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Enhancing Learners' Mathematical Performance Through Mathscore

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Abstract
This study aimed to determine the mathematical performance of 60 students who are using conventional way of learning and using the mathscore program in Sinalhan Integrated High School for the school year 2020 – 2021. A quasi-experimental research design was applied in this study. The statistical tools used are Mean, Standard Deviation, T-test of independent and dependent samples, and Cohen's d. The results reveal that the experimental group got much higher mean scores than the comparison group on their formative and post-test.
Each group shows improvement before and after the experimental study. However, the mean difference of the group that utilized the mathscore program depicts that they performed better than the comparison group, which proves that the program can help to improve the performance of the learners in terms of the lessons covered in this study.
For the conclusion of this study, there is a highly significant difference between the means scores performance of the participants. Based on the findings and conclusions, the researcher suggests using the Mathscore Program as primary or secondary assistance in teaching the topics covered in this study, as it will aid in improving the learners' mathematical performance, especially those who are having difficulty with the courses and who require the administration's assistance in offering training and seminars/webinars for such a program.
Keywords:geometry, learners' mathematical performance, mathscore program*

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I. Introduction

Mathematics is considered a difficult subject. Most students find mathematics hard to understand. Others may view it as a form of tedious and monotonous work. But what makes mathematics difficult? Many students struggle in mathematics like in solving problems due to numerous and complex formulas (Naval, Alpe, and Delos Reyes, 2019). Despite these difficulties, some students find Mathematics interesting. They can figure out those mathematical problems and understand the concepts and their relationship to other fields. Mathematics has some inherent difficulties due to its abstract and cumulative nature, but how do these students overcome their challenges? Some students can solve these problems while others look for different strategies to cope with them. During the Basic Education Curriculum (BEC), in the Philippines, there are various methods in enhancing the students' mathematical skills. One of these methods is the flashcard which teachers in teaching pre-elementary students use. This method allows the students to become familiar with the basic mathematical terms. In addition to flashcards, teachers used other methods such as window cards and Sudoku challenges to further enhance their skills in Mathematics.

Moreover, in 2018, as part of the Quality Basic Education reform plan and a move toward globalizing the quality of Philippine basic education, the Philippines joined the Organization for Economic Co-operation and Development's (OECD) Program for International Student Assessment (PISA), nonetheless, according to the results of PISA released on December 3, 2018, it revealed that the Philippines has the mean score of 353 in Mathematics and ranked 77 out of 78 participating OECD countries and this result was far from its neighbored countries like China who ranked first with 591 mean score, Singapore who ranked second with 569 mean score, and Taiwan who ranked fifth with 531 mean score to the 2018 PISA.

After a poor performance in past examination, the Department of Education vowed major changes. They launched "SulongEdukalidad," to improve the quality of basic education in the Philippines, whereby it enacted radical reforms in four key areas: (a) Upskilling teachers and school leaders through a transformed professional development program; (b) Review and updating of the curriculum; (c) Continuous improvement of the learning environment; and (d) multi-stakeholder cooperation.

In connection to the "SulongEducaklidad" program of DepEd, a new intervention in technology arises, the rapid advancement of computer and internet technologies has revolutionized how people teach and learn all over the world. According to Scharaldi (2020), technology provides dynamic options for math instruction, enhancing the learning process and bringing concepts to life through engaging and interactive media. It may also provide additional assistance to meet the needs of all students and provide personalized learning experiences. Furthermore, online web-based education provides learners with unequaled access to educational content, far outstripping the reach of traditional classrooms. It also enables open, dynamic, and distributed experiential learning, making training more engaging, participative, and efficient.

In contrast to the online web-based education, Accurate Learning Systems Corporation (ALSC), developed a web-based learning program named Mathscore, this program's aim is to: (a) improve the education of millions of kids by providing a learning environment that is superior to existing options. (b) to assist students in developing a thorough knowledge of mathematics by offering adaptive math practice that mimics self-guided lessons (Mathscore.com, 2015). Likewise, it serves as a tool to engage the students to learn more about Mathematics as well as enrich their capabilities in understanding mathematical concepts and skills. According to Mathscore.com, the goal of the program is to: (1) establish relatable, definition-level understanding: It aids a learner in grasping the essential meaning of a concept, such as the definition of addition or the definition of a fraction, by employing pictures frequently. (2) achieve computational excellence: They efficiently build great computing capabilities by employing adaptive strategies. For example, by creatively polishing select subsets of the math facts, they are extremely effective at assisting pupils in learning their arithmetic facts. (3) Enhance analytic comprehension: the goal is to apply the concept in real-life situations. This is possible after a learner has a strong understanding of definitions as well as superior computing abilities. Students will usually develop this skill by working on word problems or graphs.

The researchers have gathered evidence that Mathscore Program helps to develop the mathematical performance of the student more specially to the time of pandemic wherein no face-to-face interaction and classes were allowed and alternative delivery mode like online class was permitted by the government. The researcher conducted this study to determine the mathematical performance of students who utilized mathscore program that can help them to easily learn selected Mathematics lessons and topics. This study greatly helped the students on how they maximized the online platform and the use of Mathscore Program in enhancing and applying their mathematical skills. In addition, this study was beneficial to teachers, parents and administrator or school head as they contribute in strengthening and improving the program.

This study aimed to examine the mathematical performance of Grade 7 learners of Sinalhan Integrated High School with the application of the Mathsore program as one of the techniques and strategies in learning mathematics subject and make some recommendations to develop the mathematical skills of every student.

Theoretical Framework

This study was anchored on the Constructivism Theory. As defined by John Piaget (1972), constructivism is a theory that looks at how people learn rather than just what impacts them. Teachers have a vital role in society. Instead of lecturing, the instructor acts as a facilitator, aiding students in their understanding.

Constructivism and technology, according to Teachnology, Inc. (n.d.), are functioning together today. With regards to geometry, constructivism and technology combine to generate a better knowledge of the school curriculum in the domain of geometry, as one of the tools in educational technology. Students should be able to recognize direction and orientation, as well as have a clear understanding of object relationships, moreover, the next step in this learning process is to make logical deductions from geometric shapes and patterns. Computers can generate both two-dimensional and three-dimensional objects on the screen through constructivism and technology. This allows students to look at the screen and move the shapes to the other side, turn them around, or stretch, turn, or flip them. This also allows students to get a better view of the item they cannot hold in their hands. They will be able to improve their spatial sense as a result.

This theory by Piaget with technology helps teachers and students in teaching-learning process. In Mathscore program, facilitator focuses on the learning process and the outcomes that are produced. The teacher provides several opportunities for students to demonstrate their understanding, as one of the key goals of knowledge construction is to apply what students have learned in an immediate and meaningful way.

Furthermore, Scaffolding instruction as a teaching strategy originates from the sociocultural theory of Lev Vygotsky (1978) and his concept of the zone of proximal development (ZPD). The ZPD is the gap between what children can perform independently and the next level of learning that they can reach with professional assistance. Scaffolding, on the other hand, is the assistance provided to pupils in order for them to properly comprehend an idea. The task's difficulty determines the amount of scaffolding required. According to Haider & Yasmin (2015), it's essential to determine what a student can accomplish unaided and what that same student can achieve with assistance. In most cases, scaffolding usually takes the form of giving support in instructional content, practice exercises, and other course features to assist students in demonstrating mastery of learning objectives on their own. In terms of the zone of proximal development, scaffolding is what takes learners from what they can do with help to what they can do on their own.

On the other hand, to help students learn math quickly, the Mathscore program employs mastery-based learning methods. This concept is known as "scaffolding" which is one facet of mastery-based learning that the curriculum routinely employs. For example, the Fraction Simplification topic shows how to simplify various fractions, including mixed and improper fractions. When a student makes a mistake, the program will show a step-by-step explanation of simplifying the fraction correctly. However, when a learner works on the Fraction Addition topic and makes a mistake, the program assumes that the learner knows how to simplify fractions and provides a solution explanation. As a result, this program does not provide the stages for simplifying a fraction in the solution explanation; instead, it focuses on the procedures for adding fractions, and this software displays fraction simplification as a single step without revealing the specifics.

II. Materials and Methods

Quasi-experimental research design and the mathscore program as the main tool to gather data needed in this study. This design is to establish causality or the effect of an independent variable on the dependent variable. However, quasi-experimental studies are helpful since they assess the effectiveness of treatment (Schweizer, Braun, and Milstone, 2016).

The sixty (60) Grade VII learners were the participants of this study which came from seven sections consist of 340 learners.

The researcher gave 50 items pretest to the Grade VII learners from Section A to Section G and were paired accordingly through comparing their scores. Pretest was used to identify the members of the groups. The researcher used matched pair analysis.

Table 2 presented the pretest mean scores of Grade VII learners in Geometry.

Table 2. Experimental and Comparison Groups Mean Pretest Scores

Group	Mean	SD	Descriptive Interpretation
Experimental	21.00	8.69	B
Comparison	21.00	8.69	B

Legend: 40.00- 50.00 or 90-100% Advanced (A); 35.00-39.00 or 85-89% Proficient (P); 30.00 -34.00 or 80-84% Approaching Proficiency (AP) 25.00-29.00 or 75-79% Developing (D); and 24.00 or 74% & below Beginning (B)

The table revealed the result of the given pretest which was also used as basis in match pairing of the two groups of participants. As a result, the pairs of Grade VII learners were included in comparison and experimental groups. Both groups of participants garnered a mean score of 17.71 and standard deviation of 5.68 were obtained by both groups. It showed that the individual score obtained by learners included in the experimental and control groups were in the beginning level before the experimental study.

III. Results and Discussion

Table 2 presented the mean scores of the experimental and comparison groups on their formative tests.

Table 2. Performance of the Experimental and Comparison Groups on Formative Test Mean Scores

Learning Competencies		Mean	SD	DI
Lesson 1: illustrates subsets of a line	Experimental	4.60	0.56	A
	Comparison	2.47	0.73	D
Lesson 2: classifies the different kinds of angles	Experimental	4.50	0.51	A
	Comparison	3.13	1.04	AP
Lesson 3: derives relationships of geometric figures using measurements and by inductive reasoning; supplementary angles, complementary angles, congruent angles, vertical angles, adjacent angles, linear pairs, perpendicular lines, and parallel lines;	Experimental	3.77	0.90	P
	Comparison	2.07	0.91	D
Lesson 4: derives relationships among angles formed by parallel lines cut by a transversal using measurement and by inductive reasoning;	Experimental	4.00	0.69	P
	Comparison	2.37	1.03	D
Lesson 5: uses a compass and straightedge to bisect line segments and angles and construct perpendiculars and parallels;	Experimental	4.13	0.63	P
	Comparison	2.53	1.11	AP

Lesson 6: illustrates polygons: (a) convexity; (b) angles; and (c) sides	Experimental	4.07	0.69	P
	Comparison	2.53	1.25	AP
Lesson 7: derives inductively the relationship of exterior and interior angles of a convex polygon;	Experimental	4.10	0.88	P
	Comparison	2.47	1.25	D
Lesson 8: illustrates a circle and the terms related to it: radius, diameter chord, center, arc, chord, central angle, and inscribed angle;	Experimental	4.57	0.63	A
	Comparison	2.43	0.97	D
Lesson 9: constructs triangles, squares, rectangles, regular pentagons, and regular hexagons;	Experimental	3.83	0.87	P
	Comparison	2.97	0.89	AP
Lesson 10: solves problems involving sides and angles of a polygon	Experimental	3.47	0.94	AP
	Comparison	1.97	0.96	D

Legend: 4.50- 10.00 or 90-100% Advanced (A); 3.50-4.49 or 85-89% Proficient (P); 2.50 -3.49 or 80-84% Approaching Proficiency (AP) 1.50-2.49 or 75-79% Developing (D); and 1.00 or 74% & below Beginning (B)

The results revealed that mean scores in formative test performance of the experimental group for Lesson 1: illustrates subsets of a line has a mean of 4.60 and SD = 0.56 describes as advanced while the comparison group was developing with a mean of 2.47 and SD = 0.73. In Lesson 2: classifies the different kinds of angles, the experimental group is advanced in this lesson with a mean score of 4.50 with SD = 0.51 while the comparison group was approaching proficiency with a mean of 3.13 and SD = 1.04. In Lesson 3: derives relationships of geometric figures using measurements and by inductive reasoning; supplementary angles, complementary angles, congruent angles, vertical angles, adjacent angles, linear pairs, perpendicular lines, and parallel lines, the experimental group was proficient in this lesson with a mean score of 3.77 and SD = 0.90, while the comparison group was developing with a mean of 2.07 and SD = 0.91.

Moreover, the experimental group was advanced with a mean score of 4.00 and SD = 0.69 while the comparison group was developing with a mean of 2.37 and SD = 1.03 in Lesson 4: derives relationships among angles formed by parallel lines cut by a transversal using measurement and by inductive reasoning; while in Lesson 5: uses a compass and straightedge to bisect line segments and angles and construct perpendiculars and parallels, the experimental group was proficient in this lesson with a mean score of 4.14 and SD = 0.63 while the comparison group was approaching proficiency with a mean of 2.53 and SD = 1.11. In Lesson 6: illustrates polygons: (a) convexity; (b) angles; and (c) sides, the experimental is proficient in this lesson with a mean score of 4.07 and SD = 0.69 while the comparison group was approaching proficiency with a mean of 2.53 and SD = 1.25, for Lesson 7: derives inductively the relationship of exterior and interior angles of a convex polygon, it described that the experimental group was proficient with a mean of 4.10 and SD = 0.88 while developing for the comparison group with a mean of 2.47 and SD = 1.45 ,and in Lesson 8: illustrates a circle and the terms related to it: radius, diameter chord, center, arc, chord, central angle, and inscribed angle, the experimental group was advanced with a mean of 4.57 and SD= 0.63 and developing for the comparison group with a mean of 2.43 and SD = 0.97. Likewise, in Lesson 9: constructs triangles, squares, rectangles, regular pentagons, and regular hexagons, the experimental group is proficient with a mean of 3.83 and SD = 0.87, while comparison group was approaching proficiency with a mean of 2.97 and SD = 0.89, and in Lesson 10: solves problems involving sides and angles of a polygon, experimental group has a mean of 3.47 and SD = 0.94 describe as approaching proficiency while comparison group was developing with a mean of 1.97 and SD = 0.96.

The overall mean of 4.10 for the experimental group which described as Proficient while comparison group which described as developing with an overall mean of 2.49 that shows that the participants that utilized the Mathscore Program performed better than the participants who used the conventional materials.

Table 3 depicted the test of significant difference between the mean scores' performance of the experimental and comparison groups on their formative test.

Table 3. Significant Differences in Performance Between Experimental and Comparison Groups' Formative Test Mean Scores

Learning Competencies		Mean	Mean Difference	t-value
Lesson 1: illustrates subsets of a line	Experimental	4.60	2.13	12.6696**
	Comparison	2.47		
Lesson 2: classifies the different kinds of angles	Experimental	4.50	1.37	6.4577**
	Comparison	3.13		
Lesson 3: derives relationships of geometric figures using measurements and by inductive reasoning; supplementary angles, complementary angles, congruent angles, vertical angles, adjacent angles, linear pairs, perpendicular lines, and parallel lines;	Experimental	3.77	1.70	7.2960**
	Comparison	2.07		
Lesson 4: derives relationships among angles formed by parallel lines cut by a transversal using measurement and by inductive reasoning;	Experimental	4.00	1.63	7.1844**
	Comparison	2.37		
Lesson 5: uses a compass and straightedge to bisect line segments and angles and construct perpendiculars and parallels;	Experimental	4.13	1.60	6.8887**
	Comparison	2.53		
Lesson 6: illustrates polygons: (a) convexity; (b) angles; and (c) sides	Experimental	4.07	1.53	5.8715**
	Comparison	2.53		
Lesson 7: derives inductively the relationship of exterior and interior angles of a convex polygon;	Experimental	4.10	1.63	5.8351**
	Comparison	2.47		
Lesson 8: illustrates a circle and the terms related to it: radius, diameter chord, center, arc, chord, central angle, and inscribed angle;	Experimental	4.57	2.13	10.111**
	Comparison	2.43		
Lesson 9: constructs triangles, squares, rectangles, regular pentagons, and regular hexagons;	Experimental	3.83	0.87	3.8051**
	Comparison	2.97		
Lesson 10: solves problems involving sides and angles of a polygon	Experimental	3.47	1.50	6.1101**
	Comparison	1.97		

Legend: df = Degrees of Freedom
***Highly Significant at .05 level*

In viewing this result, it can be stated that the formative score of the experimental group was much higher than the comparison group due to the Mathscore program that the experimental group had been utilized. However, the result revealed the influence the claim of Teachnology, Inc. (n.d.) that constructivism of Piaget and technology were working together today. With the concept of constructivism, the facilitator in this situation must guarantee that the student comes to their conclusions rather than being lectured with the help and integration of educational technology. Moreover, Piaget (1972) also claimed that with technology, it helps the teachers and students in teaching-learning process. Besides in Mathscore program, facilitator focuses on the process of learning and the outcomes that were produced. The teacher gave many opportunities to express understanding, as a primary goal in constructing knowledge was the application of the learning in an immediate and meaningful way.

Table 4. showed the mean scores of experimental and comparison groups on their posttest.

Table 4. Experimental and Comparison Group Mean Posttest Scores

Legend: 40.00- 50.00 or 90-100% Advanced (A); 35.00-39.00 or 85-89% Proficient (P); 30.00 -34.00 or 80-

Group	Mean	SD	DI
Experimental	32.23	6.12	P
Comparison	21.87	7.15	B

84% Approaching Proficiency (AP) 25.00-29.00 or 75-79% Developing (D); and 24.00 or 74% & below Beginning (B)

The posttest mean scores of 32.23 (SD= 6.12) which was proficient in the experimental group was much higher than comparison group with mean scores of 21.60 (SD= 7.23) which was in the beginning level.

Table 5 revealed the test of significant difference between the mean score's performance of the experimental and comparison groups in their posttest.

Table 5. Test of Significant Difference between the Posttest Mean Scores of Experimental and Comparison Groups

Group	Mean	Mean Difference	df	*t-value*	Cohen's D	Effect Size
Experimental	32.23	10.37	57	6.0330**	1.5577	Large
Comparison	21.87					

Legend: df = Degrees of Freedom
***Highly Significant at .05 level*

The results showed that the posttest mean difference of the experimental and comparison group was 10.37. It showed that the experimental group who utilized Mathscore program performed well in their posttest.

Table 6. presented the test of significant difference between the pretest and posttest mean scores of each group.

Table 6. Test of significant difference between the pretest and posttest mean scores of each group.

Group	Test	Mean	Mean Difference	Df	t-value	Cohen's D	Effect Size
Experimental	Pretest	21	11.23	52	5.7894**	1.4948	Large
	Posttest	32.23					
Comparison	Pretest	21	0.87	56	0.4218**	0.1089	Small
	Posttest	21.87					

Cohen's d: 0.20 (Small); 0.50 (Medium); 0.80 (Large)
***Highly Significant at .05 level*

The result revealed that there were highly significant differences between the posttest and pretest mean scores of each groups of participants, for the experimental group with computed t-value of 5.7894 with Cohen's d of 1.4948 with large effect size while comparison group has 0.4218 and Cohen's d of 0.1089 a small effect size, also, both with p-values of less than 0.05 level of significance which indicated that experimental group improved their performance after the experimental process, hence the result shows that the experimental group has a higher mean difference of 11.23 compare to comparison group with a mean difference of 0.87. It also showed that the experimental group who utilized Mathscore program performed well in their lessons, and Mathscore as web-based program in online learning helps them to understand their lessons very well.

IV. Conclusion and Recommendation

The researchers concluded that the findings showed that there was significant difference between the experimental group's pretest and posttest mean scores performance of the Grade 7 learners; nevertheless,these results described that though the participants using K-12 materials helped in improving their mean scores performance, the participants who used the Mathscore Program got higher mean scores performance.

On the other hand, based on the results of this study, the researchers recommendedthat the parents as one of the stakeholders, may take a close watch at their children in using Mathscore and may support them in all of the needs of the program such as time, performance, and technology-based needs to achieve success of the program. They also recommended that the teachers may keep track of the students' progression in using Mathscore program tocontinuously diagnose the mathematical skills and performance of the students alongside the improvement of the program and therefore accommodate those needs within the classroom. In addition, they are also encouraged to utilize Mathscore program as one of the references in teaching mathematics in the 21st century learners and suggested to be used as supplementary materials in teaching the lessons covered in this study for it will help on the improvement of the learners' performance especially those having difficulties with the said lessons. Moreover, the School Head and Administration may support and provide the technological requirements of such program to improve students' learning. Likewise, researchers may explore more about Mathscore program and may use this study as one of the references in conducting more studies related to the program. In addition, this can be an edge to new researchers in verifying existing knowledge.

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