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Effect of Geoboard as a Remedial Tool in Teaching Geometry

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Abstract:

This experimental research investigated the effect of geoboard instruction on learners' mathematics achievement in geometry. Participants of the study were 60 grade 9 learners classified into two groups – the control group and the experimental group. The participants of this study were learners with low achievement geometry that needs to be remediated. The experimental group was exposed to geoboard instruction and the control group learned through non-geoboard instruction. Results show that after being exposed to geoboard and non- geoboard instruction, learners from both groups improved their achievement in geometry. Comparing the post-test scores of students between the two groups, the result shows that learners exposed to geoboard instruction have better achievement in geometry than those exposed to the non-geoboard instruction. It was concluded that geoboard instruction promoted more effective learning in mathematics.

Keywords: *geoboard, remedial tool, achievement in Geometry, mathematics education*

Introduction:

Limited focus on geometry in the mathematics curriculum up through the grade has been a longstanding issue in the field of mathematics education (Clement and Sarama, 2011). Ligett (2017) presented that the use of manipulative is one way to poster students' understanding of mathematics. Manipulative may play an important role in enhancing the geometric reasoning skill of students by creating a suitable context that allows the transition from empirical thinking to more abstract thinking (Arıcı & Aslan-Tutak, 2015).

A Geoboard is an instructional material that can be an important manipulative tool that is easy to design and utilize in Mathematics classrooms. The name is derived from the combination Geo, Geoboard, which means geometry, and plan, which means flat surface, therefore Geoboard. The Geoboard is a flat piece of wood with nails tapped the same distance apart. Geoboards are classified into four types: square, round, Trelissado, and Oval Office. The Geoboard, according to Scandrett (2008), is a versatile manipulative that may be used at all levels for teaching and learning

about various areas of Mathematics. Carroll (1992) describes the geoboard as a powerful manipulating tool for problem-solving and exploratory approaches.

Due to the current situation nowadays has been a great challenging task for the education sector to address the continuation of the teaching-learning process specifically in mathematics subjects, as the present situation schools are in a modular approach where students can see the figures but they didn't understand what's on the figure. Therefore, learning mathematics has been quite difficult on the learners' part because they will learn independently on the provided modules to them. The Department of Education (DepEd) has pushed for curricular revisions and the implementation of various teaching methodologies to produce a better curriculum and improve the educational system as part of the government's attempts to respond to perceived needs in the education sector (Capate & Lapinid, 2015).Geoboard was used in this study as a remedial tool in teaching geometry to help students to improve their achievement in geometry and help them learn independently.

Methodology:

This study employed a quasi-experimental design to determine the effectiveness of geoboard instruction in teaching geometry. The two groups were given a pre-test (control group and experimental group) to determine the differences between the groups at the beginning of the experiment and to serve as a basis for determining the achievement of both groups in the latter part of the experiment. The participants of the study are the sixty (60) Grade 9 junior high school students in mathematics, comprised of two sections, each with thirty (30) students. These participants were low-performing students in mathematics that need to be remediated.

The instrument used was Geometry Achievement Test (GAT) which underwent validity and reliability testing. The GAT is a 40 – item test that was developed from the content area used for the study. The multiple-choice items were drawn using the validated table of specifications. It was subjected to both face and content validation procedures. KR20 was used in assessing the test of internal consistency and yielded a reliability index of 0.77.

The instrument primarily focused on the topics of quadrilateral, parallelograms, theorems, proportion, the similarity of figures, and the topics for the third quarter which are based on the Most Essential Learning Competencies (MELCs) used under the K to 12 Basic Education Curriculum. For the post-test, the same instrument was used. Each correct answer was given one point and the learners' achievement was interpreted using the constructed scale. Before the intervention, the researcher prepared lesson plans to conduct the study. Geoboard and the non-geoboard group had the same lesson plan but varied on some parts of the lesson plan such as motivation, evaluation, and agreement. Lesson plans were submitted for content validation together with the pre-test and post-test.

Results and Discussions:

The difference between the pre-test and post-test scores of learners exposed to geoboard instruction and non-geoboard instruction.

The difference in the pre-test and post-test scores achievement in mathematics of the experimental and control group was determined using paired samples t-test. There was a significant difference between the pre-test (*M = 9.03, SD=2.01*), and post-test (*M= 18.10, SD= 4.11*) scores of learners exposed to geoboard instruction, *t(29)= -11.20, p < .01*(two-tailed).

This implied there was a greater difference in pre-test and post-test mathematics achievement in the geometry of learners in the experimental group. Geoboard can greatly improve learners' mathematics achievement in geometry.

There was also a significance difference between the pre-test (*M = 9.13, SD = 2.15*) and post-test (*M = 10.57, SD = 2.25*) scores of learners exposed to non-geoboard instruction, *t(29)= -3.31, p< .01*(two-tailed). This indicates that the current remedial class can also enhance learners' achievement in geometry. It simply shows that either a geoboard or non-geoboard instruction is used in the teaching geometry has an improvement in learners' mathematics achievement.

Table 1

The Difference between the Pre-Test and Post-Test Scores of Leaners Exposed to Geoboard Instruction and Non-Geoboard Instruction.

	Mean	SD	Mean Difference	CI Lower	CI Upper	t	df	p
Geoboard Instruction			9.07	-10.72	-7.41	-11.20	29	0.000*
Pretest	9.03	2.01						
Posttest	18.10	4.11						
Non-Geoboard Instruction			1.43	-2.32	-.55	-3.308	39	0.003*
Pretest	9.13	2.15						
Posttest	10.57	2.25						

The difference between the post-test scores of learners exposed to geoboard instruction and non-geoboard instruction.

The difference in the post-test achievement scores of the learners exposed to geoboard instruction and non-geoboard instruction was determined using a t-test for independent samples. There was a significance difference in the post-test achievement in geometry between geoboard

instruction (*M = 18.10, SD = 4.11*) and non-geoboard instruction (*M = 10.57, SD = 2.25*), *t(58) = -8.81, p < 0.01*. This result shows that learners exposed to geoboard instruction had acquired a better understanding of concepts in geometry which learners can appropriately connect representations, ideas, and insights about the topics compared to non-geoboard instruction. Geoboard instruction is more effective than non-geoboard in teaching geometry to address the mathematics achievement of the learners. This learning became their advantage in answering the mathematics test compared to the learners exposed to non-geoboard instruction.

Geoboards increased students' knowledge of geometric theorems, particularly geometric vocabulary and reasoning (Sibiya & Mudaly, 2019).After being taught geometry theorems using a Geoboard, Sibiya and Mudaly (2018) found that students were more eager to comprehend them.

Table 2

The Difference between The Post-Test Scores of Leaners Exposed to Geoboard Instruction and Non-Geoboard Instruction

	Mean	SD	Mean Difference	CI Lower	CI Upper	t	df	p
Geoboard Instruction	18.10	4.11						
			7.53	-9.24	-5.82	-3.99	58	0.000*
Non-Geoboard Instruction	10.57	2.25						

Conclusions:

The achievement in the geometry of learners under geoboard instruction was higher compared to those learners exposed to non-geoboard instruction. This implicit that learners exposed to geoboard instruction have an increased understanding of geometry than those in non-geoboard instruction. This further implied that geoboard instruction was more effective in teaching geometry than non-geoboard instruction. As a result, geoboard help and promotes learners' mathematics achievement and encourages learners to participate actively and be fully engaged in the learning process while taking full responsibility to create their understanding and meaning of geometry concepts. The use of geoboard activities in teaching geometry enabled learners to understand, motivate, and think comprehensively and increases memory. It also provided the learners a chance to explore positive and meaningful experiences.

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