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TRIGONOMETRY WORKBOOK: ITS EFFECT ON THE LEARNING PROCESS OF GRADE 9 SPECIAL PROGRAM FOR SPORTS STUDENTS

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ABSTRACT

The purpose of the study is to determine the effect of the trigonometry workbook on the learning process of the Grade 9 Special Program for Sports students of Governor Felicisimo T. San Luis Integrated Senior High School. The study used a quasi-experimental design in comparing two variables, the pretest and posttest. Non-equivalent group design using purposive sampling technique will be employed in groups, homogeneous in nature, in Grade 9 that the researcher is teaching which are involved in the research. The students will use the validated trigonometry workbook devised by the researcher for eight weeks. Based on the summary of findings, it shows that Trigonometry workbook has significant effect on the learning of the Grade 9 Special Program for Sports students of Gov. Felicisimo T. San Luis Integrated Senior High School.

On the basis of the foregoing findings and conclusion of the study, the following recommendations are offered: (1) It is recommended that DepEd Officials and school administrators should put in their school improvement plan ways in constructing and utilizing different instructional materials for the different learning areas based on the pretest and postest for each subject. (2) It is also recommended that Mathematics Teacher should further promote a mastery in a specific subject by developing instructional materials for the benefit of the teachers

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and students. (3) To future researchers, do further study involving two types of groups, maybe one experimental, one control group and in a different level of students to further see if there is really a significant effect.

Keywords: *Trigonometry, Workbook, Learning Process, Pretest, Posttest, Sports*

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INTRODUCTION

High school mathematics courses now include the mathematical notion of trigonometry, particularly in the context of a trigonometric function. As one of the fundamental ideas in mathematics, trigonometry unifies and serves as a shorthand for many other concepts, including calculus, geometry, and function. Calculus courses cover trigonometric functions, which are derived from the definition of trigonometry as ratios of right-triangle side in a unit circle. According to a number of studies, standard ways of teaching trigonometry are insufficient for introducing pupils to the idea of a trigonometric function. The conventional approaches described here involve mechanically teaching the courses inside the confines of trigonometry as a ratio of simply the right-triangle definitions, theorems, proofs, and problem-solving.

As explained by Prabowo, Anggoro, Adiyanto, and Rahmawati. (2018), some variables may have influenced the low number of students who have mastered trigonometry. One of them is educational content. Its fundamental rule is to improve students' performance by making instruction more efficient. The most common mistakes students make when completing trigonometry problems are comprehension, transformation, and process skill faults. It aids the teacher and encourages students to interact, allowing them to perform better and higher in class. The teacher's instructional material was a type of learning facility that had an impact on the pupils' learning activity.

There was a positive outcome based on the results of the process.

The same with the study of Bernard, Sumarna, Rolina, and Akbar (2019), through the use of media VBA for Microsoft Word, vocational students' mathematical abilities in trigonometry lessons have improved. The learning process was successfully implemented using media VBA for Microsoft Word. Students were engaged, responsive, and eager throughout the process. The conclusion is that media VBA for Microsoft Word can be developed which increases vocational students' mathematical abilities before and after using media, and students demonstrated a favorable response to learning trigonometry through media.

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In the Philippines, according to an article despite the fact that trigonometry was not included in DepEd Order No. 31 s. 2012, trigonometry is part of the spiral curriculum for Mathematics in Grade 10 (the old fourth year high school) - as described in a draft of the curriculum created in January. In this draft, the first three years of high school (Grades 7-9) will be spiraled through algebra, geometry, statistics, and probability. But as of today's curriculum, which is K to 12, trigonometry is part of Grade 9 mathematics. Because traditional teaching approaches are applied, the mathematics subject has deteriorated greatly as a result, it is unable to address the diversity of students. Problem solving, recitation, and group work are some of the regular practices and routines in the mathematics subject. Students must, however, have high reading comprehension as well as analytic and computational skills before they can successfully solve a problem.

Objectives of the Study

The general objective of the study is to determine the effect of a validated trigonometry workbook on the learning process of Grade 9 Special Program for Sports students of Governor Felicisimo T. San Luis Integrated Senior High School. Whether the experimental group which will use the workbook will improve their performance in trigonometry. This study is limited to one level of secondary which is Grade 9 Special Program for Sports students. The study will focus on devising a validated workbook which then will be used by the students. The study will be conducted to one school only which is the Governor Felicisimo T. San Luis Integrated Senior High School located at Santa Cruz, Laguna.

As a result, the following research questions were established to address the study's goal:

What is the level of validity of the developed trigonometry workbook in terms: content validity; usability; adaptability; relevance; and effectivity?

What is the level of students' academic performance in trigonometry in terms of pretest?

What is the level of students' academic performance in trigonometry in terms of posttest?

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What is the extent of learning process in terms of: knowledge; comprehension; analysis; application; evaluation; and creation?

Is there a significant difference between the pretest and posttest of the Grade 9 Special Program for Sports students of Governor Felicisimo T. San Luis Integrated Senior High School?

Does the trigonometry workbook have a significant effect on the learning process of the Grade 9 Special Program for Sports students of Governor Felicisimo T. San Luis Integrated Senior High School?

MATERIALS AND METHODS

Design and Sample

The study used a quasi-experimental design in comparing two variables, the pretest and posttest. This was used to determine the effectiveness of a validated trigonometry workbook in terms of improving the academic performance of the grade 9 Special Program for Sports students of Governor Felicisimo T. San Luis Integrated Senior High School. Non-equivalent group design using purposive sampling technique was employed in groups, homogeneous in nature, in grade 9 that the researcher is teaching which are involved in the research. According to Cristobal and Cristobal (2013), quasi-experimental design is a design in which either there is no control group or the subjects are not randomly assigned to groups. The researcher found the method useful in getting the relevant information about the relation of validated trigonometry workbooks in terms of improving the academic performance of the Grade 9 Special Program for Sports students of Governor Felicisimo T. San Luis Integrated Senior High School in trigonometry.

The study took place in one public school in Santa Cruz, Laguna in Secondary Level focusing on Grade 9 students who are all part of a Special Program for Sports students and were all enrolled in a class who are taking academic subjects including Mathematics. Out of many sections, two sections composed of forty (40) students per section was purposely chosen for the

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group. The students used the validated trigonometry workbook devised by the researcher for eight weeks. Classes met five (5) times a week having fifty minutes (50) per session, a total of thirty-three (33) hours and twenty (20) minutes for two months. For this purpose, the researcher used the purposive sampling technique to gather the sample respondents. According to Cristobal and Cristobal (2013), purposive sampling technique involves the handpicking of subjects. This is also called judgmental sampling. The goal of purposive sampling is not to randomly select units from a population to create a sample with the intention of making generalizations (i.e., statistical inferences) from that sample to the population of interest.

Materials

To be able to check the validity and reliability of the instrument, the researcher conducted pilot testing of the workbook to respondents not included in the study. The researcher utilized pretest to determine students' readiness before subjecting them into instruction. The test came from K to 12 Grade 9 Curriculum Module and is being administered at the beginning of every grading period. This test was composed of multiple-choice questions. After the pretest, the students used the validated workbook in learning trigonometry. To check the validity of the workbook it was checked by selected validators. Their comments and suggestions were noted and revisions was made in the workbook. The self-made questionnaire used in validating the workbook was composed of Content Validity, Usability, Adaptability, Relevance and Effectivity. To test the validity of the workbook, Cronbach's Alpha was used. Based on the computation, all the variables measured attained a computed value equal or greater than 0.90 which can all be interpreted as excellent. Meaning the workbook created by the researcher is deemed valid and ready to use by the students and will measure the necessary variables need for them to attained an excellent result. After validating the workbook, it will be used by the students for eight weeks. After eight weeks of using the workbook, a post-test will be administered. The post-test is a

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multiple – choice item test and will be made by the researcher based on the pre-test given at the beginning of the quarter.

Data Collection Procedure

Before starting the use of the workbook, the researcher identified the learning profile of the students by conducting a pre-test that shows the readiness of the students using the K to 12 Basic Curriculum module. It was administered to groups during the first week of the experiment. The pre-test result was used in constructing the workbook and then it was validated by the respective validators.

After assessing the pupils, the researcher prepared the lesson and used the validated trigonometry workbook in teaching the Grade 9 Special Program for Sports students of Governor Felicisimo T. San Luis Integrated Senior High School. For eight weeks, the group was exposed to the validated trigonometry workbook. During the experiment, assessment and diagnostic tests was given every two weeks in order to determine whether or not the instruction is receptive to the needs of the students.

Ethical Consideration

The results were pooled for the research and individual results of this study will remain confidential and anonymous.

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RESULTS AND DISCUSSION

Table 1 presents the level of validity of the developed trigonometry workbook in terms of content validity, usability, adaptability, relevance and effectivity.

Table 1. Validity of the Developed Trigonometry Workbook

INDICATOR	STATEMENT	Mean	Standard Deviation	Interpretation
Content Validity	The content of the learning module is sufficient to cover the target scope.	4.97	0.17	VH
	The learning module provides proficiency in the expected learning output.	4.89	0.32	VH
	The contents are within the comprehension of the target groups.	4.83	0.51	VH
	The activities are intelligible and appropriate for students.	4.89	0.32	VH
	The objectives are attainable.	4.89	0.32	VH
	Overall Mean	**4.89**	**0.30**	**VH**
Usability	1. The learning module can be easily read by its users.	4.91	0.28	VH
	2. Provides useful information and measures which can be used to assess learning.	4.91	0.37	VH
	3. Offers various activities that can be easily accomplished.	4.86	0.43	VH
	4. Can be a substitute for manuals which may be difficult to process.	4.89	0.32	VH
	5. Offers practices that are based on the knowledge that they acquired from the lesson.	4.89	0.32	VH
	Overall Mean	**4.89**	0.32	**VH**

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Adaptability	1. The learning module is versatile that can be used across curriculum.	4.86	0.43	VH
	2. Provides activities which are adopted to various learning styles of the students.	4.89	0.32	VH
	3. Can be revised in order to fit some other purposes.	4.83	0.38	VH
	4. Attainable and result oriented.	4.91	0.37	VH
	5. Through the learning module, the learning process is enhanced and strengthened.	4.86	0.43	VH
	Overall Mean	**4.87**	**0.30**	**VH**
Relevance	1. The contents of the learning module is versatile and can be used across curriculum.	4.86	0.36	VH
	2.The learning module delivers and addresses the knowledge and skills on relevant ideas.	4.91	0.37	VH
	3. The learning module contributes to the present needs of the learners.	4.91	0.28	VH
	4. The learning module provides opportunities to reflect upon and examine attitudes towards the topic presented.	4.91	0.28	VH
	5. The learning module presents activities to improve the learners' skill in analyzing.	4.91	0.37	VH
	Overall Mean	**4.90**	**0.27**	**VH**
Effectivity	1. Contains examples of works, phrases and sentences that are related to the topic.	4.94	0.24	VH
	2. Contains challenging activities that use pictures and graphic organizers.	4.91	0.37	VH
	3. Serves as a tool for instruction.	4.94	0.24	VH
	4. Illustrates real-life experiences	4.91	0.28	VH
	5. Presents activities consistent with concepts being taught.	4.86	0.43	VH
	Overall Mean	**4.91**	**0.29**	**VH**

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Legend:

4.20-5.00	**-**	**Very High (VH)**
1.80-2.59	**-**	**Low(L)**
3.40-4.19	**-**	**High (H)**
1.00-1.79	**-**	**Very Low (VL)**
2.60-3.39	**-**	**Average (A)**

The table below shows that the respondents computed response that the content of the workbook, usability, adaptability, relevance and effectivity is valid, since the workbook attained mean scores of 4.89, 4.89, 4.87, 4.90 and 4.91 respectively. Which shows that all the overall mean presented for the validity of the workbook are very high. These findings only indicate that the content of the workbook is sufficient to cover the target objectives. The activities and its result presented in the workbook are attainable. The workbook contains examples of works, phrases and sentences that serves as a tool for instruction for the learners since it is strongly agreed by the respondents.

Table 2 presents the level of students' academic performance in trigonometry in terms of pretest.

Table 2. Level of Mastery of Students' Academic Performance in Trigonometry in Terms of Pretest.

Group or Section	Mean	Standard Deviation	%	Verbal Interpretation
Group A	12.8750	3.01439	32.19	NoM
Group B	12.0500	3.09632	30.13	NoM
Overall Result	**12.4625**	**3.055355**	**31.16**	**NoM**

Legend:

80% - 100%	**-**	**Mastered (M)**
75% - 79%	**-**	**Nearly Mastered (NM)**
60% - 74%	**-**	**Least Mastered (LM)**
1% - 59%	**-**	**Not Mastered (NoM)**

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Table 2 above presents the students' academic performance in Trigonometry in terms of pretest. It can be seen that both groups of the students have no mastery of the lessons, since they attained a percentage score of 32.19 and 30.13 respectively showing an average of 31.16 percent which can also be interpreted as Not Mastered. Showing that the students lack prior knowledge of the lesson before using the workbook created by the researcher. Just like what the study of Kelly (2019) implies, that teachers can see each student's proficiency levels thanks to pretests. They should only use prior knowledge to gauge how well students are meeting expectations. Pretests use thorough evaluation to track students' progress over time. They can demonstrate a student's comprehension before and after instruction, even if instruction is still taking place. A pretest can be used to refer to two different activities. In this study the researcher saw that most of the students have no mastery of the subject.

Table 3. Level of Mastery of Students' Academic Performance in Trigonometry in Terms of Posttest

Group or Section	Mean	Standard Deviation	%	Verbal Interpretation
Group A	32.2750	3.18641	80.69	M
Group B	31.2750	3.18641	78.19	NM
Overall Result	**31.775**	**3.18641**	**79.44**	**NM**

Legend:

80% - 100% - Mastered (M)

75% - 79% - Nearly Mastered (NM)

60% - 74% - Least Mastered (LM)

1% - 59% - Not Mastered (NoM)

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Table 3 above presents the students' academic performance in Trigonometry in terms of posttest. It can be seen that they attained different results. The first group have mastery of the lesson and the other one nearly mastered the lesson since they attained a percentage score of 80.69 and 78.19 respectively showing an average of 79.44 percent which can also be interpreted as nearly mastered. Showing that the students attained the knowledge needed or required of them for the subject taken.

The researcher also measures the extent of the learning process by using the results of the pretest, posttest and its item analysis.

Table 4. Extent of Learning Process

Group or Section	**Pretest**			**Posttest**		
Knowledge						
	MPS	**%**	**Mastery level**	**MPS**	**%**	**Mastery level**
Group A	4	46.88	NoM	10	83.75	M
Group B	4	45	NoM	9	81.88	M
Overall Mean	**4**	**45.94**	**NoM**	**9.5**	**82.82**	**M**
Comprehension						
Group A	3	16.88	NoM	6	83.13	M
Group B	3	20	NoM	6	67.50	LM
Overall Mean	**3**	**18.44**	**NoM**	**6**	**75.32**	**NM**
Analysis						
Group A	2	31.25	NoM	6	81.88	M

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Group B	2	28.13	NoM	6	69.38	LM
Overall Mean	**2**	**29.69**	**NoM**	**6**	**75.63**	**NM**
Application						
Group A	1	31.25	NoM	3	81.88	M
Group B	1	28.13	NoM	3	76.88	NM
Overall Mean	**1**	**29.69**	**NoM**	**3**	**79.38**	**NM**
Evaluation						
Group A	1	30.63	NoM	3	80.63	M
Group B	1	27.50	NoM	3	76.88	NM
Overall Mean	**1**	**29.07**	**NoM**	**3**	**78.76**	**NM**
Creation						
Group A	2	42.50	NoM	3	81.25	M
Group B	1	37.50	NoM	3	90	M
Overall Mean	**1.5**	**40**	**NoM**	**3**	**85.62**	**M**

Legend:

80% - 100% - Mastered (M)

75% - 79% - Nearly Mastered (NM)

60% - 74% - Least Mastered (LM)

1% - 59% - Not Mastered (NoM)

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The researcher also measures the level of extent of the learning process by using the results of the pretest, posttest and its item analysis. Table 4 shows the extent of the learning process in terms of knowledge, comprehension, analysis, application, evaluation and creation. It can be seen that after taking the pretest the overall mean per score of 4 and a percentage of 45.94%, 3 and a percentage of 18.94% was attained which can be interpreted as Not Mastered. While after using the workbook and conducting the posttest, the overall result of mean per score and percentage are 9.5 and 82.82% respectively which can be interpreted as Mastered.

Table 5 below shows the difference between the pretest and posttest of the Grade 9 Special Program for Sports students of Gov. Felicisimo T. San Luis Integrated Senior High School.

Table 5. Difference between Pretest and Posttest of the Grade 9 Special Program for Sports Students of Governor Felicisimo T. San Luis Integrated Senior High School

Group or Section	Pretest Mean	Posttest Mean	Variance	Computed value	Verbal Interpretation
Group A	12.8750	32.275	0.34	0.001	sig
Group B	12.0500	31.275	0.5		

**** p ≤ 0.05 = significant***

The table above shows the computed value using analysis of variance. It can be seen that the computed value obtained based on the pretest and posttest mean is 0.001 lower than the significant value of 0.05. It indicates that the pretest and posttest result of the students have significant difference. Therefore, the null hypothesis will be rejected.

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Table 6 shows the effect of the trigonometry workbook on the learning process of Grade 9 Special Program for Sports students of Gov. Felicisimo T. San Luis Integrated Senior High School. The effect of the trigonometry workbook on the learning process which is knowledge, comprehension, analysis, application, evaluation and creation of the Grade 9 Special Program for Sports students of Gov. Felicisimo T. San Luis Integrated Senior High School was computed using t-Test

Table 6. Effect of Trigonometry Workbook on the Learning Process of the Grade 9 Special Program for Sports Students of Governor Felicisimo T. San Luis Integrated Senior High School Using t-Test

Learning Process	Group	Statistical Tool	Computed Value	Decision	Verbal Interpretation
Knowledge	A	t test	<0.001	Reject Ho	Significant
	B	t test	<0.001	Reject Ho	Significant
Comprehension	A	t test	0.003	Reject Ho	Significant
	B	t test	<0.001	Reject Ho	Significant
Analysis	A	t test	<0.001	Reject Ho	Significant
	B	t test	<0.001	Reject Ho	Significant
Application	A	t test	0.001	Reject Ho	Significant
	B	t test	<0.001	Reject Ho	Significant
Evaluation	A	t test	0.003	Reject Ho	Significant
	B	t test	0.001	Reject Ho	Significant
Creation	A	t test	0.002	Reject Ho	Significant
	B	t test	0.001	Reject Ho	Significant

**** p ≤ 0.05 = significant***

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The table above shows the computed value using t test. It can be seen that the computed value obtained by the first section in knowledge, comprehension, analysis, application, evaluation and creation are <0.001, 0.003, <0.001, 0.001, 0.003 and 0.002 respectively. Meaning the trigonometry workbook used by the students in the first section or group have a significant effect on their learning process. The same with the other section or group of students since the computed values are <0.001, <0.001, <0.001, <0.001, 0.001 and 0.001 respectively. It indicates that the workbook has an effect also on the other group of students. Therefore, the null hypothesis will be rejected. The Trigonometry workbook had a significant effect on the learning process of the Grade 9 Special Program for Sports students of Governor Felicisimo T. San Luis Integrated Senior High School.

CONCLUSION, LIMITATIONS AND RECOMMENDATIONS

There is significant difference between the pretest and posttest of the Grade 9 Special Program for Sports students of Gov. Felicisimo T. San Luis Integrated Senior High School. Trigonometry workbook has significant effect on the learning process of the Grade 9 Special Program for Sports students of Gov. Felicisimo T. San Luis Integrated Senior High School

On the basis of the foregoing findings and conclusion of the study, the following recommendations are offered: (1) It is recommended that DepEd Officials and school administrators should put in their school improvement plan ways in constructing and utilizing different instructional materials for the different learning areas based on the pretest and postest for each subject. (2) It is also recommended that Mathematics Teacher should further promote a mastery in a specific subject by developing instructional materials for the benefit of the teachers and students. (3) To future researchers, do further study involving two types of groups, maybe one experimental, one control group and in a different level of students to further see if there is really a significant effect.

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