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EFFECT OF PERSONALIZED LEARNING INSTRUCTIONAL STRATEGY ON SELF-EFFICACY IN MOLE CONCEPT AMONG CHEMISTRY STUDENTS IN ZARIA, NIGERIA

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ABSTRACT

Self-efficacy level of Chemistry students exposed to Personalized Learning Instructional Strategy (PLIS) in mole concept in Zaria Education Zone, Kaduna State, Nigeria, was investigated using a sample size of one hundred and forty-three (143) SS 2 Chemistry students from a population of 6, 527 SS2 Chemistry students. This study employed quasi-experimental method involving pretest posttest control group design. Two groups were formed: the experimental and the control groups. The experimental group was taught mole concept using PLIS while the control group was taught the same concept using the conventional method. An instrument, Self-efficacy Questionnaire (SEQ), was adapted by the researcher. The instrument was validated by Lecturers in Science Education and Chemistry teachers in secondary schools and the reliability coefficient of SEQ was 0.89 using Cronbach's alpha formula. The research question was answered using descriptive statistics, including mean and standard deviation; while the null hypothesis was answered using inferential statistics such as independent sample t-test at $P \leq 0.05$ level of significance to test the stated null hypothesis. The findings revealed significantly higher self-efficacy level for students in the experimental group who were taught using PLIS than the control group. It is recommended therefore that PLIS should be used by teachers of Chemistry to improve students' self-efficacy level.

Key words: Academic Performance, Chemistry, Mole Concept, Personalized Learning Instruction, Self-efficacy.

INTRODUCTION

The use of Personalized Learning Instructional Strategy may take care of individual differences since the students are allowed to learn at their pace, cognitive style, strategy, among others. Personalized learning instruction has improved students' self-efficacy in other concepts but its use on difficult concepts like the mole concept may also enhance students' self-efficacy. Bandura [1] opined that the type of learning environment and teaching method can improve self-efficacy in the classroom. Students' self-efficacy can be tested with their feedback. Bandura [2] stated that factors that improve students' academic performance will increase their self-efficacy level. Hence, teachers' direct contact and personalized instruction will affect their self-efficacy level and academic performance. While personalized learning has been studied, its influence as source of self-efficacy has not been assessed. Therefore, personalized learning instruction was used in this study to see whether it will improve students' self-efficacy in Chemistry.

The development of science in Nigeria has been reported to be hindered by low self-efficacy of students, hence affect academic performance [3]. This may be due to the use of teacher-centred instructional method. It is therefore wise for Chemistry to be taught meaningfully by using appropriate instructional strategies due to its importance.

Objective of the Study

The objective of the study was to determine the effect of personalized learning instruction on students' self-efficacy in Mole concept among secondary schools in Zaria, Kaduna State, Nigeria.

Research Question

The research question formulated to guide the study was: What is the mean difference in self-efficacy level in mole concept between Chemistry students taught using personalized learning instructional strategy and those taught with conventional method?

Null Hypothesis

The following null hypothesis was formulated and tested at $p \leq 0.05$ level of significance: There is no significant difference in self-efficacy level of Chemistry students before and after exposure to mole concept using Personalized Learning Instructional strategy as compared to conventional method.

METHODOLOGY

Four co-educational secondary schools were randomly selected through balloting with replacement from a heterogeneous population of 6,527 SS2 students admitted in the 2018/2019 academic session. The population comprised all the 35 public senior secondary schools across Zaria Education Zone in Kaduna State, Nigeria, with 24 co-educational, 5 single (boys) and 6 single (girls) secondary schools.

A pretest was administered to the students from the four schools chosen for the purpose of comparison of their academic equivalence. The result obtained from the pretest was subjected to Analysis of variance (ANOVA). From the results of the analysis, three schools showed no significant difference. Simple random sampling technique was used to finally select two schools (GSS Aminu and GSS Muchia, Zaria) out of the three. The two schools were randomly assigned to experimental and control groups respectively. Each of the two schools selected from the population as the sample for the study had one arm for science students, hence, was used as they were. The sample consisted of one hundred and forty-three (143) SS 2 Chemistry students from intact classes of 54 and 89 students respectively.

The students in the Experimental group (EG) were taught mole concept using personalized-learning instructional strategy while those in the Control Group (CG) were taught the concept using the conventional method. Based on the pilot testing, majority of the students finished the Self-Efficacy Questionnaire within 20 minutes indicating that the time allocated for the instruments was enough. Pretest (0_1) was administered to the experimental and the control groups for a period of twenty (20) minutes before the administration of treatment to determine if there was no significant difference in their self-efficacy level. After the pretest, the experimental group received treatment using personalized learning instruction (X_1), while the control group received the conventional treatment (X_0). After six weeks of treatment, both groups were subjected to posttest (0_2) for the same period in order to measure their self-efficacy level. Thereafter, the question papers and the answers were collected from each of the students. The design for the study is shown in Figure 1.

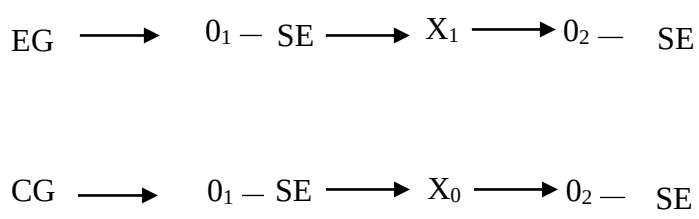

Figure 1: Research Design

Key:

EG- Experimental Group

CG- Control Group

0_1- Pretest

0_2- Posttest

X_1- Treatment (Personalized Learning Instructional Strategy)

X_0 - No treatment (Conventional method)

SE- Self-Efficacy

INSTRUMENTATION

The instrument used for the study was Self-Efficacy Questionnaire. This was adapted from Bandura general self-efficacy scale [4] and the method used by Israel [5]. The instrument was administered using the split-half method. The instrument consisted of twenty (20) questions. The students were asked to tick the most appropriate as it applied to them. The SEQ was conducted within 20 minutes for both pretest and posttest. The scale was structured using five (5) points Likert scale (SA-Strongly Agree; A-Agree; UD-Undecided; D-Disagree and SD-Strongly Disagreed) in order to measure the extent to which the respondents agreed or disagreed with a statement on the scale. Each of the response was scored as: SA=5, A=4, UD=3, D=2 and SD=1. The items were selected and fine-tuned to suit academic purview with a scoring guide of:< 42 as Low academic Self-Efficacy; 43-66 as Moderate Self-Efficacy; and ≥ 67 as High Self-Efficacy.

The instrument was validated by experts from the Department of Science Education, Ahmadu Bello University, Zaria; and a Chemistry teacher from Government Secondary School, Muchia, Zaria. This was to verify if the language used was at the ability level of the students of the study and free from ambiguity, check whether the time given to the instrument was sufficient, check the clarity of the statement and check the content of the test items if it was appropriate to the objective of the study. Based on their constructive contributions, face and content validity of the test item, corrections were effected on the number of items and content to ensure that the instrument was valid for this study. Some of the items perceived to be irrelevant to self-efficacy assessment were removed and the rest were certified. A reliability coefficient value of 0.89 was obtained indicating that the instrument was reliable.

Two lesson plans: Personalized Learning Instructional Strategy and Conventional method lesson plans addressing the same instructional objectives and content of mole concept were used for the Experimental and the Control groups respectively. The lesson plan for experimental group was based on PLIS that provided opportunities for a particular student to learn at their pace with the guidance of the instructor while the Control group was taught mole concept using the conventional method lesson plan for six weeks. At the end of six weeks of treatment, posttest was administered to determine the academic performance of the students.

DATA ANALYSIS

A number of statistical tools were used to analyze the data obtained. Descriptive statistics such as mean and standard deviation were used to answer the research questions while inferential statistics such as independent sample t-test were used to test the null hypotheses at $p \leq 0.05$ level of significance. The null hypotheses (Ho) was tested at $p \leq 0.05$ level of significance using independent sample t-test statistics.

RESULTS AND DISCUSSION

To answer research question, post-test scores of the experimental and the control groups generated from SEQ were subjected to descriptive statistics to calculate the mean and the standard deviation. Summary of the analysis is presented in Table 1:

Table 1: Summary of Post-test Self-Efficacy Scores of the Experimental and the Control Groups

Group	N	Mean	Std Deviation	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Experimental	54	77.81	10.86			
				24.46	-29.179	-19.732
Control	89	53.36	15.38			
Total	143					

The results showed that the experimental group had a higher mean score of 77.81 compared to that of the control group which had 53.36 as mean score with a mean difference of 24.46. This difference is in favour of the experimental group who were taught using PLIS. This means that personalized learning instructional strategy enhanced students' self-efficacy in mole concept. To find out how significant the difference is, independent samplet-test statistics was used in analyzing the scores.

Null Hypothesis: There was no significant difference in the self-efficacy level of the Chemistry students taught mole concept using PLIS and those taught using conventional method.

To test null hypothesis post-test scores obtained from the Self-Efficacy Questionnaire (Table 1) of the experimental and the control groups were subjected to independent sample t-test statistics at $p \leq 0.05$. Summary of the analysis is presented in Table 2.

Table 2: Summary of Self-Efficacy Scores of Students in the Experimental and the Control Groups

Group	N	Mean	Std Deviation	t	Df	P	Remark
Experimental	54	77.81	10.861	-11.115			
					141	0.00	S
Control	89	53.36	15.38	-10.235			
Total	143						

Significant at $p \leq 0.05$

The result revealed that there was a significant difference in the self-efficacy mean scores between the experimental and the control groups. The experimental and the control groups recorded a mean score of 77.81 and 53.36 respectively. The p-value is 0.00 which was less than $P \leq 0.05$ level of significance at 141 degree of freedom. Therefore, the null hypothesis which states that there is no significant difference between the self-efficacy level of Chemistry students exposed to PLIS and those exposed to conventional method was rejected. Thus, Personalized Learning Instructional strategy was found to be more effective in improving students' self-efficacy in mole concept than conventional method.

The result of the findings showed that there was significant difference in the self-efficacy level when students were exposed to personalized learning instruction and the conventional teaching method in favour of experimental group. This could be attributed to personalized learning instruction that was used to teach the experimental group. The null hypothesis was therefore rejected. This agreed with Jacobson [6] and Yazachew [7] who stated that due to the student-centered nature of the personalized learning instruction, students' self-efficacy is promoted because the strategy stimulates cognitive activities. The study also agreed with Lames [8] who found out that personalized learning instructional strategy increases student's self-efficacy. The study also agreed with that of Bichi [9] who observed that as students engage in activities, they acquire skills and confidence which aid their capacity to tackle future problem.

CONCLUSION

It can be concluded from the findings of this study that the use of Personalized Learning Instructional strategy improved the self-efficacy of Senior Secondary Chemistry students in mole concept than the lecture method.

Recommendations

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

1. Teachers of Chemistry in secondary schools can use personalized learning instructional strategy to improve students' self-efficacy.
2. Teachers of Chemistry should have training and retraining (regular courses, workshops, seminars and in-house training) on the use of personalized learning instructional strategy to maximize students' self-efficacy.

3. A similar study should be carried out in senior secondary schools and other institutions in other parts of the country and in other subjectsto see the resultsthat would be obtained.

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