Utilization of Concept Mapping Technique on Students' Performance in Science

Neil Ian G. Cabiling[1], Ehlrich Ray J. Magday[2]

[1]Tagoloan National High School, Tagoloan, Misamis Oriental, Philippines
[2]Science Education Department, College of Education, Central Mindanao University, Bukidnon, Philippines

ABSTRACT: Determination of the effects of concept mapping technique on students' performance in Grade 9 Science of one public high school in Bukidnon, Philippines was the main objective of this study. Specifically, it aimed to (1) describe the level of students' performance in science as exposed to concept mapping technique (CMT) and those exposed to non- concept mapping technique (non-CMT); and (2) find out significant difference between student's performance in science when exposed to CMT and those exposed to non-CMT. A quasi-experimental research design was utilized involving two sections. Findings of the study revealed that students exposed to concept mapping technique "did not meet expectation" in the pretest and have "fairly satisfactory" result in the post-test while those who were exposed to non-concept mapping technique "did not meet expectation" in both pretest and post-test. Performance of students exposed to CMT were significantly higher than those exposed to non-CMT. Concept Mapping Technique may be utilized in science classes to further enhance the academic performance of students.

KEYWORDS: Concept Mapping, science, students' performance, pretest, post-test

I. INTRODUCTION

Educators strive to produce morally upright, well-equipped and globally competitive graduates. To achieve this goal, there is a need to utilize varied teaching strategies and approaches that are found effective for students' learning. Teachers need to be equipped with knowledge, skills, attitudes, and values for the 21st century in order to produce students who are successful in life and at work and become productive members of the society. This is a challenge to all teachers, including the Science teachers. In science teaching, the use of different pedagogical approaches in classroom instruction has been proven to affect the academic achievement as well as the behaviour of students. Qarareh (2012) stated that teaching and learning strategies provide a wide range and advanced educational potential that will help students to enrich their information, develop their mental abilities and train them to be innovative and novel. However, this cannot be done without giving the students the opportunity to express, shape and test their ideas by providing them with appropriate sources, arousing their interests and inciting their deep thinking with the help of guided programs and various strategies and teaching methods. The K to 12 curriculum is learner-centred and problem-based which provide learners the competencies important in the field of work. It aims to develop students who will be problem solvers, responsible stewards, innovative, creative, and informed decision makers. It emphasizes the use of evidence in constructing explanation to have purposeful learning process and meaningful understanding of concepts with its application to real-life situations. In achieving these objectives of the new curriculum, the Department of Education Region 10 initiated the crafting of unified daily lesson plans which will be used in classroom instruction. This is to improve the performance of the students towards science subject where students connect and visualize information and events to avoid misconceptions and developed higher level of thinking and reasoning.

In one national high school in Bukidnon, Science teachers implement different teaching techniques to facilitate effective teaching and learning process. However, based on the National Achievements Test (NAT) results of the previous years, the school Mean Percentage Score (MPS) in science were 51.00 (SY 2013-2014), 38.3 (SY 2014-2015), and 40.00 (SY 2015-2016). Data revealed that these did not meet the national Mean Percentage Score (MPS) standard of 75%. It implies that students have difficulty in learning science concepts. While there may be several factors, traditional teaching appeared to be one of the major causes of students' low academic achievement towards learning science concepts. Thus, the need for teaching techniques that would motivate students and improve their performance. Concept mapping can be an instructional technique that can enhance

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students' performance. According to Colosimo and Fitzgibbons (2012), concept maps are graphical representations of relationships among concepts that can be an effective tool for teaching, designing, and organizing information in a variety of ways. Concept mapping can be used as a visual aid to explain complex ideas and help learners articulate their understanding of a concept. The use of concept mapping as a teaching tool provides students a more meaningful learning experience when they add information to a concept map that is based on their current knowledge. For an innovative science teacher, it is significant to discover new and effective ways of teaching to promote meaningful science learning among students.

II. METHODS

A quasi-experimental research design was used in this study. The respondents were two intact sections of Grade 9 level. Both groups received the same lessons but varies in the implementation of the content. One group was exposed to concept mapping technique while the other group was exposed to conventional teaching utilizing lecture-discussion and the use of PowerPoint presentation. To measure the students' performance, a 50-item test was used. It was pilot tested and obtained a Cronbach's alpha coefficient of 0.821. The concept mapping technique was implemented using the 7E learning model. Descriptive statistics such as mean, frequency values, percentage and standard deviation were employed to describe the performance of students. Analysis of Covariance (ANCOVA) was used to measure significant difference on students' performance exposed to Concept Mapping Technique and non-Concept Mapping Technique using the pretest as the covariate.

III. RESULTS AND DISCUSSION

Table 1 presents the students' performance in their pretest when exposed to concept mapping technique and those in non-concept mapping technique. As shown in the table, the pretest means of CMT and NCMT group were 21.60 and 20.25, respectively, equivalent to mean percentage score of 43.20 and 40.51 respectively which both indicate "Did Not Meet Expectation" as set by DepEd standards. This result can be attributed to students exhibiting least mastered concepts in the subject content.

Table 1. Level of performance of students in the pretest

	CMT n=55		NCMT n=59		Qualitative Interpretation
	Pretest		Pretest		
Range	f	(%)	f	(%)	
90%-100%	0	0	0	0	Outstanding
85%-89%	0	0	0	0	Very Satisfactory
80%-84%	0	0	0	0	Satisfactory
75%-79%	0	0	0	0	Fairly Satisfactory
74%-Below	55	100	59	100	Did Not Meet Expectation
MEAN		21.60		20.25	
MPS	43.20		40.51		

These findings are in consonance with the results in the study of Pagtulon-an and Tan (2018) that found out the low pretest scores are expected due to insufficient knowledge on the concept or they do not have foundation of the concepts.

Table 2 shows the students' posttest results between students in concept mapping technique and those in non-concept mapping technique.

Table 2. Level of performance of students in the posttest

	CMT n=55		NCMT n=59		Qualitative Interpretation
	Posttest		Posttest		
Range	f	(%)	f	(%)	
90%-100%	6	10.9	0	0	Outstanding
85%-89%	6	10.9	2	3.39	Very Satisfactory
80%-84%	9	16.36	5	8.47	Satisfactory

75%-79%	12	21.82	4	6.78	Fairly Satisfactory
74%-Below	22	40	48	81.36	Did Not Meet Expectation
MEAN		38.13		30.26	
MPS	76.25		60.52		

Based on the results, the CMT group has posttest' mean of 38.13 equivalent to percentage mean score of 76.25 indicates "fairly satisfactory" while NCMT group obtained mean of 30.26 equivalent to 60.52 that indicates "Did Not Meet Expectation". Based on the result after the intervention in the CMT group: six (6) or (10.9%) of the students achieved an outstanding performance; six (6) or (10.9%) had a very satisfactory performance; nine (9) or (16.36%) had achieved satisfactory performance; twelve (12) or (21.82%) had a fairly satisfactory performance; and twenty-two (22) or (40%) of the students "Did Not Meet Expectation. On the other hand, in the NCMT group, none of the students achieved an outstanding performance; two (2) or (3.39%) had a very satisfactory performance; five (5) or (8.47%) achieved satisfactory performance; four (4) or (6.78%) had fairly satisfactory performance; and forty-eight (48) or (81.36%) of the students did not meet expectation.

The result is supported by the findings of Stoica, Moraru, and Miron, (2010) that students exposed to concept mapping technique achieved a higher learning on the subject content.

Table 3 presents the analysis of Covariance (ANCOVA) of posttest treatments.

Table 3. Analysis of Covariance (ANCOVA) of students' academic performance in CMT and NCMT

Group	N	MPS		SD	
CMT	55	76.26		10.24	
NCMT	59	60.48		13.57	
Total	SS 114	Df 68.09	MS	14.40	Sig.
Model	536685.91	3	178528.64	1212.32	.000**
Group	29673.33	2	14836.67	100.75	.000**
Pretest (covariate)	535585.91	1	178528.64	1212.32	.932ns
Error	16346.09	111	147.26		
Total	551932.00	114			

As shown in the table, the mean percentage score under CMT is 76.26 (SD=10.24) while non-CMT group had a mean percentage score of 60.48 (SD=13.57). The students exposed to concept mapping technique obtained significantly higher scores than students under non-concept mapping technique with an F value of 100.75 (p<0.01).

This indicates that concept mapping technique is an effective tool in delivering classroom instruction in science where students learn to retrieve prior knowledge, organize ideas, and process new concepts. In this way, students learn critically in a meaningful learning experience. This is consistent with the study of Bera and Mohalik (2016) reported that students taught using concept mapping technique achieved better than those exposed to the traditional teaching method. Similar research finding was noted on the study of Sakiyo and Waziri (2015) on the use of the concept mapping teaching method on secondary school students' academic achievement in biology.

The results revealed that concept mapping method enhanced students' academic achievement in biology. Moreover, Otor and Eriba (2013) found that concept mapping technique is effective strategy in classroom instruction. These results are also in accordance with the study of Zmen, Demircio and Coll (2007) that students perform better when they are exposed to Concept mapping technique. This is because the technique helps students to link concepts and reduces their alternative conceptions while enjoying laboratory activities.
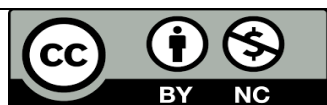
IV. CONCLUSIONS

There was an improvement on both groups' level of academic performance from the pretest and posttest. However, students' performance under concept mapping technique is numerically higher than those exposed to non-concept mapping technique. Hence, CMT can be utilized in other topics in the Science across grade levels to contribute to positive learning outcome. A significant difference was found in the performance between students in CMT and non-CMT class. The students exposed to CMT performed better than students taught using non-CMT.

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Utilization of Concept Mapping Technique on Students' Performance in Science

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