Utilization of Strategic Instructional Module to Facilitate Comprehension in Organic Chemistry: An Experiment

Alice T. Rivera[1]

[1]*Faculty, Nueva Ecija University of Science and TechnologyUniversity*

Email: alicetonidorivera @gmail.com

Abstract – This study aimed to test the efficiency of developed and evaluated module in facilitating learning in organic Chemistry. Using experimental method of research, 33 males and 27 females from Grade 9 students were grouped into control and experimental group. Both groups were pre-tested. The control group was subjected to usual lecture discussion while the experimental group used the Strategic Instructional Module. The results of the pre-test showed that there was no significance difference in the performance of both groups. *All the respondents of both groups had low academic performance on the topic Organic Chemistry.* Post-test revealed that both groups improved their scores, however, there was a significant difference in the scores of the control and experimental group that use module approach. Experimental group obtained higher scores than control group. This indicates that the utilization of the Strategic Instructional Module can help to facilitate learning and comprehension in Organic Chemistry. Across the gender, the study found out that male students have higher score than female. Based on the results of the study, the researcher recommends the necessity to use more modern means to teach students the "Science" domain such as module strategy.

Keywords – *facilitate, Organic Chemistry, Strategic Instructional Module, utilization*

INTRODUCTION

Effective learning and teaching in any subject at any institution are dependent on the instructional strategies used. This is the major factor responsible for the level of performance in any subject by the students. Using appropriate teaching methods, learning difficulties can be solved to the great extent.

Upon implementation of k to 12 Program, Organic Chemistry became one of the component subjects in Science 9. But unlike other components in Science 9, most of the students have no prior understanding about Organic compounds. It is also considered as one of the least learned concepts every year.

Organic Chemistry is relevant to every student because this lesson encompasses every aspect of human life. In fact, most of the body matrix of all living organism are composed of organic compounds. In addition, several careers also apply an understanding of Organic chemistry such as doctors, veterinarians, dentists, pharmacologists, chemical engineers, and chemists. With all of these, Chemistry students really need to understand its diversity, chemical properties, reaction and uses.

The use of instructional material such module can be a vehicle of instruction. According Abdu-Raheem (2016) as cited by Urbano (2020), instructional materials are essential and significant tools needed for teaching and learning of school subjects to promote teachers' efficiency and improve students' performance. The use of teacher made module in teaching has a goal of helping each student to think for himself and allowing the individuality to each learner. In the study conducted by Alelaimat and Ghoneem (2012), researchers have developed an educational material relevant to carry out modules strategy for teaching scientific concepts in the science textbook for primary seventh grade. Their study aimed at revealing the effect of educational modules strategy in comparison with the conventional approach.

Based upon the study's results, the researcher recommends the necessity to use more modern means to teach students such as teacher made module.

The study Mahajan (2008) was designed to find out the instructional strategies in Organic Chemistry. Based on his findings, the students' response reveals that more than one method of teaching gives students a better knowledge of the course content. Students like to receive handouts or lecture material to follow the content easily.

With this, the researcher developed a strategic instructional module as alternative teaching strategy to help Science teachers and students in improving their learning concept in Organic Chemistry. With the use of this Strategic Instructional Module, it is expected that this will facilitate comprehension in Organic Chemistry and will increase the achievement rate of Grade 9 students in Science 9.

OBJECTIVES OF THE STUDY

Generally, this study aimed test the efficiency of developed and evaluated module in facilitating learning in Organic Chemistry.

Specifically, this study aimed to answer the following specific questions:

1.How may the achievements of the students in pre-test and post test before and after the application of Strategic Instructional Module be compared?

2. Is there a significant difference in the achievements of students in the following:
   - 2.1 Pre-test of control and experimental groups before the application of Strategic Instructional Module,
   - 2.2 Pre-test and post test scores of experimental group who used the Strategic Instructional Module,
   - 2.3 Post test scores of control and experimental groups?
3. Is there a significant difference in the

achievements of male and female students after exposure to Strategic Instructional Module?

MATERIALS AND METHOD

This study employed experimental methods of research to determine the effectiveness of the module.

The Strategic Instructional Module was developed based on the prior reviews of textbooks used in Chemistry, the Learning Competencies for Science 9 and on the results on the consultation with experienced Chemistry teachers from Division of Cabanatuan. The activities presented in the module were modified and simplified to help each student to think for himself and allowing the individuality to each learner.

The student's respondents were all Grade 9 from Cesar E. Vergara Memorial High School during the school year 2016-2017 consisting of 33 females and 27 males. Control group consisted of 18 male respondent and 12 female respondents while experimental group consisted of 15 male and 15 female respondents.

The pre-test and post-test result of control and experimental group served as the basis for evaluating the effectiveness of the module. Interview among experimental group were also gathered and recorded.

To statistically analyze the data, percentage and frequency counts were used. T-test was also used to determine the significant difference of assessment results before and after the application of Strategic Instructional Module.

RESULTS AND DISCUSSION

This part of the study presents the analysis and interpretation of the data gathered from students achievement in their obtained scores from pos-test and pretest.

Table 1. Summary of Scores Before and After the Application of Strategic Instructional Module

	CONTROL GROUP				EXPERIMENTAL GROUP			
	PRETEST		POSTTEST		PRETEST		POSTTEST	
	F	%	F	%	F	%	F	%
0-10	1	3.3			9	30		
11-20	29	96.7	4	13.3	20	66.7	2	6.7
21-30			25	83.3	1	3.3	19	63.3
31-40			1	3.3			9	30
Total	30	100	30	100	30	100	30	100

Table 1 shows the scores of the control and experimental group in their pre-test and post-test. Based on the data, 29 respondents or 96.7% of the control group got scores of 11-20 points and 20 respondents or 66.7% of the experimental group got the same score. Only one or 3.3% of the respondents in experimental group got scores between 21-30 points.

For the post test result, data also shows that four students or 13.3% of the control group remain in the score bracket of 11-20 points while in the experimental group two students or only 6.7% got the same score. Data revealed that after using the module, there are 25 students or 83.3% of the control group got score of 21-30 points and 19 students or 63.3% of the experimental group got the same score. There is only one student or 3.3% of the control got score of 31-40 points. The experimental group on the other hand, 9 students or 30% of the respondents got scores between 31-40 points.

Data revealed that respondents from both experimental and control groups have the same prior knowledge in Organic Chemistry. However, the post test result shows that there are more high scores in the experimental group.

Table 2. Difference in the Pre-test Scores of Students Before the Application of

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PRE-TEST	Equal variances assumed	6.73	0.012	0.673	58	0.504	0.63333	0.94112	-1.25	2.51719
	Equal variances not assumed			0.673	46.47	0.504	0.63333	0.94112	-1.26	2.5272

Table 2 shows that at 95% confidence interval of the difference, the standard error difference was only 0.9411. The mean difference was 0.6333 which is not significant to the calculated t value (t=.673). This means that both groups have the same prior knowledge in organic compound. Furthermore, the pre- test result explained the need for instructional material that will facilitate comprehension in Organic Chemistry and thereby improve their scores in post-test. Based on the data gathered, there is no significant difference in the pre-test scores of control and experimental groups.

The efficacy of using module as teaching strategy supported the idea of Phyllis (2011) that instructional materials possess some inherent advantages that make them unique in teaching.

Table 3. Difference in the Pre-test and Post Test Scores of Experimental Group

Paired Samples Test

		Paired Differences							
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	T	Df	Sig. (2-tailed)
Pair 1	PRETEST - POSTTEST	-15.866	4.65	0.849	-17.6	-14.12	-18.68**	29	.000

**t is significant at the 0.01 level (2-tailed)

Table 3 shows that at 95% confidence interval of difference, the standard error difference was 0.849. Upon using the Strategic

After exposure to Strategic Instructional Module, the obtained mean score of experimental group was -15.866 and the calculated t value was -18.68 which was significant at the probability level of 0.01.The results of the post-test among experimental group reveals that instructional material such as module can motivate students' interest in dealing with the subject and thereby improve students' achievement and results in the change of students' attitude towards Chemistry. This result strengthens the findings of Ali and Ghazi (2010) in his study about the effectiveness of the modular instruction in Biology in the University of Pakistan. Based on his findings, modular teaching is more effective as teaching learning process for Biology as compared to traditional teaching method because in modular teaching, the students are provided the opportunities of learning at their own pace, according to their ability level and needs.

Based on the computed mean, there is significant difference in the pre-test and post test score of experimental groups.

Table 4. Difference in the Post test Scores of Control and Experimental Group

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
POSTTEST	Equal variances assumed	3.055	0.086	-4.439**	58	0	-4.733	1.066	-6.867	-2.598
	Equal variances not assumed			-4.439**	51.3	0	-4.733	1.066	-6.873	-2.592

**t is significant at the 0.01 level (2-tailed)

The mean difference in the post test of experimental and control groups is shown in Table 4. At 95 % Confidence Interval of the difference, the mean difference was -4.733 in favor of experimental group. The obtained t value (-4.439**) is significant at 0.01 probability level. This indicates that there is significant difference in the scores of students in control and experimental groups. Students in experimental group have higher scores than control group. The results of their improved summative test in the third grading period also support and validate the findings that the use of the instructional module can facilitate comprehension in Organic Chemistry. Based on the result of their summative test, 18 students or 53% of the control group had improved in their summative test while 26 students or 86% of the experimental group had

increase the result of their summative test.

Although both group had improved their performance in the post test, the experimental group had more significant gain compared to the control group. This manifested that the use of Strategic Instructional Module is an effective way of facilitating comprehension and increasing the achievement of students.

These results strengthen the claim of Alelaimat and Ghoneem (2012) in their study *"The Effect of Educational Modules Strategy on the Direct and Postponed Study's Achievement of Seventh Primary Grade Students in Science, in Comparison with the Conventional Approach"*. The study's results revealed that students in the experimental group are superior to students in the control group in both types of achievement.

The researcher also conducted some interviews to students about the module to validate the findings of the research.

Majority of the students said :

> ***"Nakakaenjoy pong basahin dahil madali pong intindihin. Excited po kaming sagutan at iperform ang ibat- ibang activities ng bawat lesson."***
>
> ***("We really enjoyed reading the module for it is easy to understand. We are also excited to answer and perform the different activities for each lesson.")***

Some students also claimed:

> ***("Nakakatuwa po yung mga graphics, madali pong basahin at madali po yung mga activities***
>
> ***"The graphics and the writing style of the module are fun that makes it enjoyable to read. The activities can be easily understood.")***

The researcher observed that the used of Strategic Instructional Module is effective however, it did not achieve the 100% student's improvement due to some problems met. Still, there are students remained in the low bracket of scores despite of using the instructional module. The major problems are students' absenteeism and students with special needs like those with poor comprehension or the so-called frustrated reader.

Table 5. Difference in the Achievements of Students After Exposure to Strategic Instructional Module Across Gender

	Respondents	N	Mean	F	Sig(2-tailed)
SCORES	Male	15	30.2667	2.173*	0.038
	Female	15	26.6667		

*F is significant at the 0.05 level

Table shows that the mean score of the male students was 30.2667 and the obtained mean score from the female students was 26.667. The computed F-value of 2.173 was significant at the 0.05 probability level. This means that the gender is a factor in describing the knowledge and achievements of respondents in Organic Chemistry. Based on the given data, the Strategic Instructional module is more effective in male respondents than female respondents. There is considerable evidence pointing to the fact that boys and girls differ in their cognitive abilities. Male respondents among experimental and control group are increasingly stimulated by the graphic and texts of the module. Therefore, there is significant difference in the achievements of male and female students after exposure to SIM.

These results supported the study of Chioma and Uzoamaka (2015) at University of Nigeria. In their study *"A SWOT (Strength, Weaknesses, Opportunities and Threats) Analysis of Male and Female Students' Performance in Chemistry: A Comparative Study",* it was concluded that boys perform better than girls in Chemistry in urban rural and coeducational schools.

The results also proved the study of Omwirhiren (2015). Attention should be adequately paid to the female folds by advising

teachers of Chemistry to effectively employ the use of discussion method in a way that it will help improve female student's performance in Chemistry. This is because the results of the study have shown a significant difference in their mean achievement scores in favor of males.

CONCLUSIONS AND RECOMMENDATIONS

Based on these findings, the researcher concludes the following in this study:

1. The use of instructional module is an effective way of facilitating comprehension and increasing the achievement of students. However, this will not achieve the 100% students' improvement due to some problems met like students' absenteeism and with special needs like those with poor comprehension or considered as frustrated reader.
2. In Organic Chemistry, the prior knowledge of the respondents both in experimental and control groups are the same.
3. The students who used Strategic Instructional Module can perform better than students who were solely exposed to lecture and discussion method.
4. In Organic Chemistry, male students of experimental and control groups can perform better than female as shown by their higher scores.

Based on these conclusions, the following recommendations are provided in this study:

8. Science teachers should adopt the developed and validated Strategic Instructional Module since it helps to facilitate comprehension the basic concept in organic compounds.
9. It was found on this research that students have improved after using the instructional module. It is recommended that students can utilize the Strategic Instructional Module, conduct the activities and gain knowledge in Organic Chemistry by themselves or with a little assistance from the teacher.
10. Science teachers should develop an instructional module that will encourage both gender and therefore increase the achievement of male and female students .

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