Effectiveness of Triangle Congruency (Tricon) Learning Guide in Improving the Proving Skills of Grade 8 Learners

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ABSTRACT: This study examined and measured the effectiveness of a triangle congruency (tricon) learning guide in improving the proving skills of Grade 8 learners at Lecheria Integrated School. Quantitative research methodology, namely Quasi Experimental Research Design, was used in this study. To select participants, match pairing techniques were used. There were two groups of students in this study: the experimental group and the comparison group. The students in the experimental group were handed out PIVOT module by DEPED together with the learning guide as supplementary material. Students in the comparison group were handed out PIVOT module only. Mean and standard deviation were used to assess participants' performance in formative testing, pretest, and posttest. Similarly, the independent t-test was used to evaluate the significant difference between the two groups' pretest and posttest scores, and Cohen's d was employed to assess the effect size or quantify the size of the difference between two test results. The study's main findings were evident. It was found out that the pretest mean score of the experimental group and comparison group were the same. The experimental group received higher points in their posttest after gathering all the relevant data. As a result, a considerable distinction between two groups was discovered. The findings revealed that learners who utilized the learning guide as supplementary material were more likely to improve their proving skills. The researcher recommended using this learning guide as supplementary material to enhance students' ability in terms of their proving skills. The results of the study revealed that students in the experimental group did better than those in the comparison group. This showed that the results implied that using a Triangle Congruency (TriCon) Learning Guide might assist students improve their academic performace (proving skills) in Mathematics.

KEYWORDS: Learning Guide, Triangle Congruency, Mathematics Performance, Proving Skills

INTRODUCTION

Learning Mathematics is very relevant to everyday life since education is very vital for everyone. Numerous factors contribute to some pupils' challenges in learning Mathematics. In accordance with this, educators who support learning should plan and implement a variety of strategies and techniques to aid students in understanding their teachings, particularly those in Mathematics. A teacher will put in a lot of effort to support students' learning by creating a learning guide. One of a teacher's duties is to create instructional materials, thus it should always receive attention. Using a learning resource, students can independently or collaboratively comprehend a particular subject. Before giving out a learning resource to the class, especially a learning guide, a teacher should carefully arrange and organize it. For people to comprehend the structure of their world, congruence is a crucial mathematical concept. Young children's daily interactions with congruence enable them to build innate perceptions of this geometric relationship. Congruence theory provides solid groundwork for understanding more complex mathematical procedures like area and volume measurement. However, prior study has shown that a variety of children, both in the elementary and secondary schools, struggle with learning congruence [1].   Relevance: Care should be taken to make sure that only Instructional Materials related towards the lesson were used when teaching. In these statements mentioned, it is evident that a good learning guide should be relevant in a sense that it can help to uplift the quality of education. [2].

Whether writing an email, blog post, magazine article, or letter to a friend, being able to write properly is essential for communicating your ideas. It is critical to write in a clear and concise manner if you want your words to be recited and comprehended. Most writing attempts to inform or encourage readers to take some action as its main objective. Readers are more likely to respond to the message and understand it more easily if using clear, concise language. When the same instructions were displayed in a less legible typeface, participants (or students) perceived the exercise to be difficult and would take nearly twice as long to complete [3].

A Learning Guide is a self-sufficient unit of work in an instructional course, as well as a teaching methodology focused towards the development of knowledge and skills in distinct units. Learning Guide characteristics are independent, self-contained,

self –education. Moreover, learning guides are self-contained units of instruction that are grounded towards the development of knowledge and skills in distinct units. The performance of students of OHS program is based on how they will deal with learning guides in order for them to learn well [4].

According to a study [5], the results of the study indicated that both methods of teaching i.e. traditional as well as self-learning modules enhance the process skills among students but, teaching through self-learning modules is more operative as compared to conventional method as it results in significantly higher gain in process skills than traditional method of teaching. The students' perspectives in Mathematics agreed on the use of a modular distant learning technique. They all agreed that this method has several advantages [6]. The learners agreed that employing a modular learning strategy in Math is simple. In Mathematics, the modular distance learning technique improved students' academic performance. The children's academic achievement was excellent, according to the percentage grade indicators.

This study aimed to test the effectiveness of Triangle Congruency (Tricon) Learning Guide in improving the proving skills of Grade 8 Learners which can therefore help teachers improve on students' mathematical learning in a distanced learning setup.

OBJECTIVES OF THE STUDY

This study examined the Effectiveness of Triangle Congruency (Tricon) Learning Guide in improving the proving skills of Grade 8 Learners of Lecheria Integrated School.

Specifically, the following are the objectives.
1. Determine the mean scores of the students in comparison and experimental group in their pretest, formative test, and posttest.
2. Identify the significant difference between the formative mean scores of the students in the comparison and experimental group.
3. Identify the significant difference between the posttest mean scores of the students in comparison and experimental groups.
4. Distinguish the significant difference between pretest mean score of each group.

MATERIALS AND METHODS

Research Design

This study used a quasi-experimental study in which a treatment, procedure, or program was introduced on purpose and a result or outcome was observed. This was a controlled test performed to demonstrate a known truth, examine the validity of a hypothesis, or determine the efficacy of something previously untested.

The researcher administered a treatment to the participants and then measured the results to determine the effectiveness of the learning guide in Triangle Congruency. An intact group of subjects was given the treatment and then measured in this design. There was no attempt to assign subjects to groups at random, and the design does not include any additional groups as comparisons. As a result, the group received one treatment and one observation.

The pretest-posttest non-equivalent control group design was used in this study. There was a treatment group in this design that was given a pretest, a treatment, and then a posttest. However, there was a non-equivalent control group that received a pretest, did not receive treatment, and then received a posttest. The question then was not simply whether participants who received the treatment improve, but whether they improved more than those who did not.

The researcher used a standardized test for Triangle Congruency as his measuring instrument in gathering and collecting data from the pre-test and post-test of the respondents.

Participants of the Study

The participants of this study were the Grade 8 students of Lecheria Integrated School SY 2021-2022. They were comprised of 52 learners which were given pretest for the match-pairing process. The experimental group were the 17 learners and the comparison group were the 17 learners as well. They were identified through match-paring technique. The comparison group used the PIVOT module from DEPED while the experimental group used the TriCon learning guide. The learners were given the pretest, the results then were analyzed, those who were identified paired, were the participants.

Table 1 presents the participants of the study.

Table 1. Participants of the Study

Group	N	Sample Size	Blind Participants
Comparison Group	27	17	10
Experimental Group	25	17	8
Total	52	34	18

Research Instrument

The main instruments that used for the experimental group in this study was the learning guide in Triangle Congruency (TriCon) that developed by the researcher and validated by roster of experts while the comparison group utilized the PIVOT module by DEPED.

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Another instrument was the standardized pretest, and posttest while the formative test was a researcher-made test. This instrument is 40 items each for pretest and posttest, and 10 items each for every formative test. The researcher conducted a pre-test and a post-test for the objective of the study. The items on the researcher-made test was used in the pre-test were the same as those in the post-test in order to get an unbiased result. Further, the developed learning guide which were used in the study underwent validation. Table 2 presents the results of the overall evaluation and validation of the research instrument.

Table 2. Overall Evaluation and Validation Result of the Research Instrument

ASPECTS	Mean	SD	DI
I. CONTENT	4.67	0.26	Very High Valid
II. LANGUAGE & STYLE	4.87	0.32	Very High Valid
III. ORGANIZATION & PRESENTATION	4.67	0.58	Very High Valid
IV. USEFULNESS	4.60	0.26	Very High Valid
Overall Mean	4.70	0.35	Very High Valid

Legend: 4.50-5.00 Very High Valid; 3.50-4.49 High Valid; 2.50-3.49 Valid; 1.50-2.49 Less Valid; 1.00-1.49 Not Valid

The results showed an overall mean of 4.70 (SD=0.35) which means very *high valid* and therefore manifested that the validators strongly accept the learning guide to be effective tool to be used as supplementary material.

RESULTS AND DISCUSSION

Table 3 presents the pretest mean scores in Mathematics 8 of the learners in the comparison group and experimental group

Table 3. Pretest mean scores in Mathematics 8 of the learners in the comparison group and experimental group.

Group (n = 17)	Mean	Std. Dev.	Descriptive Interpretation
Experimental Group	14.41	4.66	Low
Comparison Group	14.41	4.66	Low

Legend: 36.00 – 40.00 = Very High; 32.00 – 35.00 = High; 20.00 – 31.00 = Average; 10.00 – 19.00 = Low; 1.00 – 9.00 = Very Low

The results revealed that the mean score of the experimental group and comparison group are both 14.41 (SD=4.66). It can be perceived then that both groups show the low interpretation. Using the gathered data and the low results in the pre-test, intervention was made.

According to Olawale (2013), Relevance: Care should be taken to make sure that only Instructional Materials related towards the lesson were used when teaching. In these statements mentioned, it is evident that a good learning guide should be relevant in a sense that it can help to uplift the quality of education. Similarly, Gonzales (2015) discovered that using the modular method of teaching was more effective than the conventional approach. With this COVID-19 pandemic, which prevents face-to-face classes from taking place, and the difficulties in using the internet as well as technology, modular teaching method is the best option for continuing to deliver education that can possibly yield positive outcomes. [7]

Table 4 presents the formative test mean scores in Mathematics 8 of the learners in the comparison group and experimental group.

Table 4. Formative test mean scores in Mathematics 8 of the learners in the comparison group and experimental group.

Group (n = 17)	Mean	Std. Dev.	Descriptive Interpretation
Experimental Group	35.65	3.30	Very High
Comparison Group	21.47	6.46	Average

Legend: 36.00 – 40.00 = Very High; 32.00 – 35.00 = High; 20.00 – 31.00 = Average; 10.00 – 19.00 = Low; 1.00 – 9.00 = Very Low

The results revealed that the experimental group has the higher mean score of 35.65 (SD=3.30) which has the descriptive interpretation of Very High and the comparison group has 21.47 mean score (SD=6.46) with average as its descriptive interpretation. This proves the effectiveness of the learning guide (supplementary material) in the formative test.

According to Goldschmid, (2015), Modular instruction is a significant educational advancement and teaching approach. It provides a solution to the problems associated with teaching instruction. Modular approach assures a more proficient mass education by providing more operational individual instruction at a time when teachers must produce knowledge in a large group all at once. It is a self-instruction method in which students' present instructional materials to demonstrate their comprehension as well as their skills. [8]

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Table 5 presents the posttest mean scores in Mathematics 8 of the learners in the comparison group and experimental group.

Table 5. Posttest mean scores in Mathematics 8 of the learners in the comparison group and experimental group

Group (n = 17)	Mean	Std. Dev.	Descriptive Interpretation
Experimental Group	32.12	4.57	High
Comparison Group	22.12	5.72	Average

Legend: 35.00 – 40.00 – Very High; 32.00 – 35.00 – High; 20.00 – 31.00 – Average; 10.00 – 19.00 – Low; 1.00 – 9.00 – Very Low

The results revealed that the experimental group has the higher mean score of 32.12 (SD=4.96) which has the descriptive interpretation of high and the comparison group has 22.13 mean score (SD=5.72) with average as its descriptive interpretation. According to a study conducted by Sareen (2019), the results of the study indicated that both methods of teaching i.e traditional as well as self-learning modules enhance the process skills among students but, teaching through self-learning modules is more operative as compared to conventional method as it results in significantly higher gain in process skills than traditional method of teaching. [5]

Table 6 presents the test of significant difference between the formative tests mean scores in Mathematics of the learners of the two groups.

Table 6. Test of significant difference between the formative tests mean scores in Mathematics of the learners of the two groups.

Test	Group	Mean	Mean Difference	t-value	Cohen's d
Formative	Experimental	35.65	14.18	8.057**	2.76 (Large)
	Comparison	21.47			

df = 32; *Significant at .01 level; Cohen's d: 0.20 (Small); 0.50 (Medium); 0.80 (Large)

The comparative analysis was able to generate the t-value of 8.057. The results revealed a large interpretation of the standardized difference (Cohen's d). Consequently, it denies the null hypothesis that there is no significant difference between the formative tests mean scores of the two groups $[t(32) = 8.057; p < 0.01]$.

The students' perspectives in Mathematics agreed on the use of a modular distant learning technique. They all agreed that this method has several advantages, Dangle, (2020). The learners agreed that employing a modular learning strategy in math is simple. In Mathematics, the modular distance learning technique improved students' academic performance. The children's academic achievement was excellent, according to the percentage grade indicators. [6]

Table 7 presents the test of significant difference between the posttest mean scores of the two groups.

Table 7. Test of significant difference between the posttest mean scores of the two groups.

Test	Group	Mean	Mean Difference	t-value	Cohen's d
Posttest	Experimental	32.12	10.00	5.632**	1.93 (Large)
	Comparison	22.12			

df = 32; *Significant at .01 level; Cohen's d: 0.20 (Small); 0.50 (Medium); 0.80 (Large)

The results revealed the comparative analysis of the posttest mean scores in Mathematics of both experimental and comparison groups which yielded the t-value of 5.632. It exposed the large interpretation of the standardized difference (Cohen's d) which is 1.93 and therefore revealed that the null hypothesis there is no significant difference between the posttest mean scores of the two groups is also rejected $[t(32) = 5.632; p < 0.01]$.

According to Nardo, (2017), modules professionally developed for learners to use can help meet the diverse language learning needs of students. Students employ learner autonomy because it boosts their confidence, especially when they do not need as much teacher supervision. Students do well on module tasks, demonstrating their independence in carrying out tasks. The experimental and comparison groups demonstrated comparable performance in regular tasks, assigned tasks, and evaluation tasks, suggesting that students can use the modules with little to no teacher involvements. [9]

Table 8 presents the test of significant difference between the pretest and posttest mean scores in Mathematics of the pupils in each group.

Table 8. Test of significant difference between the pretest and posttest mean scores in Mathematics of the pupils in each group

Group	Test	Mean	Mean Difference	t-value	Cohen's d
Comparison	Pretest	14.41	7.71	6.938**	1.48 (Large)
	Posttest	22.12			
Experimental	Pretest	14.41	17.71	24.900**	3.84 (Large)
	Posttest	32.12			

df = 16; **Significant at .01 level; Cohen's d: 0.20 (Small); 0.50 (Medium); 0.80 (Large)

As shown in Table 8, the large interpretation of the standardized difference (Cohen's d) and therefore revealed that the null hypothesis there is no significant difference between the pretest and posttest mean scores of the experimental group $[t(16) = 24.900; p < 0.01]$ and comparison group $[t(16) = 6.938; p < 0.01]$ is also rejected.

The students in the experimental group who used the TriCon learning guide performed better and can easily solve corresponding parts of congruent triangles; proves two triangles are congruent; proves statements on triangle congruence; and apply triangle congruence to construct perpendicular lines and angle bisectors compared to the comparison group.

Fabro, (2018) demonstrated that these supplementary materials must be interesting, not complicated, and certainly familiar in terms of relevance, reliability, and readiness, such as those organized in simple language will allow the learners to make the most of their learning. Allow the students to study them wherever they like, at the front desk or in the library, without the teacher needing to be involved as much. Give students the opportunity to develop how to be responsible for their own learning. Provide the teacher with an opportunity to teach the students. [10]

CONCLUSION AND RECOMMENDATION

On the results of pre-test mean scores, both groups showed a low interpretation. On the results of the formative test of the two groups, it is perceived that the experimental group had the higher mean score which has the descriptive interpretation of very high and the comparison had average as its descriptive interpretation.

On the results of the post-test of the two groups, it showed that the experimental group had the higher mean score which had the descriptive interpretation of high and the comparison group had an average as its descriptive interpretation.

On the comparative analysis of the two groups, there was a significant difference between the pre-test and post-test mean scores obtained by the experimental group and the comparison group.

The data gathered and analyzed showed that the null hypotheses are rejected which state that, there is no significant difference between the formative tests, posttest and pretest mean scores of the two groups.

The results of the study revealed that students in the experimental group did better than those in the comparison group. This showed that the results implied that using a Triangle Congruency (TriCon) Learning Guide might assist students improve their academic performace (proving skills) in Mathematics.

Using the findings and conclusions as bases, the following are the recommendation of the researcher.

Teacher may provide appropriate learning styles among his or her learners. He or she may always see to it that in addressing the learners' needs, it is significant to know their potentials and skills.

The teachers as curriculum makers and implementers may focus on crafting intervention materials that may help in increasing the performance level of the learners.

Teacher researchers may conduct studies and intervention materials for the betterment of the learners. Additionally, they may also attend training and seminars which focus on effective delivery of the lesson to learners this pandemic.

Teachers' primary concern is to provide great teaching and learning. They may give emphasis in preparing a well-designed lesson and intervention.
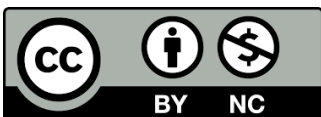
Future researchers may conduct further study focusing on developing another triangle congruency (tricon) learning guide for higher grade levels like Grade 9 and Grade 10 then test it efectiveness as well.

REFERENCES

1) Clements, D. H. & Sarama, J. (2014). Learning and teaching early math: The learning trajectories approach (2nd ed.). New York, NY: Routledge. https://files.eric.ed.gov/fulltext/ED583689.pdf

2) Olawale, S. K. (2013). The Use of Instructional Materials for Effective Learning of Islamic Studies. Olawale, S. K. (2013). The Use of Instructional Materials for Effective Learning of Islamic Studies. Jihat-al-Islam, 6, 29-40. - References - Scientific Research Publishing (scirp.org)

3) Song, H. & Shwarz N. (2018). Processing Fluency Affects Effort Prediction and Motivation | If It's Hard to Read, It's Hard to Do: Processing Fluency Affects Effort Prediction and Motivation (usc.edu)

4) Sejpal, K. (2013). Modular Method of Teaching | Foreign Literature According to Dr Kandarp Sejpal 2013 modular teaching is one | Course Hero

5) Sareen, S. (2019). EFFECTIVENESS OF SELF LEARNING MODULES ON PROCESS SKILLS IN SCIENCE IN RELATION TO STUDY HABITS OF CLASS IX STUDENTS | 19.pdf (ij360mr.com)

6) Dangle, Y. R. (2020). The Implementation of Modular Distance Learning in the Philippine Secondary Public Schools. Pe Dangle, Y. R. (2020). The Implementation of Modular Distance Learning in the Philippine Secondary Public Schools. <i>Proceedings of The 3rd International Conference on Advanced Research in Teaching and Education</i>. (sciepub.com)

7) Gonzales, E. (2015). A Modular Approach Utilizing Decision Tree in Teaching Integration Techniques in Calculus. APJMR-2015-3-3-009-A-Modular-Approach-Utilizing-Decision-Tree-in-Teaching.pdf

8) Goldschmid, et. al. (2015). Modular Teaching Technologies as Innovative Components of Modern Pedagogical Technologies Modular Teaching Technologies as Innovative Components of Modern Pedagogical Technologies | Semantic Scholar

9) Nardo, M. (2017). Modular Instruction Enhances Learner Autonomy. Retrieved from http://pubs.sciepub.com/education/5/10/3/

10) Fabro, E. (2018). Effectiveness_Of_Modular_Distance_Learning_In_Mathematics_In_The_New_Normal_A_Literature_Review.Pdf (Globalscientificjournal.Com)