

Effect of Active Learning Approach in Teaching Basic Chemistry

Vivian L. Moya

Samar State University, Catbalogan City, Philippines

vivimoya@gmail.com

Abstract

The study aimed to determine the effect of active learning approach in teaching Chemistry in Samar State University. This study employed two research designs. The descriptive-developmental design was used during the development stage using the Interest Inventory as its instrument. It aimed at determining what topics in Chemistry 101 can be developed as materials for active learning approach. The result of the Interest Inventory became the basis of the development of the materials. In the validation stage, the experimental method of research was employed in this study using randomized pretest and post-test design. The study consisted 60 students as respondents that were divided into controlled and experimental group. Thirty students comprised the controlled group who were subjected to the traditional lecture-discussion method. The other thirty students were taught in an active learning approach of instruction. The result of the study revealed that active learning approach is effective in teaching Chemistry. Hence, teachers should make use of active learning strategies in teaching college Chemistry. Training of teachers in the effective use of active learning materials should also be conducted. Similar studies could be done by conducting experimental validation in other college Chemistry topics.

Keywords: active learning approach, science teaching, teaching chemistry

I. INTRODUCTION

This study aimed to establish the effect of active learning approach in teaching Chemistry 101 in Samar State University. The mark of a Chemistry teacher who has grown in teaching is his /her ability to organize and develop instructional materials suited to the students' level of readiness, capabilities and understanding. The teaching-learning process has been the concern of chemistry educators. The problem of how to make teaching more effective and for optimum learning to take place has beset the educational system as a whole.

Ogena pointed out that "the general observation that students attend chemistry class simply to fulfill a requirement is probably not confined in the Philippines. Fewer students appreciate the thinking and rigor that goes with the subject. In the Philippine educational system one of the most disturbing problems is the poor achievement of Filipino students in the areas of science and technology" (Ogena, 1998). One, in a study entitled "Trends in International Mathematics and Science Study reported in 2003, Filipino students performed dismally in Math and Science

international tests ranking 41st and 42nd respectively, among 45 participating countries. Two, in a diagnostic test given by the Department of Education showed that only thirty percent of Grade 6 students have mastered their expected competencies in English, Math and Science subjects. The results further revealed that our students could correctly answer only half of the questions in the National Elementary Achievement Test (NEAT) and National Secondary Achievement Test (NSAT). The lowest scores were recorded in Science and Math indicating that these are the most difficult subjects for the students (PCER, 2000). Hence, educators agreed that one of the major causes of this problem has to do with the method of facilitating the learning of mathematics and science concepts and processes inside the classroom. Somehow, the current methods do not fully develop skills of both students and teachers.

Many studies show that learning is enhanced when students become actively involved in the learning process. Instructional strategies that engage students in the learning process stimulate critical thinking and a greater awareness of other perspectives. Thus, Blair commented that the best way to think of active learning in the classroom is to focus on learning processes rather than on learning products. Active learning redefines classroom practice from a static view of learning in which knowledge is poured into the passive empty minds of student learners to a more dynamic view where, through project-based, collaborative, and problem-based activities, students play a more vital role in creating new knowledge (Blair, 2011). Chickering and Gamson (1987) opined that active learning approach involves modular instruction where students themselves are the main focus of the attention while the role of the teacher is to guide and facilitate in the learning

process. This approach encourages the students to be “active learners”. Hence, active learning students must read, write and be engaged in solving problems. Most important, to be actively involved, students must engaged in such higher order thinking tasks as analysis, synthesis and evaluation.

Active learning refers to techniques where students do more than simply listen to a lecture. Students are doing something including discovering, processing, and applying information. It is involving students directly and actively to the learning process itself. This means that instead of simply receiving information verbally and visually, students are receiving and participating and doing (Mayers, 1993). Thus, students should be involved in more than listening. In active learning, less emphasis is placed on transmitting information and more on developing student’s skills and engaging them in activities such as reading, discussing, and writing.

In active learning, the principle of self-activity is emphasized wherein it does not demand of activity alone but all-sided activity of the whole self. Hence, this approach in teaching requires the learners to participate in planning, executing and evaluating tasks. If learning is to be effective, there should be an active participation of the students in the learning process.

The objective of the study is to determine the effectiveness of active learning approach in teaching Chemistry 101. Specifically the study aims to determine the profile of respondents as to age, gender, and scholastic performance in high school; identify what topics in Chemistry 101 can be developed as material for active learning approach and determine the effectiveness of active learning approach in teaching Chemistry.

II. METHODOLOGY

A. Research Design

This study employed two research designs. The descriptive-developmental design was used during the development stage using the Interest Inventory as its instrument. It aimed to determine what topics in Chemistry 101 can be developed as materials for active learning approach. In the validation stage, the experimental method of research was employed in this study using randomized pretest and posttest design. The study consisted of sixty students as respondents that were divided into two groups namely: the controlled group and the experimental group. Sixty first year Bachelor of Science in Information Technology students of Samar State University were chosen through random assignment from the two sections. In the selection of the experimental and controlled group composition, group matching was done on the four mentioned variates namely the age, sex, family monthly income and scholastic performance in high school inasmuch as individual matching/pairing of the subjects cannot be realized. They were paired off according to their entry of behavior to reduce bias. All ninety-two students were made to participate in the experimentation but only sixty students were included in the study. Hence, thirty students comprised the controlled group who were subjected to the traditional lecture-discussion method. The other thirty students were taught in an active learning approach of instruction. The experimental design by Herrin was used in the study (Herrin, 1987). The pretest and posttest were administered to both controlled and experimental groups. The performance of students in both pretest and posttest was compared statistically to determine the difference of performance of both groups which eventually reveal the effectiveness of the experimental intervention.

B. Instrumentation

The Interest Inventory was made and validated to find out what topics in Chemistry 101 can be developed as materials for active learning approach. It consisted of 20 positive statements in a five-point Likert scale and administered to first year students of BS Marine Engineering of Samar State University. The scores obtained were item analyzed using the formula by Edwards (Edwards, 1979)

The pretest and posttest were administered to both the controlled and the experimental group. A table of specification was prepared based on the syllabus in Chemistry 101 to ensure content validity. The test instrument was then subjected to analysis for facility values and discrimination indices. The formula of Wright was used in calculating the facility value and index of discrimination (Wright, undated). After the item analysis, a 30-item test was developed. The Kuder-Richardson formula 21 was applied to determine the reliability of the test instrument wherein the data used was the scores of the students who participated in the try-out (Fraenkel, 1993). The test reliability coefficient was computed to be 0.73, which is acceptable for research purposes.

III. RESULTS AND DISCUSSIONS

Profile of Respondents

Majority of the subjects in both groups were 16 years old. The oldest was 17 ½ years old for both groups. The average age in the experimental group was 16. While in the controlled group was 16.42 years. Majority of the respondents were females inasmuch as 20 or 66.67 percent out of 30 while only 10 or 33.33 percent were males. The average grade in the controlled group was 84.68, where 15 or 25 percent belonged to the "above the mean" group and the remaining 15 or

Table 1.
Pre-Test Scores of the Experimental
and Controlled Group

Groups	N	X	Sd	Computed t
Experimental Group	30	13.07	3.39	0.42
Control Group	30	13.40	2.70	

Table 2.
Pre-Test and Post-Test Scores of the Experimental
and Controlled Group

Groups	N	X	Sd	Computed t
Pre-Test	30	13.40	2.70	5.88
Post-Test	30	17.60	2.84	

50 percent belonged to the “below the mean” group. The data on the scholastic performance of the subjects implied that the performance of the experimental and controlled groups was both satisfactory. Both the experimental group and the controlled group have a favorable interest level in chemistry as evident by the grand means of 4.85 and 4.05, respectively.

Interest Inventory

The subjects pegged the highest mean of 4.48 on which they “strongly agree” on the statement that they can relate scientific method in solving problems and do activity related to it. It was followed with a mean of 4.43 which interpreted as “agree” to the statement that the subjects love to do experiments related to solid, liquid and gas. The third highest mean of 4.37 signified agree to the statement that the subjects can easily classify matter into elements, compounds and mixtures.

Based on the interest inventory, the three statements on the topic “Matter” posted the highest mean of 4.83, 4.75 and 4.60 respectively. Hence, topics on Matter were developed as Active Learning Materials for the study.

Comparison of Pre-Test Scores of Experimental and Control Group

Table 1 shows that the experimental and

Table 3.
Post-Test Scores of the Experimental
and Controlled Group

Groups	N	X	Sd	Computed t
Pre-Test	30	13.07	3.39	9.34
Post-Test	30	22.10	4.07	

Table 4.
Post-Test Scores of the Experimental
and Controlled Group

Groups	N	X	Sd	Computed t
Experimental Group	30	22.10	4.07	4.97
Control Group	30	17.60	2.84	

controlled group have the same level of performance prior to experimentation. When the t-test of independent samples was employed, the result showed that computed t of 0.42 was lesser than the tabulated t which were 1.67 for one-tail and 2.00 for two-tail at $\alpha=0.05$ level of significance and 58 degrees of freedom.

Comparison of the Pre-Test and Post-Test Scores of the Controlled Group

Table 2 shows that the use of traditional method of teaching Chemistry was effective. The standard deviation in the pretest was 2.70 while in the posttest was 2.84. The t-test for dependent samples was employed to find out if significant difference existed between the two sets of data. The computed t which was 5.86 was proved to be higher than the tabulated t of 2.05 at $\alpha=0.05$ and 29 degrees of freedom.

Comparison of the Pre-Test and Post-Test Scores of the Experimental Group

Table 3 shows that the experimental group gained marked improvement after they were taught using active learning approach in Chemistry. The t-test for dependent samples was employed to find if significant difference existed between the two sets of data. The computed t

Table 5. Evaluation of the Active Learning Material

Statements	X	Interpretation
The purpose of the active material is well-defined.	4.43	A
The objectives of the active learning approach and materials are attainable.	4.47	A
Content presentation is clear and logical.	4.23	A
Level of difficulty is appropriate for the target audience.	4.10	A
Use of active learning approach is motivational.	4.90	SA
The active learning approach effectively stimulates student's creativity.	4.47	A
Feedback on student's responses is effectively employed.	3.90	A
The learner controls the rate and sequence of presentation and drill.	4.17	A
GRAND MEAN	4.33	Agree

Legend: 5-Strongly agree (SA) 2-Disagree (D)
4-Agree (A) 1-Strongly disagree (SD)
3-Uncertain (U)

which was 9.34 was proved to be higher than the tabulated t of 2.05 at $\alpha = 0.05$ and 29 degrees of freedom.

Comparison of the Post-Test Scores of the Experimental and Control Group

Table 4 shows that there is a significant difference in the post-test scores of the control and the experimental group.

Evaluation of the Active Learning Approach

Table 5 shows that the active learning approach in teaching Chemistry was favorable to the experimental group.

IV. CONCLUSIONS AND RECOMMENDATIONS

According to the results of the t-test analyses of the post-test scores of the treatment group ($X=22.10$, $SD=4.07$) and controlled group ($X=17.60$, $SD=2.84$) showed that the use of active learning approach was effective.

The use of the active learning approach in teaching Chemistry showed a positive response from the experimental group as evidenced by the evaluation of the active learning approach administered after the instruction.

Based on the foregoing findings and conclusion, it is recommend that:

- Teachers should make use of active learning strategies in teaching college Chemistry besides the traditional lecture discussion method to break the monotonous mode in the classroom.
- Training of teachers in the effective use of active learning materials and other innovative strategies, techniques and methods of teaching appropriate to the level of their students be conducted.
- Administrators should provide opportunity to teachers to actively involve in the development and use of innovative teaching strategies.
- Administrators should strengthen and sustain professional development program to teachers to update their knowledge and upgrade their strategies of teaching which enhance effective and meaningful learning of students.
- Similar studies could be done by conducting experimental validation of active learning materials on

other topics in college Chemistry as well in other fields in the area of science.

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