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Integration of Gradual Release of Responsibility Instructional Model (GRRIM) in the Development of Learning Module in Geometry

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ABSTRACT

This mixed methods study aims to determine the effects of the developed Gradual Release of Responsibility Instructional Model (GRRIM) learning module on the academic achievement of Grade 9 students in Geometry. The topic chosen for the module development is one of the students' identified least learned competencies, particularly in parallelograms and their properties. The study participants were five (5) module development experts and 110 students grouped into control and experimental groups. The control group was exposed to DepEd SLM, while the experimental group was exposed to GRRIM LM. Data were analyzed using thematic analysis, mean, independent samples t-test, and ANCOVA. The results of the thematic analysis of the focus group discussion revealed a module's characteristics that embody the GRRIM approach's different stages. Furthermore, findings indicated that after the intervention, the experimental group's post-test mean scores were found to be at a moderate level. In contrast, the control group remained at a low level. Finally, the study revealed that when pre-test mean scores were treated as a covariate, there was a significant difference in the post-test mean scores between the control and experimental groups. The findings revealed that the students exposed to GRRIM LM performed better than those exposed to DepEd SLM.

INTRODUCTION

The pandemic caused tremendous disruption in the education system across the globe. As a result, the Philippine Department of Education (DepEd) implemented Modular Distance Learning (MDL) to ensure the continuity of instruction delivery throughout the country (Dangle & Sumaoang, 2020). The DepEd implemented the MDL by providing self-learning modules (SLMs) to learners throughout the Philippines (DepEd, 2020). The DepEd SLMs addressed the most essential learning competencies (MELCS) for learners. SLMs aimed to allow students to learn independently and follow through on motivation, learning activities, and assessments that acted as a comprehensive manual for students' and teachers' desired competencies (FlipScience, 2020). However, this response by the DepEd to the pandemic also has limitations.

Although using SLMs and other distance learning modalities promoted independent learning among students (Nardo, 2017), studies of these approaches have revealed several issues. First, learners could not fully concentrate on answering the SLMs due to the lack of face-to-face instruction (Guiamalon, 2021). Second, the academic and learning performance of students in mathematics, especially those who performed well before the pandemic, decreased due to the extended school closures (Contini *et al.*, 2021). Third, students experienced difficulties in accomplishing the modules. At the same time, teachers realized the difficulty of students following instructions written in these modules and found many errors in them (Gatus & Vargas, 2022). This modality also has a problem because teachers could not provide real-time feedback on their students' learning difficulties (Gatus & Vargas, 2022). Fourth, the examples presented in self-learning modules did not scaffold students toward gaining the competencies required for topics such as exponents (Meniano & Tan, 2022). Lastly, it appears that parents lacked the necessary training to effectively facilitate the numerous activities outlined in the SLMs (Abude, 2021). These problems reported in published research were challenges experienced by students and teachers while learning and teaching mathematics in general and internationally during the pandemic. The modifications introduced in the education field were foreseen due to the impact of COVID-19 because of the challenges mentioned earlier (Sutarto *et al.*, 2022). The researcher was interested in examining the papers published on teaching pedagogies in geometry during the pandemic.

Even before the pandemic, low student competence in geometry was reported and required intervention (Özerem, 2012; Mason, 2009; Idris, 2005; Parreño & Marpa, 2019; Uduosoro, 2011). These reports require interventions in geometry education, particularly during the pandemic. However, only a few studies on geometry instruction during and after the pandemic have been published (Khairiree, 2020; Suryani *et al.*, 2020; Sutarto, 2022; Uyen *et al.*, 2022; Wojtowicz *et al.*, 2020). Experiential learning has been used to address the limitations brought by the pandemic on Vietnamese students' geometry achievement but did not significantly improve students' performance when applied for a limited time (Uyen *et al.*, 2022). Remote teaching and online strategies in teaching

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descriptive geometry to engineering students proved to be a productive strategy in Poland during the pandemic (Wojtowicz *et al.*, 2020). Teaching strategies incorporating local culture in teaching geometry concepts in Indonesia through various online approaches improve students' competencies in geometry (Suryani *et al.*, 2020; Sutarto *et al.*, 2022). Online learning of transformation geometry using augmented reality is promising to support students' learning in Thailand (Khairiree, 2020). These published studies addressed the low performance of students in geometry through the developed novel teaching strategies during the pandemic. However, these studies were still limited in the following respects. First, these existing approaches have proposed online learning approaches, which may not apply to the Philippines given the limitations of internet and gadget access of students (Gatus & Vargas, 2022). Second, published research has not covered a variety of topics in geometry. Lastly, these developed modules did not provide a framework that scaffolds students' learning, especially after the pandemic. These limitations were gaps in knowledge which were opportunities that the researcher could address.

One instructional model used in some studies that showed potential to address students' learning difficulties in geometry was the gradual release of responsibility instructional model (GRRIM) proposed by Fisher & Frey (2008). The founding premise of this instructional model was to optimize students' learning, wherein instruction began from the teacher, and learning responsibility was gradually transferred to students until the achievement of independent learning (Fisher & Frey, 2008). Studies on GRRIM used this instructional model in lecturing English (Read *et al.*, 2014; Fullerton *et al.*, 2015) and science and technology subjects (Whittaker, 2016), where students' performance improved. Saligumba and Tan (2018) used GRRIM in teaching quadratic equations, functions, graphs, and their properties in mathematics. They reported no significant difference in students' scores among those who utilized and did not utilize the GRRIM approach. This study applied GRRIM in addressing student learning in geometry, which previous studies did not utilize.

This study contributes to knowledge in education, given that no studies developed a learning module following GRRIM on parallelograms and their properties. Through this study, a contribution can be made to theory, practice, and policy. Specifically, it strengthens the theoretical claims that the GRRIM approach was a practical, theoretical framework for teaching mathematics, specifically in geometry. Moreover, it extends the theory of its use in teaching mathematics, specifically parallelograms and their properties.

The current research provided a teaching methodology and learning module for classroom use. In addition, at the policy level, schools and the DepEd may implement GRRIM LM as a teaching method in Philippine high schools by establishing policies. Ultimately, this study aimed to answer the following questions:

1. What module could be developed in learning geometry?
2. What is the content evaluation of the developed learning module?
3. What are the pre-test and post-test scores of the students using GRRIM LM and DepEd SLM?
4. Is there a significant difference in the pre-test and post-test mean scores between students exposed to GRRIM LM and DepEd SLM?
5. Is there a significant difference in post-test scores between students using GRRIM LM and DepEd SLM while controlling for the pre-test scores?

MATERIALS AND METHODS

Research Design

This mixed-method study used research and development (R&D) as an educational research design, as Gustiani (2019) described. This design is appropriate for this study since R&D is used to design, develop, and validate materials, products, and models for educational purposes. This study aims to develop learning materials informed by the gradual release of responsibility instructional model to address the least mastered competency in Geometry, especially on parallelogram and its properties. This study involves gathering inputs from key individuals through a focus group discussion on developing a learning module in geometry and testing its efficacy on students' academic achievement. A GRRIM LM in geometry was developed from the identified themes based on the focus group discussion (FGD). Moreover, a quantitative method was applied to test the effectiveness of the learning module on students' academic achievement in geometry.

Moreover, this study employed the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) framework for instructional design. This framework was used in the design of modules and instructional design (Hess & Greer, 2016). The ADDIE model provided a good starting point for developing effective learning materials to optimize students' learning (Culatta, 2022). This research used this framework's Development, Implementation, and Evaluation (DIE) components. Development referred to preparing the learning module that follows the GRRIM framework to ensure that students' least learned competencies (LLCs), specifically on parallelogram and its properties, were addressed. Implementation refers to utilizing the developed GRRIM learning module as an instructional approach for the students. Finally, evaluation was the assessment of GRRIM LM if it achieved the set goals.

Participants

Five (5) experts in module development participated in the study's qualitative phase, which was selected using the purposive sampling design. For the quantitative phase, the study was participated by 110 grade 9 students enrolled for S.Y. 2022-2023 in a public high school in Davao City, Philippines. The selection of the 110 students was made by random sampling. Of this number, 55 students were clustered as Grade 9-A and the other 55 as Grade 9-B. The two sections were heterogeneous, with equal male and female students. The control and experimental group were identified by flipping a coin. Section A was chosen as the experimental group, and section B was designated as the control group. The experimental group utilized GRRIM LM, while the control group utilized DepEd SLM.

Research Instruments

FGD Questionnaire

A semi-structured interview questionnaire was developed for the purposes of this study to qualitatively draw themes that will guide the development of GRRIM LM for geometry. Experts validated this questionnaire and gained an "excellent" qualitative description.

Learning Resources Management and Development System (LRMDS) Evaluation Tool

The researcher used the Learning Resources Management and Development System (LRMDS) evaluation tool used by the DepEd in evaluating print resources to assess the content validity of the developed learning module in geometry.

Mathematics Achievement Test

The researcher used a Mathematics Achievement Test created to objectively measure students' academic performance in both the control and the experimental groups. The questions were taken from the third quarter summative tests in different school years from the Department of Education in Davao City. The math concepts covered were on parallelograms and their properties specifically to (1) determine the conditions that make a quadrilateral a parallelogram and (2) use properties to find measures of angles, sides, and other quantities involving parallelograms, which were among the identified least mastered skills in geometry. The test was a 15-item multiple-choice test and was validated by experts. The questionnaire was pilot tested with the school's top 55 grade 10 students. Kuder-Richardson 20 (K-R20) was used to calculate the reliability of the multiple-choice items with a result of 0.760. Table 1 shows the scale used to determine the student's academic achievement level in geometry.

Table 1: Measurement Scale to Determine the Level of Students Achievement

Mean Range	Qualitative Description	Qualifying Statements
13-15	Very High	The students demonstrate a very high level of achievement.
10-12	High	The students demonstrate a high level of achievement.
7-9	Moderate	The students demonstrate a moderate level of achievement.
4-6	Low	The students demonstrate a low level of achievement.
0-3	Very Low	The students demonstrate a very low level of achievement.

Data Analysis

Thematic Analysis

Thematic analysis was used for analyzing the qualitative data. The researcher carefully studied the data to find recurring themes—topics, notions, and patterns of meaning.

Mean

This was employed as a tool to determine the average scores of students in the pre-test and post-test administered before and after the delivery of interventions on the control and experimental groups. Table 1 serves as the basis for the data analysis and interpretation of the pre-test and post-test scores of the test. Raw scores were used to calculate students' mean scores and describe their mathematics achievement.

Independent Samples t-Test

This was used to determine the significant difference between the two variables compared in the study (e.g., the pre-test and post-test scores between GRRIM LM and DepEd SLM). The level of significance used in this study is at 0.05.

Analysis of Covariance (ANCOVA)

It involved using a covariate while analyzing the significant difference between two groups to ensure that the effects of the covariate do not affect the comparison between the groups being considered. In the context of the study, this determined a significant difference in the mathematics achievement of students in geometry after the pre-test scores were controlled as covariates.

RESULTS AND DISCUSSION

Development of a GRIMM LM in Geometry

The first part of the study sought to develop a module in learning geometry for Grade 9 students. The data gathered from the focus group discussion conducted among DepEd module writers for mathematics was used to develop GRRIM LM. The data from the FGD was transcribed, and two (2) emergent themes were identified: A module that (1) scaffolds learning and (2) encourages collaboration.

Theme 1: A Module That Scaffolds Learning

A module should promote instructional scaffolding, particularly in learning geometry. Instructional scaffolding is a process where a teacher supports learners and helps them master learning tasks (Fisher & Frey, 2008). Teachers should provide scaffolding when introducing new concepts or skills to learners to ensure the accomplishment of learning goals. This support can be achieved through teacher demonstrations, among others. This theme was extracted from the following excerpts of responses gathered during the FGD:

"Direct instruction should be implemented to ensure clarity of concepts." (Participant 2)

"The teacher should discuss the content from the module to ensure understanding of the concept." (Participant 3)

The findings above supported the claim of Fisher and Frey (2008), wherein they put a premium on the teacher being the primary source of knowledge at the beginning of the process, which students can follow. After the teacher delivers the instruction, the teacher asks students to follow her as they work on learning tasks together to scaffold learning. The findings agreed with the results of Aldrige (2018), Reyes (2019), and Holmberg (2022) that explicit procedures given by the teacher would be suitable to support teaching facts and concepts to the entire class. This allows students to be exposed to guided practice to enable them to correct errors early on. Along this line, informants interviewed during the FGD provided the following inputs:

"There should be examples of how to solve problems in a step-by-step process and should be presented by guiding students on how to do it." (Participant 1)

"The presentation of content should scaffold students' learning." (Participant 4)

This finding aligned with the discussions of Hollingsworth & Ybarra (2009) that the teacher should work with the students together and stepwise to ensure that students can replicate the task. Moreover, these are supported by the importance of scaffolding which guides students through the learning process, as reported by Aldrige (2018), Reyes (2019), and Holmberg (2022). Additionally, the result is in accordance with the idea of Fisher and Frey (2008) that teachers should ask questions from time to time to check learners' understanding. Questions asked by the teacher to students serve as good stimuli for deep thinking and collaboration among students.

The attainment of autonomous learning was accomplished after the utilization of structured assistance furnished. According to Fisher and Frey (2008), this phase denotes the period during which learners autonomously acquire knowledge, demonstrating self-assessment and understanding of their learning. Additionally, metacognitive levels could be reached when students can correct errors during the learning process. This theme was extracted from the response gathered during the FGD:

"The content should be presented in a logical manner in such a way that it promotes independent learning." (Participant 3)

The findings above supported the claim of Fisher *et al.* (2016) that an independent task promotes metacognition. This result also explains the fact that at this level, students could take charge of the learning process (National Research Council, 2000).

Theme 2: A Module That Encourages Collaboration

Collaborative learning activities allowed students to become more engaged. They oversaw their learning and, ultimately, how it turned out. Students teamed together and worked together where they could freely communicate with one another and created ideas together to accomplish the task leading to the development of math concepts (Fisher & Frey, 2008). With this, students' interest could be enhanced, stimulating their mathematics achievement. This theme was extracted from the following excerpts of responses gathered during the FGD:

"Activities where students learn from each other." (Participant 1)

"Problem-Solving individually and as a group." (Participant 2)

"Reporting of group work." (Participant 3)

"Games or Contests." (Participant 4)

"Group work." (Participant 5)

The findings above supported the claim of Frey *et al.* (2009) indicated that creative learning strategies are at play when students can work with their peers. Additionally, Aporbo (2023) found that students engaged in cooperative learning obtained a more favorable academic performance compared to those exposed in traditional approach. Furthermore, it supported the ideas of Summers (2006) that learning is retained when collaborative approaches are implemented.

Based on the generated themes, GRRIM LM to be developed in this study should scaffold learning and encourage collaboration. It should start with direct instruction, guided instruction, collaboration, and independent learning, which is embodied in GRRIM. The learning activities to be included should be engaging, fostering collaboration among students. A GRRIM LM was developed using these themes. This learning module was sent to experts for evaluation, which will be explained in the next section.

Content Evaluation of the Learning Module on Parallelogram and its Properties

After considering the emergent themes that came up during the FGD conducted with informants, a module on the properties of parallelograms was prepared. To validate the content of the module, this was submitted to experts to evaluate its content using the LRMDS assessment and evaluation tool. The LRMDS is used to increase the access and distribution of learning resources developed by the DepEd throughout the country. In line with this, the DepEd promulgates an evaluation rating sheet for print resources for all teaching materials developed and used for DepEd schools. Thus, this tool was used to evaluate the contents of the developed GRRIM LM.

In the case of this study, only Factor 1 of the LRMDS tool was used because it covered the items that would evaluate the content of the prepared module. Since the current module was still in its developmental stage, this research focused on the items stipulated in Factor 1. In this research, three experts evaluated the developed GRRIM LM on the properties of parallelograms using the LRMDS assessment and evaluation tool. The mean scores per criterion are presented in Table 2.

Table 2: Mean score given by experts on each criterion in the LRMDS.

Criteria	Mean Score	Interpretation
Content is suitable to the student's level of development	4	Very Satisfactory
Material contributes to the achievement of specific objectives of the subject area and grade/year level for which it is intended.	4	Very Satisfactory
The material provides for the development of higher cognitive skills such as critical thinking, creativity, learning by doing inquiry, problem-solving, etc.	4	Very Satisfactory
Material is free of ideological, cultural, religious, racial, and gender biases and prejudices.	3.33	Very Satisfactory
Material enhances the development of desirable values and traits such as: pride in being a Filipino, scientific attitude and reasoning, desire for excellence, love for country, helpfulness/teamwork/cooperation, unity, desire to learn new things, honesty and trustworthiness, ability to know right from wrong, respect, critical and creative thinking, productive work, and others.	4	Very Satisfactory
Material has the potential to arouse the interest of the target reader	4	Very Satisfactory
Adequate warning/cautionary notes are provided in topics and activities where safety and health are of concern.	3.67	Very Satisfactory
Total	**3.86**	**Very Satisfactory**

As shown in Table 2, the mean score of the content evaluation of GRRIM LM was 3.86. This translated to an adjectival rating of very satisfactory. This indicated that the prepared module was suited for implementation in the experimental group through the experts' assessment. Before GRRIM LM was implemented in the experimental group, a pre-test was given to all the participating students.

Students' Academic Achievement (Pre-test and Post-test) in Geometry

After the content evaluation of the developed GRRIM learning module on the properties of a parallelogram, it was used in the experimental group (N=55). In contrast, the DepEd SLM was used in the control group (N=55). Before implementing the modules in the control and experimental groups, a pre-test was given to the students. The pre-test scores of the two groups are presented in Table 3. As shown in Table 3, students who utilized GRRIM LM obtained a mean score of 3.7404 which had a low academic achievement in geometry. Conversely, students exposed to the DepEd SLM had a low achievement obtaining a mean score of 3.9568.

Table 3: Level of the Pre-test Score of the Students

	Type of Module	Mean	Std. Deviation	Qualitative Description
Pre-test Scores	GRRIM	3.7404	1.43030	Low
	DepEd	3.9568	1.48202	Low

This research revealed that both groups had a low level of academic achievement in the pre-test. The students from JJSNHS either do not have prior knowledge on the topic or are not yet exposed to learning materials about the properties of the parallelogram, which is the topic of the learning modules implemented in the two groups. This result supported the study of Panlaan (2019), Reyes (2019), and Saligumba and Tan (2018), which noted that students reported low scores during pre-tests in mathematics. In the case of this research, the same observation was gathered from the data.

After conducting the pre-test, the two groups of students were subjected to their respective learning interventions. The control group was given the self-learning module developed by DepEd. In contrast, the experimental group utilized the developed GRRIM LM. After exposing the two groups of students to their respective learning modules, they were given a post-test to check the effect of GRRIM LM and the DepEd SLM on students' academic achievement. Table 4 shows the post-test scores in the geometry of students exposed to the two learning modules. It can be seen in Table 4 that those students who utilized GRRIM LM obtained a mean score of 7.2777 which had a moderate level of achievement in geometry. Conversely, the students who utilized the DepEd SLM had a low level of achievement, obtaining a mean score of 5.9614.

Table 4: Level of the Post-test Score of the Students

	Type Module	Mean	Std. Deviation	Qualitative Description
Post-test Scores	GRRIM	7.2777	2.49237	Moderate
	DepEd	5.9614	1.89766	Low

The result showed that the developed module adequately addressed the emergent themes that came out of the FGD conducted with the experts before crafting GRRIM LM on the properties of parallelograms. The FGD provided a promising avenue where comments from experts were consolidated and used to craft GRRIM LM in the study. Moreover, the L.M.'s validation by experts using the LRMDS tool provided greater confidence in the module's appropriateness to support students' learning. These considerations for the module development may be attributed as factors that promoted an improvement of post-test scores among students from JJSNHS exposed to the GRRIM approach.

This result supported the study of Reyes (2019), Panlaan (2019), and Saligumba and Tan (2018) that the students who utilized GRRIM LM improved their achievement from a low to moderate performance level while the control group retained a low-performance level. However, the result of this research contradicted the results of Aldrige (2018) and Villaver (2014), where after they exposed the experimental group to learning interventions, student scores were still low or at the beginning level.

Statistical Analysis of Pre-test and Post-test Scores in Geometry

A statistical analysis employing the t-test was performed on the results of the pre-and post-tests to determine the significant differences between (a) pre-tests scores of students who utilized GRRIM and DepEd modules, (b) post-test scores of students who utilized GRRIM and DepEd modules and using ANCOVA to determine the (c) significant differences of students' post-test scores after controlling their pre-test scores and treating it as a covariance. The results for these statistical tests were presented in Tables 5-7, respectively.

The findings of the independent sample t-test conducted on the pre-test results of students from two independent groups who utilized GRRIM LM and DepEd SLM on parallelogram properties are shown in Table 5. This data provided baseline information on students' prior knowledge before they utilized GRRIM LM and DepEd SLM.

Table 5: Test of Difference Between Pre-test Scores According to Type of Module

t-test for Equality of Means					
	t	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Remarks**
Pre-test Scores	-.779	108	0.438	-0.21642	Accept H01 (Not Significant)

As can be seen in Table 5, it yielded a result of t = -.779, df = 108, and p = 0.438. Since the p-value of 0.438 that resulted from the t-test is above 0.05, it can be said that the pre-test scores of the students who utilized GRRIM LM and the DepEd SLM on properties of a parallelogram were not significantly different, accepting the null hypothesis which claimed that there is no significant difference on the pre-test mean scores between students who are exposed to GRRIM LM and DepEd SLM. Moreover, the pre-test scores of the two groups were very close numerically, implying not much difference in the prior knowledge among the students from the two groups. Panlaan (2019) and Reyes (2019) reported results that align with the results of the current study. The significance of this finding ensures that the population distribution between the two groups was homogeneous and did not affect the results of the study.

The findings of the independent sample t-test conducted on the post-test results of students from two independent groups who utilized GRRIM LM and DepEd SLM on parallelogram properties are shown in Table 6. As shown in Table 6, the results revealed values of t =3.116, df = 108, and p = 0.002. Since the p-value of 0.002 is much lower than 0.05, it can be said that students who utilized the GRRIM LM post-test had considerably higher post-test mean scores than those who utilized DepEd SLM. With this result, the null hypothesis, which claimed that there is no significant difference in the post-test mean scores between students who utilized GRRIM LM and DepEd SLM, is rejected. The findings of Panlaan (2019), Reyes (2019), and Saligumba and Tan (2018) support the findings of this research that GRRIM assists in improving students' post-test scores in mathematics. This provided confidence in the positive effects of GRRIM provided on the students' post-test scores.

However, it would be more reliable to test the significant difference in these post-test scores by controlling the effects of the pre-test scores, which can be considered covariance. This could be accomplished by conducting ANCOVA, presented in Table 7.

Table 6: Test of Difference Between Post-test Scores According to Type of Module

t-test for Equality of Means					
	t	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Remarks**
Post-test Scores	3.116	108	0.002	1.316291	Reject H02 (Significant)

Table 7 compares the post-test results between students who utilized GRRIM LM and the DepEd SLM on the properties of a parallelogram. The pre-test was employed as a covariate shown in the ANCOVA table to statistically compare disparate prognostic factors that might affect the analysis.

Table 7: Test of Between-Subjects Effects

Dependent Variable: Post-test						
Source	**Type III Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**	**Partial Eta Squared**
Corrected Model	107.936a	2	53.968	12.296	0.000	0.187
Intercept	292.571	1	292.571	66.661	0.000	0.384
Pre-test	60.289	1	60.289	13.737	0.000	0.114
Type Module	55.711	1	55.711	12.694	0.001	0.106
Error	469.613	107	4.389			
Total	5397.602	110				
Corrected Total	577.549	109				

a. R Squared = .187 (Adjusted R Squared = .172)

The pre-test scores of both groups were taken as a covariate to remove their influence when conducting the statistical analysis. The F-value of the pre-test scores is 13.737 with a p-value of 0.000, as shown in Table 7. Implementing this correction through ANCOVA, the new F-value between the group's post-test scores receiving GRRIM and DepEd intervention is 12.964 with a corresponding p-value of 0.001. The students who utilized GRRIM LM and DepEd SLM, using the pre-test mean scores as a covariate, showed significantly different post-test results. This is indicated by the p-value being less than 0.05. This means that the null hypothesis was rejected, which claimed that there was no significant difference in the mathematics achievement of the two groups in geometry after the pre-test scores were controlled. The findings of Panlaan (2019), Reyes (2019), and Saligumba and Tan (2018) support the findings of this research. Therefore, including the pre-test as a covariate significantly reduced error variance and improved the precision of the results, but still jibes with the t-test presented in Table 6. This indicated that students who utilized GRRIM LM performed better than those who utilized DepEd SLM. Also, the result of this study is similar to that of Santos (2023) that the use of modified learning materials such as Mobile-Supported Self-Learning Modules (MSSLM) could enhance the performance of the students as compared to those of DepED provided modules. This highlights the ability of teachers to think outside the box and adjust the instruction to better fit the needs of their learners.

The findings of this study, which built on the development and validation of a GRRIM LM, proved beneficial in preparing an effective teaching tool that effectively improved students' post-test scores in learning the properties of parallelograms. This indicated that the GRRIM approach could be used as a possible teaching approach to support the teaching of mathematics, which in this context is on learning the properties of parallelograms at JJSNHS. This research aligned with the research of Holmberg (2022), Panlaan (2019), Reyes (2019), and Saligumba and Tan (2018) in the aspect of the increase of students' scores from low pre-test to moderate post-test scores after exposing the experimental group to GRRIM learning module. However, the ANCOVA analysis done in this study showed a significant difference between the pre-test scores of the students who utilized GRRIM LM and DepEd SLM, which was contrary to the report of Saligumba and Tan (2018) but aligned with the results of Panlaan (2019), and Reyes (2019). The novelty of this research lies in the new knowledge it offers on the levels of education theory, practice, and policy. Specifically, through this study, the theoretical claims that GRRIM is an effective approach in teaching mathematics, specifically in geometry, was made, as shown in the significant difference in the students' post-test scores, especially in the context of students in Mindanao (Callaman & Itaas, 2020).

Moreover, it extends the theory of its use in teaching mathematics, specifically parallelograms and their properties. On the level of teaching practice, the current research provides a teaching methodology and learning module that can be adopted in the classroom. Moreover, the importance of teacher intervention, scaffolded learning, and collaborative learning approaches contribute to students' capacity to learn more about the mathematical concepts taught. Finally, at the policy level, schools and the Department of Education may adopt the GRRIM LM approach as part of the teaching methods in high schools in the Philippines through the institution of policies and curriculum review (Callaman & Itaas, 2020).

CONCLUSIONS

Based on the results of this study, the following conclusions were generated. Learning modules should have features that highlight scaffolding in learning and encourage collaboration. Additionally, the integration of the gradual release of responsibility instructional model (GRRIM) creates a favorable impact on students' achievement in geometry. Moreover, the researcher would like to recommend that learning module developers and writers may consider the use of gradual release of responsibility instructional model (GRRIM) to better assist the students in learning geometry. Replication of this study must be conducted to provide data to align or refute the results of the study. Additional research would offer comparative data for which results can be generalized.

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