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Micro Learning-based Module: A Teaching Tool to Enhance Students' Competence in Grade 9 Trigonometry

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Abstract:- Globally, as the education field gear towards recovery from the Covid 19 pandemic, there is a must to adapt teaching strategies that will equip the teachers to continuously provide quality and engaging activities in a simplified manner that will bring out the best of the students. This paper describes the effectiveness of microlearning-based module as a teaching tool in enhancing students' competence in Trigonometry.

Data analysis gave results that there was mean difference of of 4.46 in illustrating, 5.02 for identifying, and 4.5 in solving after being exposed to the created learning material. The posttest result suggests that microlearning-based useful tool for enhancing students' competence of the 9th – grade students in Trigonometry. Level.

The hypotheses that claimed there was no significant difference between mean scores in the pretest and post-test of the three competencies in Trigonometry was negated. According to the results, students' competence in Trigonometry were enhanced in terms of mean scores. Future student performance in the three competencies in Trigonometry can be projected to be better and more satisfying if this trend holds if it does. The created learning material can be credited with enhancing students' competence in illustrating the following topics: the six trigonometric ratios, the trigonometric ratios of special angles, and angle of elevation and angle of depression. Also, the microlearning module can improved the competency of identifying the trigonometric ratio that can be used in relating the angles and sides of a right triangle. The designed learning material can help the students enrich their solving skills such as solving the missing parts of a right triangle, evaluating trigonometric expressions of involving special angles, and problem solving involving right triangle, angle of elevation, and angle of depression. Hence, it is highly recommended that the school use this learning material to encourage effective teaching and quality learning.

Keywords:- *Micro-Learning-Based Module; Students' Competence; Trigonometry.*

I. INTRODUCTION

Due to the pandemic, the shifting back to face-to-face learning modality brings about chronic educational problems that need to be addressed. While there is a wide array of such dilemmas, they all lead to taking effect on one of the most ultimate goals of education, the learning of the students, which can be observed through their academic performance.

According to the in-depth report by World Bank (2021), four in every five 15-year-old students who happen to be in Junior High School level do not understand basic mathematical concepts such as fractions and decimals that should be mastered by fifth graders. Hence, it has been observed that Filipino learners obtained relatively poor scores in the learning tests conducted by the multilateral lender, namely in the domains of mathematics, science, and reading. This only denotes that the learners, even if already promoted to intermediate levels, lack basic or foundation skills pre-requisite to the grade level that they are in. Moreover, longer lesson formats inhibit the learning of the students as they must be given the foundation skills before discussing the main lessons while making them simple without compromising their target learning competency.

While there is a wide array of branches of Mathematics, several have stood up to be more difficult than others as perceived by Filipino students. Mijares (2022) affirmed that amongst these are Algebra and Calculus but topping this list is Trigonometry. In this light, further studies have shown a sequence of parallel findings supporting why students find it hard to learn the dreaded Trigonometric learning competencies. For one, Whittingham (2021) noted several reasons for this manifestation. First, students find it hard to understand Trigonometry due to lack of foundation in the concepts and principles governing the study. Second, the teaching approaches and tools used by teachers. It was emphasized to use simpler inductive approaches that encapsulate the competencies needed to learn. Lastly, the consistent realization of how Trigonometry can be practically seen and observed in real-life situations. Hence, if these reasons that cause the stigma in learning Mathematics, specifically Trigonometry, can be targeted, an alleviation in students' competence is possible.

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In the academic world, it is seen that students' attention span diminishes as they increasingly gravitate towards the internet and social media platforms. Furthermore, this worsens the predicament surrounding the mathematics instruction to students. These practices have still been brought by the students to the current face-to-face classes.

Studies show that during the latter phases of the epidemic, there has been a discernible decrease in the worldwide attention span, with an average duration of barely eight seconds (Wong, 2023). This was also projected by Reyes (2020) with a noted report stating that the absence of face-to-face learning in the past academic years marked tremendous shift for learners' attention span. This is due to students' high inclination and distraction towards gadgets and the internet.

Anchored on DepEd Memorandum 024, s, 2022 which stipulates the adoption of the Basic Education Development Plan (BEDP) 2030, this study seeks to propose and assess the feasible potential and impact of Microlearning-Based Module, a researcher-made learning module that utilizes bite-sized learning that fits the attention span and cognitive load of the modern-day Filipino learners in Introduction, Development, Engagement, and Assimilation (I.D.E.A.) format. Purposively, this module will be developmental in not only enhancing students' competence in Trigonometry but also producing a learning material that is ample and enough to sustain the attention span of students in learning Trigonometry.

As a synthesis, targeting the students' attention span as a leverage to make students learn Trigonometry in a simplified yet nutritive manner is one way to alleviate their academic performance and improve their competence. Hence, it the main purpose of this study is to analyze if Microlearning-based module as a teaching tool will help the students to focus on and master bite-sized content that can be more easily used and reinforced in which students' competence in Trigonometry will be enhanced.

II. PROBLEM STATEMENT AND RESEARCH QUESTIONS

This study aimed to assess the impact of Microlearning-Based Modules in enhancing the competence in Trigonometry of grade 9 learners.

➢ *Hence, this Study Explored the Following Research Questions:*

- *What is the Pretest Score of the Learners before Being Exposed to Micro-Learning-Based Module in Terms of:*

✓ Illustrating;
✓ Identifying; and
✓ Solving?

- *What is the Post - Test Score of the Learners after Being Exposed to Micro-Learning-Based Module in Terms of:*

✓ Illustrating;
✓ Identifying; and
✓ Solving?

- Is there a significant difference between the pretest and post-test scores of the students before and after their exposure to Micro Learning-Based Module?

III. RESEARCH METHODS

This section explains the research design, context and participants, and the research instrument employed in the present research.

A. Research Design

The present study employed the quantitative method, experimental research with a within-subjects approach and a pretest-posttest research design. Quantitative is the best method to be utilized in this study since it seeks to compare statistically measurable variables such as the academic performance of learners exposed to the Microlearning-Based Module in terms of their pre-test and post-test mean scores.

Moreover, this study also utilized pre-experimental design, specifically the Pretest-Posttest Design. In this research design, a group is tested or studied before and after a particular experiment or activity is administered. In this way, it is possible to determine what changes if any have taken place and thereby judge the effect or value of the experiment. (Yang, 2023). This is manifested in this study since the Microlearning-based Module's effectiveness in enhancing students' competence in Trigonometry is tested through assessing their pre-test and post-test results. This also implies that this qualifies under the within-subjects which is also often conducted for the purpose of determining the treatment effects in the participants.

B. Context and Participants

The participants of this study were fifty (50) grade nine (9) students who are in one section in Makiling Integrated School which represents the whole Cluster 4 secondary schools in the Division of Calamba City. They are specifically selected because it is the grade level in the Junior High School Department of the said school with the lowest mean scores in the diagnostic test conducted at the beginning of the School Year 2023-2024 and the section which got the highest index of difficulty in the competencies of Trigonometry.

C. Research Instrument

This study utilized three research instruments to gather the data pertinent to its conduct. These are the pre-test, the Microlearning-Based Module, and the post-test.

First, the pretest, a teacher – made test that is composed of thirty (30) multiple choice items covering the most essential learning competencies in Trigonometry such as illustrating, identifying, and solving. Each competency comprises of 10 items. The pre-test was used as a baseline of

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the progress of the learners before their exposure to teaching strategy in learning Trigonometry.

The second research instrument is the microlearning–based module designed by the instructional designer and aligned to the Most Essential Learning Competencies of Grade 9 Trigonometry prescribed by the Department of Education. It is the proposed learning module in this study. It is a researcher-made learning module based on the concept of microlearning. Hence, the four parts of the lesson delivery such as the Introduction, Development, Engagement, and Assessment (I.D.E.A.) are all transformed into bite-sized knowledge and learning activities that will maximize the learning potential of students in learning Mathematics in a short amount of time without compromising their attention span. It is composed of four weeks which encompass four Most Essential Learning Competencies (MELCs) that learners should learn in the fourth quarter of Mathematics 9.

Lastly, is the post-test. It is basis of the research to test the efficacy of Microlearning – Based Module as a teaching tool to enhance students' competence in Trigonometry. This includes a 30-item test covering the competencies such as illustrating, identifying, and solving that are included in the most essential learning competencies prescribed by the Department of Education that they studied during the four-week exposure to microlearning-based module strategy. It is composed of 30 multiple-choice test items too.

Each test pretest and post-test were a teacher-made test that were checked and evaluated by the experts to make sure that there is consistency and balance of information. It also verified that the test jives to the three learning competencies that students need to improve.

All the instruments were validated by language experts such as English teachers, master teachers, head teachers, and other experts in the field of Mathematics.

IV. RESULTS AND DISCUSSION

This section constitutes tabular presentations of the gathered data that show its analysis with respective interpretations based on the statistical treatment used.

Table 1: Pre-Test Scores of the Students in Terms of Illustrating

Score	Frequency	Percent	Verbal Interpretation
9 to 10	0	0	Very High
7 to 8	0	0	High
5 to 6	13	26	Average
3 to 4	27	54	Low
0 to 2	10	20	Very Low
TOTAL	**50**	**100**	

Legend: 9 – 10 Very High, 7 – 8 High, 5 – 6 Average, 3 – 4 Low, 0 – 2 Very Low

In terms of illustrating, Table 1 shown the frequency distribution of the students' pretest scores. Data displays that there were ten (10) students or twenty percent (20%) of the respondents who got a score range from 0 to 2, twenty-seven (27) students or fifty-four percent (54%) scored 3 to 4, and thirteen (13) students or twenty-six percent (26%) got a score range of 5 to 6.

Likewise, the data showed that most students received low scores on the pretest, showing that students struggle to conceptualize, explain, sketch, describe, represent, and illustrate the trigonometric ideas and principles required for real-life applications of trigonometry in mathematics.

This simply indicates that the Department of Education's 2019 report, like the present study, found a fluctuation in the level of poor mathematics achievement.

In connection with this, teachers really need to employ teaching tools in mathematics that are easily understood and learnt by students.

Table 2: Pretest Scores of the Students in Terms of Identifying

Score	Frequency	Percent	Verbal Interpretation
9 to 10	0	0	Very High
7 to 8	0	0	High
5 to 6	9	18	Average
3 to 4	25	50	Low
0 to 2	16	32	Very Low
TOTAL	**50**	**100**	

Legend: 9 – 10 Very High, 7 – 8 High, 5 – 6 Average, 3 – 4 Low, 0 – 2 Very Low

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The result of Table 2 showed the score obtained, frequency, and percentage of the pretest scores in terms of identification. Only nine (9) students or eighteen percent (18%) got a score range of 5 to 6, which falls within the verbal interpretation of "average.". There were twenty-five (25) students or fifty percent (50%) who scored 3 to 4 and were classified as "low." Additionally, sixteen (16) students or thirty-two percent (32%) scored between 0 and 2, indicating a "very low" level of performance. Overall, students acquired low scores in the pretest in terms of identification.

This suggests that students were unable to recognize, establish, apply, and determine trigonometric concepts in the provided illustration and description needed in solving the missing parts of a right triangle.

This result is somewhat related to the study conducted by Nurmeidina, R., and Rafidiyah, D. (2019), they found out that students had difficulties in understanding the information given to solve the problems such as difficulties in understanding and identifying the intent of mathematical statements. This situation could lead to errors in applying trigonometry concepts to get the solution of the problem.

Table 3: Pre-Test Scores of the Students in Terms of Solving

Score	Frequency	Percent	Verbal Interpretation
9 to 10	0	0	Very High
7 to 8	0	0	High
5 to 6	6	12	Average
3 to 4	25	50	Low
0 to 2	19	38	Very Low
TOTAL	**50**	**100**	
Legend: 9 – 10 Very High, 7 – 8 High, 5 – 6 Average, 3 – 4 Low, 0 – 2 Very Low			

Table 3 revealed the students' pretest scores in terms of solving. There were nineteen (19) students, or thirty-eight percent (38%) of the total respondents, who earned a score range of 0 to 2. There were twenty-five (25) students, or fifty percent (50%) of the respondents, who obtained a score range of 3 to 4. There were only six (6) students, or twelve percent (12%) of the respondents, who got a score of 5 to 6. It is evident that half of the respondents scored low in the pretest when it comes to solving. This implies that students were not able to find the correct answers in solving the missing concepts in a right triangle such as angles and sides. The data also signifies that students struggled to illustrate real-life problems involving angle of elevation and depression, including identifying the appropriate trigonometric ratio for the problem.

Relating the results to the study conducted by Capuno, Necessario, Etcuban, Espina, and Padillo (2019), in their study about analyzing the Attitudes, Study Habits, and Academic Performance as well as the competence of Junior High School Students in Mathematics, it was affirmed that Mathematics, as an academic field, is often regarded as a challenging subject for Filipino learners. Consequently, the results indicate that there is a notable suggestion to incorporate enhancement programs in the instruction of mathematics for junior high school learners.

Table 4: Post-Test Scores of the Students in Terms of Illustrating

Score	Frequency	Percent	Verbal Interpretation
9 to 10	19	38	Very High
7 to 8	27	54	High
5 to 6	4	8	Average
3 to 4	0	0	Low
0 to 2	0	0	Very Low
TOTAL	**50**	**100**	
Legend: 9 – 10 Very High, 7 – 8 High, 5 – 6 Average, 3 – 4 Low, 0 – 2 Very Low			

Table 4 presented the frequency distribution of the post-test scores of the students in terms of illustrating. Based on the results, there were nineteen (19) students, or thirty-eight (38%) of the participants, who earned a score range of 9 to 10 that falls within the verbal interpretation of "Very High". There were twenty-seven (27) students, or fifty-four percent (54%) of the participants, who obtained a score range of 7 to 8 that was considered as "High" scores. There were only four (4) students, or eight percent (8%) of the participants, who scored 5 to 6, which was interpreted as "Average" scores. These results concluded that the majority of the students scored highly in the post-test in terms of illustrating. Also, the table revealed that the students' trigonometry illustration skills evidently improved after their exposure in

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the developed learning material in Trigonometry. This implies that students conceptualized, describe, explain, and illustrate trigonometric concepts. Thus, it means that the use of microlearning-based module had an impact on improving the performance of the students in illustrating competency in basic Trigonometry.

This result is similar to the study conducted by Nikou and Economides (2018) that microlearning has the ability to improve learners' essential psychological requirements of autonomy, competence, and relatedness, as well as their motivation and engagement. Because students feel empowered to manage their learning journey independently by providing bite-sized lessons which they can consume at their own pace and convenience. Besides, through presenting information in digestible segments, students can grasp concepts more easily and experience a sense of progress as they complete each module or lesson.

Table 5: Post-Test Scores of the Students in Terms of Identifying

Score	Frequency	Percent	Verbal Interpretation
9 to 10	21	42	Very High
7 to 8	26	52	High
5 to 6	3	6	Average
3 to 4	0	0	Low
0 to 2	0	0	Very Low
TOTAL	**50**	**100**	

Legend: 9 – 10 Very High, 7 – 8 High, 5 – 6 Average, 3 – 4 Low, 0 – 2 Very Low

It can be gleaned in Table 5 that most of the students scored high in post-test in terms of identifying. There were twenty-one (21) students or forty-two percent (42%) of the repondents earned a score range of 9 to 10 with a verbal interpretaiom of "Very High". Also, there were twenty-six (26) students or fifty-two percent (52%) of the respondents who got a score range of 7 to 8 which considered as "High" scores. While there were only three (3) students or six percent (6%) of the respondents reached a score range of 5 to 6 which falls within a verbal interpretation "Average". This indicates that identifying skill in Trigonometry was evidently enhanced.

Through the guidance of the developed learning material, students were able to recognize trigonometric ratios to be used in solving the missing parts of a right triangle, to determine the angle formed after illustrating a situation involving angle of elevation and angle of depression, and to identify special right triangle theorem to be utilized in finding the unknown side.

This supports the remarks of (Jomah, 2016) that when lessons are delivered in a short and narrow form, students are actively engaged and tend to follow the lesson schedule and time frame until the completion of it. Furthermore, the feedback from the students corroborates with what was revealed in the study of (Mohammed, Wakil, & Nawroly, 2018) that microlearning can make the learning subjects easy to understand and memorable for a longer period.

Table 6: Post-Test Scores of the Students in Terms of Solving

Score	Frequency	Percent	Verbal Interpretation
9 to 10	12	24	Very High
7 to 8	28	56	High
5 to 6	10	20	Average
3 to 4	0	0	Low
0 to 2	0	0	Very Low
TOTAL	**50**	**100**	

Legend: 9 – 10 Very High, 7 – 8 High, 5 – 6 Average, 3 – 4 Low, 0 – 2 Very Low

The table 6 showed that the students scored high in post-test in terms of solving skill. There were twelve (12) students or 24% of the participants earned a score range of 9 to 10 which falls within a verbal interpretation of "Very High". There were twenty eight (28) or 56% of the particpants who obtained a score range of 7 to 8 with a verbal interpretation of "High". There were ten (10) or 20% of the participants acquired a score 5 to 6 that indicates an "Average" score. In a 10 – item test, most of the students were able to get favorable scores of at least 8 which attained a standard mastery level of proficiency of 75%. Thus, it means that the use of microlearning-based module as a tool in teaching had an impact on improving the solving skill of the students in Trigonometry. This indicates that students were capable to apply illustrating and identifying skills in solving real-life problems involving situations that can be represented using a

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right triangle such as angle of elevation and angle of depression.

The result is similar with the previous study by Enu, Agyeman, and Nkum (2018), which found that adequate teaching and learning materials, as well as the instructional strategy used by the teacher, improved students' mathematics academic attainment, and improve students' thorough understanding of mathematical concepts that can be used in solving problems.

Table 7: Test of Significant Difference between the Pre-Test and Post-Test Mean Score of the Students in the Three Learning Competencies

MICROLEARNING BASED MODULE	PRE-test		POST-test		t	df	Sig. (2-tailed)	Verbal Interpretation
	Mean	SD	Mean	SD				
Illustrating	3.58	1.36	8.04	1.24	-20.12	49	.000	**SIGNIFICANT**
Identifying	3.26	1.35	8.28	1.25	-21.55	49	.000	**SIGNIFICANT**
Solving	2.88	1.24	7.38	1.37	-21.19	49	.000	**SIGNIFICANT**

Legend: If p-value Sig. (2-tailed) ≤.05, then it is statistically significant. If p-value Sig.(2-tailed) >.05, then it is NOT statistically significant.

Table 7 displayed the significant difference between the pretest and post-test mean score of the students in the three (3) learning competencies to be enhanced. In illustrating skill, the results showed that there is a significant difference between the pretest mean scores and the post-test mean scores as indicated by the computed t-value of 20.12, which is higher than the critical value of 2.010 at 0.05 level of significance with degrees of freedom of 49. The mean score in post-test is (8.04) with a SD of (1.24) while the pretest mean score is (3.58) with a SD of (1.36). This can also be inferred that there was a mean difference of (4.46) in illustrating. The results imply that students were capable to explain, show, represent, demonstrate, and illustrate trigonometric concepts and problems involving which can be depicted using a right triangle.

Moreover, Table 3 displayed that there is a significant difference between the pretest mean scores and the post-test mean scores of the students in terms of identifying skill. It can be gleaned that the computed t-value is 21.55 which is larger than the critical value of 2.010 at 0.05 level of significance with degrees of freedom of 49. The mean pretest score is (3.26) with a SD of (1.35) while the post-test mean score is (8.28) with a SD of (1.25). There was a mean difference of (5.02) in terms of identifying skill. This denotes that students were able to determine what trigonometric ratio can be used in the given illustration in finding the missing parts of a right triangle.

Futheremore, table 3 revealed that there is a significant difference between the pretest mean scores and pos-test mean score of the students in terms of solving skill. The computed t-value is 21.19 that is greater than the critical value of 2.010 at 0.05 level of significance with degrees of freedom of 49. The pretest mean score is (2.88) while the post-test mean score is (7.38) for solving skill. This concluded that there is a (4.5) mean difference in solving before and after being exposed to microlearning-based module. This suggests that students were able to find the missing angles in a right triangle, determine side lengths in a right triangle, solve trigonometric expressions or equations involving special angles, and solve real-life trigonometric problems such as finding distances, heights, or angles in various situations.

The findings of the current study are consistent with those of Mohammed, Wakhil, and Nawroly (2018), who found that microlearning is beneficial in improving students' learning abilities. In their study, they discovered that when comparing two groups, one using microlearning and the other using a traditional approach, the microlearning group had an 18% better degree of learning accomplishment than the traditional group. Both studies concluded that the use of microlearning methodologies has the potential to increase the efficacy and efficiency of the learning process.

This implies that the students' competence in Trigonometry such as illustrating, identifying, and solving was greatly ehanced after their exposure in the developed microlearning materials. Similarly, substantial variations between the mean pretest and post-test scores of the students indicate that the microlearning-based module is an effective teaching tool in enhancing students' competence in Trigonometry.

V. CONCLUSIONS

Based on the findings of the study, it was concluded that students' comptence in Trigonometry greatly enhanced after their exposure to Microlearning-based module in Grade 9 Trigonometry. The developed microlearning-based module in Grade 9 Trigonometry should be used by other Grade 9 teachers because it was found effective in enhancing students' competencies in right triangle Trigonometry such as illustrating, identifying, and solving.

Hence, the hypothesis stating that there is no significant difference in the pretest and post-test results in the three competencies of the Grade 9 students is rejected.

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It is believed the present study is valuable to school administrators, educators, learners, future researchers, and all those concerned with educational policy.

RECOMMENDATIONS

Based on the work performed in this research, the following recommendations are offered based on the work accomplished during this study and on the conclusions given previously.

- School administrators may raise awareness through enrich school learning action cell, training, seminars, and workshops for the teachers on how Microlearning-based modules can be used as a teaching tool to enhance students' competence and to have mastery in specific skills in different subjects and how to make microlearning-based module that is more engaging through creating visual and well-presented learning material that will facilitate the content of learning.
- Teachers are strongly encouraged to utilize microlearning-based module as a tool in teaching Trigonometry and may include other subjects that contains bite-sized information that is easily to understand. Likewise, a capsule-sized content helps the learners to be more focused since they do not have to entertain unnecessary information. This facilitates comprehension without requiring excessive effort.
- Students are encouraged to use microlearning-based module as a tool for learning and continue their study anytime and anywhere with the provided copy of module.
- Future researchers can incorporate other microlearning tools such as microlearning-technology based module incorporating games and applications. Since most of the learners have mobile phones where they installed games and applications, they will be able to access the microlearning content anytime and anywhere. In addition, future researchers may also investigate the influence of the microlearning-based module on the students' participation, attitude, level of retention, level of reasoning and other variables.

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