

## Managing Students' Attitude towards Science through Problem – Solving Instructional Strategy

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**Abstract** The study was designed to further clarify the claim by several authors that methods of instruction could change students' attitude positively towards science. It was the belief of the author that if students were allowed to develop higher cognitive processes through problem solving strategies, either as teacher directed or self-directed, their attitudes toward chemistry might change positively. Therefore, the effect of teacher-directed and self-directed problem-solving strategies on students' attitude toward chemistry was investigated. The four-stage (logical) model of solving Chemistry problems as suggested by Ashmore, Casey and Frazer (1979) was adopted for the study. The findings in this study showed that students in the experimental group developed more positive attitude towards Chemistry after the treatment. It was then recommended that teachers should adopt problem solving strategies in their teaching in order to win many more students to chemistry. Besides giving students the content, the process is equally important for them to comprehend some scientific concepts and principles. This could make them develop more positive attitude toward the learning of science.

### INTRODUCTION

Many factors could contribute to student's attitude towards studying science. Slee (1964) indicated that students' attitude and interests could play substantial role among pupils studying science. Several studies (including Simpson, 1978, Wilson, 1983, Soyibo, 1985) report that students' positive attitudes to science correlate highly with their science achievement. Again, Balogun (1975) reported that, in general, the attitudes of Nigerian students towards the basic sciences tend to decrease in the order, Biology, Chemistry, Physics and Mathematics. Defiana (1995) found that using integrated science environment activities improved high school students' attitudes toward and awareness about the environment. Armstrong and Impara (1991) in their studies determined that fifth and seventh-grade students using nature score as a curriculum supplement developed more positive attitudes than those who did not.

Abimbade (1983) reported that students exposed to a programmed instruction recorded higher and more favourable attitude toward mathematics. Aiyelaagbe (1998) also reported a more positive attitude of students after exposing them to self learning strategy. Similar results were obtained by Udousoro (2000) after using computer and text assisted programmed instruction and Popoola (2002) after exposing students to a self learning device.

Halladyna and Shanghnessy (1982) have concluded that a number of factors have been identified as related to students' attitude to science. Such factors include; teaching methods, teacher's attitude, influence of parents, gender, age, cognitive styles of pupils, career interest, societal view of science and scientists, social implications of science and achievement. Studies have revealed the influence of methods of instruction on students' attitude towards science. Kempa and Dube (1974) worked on the influence of science instruction; the result was that attitude becomes more positive after instruction. Long (1981) also concluded that diagnostic-prescriptive treatment promotes positive attitude. Hough and Piper (1982) also said that groups that scored significantly high in science achievement test also scored significantly high in attitude test.

Atwood (1978) in a study of the relationship between interest and achievement found that science interest was significant at 0.05 level as predictors of science progress scores. Wasik (1978) also supported the view of predictability of achievement from the knowledge of attitude.

The studies thus reviewed suggest that there is a relationship between attitude and methods of instruction and also between attitude and achievement; and that it is possible to predict achievement from attitude scores. What is needed to complement the results of such studies however is the nature of relationship between students' attitudes and problem-solving techniques.

Results of this type of study are likely to broaden our knowledge as to how we can influence students' attitude positively towards problem-solving in science.

**Statement of the Problem:** The purpose of this study was to investigate whether the attitude towards chemistry would change when students are exposed to both problem-solving techniques (as teacher directed and self-directed).

**Hypothesis:** There is no significant difference in the attitude of students towards chemistry after exposing them to teacher-directed and self-directed problem solving techniques.

## METHOD

**Subjects:** Three hundred and sixty (360) Senior Secondary School class two chemistry students were randomly selected from twelve schools in Osun State of Nigeria. Thirty students were randomly picked from each of the twelve schools and each of the three groups—teacher directed and self-directed problem solving techniques (experimental groups) and a control group was allotted a total sample of one hundred and twenty (120). Allocation of schools to the experimental and control groups also followed a random process. The experimental groups were exposed to problem-solving techniques, one was teacher directed while the other was self directed. The control group was exposed to lecture method.

**Treatments and Instrument:** Two treatments and one instrument were developed for the use in the study. The treatments (stimulus instruments) were:

- (a) Problem-solving Technique Procedure (PSTP) based on electrolysis; and
- (b) The self-learning material called, programmed text for Chemistry (SLT) (a problem solving package based on electrolysis).

**The Instrument:** An attitude measuring scale, used for pre- and post- attitude measure.

The PSTP was in line with the four stages (logical) model of solving chemistry problems (Ashmore et al., 1979). The SLT was based on the content of the Problem-Solving Technique Procedure but now programmed in branching form. The researcher developed both the PSTP and the SLT. The key-relations chart was included as a guide to solving the problems (Kramers-Pal et al., 1982).

The attitude measuring scale was a twenty-item Likert-type of four options. They were constructed and validated by the researcher and

three experts in test construction. The options of the attitude scale were Strongly Agree, (SA), Agree, (A), Disagree (D) and Strongly Disagree (SD).

**Validity and Reliability:** A committee of three experts moderated the frames of the SLT. The content of the "problem-solving Technique Procedure" (PSTP) was checked and validated by five chemistry education lecturers who certified the procedure to be adequate for teaching steps and strategies of problem solving as given by Ashmore *et al.* (1979). Experts in Science education helped to vet the 20-item attitude scale. They also helped to identify the positive and negative statements. The reliability determination of the instrument was carried out using Cronbach alpha method with the scores obtained from the responses of sixty students. The value was found to be 0.78. The questionnaire contained personal data, such as name, sex, age, and parent/guardian's occupation.

**Procedure:** The three groups had lectures on the selected topic for three weeks after the completion of the attitude scale. PST group was taught Problem-Solving Technique Procedure for another three weeks by the researcher before they were made to complete the attitude scale. Programmed texts, based on the systematic approach to problem solving were distributed to students in the SLT group each time they had chemistry for independent study. They also completed the attitude scale after treatment. The LM group received lectures on the selected topic for three weeks without any trace of problem solving. They were also made to complete the attitude scale thereafter.

## RESULTS AND DISCUSSION

To test the earlier stated hypothesis, the scores of the Experimental groups (PST and SLT) and control group (LM) in the attitude scale before treatment were subjected to Analysis of Variance (ANOVA) in order to know whether they had a different attitude towards solving problems in electrolysis. The result is shown in Table 1.

The result showed that there was no significant difference in the attitude of the three groups towards solving problems on electrolysis before the treatment. Thus, the scores of the groups in the attitude scale after post-test were subjected to Analysis of Variance. The result is shown in Table 2.

The result showed that there was significant difference in the attitude of the Experimental groups (PST and SLT) and Control group (LM) after treatment. In order to know which group had more positive attitude, the mean scores of the three groups were contrasted using Schéffe test. The result is shown in Table 3.

The results in the table showed that the attitude of the PST group towards chemistry was more positive than for those of the SLT and LM groups after treatment. Therefore, the stated hypothesis was rejected. However, there was no significant difference in the attitude of SLT and LM groups towards chemistry after treatment.

What could be deduced from the above findings was that the problem-solving technique was more interesting to the students. This was reflected in their attitude after the treatment. Although the SLT group received problem-solving technique through individualized instructional package, their attitude towards Chemistry did not differ from those exposed to ordinary lecture method after treatment. This might be due to the fact that students do not like independent work. They are used to being spoon-fed by the teachers; this is done by giving lectures at the end of which notes are given.

## CONCLUSION AND RECOMMENDATION

The findings of this study had further established the fact that acceptable methods of instruction are capable of changing students' attitude towards science. The PST group developed more positive attitude after treatment. This attitude was also significantly higher than for those of SLT and LM groups. If problem-solving instructional strategy could draw many students to offering science in Nigeria, it would be necessary for science teachers to adopt this method so as to solve the problem of many students withdrawing from science at the secondary school level. If many of our students could be drawn towards science through appropriate instructional strategies, the anticipated 60:40 science students to Liberal Arts students in Nigerian Universities would be a reality. In this case, teacher educators should embrace problem-solving techniques in their various institutions if we want the method to get to the secondary schools. It would also be necessary to organize workshops and seminars for practicing teachers whereby the importance and appropriateness of the problem-solving technique for science teaching and learning, could be stretched.

**Table 1: One-Way Analysis of Variance (ANOVA) of the scores in attitude scale of experimental and control groups before treatment.**

| Source of Variation | Df  | SS        | MS       | F       |
|---------------------|-----|-----------|----------|---------|
| Between Groups      | 2   | 1.0766900 | 0.535187 | 0.0028* |
| Within groups       | 357 | 1.17      |          |         |
| Total               | 359 | 66901.17  |          |         |

\* P>0.05

\*Not significant at 0.05 alpha level.

**Table 2: One-Way Analysis of Variance (ANOVA) of the scores in attitude scale of experimental and control groups after treatment.**

| Source of Variation | Df  | SS          | MS        | F      |
|---------------------|-----|-------------|-----------|--------|
| Between Groups      | 2   | 3760.449067 | 1880.2137 | 13.68* |
| Within groups       | 357 | 52827.5     |           |        |
| Total               | 359 |             |           |        |

\* P<0.05

\*Significant at 0.05 alpha level.

**Table 3: Schéffe's pairwise comparison of the mean scores of experimental and control groups in the attitude scale**

| (I) Treatment | Mean | (J) Treatment | Mean | N   | Mean Difference (I-J) | Sig.  |
|---------------|------|---------------|------|-----|-----------------------|-------|
| PST           | 12.3 | SLT           | 6.8  | 120 | 5.45*                 | 0.02* |
| PST           | 12.3 | LM            | 5.1  | 120 | 7.15*                 | 0.00* |
| SLT           | 6.8  | LM            | 5.1  | 120 | 1.69                  | 0.53  |

\*The mean difference is significant at p < 0.05

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