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Enhancing Geometry Understanding in Grade 8: Development and Evaluation of a Learning Package

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Abstract
This study developed and evaluated a comprehensive learning package for Grade 8 Geometry, aligned with the curriculum to address diverse student needs. The package included a teacher's guide, modules, manipulatives, PowerPoint presentations, and lesson plans. Evaluators assessed the package based on instructional, content, and technical quality, rating it as very good. A quasi-experimental approach was employed to measure the package's effectiveness in enhancing geometric knowledge and problem-solving skills. The study involved two schools, one public and one private, each with two sections of Grade 8 students. One section in each school served as the experimental group, while the other served as the control group. Effectiveness was determined by comparing pretest and posttest scores using appropriate statistical tests. The results indicated significant improvements in student performance due to the learning package, with notable differences between public and private school students. These findings emphasize the importance of tailored educational interventions that consider the specific contexts of different school environments. It is recommended that teachers adopt this learning package to enhance student learning in geometry.

Keywords: Geometry, Instructional Learning Package, ADDIE Model, Quasi-Experimental, Student Performance

Introduction

Effective education plays a transformative role in equipping students with the critical knowledge and essential skills necessary to navigate the complexities of the modern world (Yuanita et al., 2018). Mathematics education holds particular significance as it forms the foundation for numerous disciplines, shaping critical thinking, problem-solving abilities, and analytical skills. However, mathematics is often perceived as a challenging subject for Filipino learners, leading to anxiety and difficulties (Capuno, 2019). The Philippines recognizes the importance of strengthening mathematics education to cultivate quality human resources and bridge the gaps in learning (Balagtas et al., 2019). Geometry, as a branch of mathematics, is of paramount importance in developing students' critical thinking and problem-solving skills (Serin, 2018). The abstract nature of geometric concepts and traditional teaching methods can contribute to students' lack of engagement and understanding. Additionally, the lack of prior knowledge retention and the fear associated with studying mathematics further hinder students' progress (Laurens et al., 2018; Gafoor & Kurukkan, 2015).

Mathematics education in the Philippines faces challenges in terms of student difficulties and anxiety (Laurens et al., 2018). To address these challenges, innovative and engaging learning materials that reinforce mathematical concepts and problem-solving skills are essential. Learning packages are crucial tools in delivering effective instruction, encompassing a wide range of resources, both in print and digital formats, that teachers use to transmit knowledge to learners (Dahar & Faize, 2011). They promote active student participation, engagement, and motivation, leading to higher achievement (Ajoke, 2017; Haruna, 2022).

The conventional approach to teaching geometry in early grades is often inflexible, exposing children primarily to standard shapes and providing limited exposure to non-examples or variations of shapes. These difficulties can persist into adolescence if not effectively addressed in education, thereby impeding students' ability to engage with formal mathematics in higher grades (Clements & Sarama, 2011). Zhang, Ding, Stegall, and Mo (2012) tested the effect of Visual-Chunking Representation on geometry testing for students with math disabilities and found that the visual-chunking representation accommodation improved students' performance on problem-solving tasks in geometry. Erbas and Yenmez (2011) investigated the effects of using a Dynamic Geometry Environment (DGE) together with inquiry-based explorations on sixth-grade students' achievements in polygons and the congruency and similarity of polygons. Their results showed that the DGE, along with open-ended explorations, significantly improved students' performance in these areas.

Learning tools can boost students' interest in learning, making the activities more effective and meaningful as students are provided with realistic problems they can easily imagine (Komalasari, 2012). Learning tools developed to meet effective aspects in terms of clarity of learning classically and positive student responses (Hasibuan et al., 2019) play a vital role in enhancing high learning achievement. This is because learning packages often combine multimedia elements, encompassing course objectives and content learning experiences (Sawangsri, 2016). Smith and Jones (2015) found that students who used structured and comprehensive learning packages showed significant improvement in their mathematical skills compared to those who received traditional instruction, suggesting that well-designed instructional materials can positively impact student learning in mathematics.

Statements of the Problem

The study aimed to develop and evaluate a learning package in Geometry for Grade 8 students. Specifically, the study addressed the following objectives:

1. Develop a learning package in selected competencies in Geometry for Grade 8 students.
2. Evaluate the developed learning package in terms of the following criteria:

a. Instructional Quality
b. Content Quality
c. Technical Quality

3. Determine the effectiveness of the developed learning package in improving students' performance.

Method

This section presents the research design, research environment and participants, research instruments, and statistical treatments used in the study.

Research Design

This research employed two fundamental components of research design: Development and Evaluation, and Quasi-Experimental Design. The Development and Evaluation approach is a systematic method focused on creating and assessing new products, technologies, programs, or interventions. It consists of two primary phases: development and evaluation. In the development phase, researchers conduct needs assessments, conceptualize ideas, and engage in iterative prototyping to generate innovative solutions tailored to specific problems. This phase is marked by exploratory investigations, idea generation, and hypothesis testing. The evaluation phase involves rigorous testing and assessment of the developed products or interventions to determine their effectiveness, efficiency, and impact.

On the other hand, the Quasi-Experimental Design allows researchers to investigate causal relationships while considering practical and ethical constraints. It approximates the rigor of true experimental designs, providing valuable insights into cause-and-effect relationships, especially when random assignment of participants is not feasible or ethical. This design helps establish stronger evidence for the impact of interventions, thereby enhancing the validity of the findings.

The ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model offers a systematic and comprehensive framework for designing and evaluating educational interventions. By following the stages of Analysis, Design, Development, Implementation, and Evaluation, researchers ensure their interventions are well-planned, structured, and aligned with desired outcomes. The model guides researchers in conducting needs assessments, defining learning objectives, developing instructional strategies, creating materials and resources, implementing the intervention, and evaluating its impact. This systematic approach enhances the development and evaluation process, leading to more effective and impactful research outcomes.

Research Environment and Participants

This study is conducted in the selected public high schools of Municipality of Norala and Tantangan, South Cotabato, Philippines. The subjects of this study are the selected Grade 8 students from the Academic Year 2022-2023. They were chosen using intact sampling. The distribution of participants according to school, gender and ethnicity presented in Table 1.

Table 1: Distribution of Research Participants

School	Gender	Ethnicity		
		Ilonggo	Ilocano	Others
School A	Male	7	8	13
	Female	12	5	12
School B	Male	10	9	4
	Female	16	11	7

Research Instruments

The research instruments developed for this learning package evaluation were designed to comprehensively assess its effectiveness and impact on learners. The learning package is a meticulously curated educational resource aimed at enhancing knowledge acquisition and critical thinking in a specific subject or skill domain. It includes a structured set of materials, activities, assessments, and guidelines to optimize the learning experience for the intended audience, promoting both independent and collaborative learning.

The validation tool for the learning package serves as a crucial assessment instrument to evaluate its quality and relevance. This tool allows researchers, educators, and stakeholders to review the learning materials, instructional strategies, and learning objectives. By utilizing this tool, they can determine whether the learning package aligns with the intended learning outcomes and effectively addresses the diverse needs of learners. The validation process assesses various aspects of the package, including its content, instructional design, and technical elements, ensuring it meets the highest standards of educational effectiveness.

To create a balanced and comprehensive assessment, the Table of Specifications (TOS) for the pretest/posttest plays a pivotal role. This detailed blueprint outlines the distribution of assessment items across different cognitive levels and content areas, providing researchers and educators with a clear guide for test construction. The TOS specifies the number of questions related to each learning outcome, the weight assigned to different topics, and the complexity level of the questions. Following the TOS ensures that the pretest and posttest accurately measure learners' knowledge and progress, aligning with the learning package's educational objectives.

The pretest/posttest combination forms a fundamental aspect of the evaluation process. Administered to learners before and after their engagement with the learning package, the pretest assesses their baseline knowledge, while the posttest evaluates the knowledge gained and the overall impact of the learning package. By comparing pretest and posttest scores, researchers can gauge the effectiveness of the learning package in facilitating learning and knowledge retention. These data provide valuable insights into learners' progress, offering a clear understanding of the package's success in achieving its intended educational objectives.

To ensure the validity and reliability of the assessments, a validation tool for the pretest/posttest is employed. This tool scrutinizes the clarity and appropriateness of the test questions, their alignment with learning objectives, and their suitability for the target audience's difficulty level. Through this tool, researchers and educators can identify any biases, ambiguities, or issues with the pretest/posttest, enabling necessary adjustments to improve the accuracy and credibility of the assessment results. Ultimately, the validation tool for the pretest/posttest strengthens the overall research findings related to the learning package's effectiveness and impact on learners.

Statistical Treatment

The statistical tools employed in this study included a variety of techniques to analyze the data. The mean, a measure of central tendency, were used to determine the quality level of the developed learning package in terms of content, instructional, and technical qualities. Standard deviation, on the other hand, gauged the dispersion or spread of scores around the mean, offering insights into the variability of the data. Aikens V, also known as the point-biserial correlation coefficient, served as a statistical tool in item analysis, determining the relationship between an individual item and the total test score, thus, assessing how well an item discriminates between high and low scorers. Item analysis further includes the Difficulty Index, which measures item difficulty by calculating the proportion of participants who answered an item correctly, and the Discrimination Index, which evaluates an item's ability to differentiate between high and low performers. Lastly, Cronbach's Alpha was employed to assess internal consistency reliability, providing an indication of how well the items on a test measure the same underlying construct. These statistical tests play crucial roles in evaluating the quality, validity, and reliability of tests and measurements, assisting researchers in making informed decisions about the effectiveness of their instruments and the accuracy of the data collected.

Additionally, Chi-Square Test for Independence is a statistical test used to examine the association between two categorical variables. By comparing observed frequencies in a contingency table with expected frequencies under the assumption of independence, one can determine whether the variables are significantly related or independent of each other. The Shapiro-Wilk Test, on the other hand, is a statistical test used to assess the normality of a dataset. It determines whether a given sample of data follows a normal distribution, which is crucial for performing parametric tests like the t-test or ANOVA. If the data is normally distributed, these tests can be applied; if not, alternative non-parametric tests may be more appropriate. The t-Test for Independent Samples is a hypothesis test used to compare the means of two independent groups to determine if they differ significantly from each other. It is particularly useful when comparing the means of two groups that have different participants or have undergone different conditions or treatments. The t-test calculates the t-value, representing the difference between the group means relative to the variability within the groups. Lastly, the Two-Way Analysis of Variance (ANOVA) is a statistical test used to explore the effects of two independent categorical variables on a continuous dependent variable. It allows the examination of main effects of each categorical variable and the interaction effect between the two variables. Two-Way ANOVA is often used in experimental and quasi-experimental research designs to investigate complex relationships between multiple factors.

Results and Discussion

The results of this study provide a comprehensive evaluation of the developed learning package for Grade 8 Geometry. By employing a quasi-experimental design, we examined the impact of the learning package on students' geometric knowledge and problem-solving skills. This section presents a detailed analysis of the data collected from both the experimental and control groups, highlighting key findings and their implications. The discussion delves into the effectiveness of the learning package, comparing pretest and posttest scores, and exploring differences in performance between public and private school students.

The Developed Learning Package

The developed learning package in Geometry for Mathematics 8 is consisted of the following instructional tools: Detailed Lesson Plans, Learning Modules, Teacher's Guide, Manipulatives, and PowerPoint Presentations.

Lesson Plan

The detailed lesson plan in geometry for Mathematics 8 includes various components that help guide teachers in delivering effective instruction on Triangle Congruence. It begins by stating clear objectives aligned with the learning competencies, specifying what students should achieve by the end of the lesson. The lesson plan lists the necessary materials and resources required, such as textbooks, manipulatives, and worksheets, to support instruction and student activities. The lesson plan incorporates a warm-up or introduction activity to engage students and activate their prior knowledge on Triangle Congruence. It then outlines the teaching strategies and procedures in a step-by-step manner, breaking down the lesson into smaller parts and providing detailed instructions for each stage. Figure 1 shows the screenshot of the lesson plan.

	LESSON PLAN IN MATH	School:		Grade Level:	VIII
		Teacher:		Learning Area:	MATHEMATICS
		Teaching Date:	April 2, 2023	Quarter:	1st
		Teaching Time:	08:00 am – 09:00 am	Section:	A

I. OBJECTIVES	
A. Content Standards	The learner demonstrates understanding of key concepts of axiomatic structure of geometry and triangle congruence.
B. Performance Standards	a. The learner is able to formulate an organized plan to handle a real-life situation. b. is able to communicate mathematical thinking with coherence and clarity in formulating, investigating, analyzing, and solving real-life problems involving congruent triangles using appropriate and accurate representations
C. Learning Competencies	Proves two triangles are congruent
D. Learning Objectives	At the end of the discussion, the students are expected to and; a. state the different triangle congruence postulate; b. apply the definition of congruence triangle to show congruence between triangles
II. CONTENT (Subject Matter)	Proves two triangles are congruent
III. LEARNING RESOURCES	RME learning modules, manipulative tools,
A. References	

Figure 1: A Screenshot of the Lesson Plan

The researchers followed the format of the DepEd Order No.42, S. 2016 lesson plan. The DepEd Order No.42, S. 2016 lesson plan has been used by the researcher to create the detailed lesson plan and it includes Objectives, Content/Subject Matter, Resources, Procedures, Assessment and Assignment.

Learning Module

The learning module in the learning package for Mathematics 8 provides a comprehensive and structured approach to understanding and applying concepts related to Triangle Congruence. It is designed to facilitate self-directed learning and includes various activities, exercises, and examples to engage students and reinforce their understanding. The learning module is organized into several sections, each focusing on specific aspects of Triangle Congruence. These sections include: Introduction to Triangle Congruence: Definition of congruent triangles Importance and applications of proving triangle congruence Methods of Proving Triangle Congruence like Side-Angle-Side (SAS) congruence Side-Side-Side (SSS) congruence Angle-Side-Angle (ASA) congruence.Moreover, other sections include Applying Triangle Congruence: Building Perpendicular Lines Using Triangle Congruence Building Angle Bisectors Using Triangle Congruence. Some examples and practice exercises are also indicated like using congruence theorems and postulates to prove specific statements about triangles. Step-by-step explanations and more examples for proving statements are provided by the learning module to meet the needs of various learners, it also contains exercises and practice problems with differing degrees of difficulty. Figure 2 show the screenshot of the title page of the learning module.

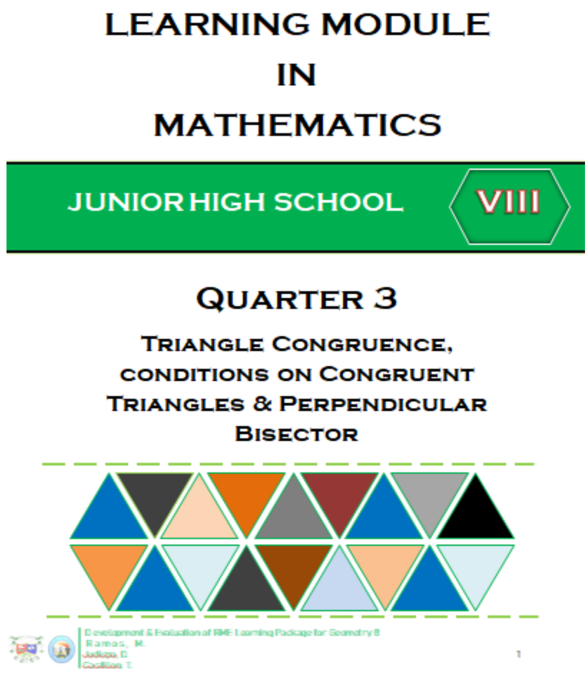


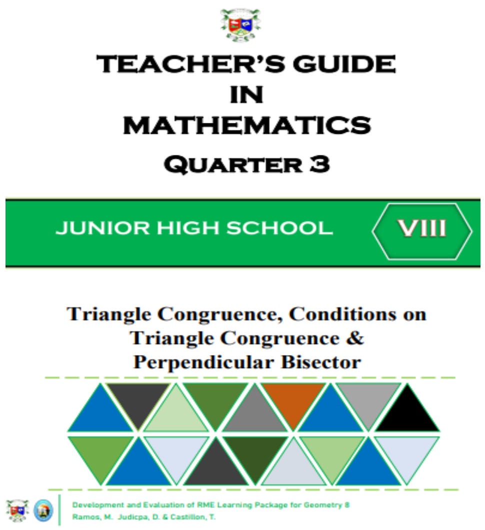
Figure 2: A Screenshot of the Learning Module

The learning module serves as the student's learning aid for learning the lessons in Triangle Congruence: Proves Two triangles are Congruent, Proves Statements on Triangle Congruence and Applies Triangle Congruence to construct Perpendicular Lines and Angle Bisectors Geometry 8 wherein its contents are based on the Curriculum Guide K-12 in Mathematics.

Teacher's Guide

The teacher's guide in the learning package provides comprehensive support to educators in effectively implementing the learning materials. It includes detailed instructions, suggested teaching strategies, and tips for facilitating classroom discussions and activities. The guide also provides answers and explanations for the exercises and activities in the learning module. Figure 3 shows the teacher's guide used by teacher to be guided in the lesson and activities.

Figure 3: A Screenshot of The Teacher's Guide



Manipulatives

The learning package includes manipulatives such as triangle shapes, protractors rulers and GeoBoard. These hands-on tools allow students to explore and manipulate geometric concepts, facilitating a deeper understanding of Triangle Congruence. Manipulatives provide a concrete and visual representation of abstract ideas, enabling students to make connections and reinforce their learning. The Geoboard typically has a 5x5 or 10x10 grid, although variations with larger grids are also available. The pegs are evenly spaced, allowing students to stretch rubber bands or elastic bands around them to create different geometric shapes and patterns. The rubber bands are stretched across the pegs to form line segments, angles, polygons, and other geometric figures. The Geoboard consists of a square or rectangular board with a grid of evenly spaced pegs or nails. Students can stretch rubber bands or elastic bands around the pegs to create various geometric shapes, patterns and to prove congruence triangle (see Figure 4).

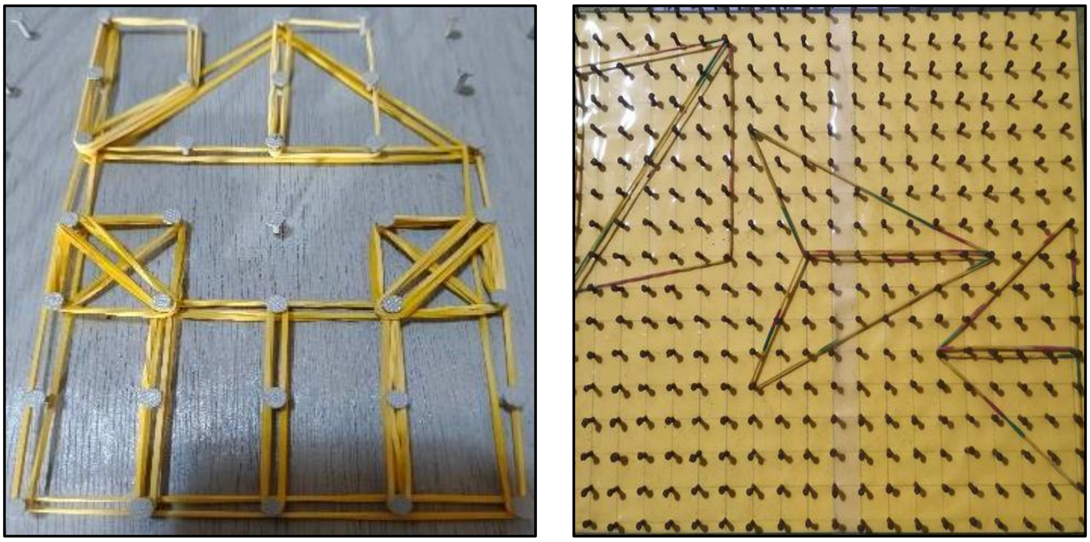


Figure 4: Image of the Manipulatives

The Geoboard provides a tangible and interactive way for students to experiment with geometry. They can manipulate the rubber bands to create different shapes, change their sizes and orientations, and explore the relationships between angles and sides. By physically stretching and moving the rubber bands, students can gain a better understanding of concepts such as congruence, symmetry, and the properties of various geometric shapes. With the Geoboard, students can investigate geometric properties, make conjectures, test hypotheses, and discover patterns through hands-on exploration. It encourages them to actively engage in mathematical thinking, problem-solving, and reasoning.

The manipulative helps bridge the gap between abstract geometric concepts and concrete, visual representations, allowing students to develop a deeper understanding of geometry. In our Learning package, the Geoboard serves as a valuable tool for students to actively participate in geometry lessons, fostering a deeper conceptual understanding of geometric concepts and promoting a more interactive and engaging learning experience.

PowerPoint Presentations

The PowerPoint presentations included in the learning package serve as visual aids to support classroom instruction. These presentations feature engaging visuals, diagrams, and step-by-step explanations, making complex concepts more accessible and comprehensible to students. The PowerPoint presentations can be used by teachers to deliver interactive lessons, stimulate class discussions, and reinforce key points. Figure 8 shows the PowerPoint presentation utilized by teacher in class. Figure 5 shows the title pages of the PowerPoint presentations.

Figure 5: The PowerPoint Presentation

The PowerPoint presentation serves as the students' learning aid for their learning and understanding of the lesson in Triangle Congruence: Proves Two triangles are Congruent, Proves Statements on Triangle Congruence and Applies Triangle Congruence to Construct Perpendicular Lines and Angle Bisectors Geometry 8. The researchers utilize Microsoft PowerPoint to create the Presentation. The researchers created this instructional tool to help the teachers to easily navigate and present the different topics, terms, content and figures in the lesson to the learners. Its content is based on the K-12 Curriculum Guide in Mathematics. It includes the objectives of the lesson, the content, the activity, the application and assessment.

Moreover, the sequence of the PowerPoint presentation, with its slides and content arrangement, closely mirrors the organization and progression of the learning module. This alignment ensures that learners can seamlessly transition from the PowerPoint presentation to the learning module, facilitating a coherent and consistent learning experience. By maintaining consistency in the sequence of information and concepts, educators can enhance comprehension, reinforce key points, and effectively guide learners through the material. Furthermore, aligning the presentation sequence with the learning module promotes a logical flow of information, aiding learners in retaining and applying knowledge effectively. Figure 6 shows the PowerPoint phasing.

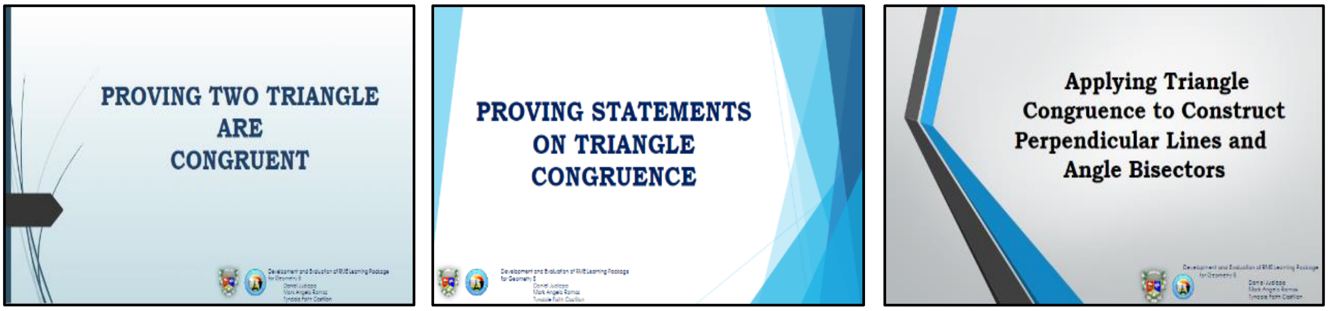


Figure 6: The PowerPoint Phasing

The phasing of this PowerPoint presentation is helping the learners to understand the concept and illustrations of different geometric figures. Lastly, the slideshow presentation was designed to be used in either face-to-face or online classes.

Overall, by incorporating detailed lesson plans, learning modules, a teacher's guide, manipulatives, and PowerPoint presentations, the learning package provides a well-rounded and interactive learning experience for Mathematics 8 students. It aligns with the specific learning competencies (M8GE-IIIg-1, M8GE-IIIh-1, and M8GE-III-j-1) and ensures the attainment of students' performance standards and content standards outlined in the K-12 Curriculum Guide in Mathematics 8-3rd Quarter Week 6-8.

Evaluation Results of the Developed Learning Package

Table 2 presents the results of the evaluation of the learning package in terms of content quality. The table displays various indicators along with their corresponding means, providing a comprehensive assessment of the learning package's content. These indicators include factors such as accuracy, relevance, depth, and coherence of the content. Each indicator's mean value allows for a quantitative understanding of the content quality.

Table 2: Results of the Evaluation of the Developed Learning Package in Terms of Content Quality

Content Quality	Mean	Interpretation
1. It is mathematically accurate	4.25	Very Good Quality
2. It emphasizes active learning	4.00	Very Good Quality
3. Contents of each activity is relevant to the objectives	4.00	Very Good Quality
4. It is well-organized	4.25	Very Good Quality
5. It evaluates student learning as stated in objectives	4.00	Very Good Quality
6. It allows the development of multiple intelligences.	4.00	Very Good Quality
7. Topics are supported by illustrations and tasks suited to students	3.75	Very Good Quality
8. It is aligned to curriculum	4.25	Very Good Quality
9. The contents are free to ethnic, gender, and other stereotypes.	4.25	Very Good Quality
OVERALL RESULT	**4.14**	**Very Good Quality**

Mean Interpretation: 1.00-1.50 Very Poor Quality | 1.51-2.50 Poor Quality | 2.51-3.50 Good Quality | 3.51-4.50 Very Good Quality | 4.51-5.00 Excellent Quality

The four (4) highest means are of statement number 1, 4, 8, and 9 with the mean of 4.25 interpreted as Very good Quality. It is said that the learning package is mathematically accurate, organized, and free from ethnic, gender, and other stereotypes and it is based on the Curriculum Competencies. The lowest mean score is statement number 7 with a mean score of 3.75 that the illustrations in the learning package should support the tasks. Overall, the learning package has a very good quality in terms of content with overall mean of 4.14.

Similarly, Table 3 presents the results of the evaluation of the learning package in terms of instructional quality. The table includes various indicators along with their corresponding means, providing a comprehensive assessment of the learning package's effectiveness. These indicators include factors such as clarity of instructions, organization of content, engagement of learners, and effectiveness of assessment methods. These visual representations help in identifying areas of improvement and facilitating decision-making processes regarding the learning package's enhancement.

Table 3: Results of the Evaluation of the Developed Learning Package in Terms of Instructional Quality

Instructional Quality	Mean	Interpretation
1. It is easier to understand.	4.00	Very Good Quality
2. It is of high educational value.	4.00	Very Good Quality
3. It is a good supplement of the curriculum.	4.00	Very Good Quality
4. It addresses the needs and concern of the students.	3.75	Very Good Quality
5. The manual facilitates collaborative and interactive learning.	4.25	Very Good Quality
6. It integrates student's previous experience.	3.50	Very Good Quality
7. The learning package introduction helps answering test questions.	4.25	Very Good Quality
8. It reflects current trends in mathematics education.	3.75	Very Good Quality
9. The graphics, and colors used are appropriate for instructional objectives.	4.00	Very Good Quality
10. The learning material helps the teacher in delivering the lesson.	4.00	Very Good Quality
OVERALL RESULT	**3.95**	**Very Good Quality**

Mean Interpretation: 1.00-1.50 Very Poor Quality | 1.51-2.50 Poor Quality | 2.51-3.50 Good Quality | 3.51-4.50 Very Good Quality | 4.51-5.00 Excellent Quality

The overall mean in the instructional quality of the learning package is 3.95 which mean that it has a Very good Quality in terms of instructions. Statement number 5 and 7 got the highest mean of 4.25 which indicates that the learning package facilitates collaborative and interactive learning and helps answer test questions. On the other hand, statement number 6 got the lowest mean which indicates that the learning package integrates students' previous experience. Furthermore, the result of the evaluation for the learning package indicates that it has a very good quality in terms of instructional quality with an overall mean of 3.95.

Moreover, Table 4 presents the results of the evaluation of the learning package in terms of technical quality. The table shows different indicators and their corresponding means, providing an assessment of the learning package's technical aspects. These indicators include factors such as usability, functionality, accessibility, and reliability of the learning platform or software. The mean values associated with each indicator offer quantitative insights into the technical quality of the learning package.

Table 4: Results of the Evaluation of the Developed Learning Package in Terms of Technical Quality

Technical Quality	Mean	Interpretation
1. The manual is easy to understand.	4.00	Very Good Quality
2. The manual allows learner to control pace of learning.	3.75	Very Good Quality
3. The graphics are excellent.	4.00	Very Good Quality
4. The layout and the design are attractive.	3.50	Very Good Quality
5. Intend users can easily and independently use the manual.	3.75	Very Good Quality
6. The language use is clear, concise, and motivating.	4.00	Very Good Quality
7. The learning package is aesthetically pleasing.	3.50	Very Good Quality
8. The symbols used are well-define.	3.50	Very Good Quality
9. Topics are presented in a logical and sequential order.	4.25	Very Good Quality
OVERALL RESULT	**3.83**	**Very Good Quality**

Mean Interpretation: 1.00-1.50 Very Poor Quality | 1.51-2.50 Poor Quality | 2.51-3.50 Good Quality | 3.51-4.50 Very Good Quality | 4.51-5.00 Excellent Quality

The overall mean in the technical quality for the learning package is 3.83, which is interpreted as a Very Good Quality. Statement number 9 got the highest mean of 4.25. Statement states that the topics are presented in a logical and sequential order. It means that the lesson in the PowerPoint presentation is logically presented. Statements 4, 7 and 8 got the lowest mean of 3.50 meaning the layout and the designs are attractive, the package is aesthetically pleasing and the symbols are well defined. The evaluators agreed that the technical quality of the learning package has a very good quality with an overall mean of 3.83. Furthermore, the Table 5 presents the summary of the developed learning package.

Table 5: Summary Results on the Evaluation of Developed Learning Package

Criteria	Overall Mean Score	Interpretation
Content Quality	4.14	Very Good Quality
Instructional Quality	3.95	Very Good Quality
Technical Quality	3.83	Very Good Quality
OVERALL RESULT	**3.97**	**Very Good Quality**

Mean Interpretation: 1.00-1.50 Very Poor Quality | 1.51-2.50 Poor Quality | 2.51-3.50 Good Quality | 3.51-4.50 Very Good Quality | 4.51-5.00 Excellent Quality

The results of the evaluation of the developed learning package demonstrate that it is of "Very Good Quality" across multiple dimensions, with an overall mean score of 3.97. Specifically, the content quality received a mean score of 4.14, indicating strong performance in areas such as mathematical accuracy, organization, and alignment with the curriculum. The instructional quality, with a mean score of 3.95, highlights the package's educational value, its facilitation of collaborative learning, and its support for teachers in delivering lessons. The technical quality scored slightly lower at 3.83, but still falls within the

"Very Good Quality" range, reflecting the clarity of the manual, the quality of graphics, and the logical presentation of topics.

These findings align well with existing literature on the importance of comprehensive and well-structured educational resources. According to studies by Jonassen and Land (2012), effective learning packages should integrate clear objectives, relevant content, and engaging instructional methods, all of which were confirmed in this evaluation. Furthermore, the high scores in content quality support the claims by Mayer (2009) that instructional materials should be free from stereotypes and biases while promoting active learning and multiple intelligences. The slightly lower score in technical quality suggests areas for improvement, particularly in the aesthetics and user independence of the manual, which aligns with research by Clark and Mayer (2016) emphasizing the importance of user-friendly design in educational materials.

Effectiveness of the Developed Learning Package

Table 6: Independent Samples t-Test Results for Pretest Scores of Students With Learning Package and Without Learning Package

School	Group	Mean	N	SD	t	df	p-value	Interpretation
A	With learning package	12.93	30	2.65	1.47	57	0.15	No Significant Difference
	Without learning package	11.76	29	3.44				
B	With learning package	12.48	27	4.32	0.36	53	0.71	No Significant Difference
	Without learning package	12.14	28	2.00				
Overall	With learning package	12.71	57	3.51	1.30	112	0.20	No Significant Difference
	Without learning package	11.95	57	2.81				

The pretest results indicated that there was no significant difference in the initial mathematical proficiency between students who used the learning package and those who did not. For School A, the mean pretest score for students with the learning package was 12.93 (SD = 2.65), while for students without the learning package, it was 11.76 (SD = 3.44). The t-test results showed no significant difference between the two groups ($t(57) = 1.47$, $p = 0.15$). Similarly, in School B, the mean pretest score for students with the learning package was 12.48 (SD = 4.32), compared to 12.14 (SD = 2.00) for those without the learning package, with no significant difference ($t(53) = 0.36$, $p = 0.71$). Overall, the combined pretest scores across both schools were 12.71 (SD = 3.51) for the learning package group and 11.95 (SD = 2.81) for the non-learning package group, also showing no significant difference ($t(112) = 1.30$, $p = 0.20$).

These results are consistent with existing literature that emphasizes the importance of ensuring baseline equivalence in educational intervention studies. Studies by Shadish, Cook, and Campbell (2002) highlight the necessity of establishing comparable groups before the intervention to accurately measure its impact. The absence of significant differences in pretest scores suggests that any observed changes in posttest scores can be more confidently attributed to the intervention itself.

Table 7: Independent Samples t-Test Results for Posttest Scores of Students With Learning Package and Without Learning Package

School	Group	Mean	N	SD	t	df	p-value	Interpretation
A	With learning package	19.07	30	2.97	-0.13	57	0.90	No Significant Difference
	Without learning package	19.17	29	3.32				
B	With learning package	19.63	27	2.81	5.74	53	0.00	Significant Difference
	Without learning package	15.25	28	2.84				
Overall	With learning package	19.33	57	2.89	3.40	112	0.01	Significant Difference
	Without learning package	17.25	57	3.65				

The posttest results revealed significant differences in the mathematical performance of students who used the learning package compared to those who did not. In School A, the mean posttest scores were 19.07 (SD = 2.97) for the learning package group and 19.17 (SD = 3.32) for the non-learning package group, with no significant difference ($t(57) = -0.13$, $p = 0.90$). However, in School B, the learning package group scored significantly higher (mean = 19.63, SD = 2.81) than the non-learning package group (mean = 15.25, SD = 2.84), with a t-test showing a significant difference ($t(53) = 5.74$, $p < 0.001$). When considering both schools together, the overall posttest scores were 19.33 (SD = 2.89) for the learning package group and 17.25 (SD = 3.65) for the non-learning package group, with a significant difference ($t(112) = 3.40$, $p = 0.001$)(Posttest t).

These findings are consistent with prior research indicating the positive impact of well-designed educational interventions on student performance. According to Hattie (2008), instructional strategies that actively engage students and are aligned with their learning needs can significantly enhance academic outcomes. The significant improvement observed in School B suggests that the learning package effectively facilitated the development of mathematical skills, supporting the assertion by Mayer (2009) that multimedia learning materials can enhance understanding and retention when properly designed and implemented. Meanwhile, Table 11 shows the Two-way ANOVA results for posttest scores.

Table 8: Two-way ANOVA Results for Posttest Scores

Source	Sum of Squares	df	Mean Square	F	p-value
Corrected Model	347.87[a]	3	115.97	12.89	.000
Intercept	38034.03	1	38034.03	4227.92	.000
School	80.29	1	80.29	8.93	.003
With learning package and Without learning package	129.96	1	129.95	14.45	.000
School * With learning package and Without learning package	143.12	1	143.12	15.91	.000
Error	989.55	110	9.00		
Total	39471.00	114			
Corrected Total	1337.45	113			

The results of the two-way ANOVA revealed significant effects of school type, the presence or absence of the learning package, and their interaction on posttest scores. Specifically, the main effect of school type was statistically significant ($F(1, 110) = 8.93$, $p = .003$), indicating that there were significant differences in student performance between public and private schools. Similarly, the main effect of the learning package was significant ($F(1, 110) = 14.45$, $p < .001$), suggesting that students with the learning package performed significantly better than those without it. Furthermore, the interaction effect between school type and the presence of the learning package was significant ($F(1, 110) = 15.91$, $p < .001$), indicating that the impact of the learning package on student performance varied depending on the school type. The overall model was statistically significant ($F(3, 110) = 12.89$, $p < .001$), with a corrected model sum of squares of 347.87.

These findings suggest that both the type of school and the provision of the learning package significantly influence student performance. Moreover, the interaction effect implies that the effectiveness of the learning package is context-dependent, varying between public and private schools. This highlights the importance of considering the school environment when implementing educational interventions.

Comparing these results to existing literature, we observe consistency with previous studies. For instance, research has shown that private schools often have more resources and different instructional practices compared to public schools, which can lead to variations in student outcomes (Lubienski & Lubienski, 2006; Coleman, 1988). The significant effect of the learning package aligns with studies emphasizing the positive impact of targeted instructional interventions on academic performance (Slavin, 2010; Hattie, 2009).

The significant interaction between school type and the learning package underscores findings in the literature that contextual factors, such as school environment, can moderate the effectiveness of educational interventions (Baker, 1992; Darling-Hammond, 2000). For example, private schools may offer environments more conducive to the successful implementation of new instructional tools, while public schools may face challenges that could affect the outcomes of such interventions (Bryk, Lee, & Holland, 1993).

These results have important implications for educational policy and practice. They suggest that tailored instructional approaches, which take into account the specific characteristics of different school environments, are necessary. Policymakers should consider providing additional support to public schools to ensure the effective implementation of educational interventions. Practitioners should adapt their strategies to the context of their schools to maximize the benefits of such interventions.

Conclusion

The research concludes that the development and implementation of the geometry learning package significantly improved the performance of Grade 8 students in both public and private schools. The findings demonstrate that students who utilized the learning package exhibited marked improvements in their understanding and application of geometric concepts compared to those who did not use the package. Notably, the results revealed significant differences in the effectiveness of the learning package between public and private school students, underscoring the importance of considering school environment in educational interventions. The study highlights the necessity for tailored instructional strategies that cater to the unique needs of different educational settings. These outcomes suggest that policymakers and educators should prioritize the provision of additional resources and context-specific instructional support, particularly for public schools, to enhance the efficacy of educational programs and promote equitable learning opportunities across diverse school environments

Recommendations

Based on the research findings, several key recommendations are made to enhance the effectiveness of educational interventions using learning packages:

1. It is crucial to provide ongoing professional development for teachers to ensure they are well-equipped to implement the learning package effectively. This includes training on using detailed lesson plans, learning modules, teacher's guides, manipulatives, and PowerPoint presentations, as well as strategies for engaging students in active learning.
2. The learning package should be adapted to meet the specific needs and contexts of different school environments. Given the observed differences in effectiveness between public and private schools, it is important to tailor instructional materials and support to address these disparities. This may involve providing additional resources and support for public schools to bridge the gap in educational outcomes.
3. Continuous evaluation and refinement of the learning package are essential. This involves regularly collecting feedback from both teachers and students, as well as conducting periodic assessments to ensure the materials remain relevant and effective. Based on the feedback and assessment results, the learning package should be updated to address any identified gaps or areas for improvement.
4. Policymakers should consider integrating such learning packages into the broader educational curriculum. By doing so, they can promote a standardized approach to teaching complex subjects like geometry, ensuring that all students have access to high-quality instructional materials. This integration should be supported by adequate funding and resources to sustain the implementation and scaling of the learning package across different educational settings.

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