CASE-BASED LEARNING APPROACH: ITS EFFECTS ON STUDENTS' ACADEMIC PERFORMANCE IN CHEMISTRY

[1]Maryjo R. Liboon, [2]Ehlrich Ray J. Magday

[1], Teacher III, [2]Associate Professor II

[1]Malinao High School,[2]Central Mindanao University

[1]Malinao High School, Banisilan, Cotabato, [2]Maramag, Bukidnon, Philippines

***Abstract*— The study examined the students' academic performance under Case-Based Learning Approach (CBLA) in Chemistry of Malinao High School. Specifically, it aimed to describe the level of academic performance of students as exposed to CBLA and those exposed to the non-CBLA; and ascertain significant difference on students' academic performance between the two groups. A quasi-experimental design was employed where two intact classes exposed to CBLA and non-CBLA were administered a teacher-made test with a Cronbach Alpha of 0.83 to measure academic performance. ANCOVA was used to determine the difference in the academic performance. Results showed that there is a significant difference on the academic performance between two groups indicating that students exposed to CBLA performed better than those exposed to non-CBLA. Case-Based Learning Approach may be utilized in science teaching to further enhance students conceptual understanding.**

***Index Terms*—Case-based learning, academic performance, chemistry**

I. INTRODUCTION

The science competencies in the K to 12 curriculum of the Department of Education envisions the development of scientific, technological and environmental literacies among the learners as well as training them to possess effective communication, interpersonal and lifelong learning skills coupled with scientific values and attitudes. These can be acquired through contemporary pedagogies that focuses on knowledge relevant to the real world, encompasses methods of inquiry and ideally implemented in a learning environment that promotes the construction of ideas and instills respect for others. The learning of science is also important for the nation's cultural development and preservation of its cultural identity. Science is most useful to a nation when it is utilized to solve its own problems and challenges, keeping a nation's cultural uniqueness and peculiarities intact. Thus, in many countries, science teaching and learning is linked with culture.

However, there seems to be a mismatch between attaining the competencies and how teachers are supposed to teach them. As observed, traditional lecture methods are still commonly practiced today where teachers dominate the whole learning process with "talk and chalk" and perceived their roles as sole dispensers of knowledge and the student passive listening role as a mark of respect for teachers' authority. This situation does not allow student the freedom to express their ideas and experiences of the new world (Ajaja, 2015; Abbas & Arshad, 2014).

The subject of chemistry is undoubtedly one of the challenging science subjects of the spiral progression in Junior High School. Since many students have difficulty understanding the concepts and theories, they begin to lose interest in it. This lack of motivation in the subject eventually results in poor performance and low or failing grades. Hence, the burden of continuously motivating and guiding the students to focus on the subject.

The Grade 8 students in Malinao High School in Banisilan, North Cotabato are facing the same challenge in learning Chemistry. Their teachers are occupied with finding effective ways to make the subject matter relatable and interesting to them. It is noted that Malinao National High School's recent NAT result had a measly rating of 49.12% which is far from the Division target of 75%. Thus, the need to explore the avenues of improving the performance of students in science by introducing a pedagogical approach that is contextualized and can easily translate learned concepts to real life applications.

Case-based learning (CBL) is an established method used across disciplines whereby students develop and apply course knowledge to solve a more tangible or actual "real life" problem. Students are certainly more motivated to learn something that can be readily applied to the real world; hence, this explains why this method is perceived to be so engaging as it also promotes higher levels of understanding or cognition. Unique to CBL classes are case studies that involves stories with one or more scenarios and characters, each deal with a specific problem in a certain area of study where students working in groups or pairs create solutions to such problems under the teacher's supervision (Herreid, 2013).

II. THEORETICAL FRAMEWORK

Building on the notion of social constructivism by Vygotsky, case-based or case method learning represents a paradigm shift towards a more active, collaborative and inquiry-based approach to teacher education. Case-based learning promotes active, self-directed learning (Perkins, 1991) through the process of applying theoretical knowledge to classroom scenarios in ways that can encourage and stimulate problem-solving, critical thinking, and decision making. As such, case-based learning ties in with the principles of social constructivism. A constructive approach to teacher education involves teachers and students constructing meaning out of cases through active participation and interaction. CBL has several defining characteristics, including versatility, storytelling power, and efficient self-guided learning. This study is also hinged on Merseth (1996) when he outlined the uses of cases as exemplars to illustrate a model, theory or instructional technique or to showcase best practices; cases used to promote

decision making and problem-solving skills, and cases used to stimulate personal reflection. In addition, Heitzman (2008) posits that CBL is a pedagogy that offers many strategies and opportunities for prospective teachers to gain insight into events that occur within the school and classroom. It would enable preservice teachers to analyze and think critically so that they can make decisions to solve potential problems faced in the classroom.

III. METHODOLOGY

This study utilized the quasi-experimental pretest-posttest design to determine the students' academic achievement and motivation in chemistry. Two (2) sections of Grade 8 Science classes were utilized as participants of the study. Both groups received the same content of the lesson however, the implementation varied as one group was exposed to CBLA using the 7E framework while the other group was exposed to non-CBLA. The academic assessment was a performance test based on the Grade 8 topics and activities in chemistry. A 45-item test was prepared on various concepts in Particle Nature of Matter, Atoms Inside Out, and Periodic Table of Elements varying in levels based on the prepared Table of Specifications. A Cronbach alpha value of .830 was obtained indicating that the instrument is reliable. The descriptive statistics like mean, percentages, and standard deviation were used to determine level of academic performance of students. Analysis of Covariance (ANCOVA) was employed to determine any significant differences in the academic performance of students exposed to CBLA and non-CBLA.

IV. RESULTS AND DISCUSSION

Table 1 presents the level of academic performance of students in their pre-test and posttest, frequency and percentage of scores of students exposed to CBLA and non- CBLA.

Table 1. Students' pretest and posttest scores when exposed to case-based learning approach and non-case-based learning approach.

RANGE	CASE-BASED LEARNING APPROACH				NON-CASE –BASED LEARNING APPROACH				QUALITATIVE INTERPRETATION
	PRETEST		POSTTEST		PRETEST		POSTTEST		
	N	%	N	%	N	%	N	%	
90 – 100	0	0	16	35.56%	0	0	0	0	Outstanding (O)
85 - 89	0	0	20	44.44%	0	0	0	0	Very Satisfactory (VS)
80 – 84	0	0	3	6.67%	0	0	3	6.67%	Satisfactory (S)
75 – 79	0	0	4	8.89%	0	0	4	8.89%	Fairly Satisfactory (FS)
74 - below	45	100	2	4.44%	45	100	38	84.44%	Did Not Meet Expectation (DNME)
TOTAL	45	100	45	100	45	100	45	100	
MPS	16.46		88.64		14.16		26.82		
Descriptive Rating	(DNME)		(VS)		(DNME)		(DNME)		

As shown, students' pretest scores under case-based learning approach obtained an overall mean score of was 16. 46%" while students under non-case-based learning approach was 14.16% both indicating "Did Not Meet Expectation". The result is indicative of students in both groups having less prior knowledge on specified chemistry concepts considering that the topics are in spiral progression. This is supported by Berry (2008) when he pointed out that pre-test is administered prior to delivery of specific content or lesson where learners are not expected to know the presented concepts, thus, resulting to low scores.

Meanwhile, posttest scores reveal that students exposed to case-based learning approach showed a notable increase after the strategy was implemented. There were 16 (35.56%) that obtained "Outstanding", 20 (44.44%) performed "Very satisfactory", 3 (6.67%) got "Fairly satisfactory", 4 (8.89%) obtained "Satisfactory" and there were 2 (4.44%) of the students who still "Did Not Meet Expectations". The overall posttest mean score was 88.64% which indicates "Very Satisfactory" results when exposed to case-based learning approach

On the other hand, an increase on students' posttest mean scores was also observed under non-cased learning approach. Three students (6.67%) student obtained "Fairly Satisfactory", 4 (8.89%) got "Satisfactory" while 38 (84.44%) students obtained a mean score below 74 which indicates "Did Not Meet Expectation". Even there is an increase of total mean percentage score of 26.82 which still indicates "Did Not Meet Expectation". The implementation of Case-Based Learning in science instruction showed positive results as reflected in the students' improved performance.

These findings share the same results with the study of Sungur & Tekkaya (2016) that the use of Case-Based Learning is found to enhance self-regulatory skills in students thereby improving academic performance. Moreover, the study of Bansal & Goyal (2013) concluded that the use of CBL has improved the subjects' performance in their classes.

Table 2 presents the analysis of covariance (ANCOVA) on students' academic performance exposed to case-based learning approach and non-case-based learning approach.

Table 2. Analysis of Covariance (ANCOVA) on students' academic performance

GROUP	N	(MPS)	SD
CBLA	45	88.64	4.97
Non-CBL	45	59.60	11.29
TOTAL	90	74.13	6.98

Source	SS	df	MS	F-value	Sig.
Group	29759.863	2	14879.932	235.874	.000*
Pre-test (Covariate)	1213.014	1	1213.014	19.228	.000
Error	5488.331	87	63.084		
Total	520158.025	90			

*Significant at $p<0.05$

As seen in the table, students exposed to case-based learning approach acquired a mean percentage score (MPS) of 88.64 (SD =4.97) while students exposed to non-case-based learning approach had a mean percentage score (MPS) 59.60 (SD= 11.29). The F-value is equal to 235.87 ($p<0.05$) between groups indicating highly significant difference. Students exposed to CBL performed much better compared to non-CBL students, thus rejecting the null hypothesis that there is no significant difference on the academic performance of students exposed to Case-based learning approach and those exposed to non-case -based learning.

Similar result was reported by Hereid (2014) that the use of Case-Based Learning has a significant effect on students' achievement in chemistry. Likewise, in the work of Gallagher et al. (2015) they reported that CBL the use of CBL produced higher performance in the test results as compared to the traditional instruction.

V. CONCLUSIONS

The students' academic performance under CBLA and non-CBLA similarly did not meet expectation on their pretest results. However, posttest results under CBLA improved to very satisfactory. On the contrary, those exposed to non-CBLA still did not meet expectation. Thus, exposure to CBLA may positively impact the performance of students. When compared, the students' academic performance was significantly different between CBLA and non-CBLA group, in favor of the CBLA group. In as much that a significant increase was noted on academic performance when exposed to case-based learning approach in chemistry, educators may look into the use of case-based learning approach and utilize the strategy in enhancing students' academic performance.

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