

Comparison between Traditional Approach and Concrete-Pictorial-Abstract (CPA) Approach in Teaching College Algebra

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Abstract— The study focused on the comparison between Traditional approach and Concrete-Pictorial-Abstract (CPA) approach in teaching College Algebra among BEE students of College of Teacher Education of President Ramon Magsaysay State University A.Y. 2017-2018. Quasi-experimental research design was utilized in the study with formative test as the main instrument for data gathering. There were 80 first year BEE students who served as control and experimental respondents. Based on the findings, the researcher concluded that the levels of achievement in the pre-test were Poor and in post-test were interpreted as Fair in terms of Traditional approach, while for the levels of achievement in Concrete-Pictorial-Abstract approach, the pre-test was interpreted as Fair and in post-test were Good. Revealed further that there is a significant difference in the levels of achievement in the pre-test and post-test in using of Concrete-Pictorial-Abstract and Traditional approaches. In view of the findings and conclusions, the researcher recommended that Mathematics Instructor may use Concrete-Pictorial-Abstract approach to provide students with a structured way to learn math concepts. Teachers' instructional design should include opportunities for external-internal interactions to facilitate image formation, external-external interactions to facilitate empirical abstraction of mathematical idea and internal-internal interactions to facilitate schematic connections and organizations. The teachers are encouraged to use different techniques to suit the learning needs of the students. Lastly, seminars and trainings in different teaching strategies may be attended by Mathematics Instructor.

Index Terms— College Algebra, Concrete-Pictorial-Abstract Approach, Control Group, Experimental Group, Pre-Test, Post-Test, Traditional Approach.

1 INTRODUCTION

MATHEMATICS educators have been trying to find the best way to help students learn. There is the discovery approach that allows the students the opportunity to collect information and use teacher provided tools in order to create the knowledge. This method has led to peer teaching and is commonly known as group work. The discovery approach is hands-on, practical and concrete motivating students by giving them real world scenarios where math is used and is important.

Singapore is considered the best in the world as far as mathematics teaching is concerned. This has been proven from the results of international assessments like the PISA and TIMSS. Numerous studies have shown that among the reforms undertaken in the last few decades by Singapore was the use of the Concrete-Pictorial-Abstract Approach in teaching mathematics.

Concrete, pictorial, abstract (CPA) is a highly effective approach to teaching that develops a deep and sustainable understanding of math for pupils. Often referred to as the concrete, representational, abstract framework, that was developed by American psychologist Jerome Bruner. This activity-based approach is about learning by doing. It is particularly effective for teaching mathematical concepts and skills at primary and lower secondary levels, but is also effective at higher levels.

Although the CPA sequence has been shown to be

primarily effective for teaching early numeracy and has limitless potential for learners in Mathematics, it is also effective for more complete Mathematical processes. It can thus be applicable to higher subjects including College Algebra. Hence, there is a need to conduct a study regarding the effect of Concrete-Pictorial-Abstract Approach in teaching College Algebra.

This study is hoped to develop a tangible understanding of the math concepts/skills and sustain interest in abstract subjects. The findings of this study will significantly contribute specifically to teachers, students and school administrators.

1.2 OBJECTIVES OF THE STUDY

The study determined the comparison between the Traditional Approach and Concrete-Pictorial-Abstract (CPA) Approach in teaching College Algebra among BEE students of College of Teacher Education of Ramon Magsaysay Technological University (RMTU) Academic Year 2017-2018.

Specifically, the study aimed to determine the level of achievement in the pre-test using Traditional Approach; level of achievement in the post-test using Traditional Approach; level of achievement in the pre-test using Concrete-Pictorial-Abstract Approach; level of achievement in the post-test using Concrete-Pictorial-Abstract Approach; and test the significant

difference on the level of achievement in the pre-test and post-test of the two teaching approaches.

2 LITERATURE REVIEW

Mathematics is one subject that pervades life at any age and in any circumstance. Thus, its value goes beyond the classroom and the school. Mathematics as a school subject, therefore, must be learned comprehensively and with much depth [1].

Algebra is an abstract system in which interactions reflect structure of arithmetic [2]. Its processes are abstract schemas or structure conceptions of the arithmetic operations, equals, and operational laws, combined with the algebraic notion of variable. Arithmetic does not operate at the same level of abstraction as algebra for although they both involve written symbols and an understanding of operations, arithmetic is limited to numbers and numeral computations. Arithmetic and algebra differ fundamentally in that arithmetic computational procedures are separated from the object obtained. That is, students in arithmetic are not expected to conceive of groups of numbers and symbols as objects, whereas in algebra this is necessary.

Most of the literature actually do not dwell on the precise definition of Mathematics achievement. In fact, most of the studies here and abroad focus instead on the factors that contribute to mathematics achievement. There are two schools of thought in Mathematics achievement literature. One school of thought focuses on the "factors" that affect or influence achievement.

In an effort to understand the factors associated with mathematics achievement, researchers have focused on many factors. The impact of various demographic, social, economic and educational factors on students' math achievement continues to be of great interest to the educators and researchers. [3] concluded that parents' socioeconomic status is correlated with a child's educational achievement. Also, [4] showed that factors such as individual study, parents' role, and social environment had a significant influence on "further education" decisions and achievements of young students'.

The other school focuses on interventions aimed at improving mathematics achievement. For one, researchers explored the need for educators to align instructional design in order to achieve better performance in mathematics [5].

The CPA sequence of instruction differs from other approaches with regard to instructional methods and activities and teacher involvement. The major focus of instruction is on conceptual understanding and students' demonstration of their mastery of this understanding. The use of manipulative objects is not unique to this method. The combination of teacher demonstration, guidance, and student demonstration of mastery over three lessons differentiates this from other methods.

The teacher is directly involved in each level of instruction until the student masters the mnemonic device and increases his or her level of automaticity and independence from the teacher. The direct involvement of the teacher separates CPA from constructivist approaches, but the fading of the teacher's direction differentiates CPA from other remedial approaches [6].

CPA may be at the heart of teaching for mathematical mastery, but giving pupils objects and drawings to help them to understand key concepts isn't anything new. So, what is it that makes this approach so valuable to the study of math and particularly to the teaching for mastery? Firstly, CPA is not about getting the answer quickly. Concrete manipulatives are often used to help low-ability students to work through questions, but it is important that teachers also use them to encourage the transition to pictorial and abstract. After all, math lessons aren't about teaching tricks; they are about giving pupils the tools to understand the problem in front of them. Interestingly, in a mastery classroom, there doesn't have to be a linear progression from concrete to pictorial to abstract. Instead, teachers should apply a cyclical approach. For example, even when a pupil has worked out the answer using an abstract method, it is worth asking them to use concrete manipulatives to convince others that they are correct.

Secondly, CPA is for everyone; all abilities and ages. Concrete manipulatives are a common feature of KS1 classrooms across the country. By KS2, they barely exist and are only occasionally brought out for students who are struggling. Mastery teaching encourages the use of concrete manipulatives in any lesson and suggests that there is value in KS2 students having a variety of equipment to aid their thinking. For these pupils, concrete objects can often kick-start learning about a new concept and are gradually abandoned as pupil's progress through the lesson. Finally, CPA is a way to deepen and clarify mathematical thinking. Students are given the opportunity to discover new ideas and spot the patterns, which will help them reach the answer. From the start of KS1, it is a good idea to introduce CPA as three interchangeable approaches, with pictorial acting as the bridge between concrete and abstract. When teaching for mastery, the CPA approach helps learners to be more secure in their understanding, as they have to prove that they have fully grasped an idea. Ultimately, it gives pupils a firm foundation for future learning [7].

3 METHOD

The quasi-experimental research design was used to observed and manipulate the outcome performed in the experimental group which estimates the causal impact of an intervention on the comparison of Concrete-Pictorial-Abstract Approach and Traditional Approach in teaching College Algebra among BEEed student in Ramon Magsaysay

Technological University.

The respondents were the (80) first year BEEED students of College of Teacher Education.

A researcher-made questionnaire was used as the main instrument in gathering the data. Indicators were taken from the different materials/sources such as the internet, and Mathematics books. The test question was composed of two (2) parts. The first part included the personal profile of the respondents such as age, sex, and the group they belong to. The second part of the questionnaire dealt with the problems in the following strands: Positive Exponents, Factoring of Polynomials, and Graphs of Linear Equations.

Proper validation of the test was done thru parallel examinations subjected to the expert analysis of three (3) subject matter experts/professors in College Algebra from the University. Permission from the CTE Dean was also sought for the test administration.

The data gathered were tallied, analyzed, and interpreted accordingly. The data were treated using Frequency, Percentage, Weighted Mean and T-test. The statistical software SPSS was use in the analysis of data.

4 RESULTS AND DISCUSSION

Table 1 shows the level of achievement in the pre-test and post-test of the respondents in terms of Traditional Approach.

For Pre – test, out of 40 students–respondents, majority or 27 or 67.50% got a score from 0 – 7 and 13 or 32.50% has a score from 8 - 14.

For Post – test, out of 40 student – respondents, 12 or 30.00% got a score from 0 – 7 and 8 – 14 respectively; 11 or 27.50% has a score from 15 – 21; 5 or 12.50% has a score from 22 – 28 and nobody got a score from 29-35.

According to the study of [8], there is a 10% increase in knowledge gained by participants over traditional method of tallying pre-/post-test. He states that the method also provides instructor feedback to improve the workshop content and allowing him/her to better gauge the time needed for program components, measure confidence in answers, and identify where incorrect answers are actually thought to be corrected by participants.

Table 1. Level of achievement in the pre-test and post-test in terms of Traditional Approach.

Descriptive Value	Score	Pre - test		Post - test	
		Frequency	Percent	Frequency	Percent
Excellent	29 - 35	0	0.00	0	0.00
Very Good	22 - 28	0	0.00	5	12.50
Good	15 - 21	0	0.00	11	27.50
Fair	8 - 14	13	32.50	12	30.00
Poor	0 - 7	27	67.50	12	30.00
	Total	40	100.00	40	100.00

Table 2 shows the level of achievement in the pre-test and post-test of the respondents in terms of Concrete-Pictorial-Abstract Approach.

For Pre – test, out of 40 student – respondents, majority or 21 or 52.50% got a score from 0 – 7; 13 or 32.50% has a score from 8 – 14 and 6 or 15.00% got a score from 15 - 21.

For Post – test, out of 40 student – respondents, 1 or 2.50% got a score from 0 – 7; 5 or 12.50% has a score from 8 – 14; 19 or 47.50% got a score from 15 – 21; 15 or 37.50% has a score from 22 – 28; and nobody got a score from 29-35.

Concrete Pictorial Abstract approach helps learners to be more secure in their understanding, as they have to prove that they have fully grasped an idea. Ultimately, it gives pupils a firm foundation for future learning.

As cited by [7] students are given the opportunity to discover new ideas and spot the patterns, which will help them reach the answer. It is a good idea to introduce CPA as three interchangeable approaches, with pictorial acting as the bridge between concrete and abstract.

Table 2. Level of achievement in the pre-test and post-test in terms of Concrete-Pictorial-Abstract Approach

Descriptive Value	Score	Pre - test		Post - test	
		Frequency	Percent	Frequency	Percent
Excellent	29 - 35	0	0.00	0	0.00
Very Good	22 - 28	0	0.00	15	37.50
Good	15 - 21	6	15.00	19	47.50
Fair	8 - 14	13	32.50	5	12.50
Poor	0 - 7	21	52.50	1	2.50
	Total	40	100.00	40	100.00

Table 3 shows the difference on the level of achievement in the pre – test and post – test of the respondents in terms of Traditional Approach.

The computed significant value of 0.00 is less than 0.05 alpha level of significance, therefore the null hypothesis was rejected; this indicate that there was a significant difference in the pre – test and post – test of the respondents in terms of traditional approach.

[9] stated that the students in both intervention groups outperformed students in the control group on a measure of mathematics achievement. On a state accountability measure in mathematics, students in the experimental group performed better than other students. The result revealed that the mathematical game approach is superior to the conventional method in facilitating achievement in mathematics.

Table 3. Difference on the level of achievement in the pre-test and post-test using the Traditional Approach

Approach	t	df	Sig. (2-tailed)	Decision/ Interpretation
Traditional	4.86	39	0.00	Reject Ho Significant

Table 4 shows the difference on the level of achievement in the pre – test and post – test of the respondents in using Concrete Pictorial Abstract Approach.

The computed significant value of 0.00 is less than 0.05 alpha level of significance, therefore the null hypothesis was rejected; this indicate that there was a significant difference in the pre – test and post – test of the respondents in terms of concrete pictorial abstract approach.

In associating and redefining Bruner’s learning stages of Enactive, Iconic and Symbolic from a learning perspective to a teaching perspective of CPA, it is evident that teaching and learning with external representations encapsulates many important interactional processes that is not spelt out in the original documents. Students who use concrete materials develop more precise and more comprehensive mental representations, often show more motivation and on task behavior, understand mathematical ideas, and better apply these ideas to life situations [11].

Table 4. Difference on the level of achievement in the pre-test and post test using Concrete-Pictorial-Abstract Approach

Approach	t	df	Sig. (2-tailed)	Decision/ Interpretation
Concrete Pictorial Abstract	8.33	39	0.00	Reject Ho Significant

Table 5 shows the difference on the level of achievement in the pre – test and post – test of the respondents using traditional and Concrete-Pictorial-Abstract Approach.

The computed significant value for pre – test (0.03) and post – test (0.00) were all less than 0.05 alpha level of significance, therefore the null hypothesis was rejected; this indicate that there was a significant difference in the pre – test and post – test of the respondents in using traditional and concrete pictorial abstract approaches.

[6] concluded that students show improvement in fluency and confidence in doing arithmetic computations involving subtractions. A number of other studies have provided evidence of positive effect of using CRA on low achievers in the area of fractions, word problems, simple linear functions, and advanced linear functions. Indeed, the use of CRA approach to teaching mathematics concepts, especially at the elementary level has been proven to be effective.

Table 5. Difference on the level of achievement in the pre-test and post-test using Traditional Approach and Concrete-Pictorial-Abstract Approach

Source of Variation	df	F	Sig.	Decision/ Interpretation	
Pre - Test	Between Groups	1	4.66	0.03	Reject Ho Significant
	Within Groups	78			
	Total	79			
Post Test	Between Groups	1	23.40	0.00	Reject Ho Significant
	Within Groups	78			
	Total	79			

5 CONCLUSIONS AND RECOMMENDATION

In conclusion, it revealed that the levels of achievement in the pre-test were Poor and in Post-test were interpreted as Fair in terms of Traditional Approach while in the levels of achievement in the pre-test were interpreted as Fair and in post-test were Good in terms of Concrete-Pictorial-Abstract Approach. More so, it revealed that there is a significant difference on the levels of achievement in the pre-test and post-test using Traditional Approach and Concrete-Pictorial-Abstract Approach.

Based on the conclusions, the researchers recommend the following: mathematics instructor may use Concrete-Pictorial-Abstract Approach in teaching College Algebra to provide students with a structured way to learn math concepts; teachers’ instructional design should include opportunities for external-internal interactions to facilitate image formation, external-external interactions to facilitate empirical abstraction of mathematical idea and internal-internal interactions to facilitate schematic connections and organizations; the teachers are encouraged to use different techniques and attend trainings related to teaching strategies to suit the learning needs of the students.

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