution to quality of life and nation building are worthwhile in all aspects. According to Oak (2011), the knowledge of chemistry is brought to play in the manufacture of products that improves man's luxury such as herbicides, insecticides, plastic products, foams, drugs, clothing materials etc. A lot of activities centered on the study of chemistry and they include the management of natural resources, manufacturing, processing and storage of food and health facilities and a favorable living environment draw their basis from chemistry. In the view of Ababio (2014), chemical technologies enrich our quality of life in numerous ways by providing new solutions to problems in health, materials and energy usage. Chemistry education is a necessary ingredient for becoming self-reliant, earning a living and contributing towards building a sustainable economy. This explains why chemistry is a compulsory science subject at the secondary school level in Nigeria.

Unfortunately, the performance of chemistry students in the Senior Secondary Certificate Examinations (SSCE) has been poor despite the several studies and their recommendations.

Table 1: Performance of Chemistry Students in the West African Senior School Certificate Examination (WASSCE).

S/No	Year	% of Candidates with Grades 1 – 6
1	1997	25.30
2	2001	36.25
3	2002	34.42
4	2003	50.98
5	2005	50.91
6	2006	44.90
7	2007	45.96
8	2008	44.44

9	2009	43.70
10	2010	50.70
11	2011	49.54
12	2012	43.13

Source: The West African Examination Council (2012)

Danjuma (2005) and Gongden (2015) observed that various reasons have been given for students' dismal performance in chemistry. They include the abstract nature of the concepts, misconceptions by teachers and students and students' inability to solve chemistry problems. Another important factor is the student's attitude. Students' attitude toward chemistry is essential and crucial in discussing factors in chemistry achievement. Attitude and academic achievement are important outcomes of science education in secondary schools (Najdi, 2013). Student's attitude and interest could play substantial role in students' decision to study science (Abulude, 2009). Hofstein and Naaman (2011) lamented that recent publications presented a gloomy picture regarding students' ignorance in chemistry and decline in enrollment in science – based careers. Mukherjee (2002) explained attitude as someone's feelings, thoughts and predispositions to behave in some particular manner towards some aspects of his environment. Attitude regarding students' learning has to do with the feelings or opinions that they have towards the subject as an organized body of knowledge. This can be positive or negative depending on their perception of problem-solving in chemistry. Several studies (e.g., Yunus & Ali, 2012; Najdi, 2013) showed that most chemistry students have negative attitude towards chemistry hence low attitude towards problems-solving in chemistry. They lack interest in the subject and syllabus and do not grasp the concept of chemistry. The inadequate teachers' approach to the materials and poor non-formal instructional materials were also identified as reasons for the negative attitude of students towards chemistry. They suggested the development of positive attitudes in students towards chemistry problem-solving through suitable instructional methods. Berkeley (2015) noted that good teaching occurs when students learn. Therefore there is need for teachers to ensure that whatever method of instruction they adopt in classroom promotes learning among students'. It is envisaged that the use of problem-solving method of instruction in teaching chemistry will help students to acquire desirable scientific attitude as well as improve their attitude and achievement chemistry generally. It was the purpose of this study to investigate the influence of chemistry problems-solving techniques (CPST) on students' attitudes and performance in chemistry.

### **Research Hypotheses**

Two null hypotheses were tested:

1. There is no significant difference between the mean scores of students' exposed to CPST in the experimental group and those in the control.
2. There is no significant difference between the attitudes of chemistry students who were exposed to CPST in the experimental group and those in the control

### **MATERIALS AND METHOD**

The study was an experimental study designed to establish the relationship between two or more variables: the CPST and students' attitude and performance in chemistry. The sample consisted

of 100 senior secondary school students. The students were randomly assigned to control and experimental groups with each group having fifty students. The experimental class was taught electrolysis using the CPST. Specifically, the chemistry problem solving technique put forward by the Rapid Learning Centre (2010) was used. The strategy consisted of: identification of what is given, clarification of what is being asked, and selection of a strategy, solving using elected strategy and reviewing the answer arrived at. The control group was also taught the same concept of electrolysis but using the traditional lecture method. Topics covered for the four hours in the week include; factors affecting the selective discharge of ions, the electrochemical series of element, the laws of electrolysis and calculation in electrolysis and uses of electrolysis. All the students were taught by the same teacher. Both groups were administered a post-test after the period of instruction. The test included a 4-item electrolysis problem solving test (EPST) and a 23-item attitude towards chemistry problems – solving technique inventing (ATCPSI). Results were analyzed using the t-test

## RESULTS

Data obtained from the students were analyzed using the t-test but applying the z-test approximation. The results are shown in tables 2 and 3 below.

Table 2: T-Test Analysis of the Post-Test Scores of Students in Problem Solving of Experimental and Control Groups

Group	N	Mean	SD	df	t-cal	t-crit
Expt	50	67.78	9.85	45	3.48	0.001
Control	50	62.04	8.13			

The results of table 2 showed that the mean score of the experimental group (67.78) was higher than that of the control (62.04), indicating that the performance of the experimental group in problem – solving was more positive than those of the control group after treatment.

Hypotheses one: there is no significant difference between students’ performance after exposing them to CPST.

From the results, the t – calculated (3.48) was greater than t – critical (0.001) at 45 degree of freedom and 0.05 level of significance. Therefore, the null hypothesis was rejected. Therefore there was a significant difference between the mean scores of students’ exposed to CPST in the experimental group and those in the control. It could be deduced from the findings that CPST was more interesting to the students. This was reflected in their performance after treatment.

Table 3: T-Test Analysis of Students’ Perception and Attitude of the CPST Value in Studying Chemistry

Group	N	Mean	SD	df	t-cal	t-crit
Expt	50	2.52	76	49	3.48	0.001
Control	50	2.18	77			

From table 3, the experimental group had a mean score of 2.52 while that of the control group was 2.18. This shows that the experimental group students had better perception and attitude towards the use of CPST in studying chemistry.

**Hypothesis two:** There is no significant difference between the attitudes of chemistry students who were exposed to CPST in the experimental group and those in the control.

From table 3,  $t$  – cal (3.48) was observed to be higher than  $t$  – critical (0.001) at significance level of 0.05. The null hypothesis was therefore rejected because it has no sufficient ground to be retained. Therefore there was a significant difference between the attitudes of chemistry students who were exposed to CPST in the experimental group and those in the control.

## DISCUSSION OF RESULTS

The study found out that the CPST enhanced chemistry students' performance in chemistry. There was a significance difference in the mean score in favour of those taught using the CPST. This result agreed with those of Danjuma (2005) and Gongden (2015) who found out that chemistry problem solving is key to successful learning of chemistry. It also agreed with Armagan, Sagir and Celik, (2009) who stated that the first thing that is necessary for problem solving, whether personal, scientific or an organizational problem is the knowledge of the problem solving process.

The research also showed that the students taught electrolysis using the CPST were motivated than those in the control. The same students in the experimental group performed better than those in the control. This means that when students are motivated to have positive attitude towards chemistry, they will performed better in chemistry examinations. This result agreed with those of Kan and Akbas (2006), Bassey, Umoren and Udida (2008) and Oluwatelure and Oloruntegbe (2010). These all who found out that there is a significant relationship between students' attitude towards chemistry and their performance

## CONCLUSION

The eminent purpose of the CPST is to make students to be actively involved in the teaching–learning process through problem – solving and to enhance their thinking ability and improved their skills rather than being passive recipients of knowledge. The study showed that the CPST can be used to motivate students and help them develop more positive attitude towards chemistry. It also established the fact that positive attitude towards a subject enabled better performance in the subject.

Chemistry teachers should embrace chemistry problem solving technique as one of the strategies to teach their students. It is necessary to organize workshops and seminars for practicing chemistry teachers to intimate them on the importance of CPST for teaching and learning of chemistry.

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