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Improving Students' Performance and Attitude towards Chemistry through Problem-Based-Solving Techniques (PBST)

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Abstract

This study aimed at investigating the influence of PBST on students' performance and attitude towards Chemistry was designed to further clarify the claim by several authors that methods of instruction could change students positively towards Chemistry. The subjects of this study was 98 senior secondary school two (aged 14-16 years) students enrolled to gas laws course in all the public schools in Obio/Akpor Local Government Area of Rivers State. Two different classes assigned experimental and control groups were used. Therefore, the effect of PBST on students' performance and attitude toward chemistry was investigated. The findings of this study had further established the fact that acceptable methods of instruction are capable of changing students' performance and attitude towards chemistry and recommendations were made based on the results obtained.

Keywords: PBST, Performance, Attitude, Chemistry and Students

Introduction

Science and technology have become the hallmark for sustainable development in any national economy, but cannot strive ahead without chemistry. The developed countries forged ahead by recognizing the relevance of chemistry in their national economy. Research evidences have proved that chemistry's contribution to quality of life and nation building are worthwhile in all aspects. It was based on this that the Federal Government through her national policy on education made chemistry a compulsory science subject at the secondary school level (NPE, 1984, 2004). There have been researchers such as Eke (2008), accepting that any nation aspiring to be scientifically and technologically developed must have adequate level of chemistry education. These lead chemists in 2008 to declare "what on earth is not chemistry". However, there have not been remarkable improvements in the interest of students toward chemistry,

mostly in problem solving. This is evidenced in the level of students' performance in both internal and external (WAEC; Table 1) examinations and even in showing the level of understanding basic concepts in chemistry.

Year	No. of candidates	% in Gr 1-6	Year	No. of candidates	% in Gr 1-6
1993	170,537	23.0	2001	301,740	36.25
1994	161,232	23.0	2002	262,824	34.42
1995	144,990	33.5	2003	282,120	50.98
1996	144,990	33.5	2006	389,462	44.90
1997	138,572	25.3	2007	432,230	45.96
			2008	428,513	44.44

Source: Research Unit, WAEC Board.

Students' performance in chemistry depends on many factors and stands out to show how well a student is doing. Festus (2007), contend that performance appears generally to be the fundamental goal behind every life struggle, but the positive platform has consequential effects of improving the worth of the student and can only be achieved through acquisition of positive learning attitudes. The attitudes of a student trigger his behavior. Attitudes are antecedents which serve as inputs or stimuli that trigger actions.

Attitudes can distort the perception of information and affect the degree of their retention. Slee (1964) affirmed by saying that students' attitudes and interest could play substantial role among pupils studying science. However, Rosemund (2006), opined that attitude implies a favorable or disfavoured evaluative reactions towards something, events, programmes, etc exhibited in an individual's beliefs, feelings, emotions or intended behaviors. Wilson (1983); Soyibo (1985), in their studies reported that students' positive attitudes to science correlate highly with their science achievement. Abimbade (1983) maintained that students exposed to programmed instruction recorded higher and more favorable attitude toward mathematics. Similar reports were recorded by Anyelaagbe (1998); Udousoro (2000); Popoola (2002), that students show more positive attitudes after been exposed to self learning strategy, such as computer and text assisted programmed instruction, self learning device and self instructed problem based.

In order to solve chemistry problems in an acceptable manner, the problem solver must have both conceptual scientific and procedural knowledge (Gabel, 1994; Ekpete, 2002). However, many studies showed that students frequently do not use conceptual understanding in solving chemistry problems. These studies also provided evidence that students were limited in their ability to solve distant transfer problems without an in-depth understanding of relevant chemistry concepts. Nakhleh (1993) opined that chemical educators and teachers have often assumed that success in solving chemistry problems should indicate mastery of the chemistry concepts. According to Greenwald (2000), the best way for students to learn science is to experience challenging problems and the thoughts and actions associated with solving them. Ram (1999); Wilkinson and Maxwell (1991) affirmed that problem solving using ill-structured

problems motivates students and encourages understanding the epistemology of the discipline.

Nwamuo (1986) indicated that students as humans respond to whatever situation exposed to base on the situation's influence on their attitude. Attitude, therefore affects people in everything they do and in fact reflects what they are, hence a determining factor of students' behaviour (Aiken, 2000). A number of factors have been identified to affect students' attitudes to science like attitude of teachers (Ale, 1989), content difficulties (Adebayo, 1999), parental influence, gender, career interests, and social implications of science and achievements (Hallayna and Shanghnessy, 1982), instructional techniques (Obioma and Ohuche, 1986), quantity and quality of teachers (Sule, 1991; Eremie and Ekpete, 2008) etc. The extents to which students' attitudinal interest change toward chemistry are yet to be empirically investigated. On this lies the overall inspiration of this present study as part of continuation on our study on improving students' attitude toward chemistry education.

Statement of the Study

Kempa and Dupe (1974), pointed out that students' attitude becomes more positive after been exposed to science problem-based instruction. Adesoji (2008) maintained that problem solving strategy is a basic means of changing students' attitude towards science. Recent reports on students' performance in chemistry have shown that they still possess low attitudes towards problem-solving in chemistry. It is the purpose of this study to investigate the influence of problem-based- solving techniques (PBST) on students' attitudes and performance in chemistry.

Research Hypotheses

Two null hypotheses were tested:

1. There is no significant difference between students' performance after exposing them to PBST in chemistry.
2. There is no significant difference between the attitude of chemistry students when exposed to PBST and when not exposed.

Methodology

The study adopted correlational and survey research designs as it establishes relationship between two or more variables. This present study establishes relationship between "PBST and students' attitude and performance in chemistry" This study was conducted in Obio/Akpor Local Government Area of Rivers State.

The population of the study was 98 senior secondary school two (aged 14-16 years) students enrolled to gas laws course in all the public schools in the selected area. Two different classes were used, one assigned experimental group (Eg: n=50), while the other control group (Cg: n=48). Students in the Eg were taught with PBST while the Cg received traditional instruction. Topics covered for the six (6) hours teaching in a week include Boyle's, Charles's, and partial pressure and ideal gas laws. All the students were taught by the same teacher.

Instrument

The instrument for data collection is a researcher-developed 12 test items. The two groups were exposed to the same test instrument divided into two parts, section one consists of demographic data and class type of students while the other with twelve items. The data were analyzed using qualitative and quantitative methods.

Validity and Reliability of Instrument

The instrument was face-validated by three chemistry lecturers from Rivers State University of Education, Port-Harcourt. The instrument was also tested using the equivalent forms method.

Results and Discussion of Findings

To test the stated hypotheses, the students were subjected to a pre-test before treatment and the data obtained showed that there was no difference in the performance and attitude of the groups (Eg and Cg) towards problem-solving in chemistry. However, the scores of the groups' performance and attitude after the post-test were subjected to analysis using t-test (but applying the z-test approximation since $^1x_1 \neq ^1x_2$ are not the same). The results are shown in Table 2 and 3 below.

Hypothesis one: There is no significant difference between students' performance after exposing them to PBST in chemistry

Table 2: t-test analysis of the scores of students in problem solving of Eg and Cg after treatment

Group	X	1x	S.D	Df	t-cal	t-critical
Eg	50	56.2	9.6	96	7.19	1.960
Cg	48	51.9	7.95			

The results of table 2 showed that the calculated mean score of Eg (56.2) was higher than that of the cg (51.9), indicating that the performance of the former in problem solving was more positive than those of the later after treatment. It was also observed that t-calculated (7.19) was greater than t-critical (1.960) at 96 degree of freedom and 0.05 level of significance. Therefore, the null hypothesis was rejected. However, it could be deduced from the findings that the PBST was more interesting to the students. This was reflected in their performance after treatment. Senocak et al (2007) carried out seminar study and found out that there was a statistically significant difference between the problem based learning and conventional groups in terms of their attitude towards chemistry, skills development and conceptual understanding.

Hypothesis one: There is no significant difference between the attitudes of chemistry students when exposed to PBST and when not exposed.

Table 3: t-test analysis of students' perception and attitude of the PBST value in studying chemistry

Group	X	1x	S.D	Df	t-cal	t-critical
Eg	50	56	8.83	96	28.6	1.96
Cg	48	38.9	9.87			

From Table 3, the Eg (56) students had higher calculated mean score than the Cg (38.9) students. This shows that the Eg students had better perception and attitude toward the use of PBST in studying chemistry. It was also confirmed t-cal (28.9) was observed to be higher than t-critical (1.96) at significance level of 0.05. The null hypothesis was therefore rejected.

Conclusion and Recommendation

The prominent aim of the PBST is to make students active, free and self-learning individuals through problem solving and to enhance their thinking skills rather than being passive recipients of the knowledge (Boud and Feletti, 1997) as to perform better towards the learning of chemistry. The findings of this study had further established the fact that acceptable methods of instruction are capable of changing students' performance and attitude towards chemistry. The Eg developed more positive performance and attitude after treatment. Based on the findings of the study, the following recommendations could be made;

1. Chemistry teachers should embrace PBST in their various secondary schools, if we really want to solve the problem of students withdrawing from the study of chemistry and performing poorly in internal and external examinations.
2. PBST is capable of developing students' communicative and collaborative working skills and their skills on accessing information and utilizing it. So should be adopted as one of the basic methods of teaching chemistry in secondary schools.
3. That PBST should be also be adopted in laboratory teaching, since it involves a range of activities and analysis of events and making of experiments to test such events.
4. It is necessary workshops and seminars are organized for practicing chemistry teachers to intimate them on the importance of PBST for teaching and learning of chemistry.

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