

Original Article

Development and Validation of a Supplementary Learning Material in Grade 8 Geometry Using the Think-Pair-Share Strategy with Technology Integration

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Abstract. This study developed and validated supplementary learning materials for Grade 8 Geometry using the Think-Pair-Share strategy with technology integration to address the need for valid, acceptable learning resources. Specifically, it aimed to determine the level of validity in terms of content quality, instructional quality, technical quality, and other findings, and determine the level of acceptability in terms of clarity, usefulness, suitability, adequacy, timeliness, language, style, and format, illustrations, and presentation of the developed material based on the evaluations of the teachers and expert validators, and if there is significance difference between the two validators ratings on the validity and acceptability of the developed learning material. The study used a developmental research design and involved 44 validators, composed of 23 mathematics teachers and 21 experts. Data were gathered using the Department of Education Learning Resource Management and Development System questionnaire for validity and an adapted acceptability tool. Results showed that the material was rated Very Satisfactory in validity by both teachers and experts. It was also rated Very Much Acceptable by teachers and experts. Statistical results further showed no significant difference in ratings between the two groups for validity and acceptability. These findings indicate that the developed supplementary learning material is valid through expert and teacher evaluation and highly acceptable for use in Grade 8 Geometry. Future studies may examine its effect on students' academic performance and learning outcomes.

Keywords: *Geometry; Supplementary learning material; Technology integration; Think-Pair-Share strategy; Validation*

In today's technology-driven world, students are expected to develop not only content knowledge but also higher-order skills such as critical thinking, problem-solving, collaboration, and digital literacy. These competencies are increasingly recognized as essential for meaningful participation in school, work, and society. To support this, learners must be provided with quality education responsive to current academic and societal demands, as emphasized by UNESCO (2024) and the OECD (2023). In the Philippine context, the MATATAG Curriculum reflects this direction by placing greater emphasis on conceptual understanding, active learning, and the purposeful integration of technology to enhance and reinforce students' learning in geometric

concepts. For Grade 8 learners, this is especially important in geometry, a subject area that requires students to interpret shapes, relationships, space, and visual representations in ways that go beyond rote memorization. However, despite these curriculum reforms, international large-scale assessment results continue to show that Filipino students struggle with mathematics, particularly in tasks involving geometry, spatial reasoning, and visualization, as reflected in the findings of Mullis et al. (2019) and OECD (2023).

The persistent difficulty in geometry is well-documented in the literature. Geometry is often challenging for students because many of its concepts are abstract and require mental visualization, spatial reasoning, and connecting two-dimensional representations to three-dimensional ideas. Traditional teaching approaches, which often rely on static illustrations, verbal explanations, and teacher-centered delivery, may not be sufficient to help students build strong conceptual understanding (Van de Walle, 2019). Research has shown that students learn mathematics more effectively when they are actively engaged in constructing meaning, testing ideas, and interacting with visual and manipulable representations. This view is consistent with constructivist theory, which holds that learners build knowledge through active experience and reflection, rather than simply receiving information passively (Piaget, 1972). In the same way, social constructivist theory highlights the importance of interaction, dialogue, and shared meaning-making in the learning process, suggesting that understanding is strengthened when students learn with and from others (Vygotsky, 1978). These theoretical perspectives provide a strong basis for designing interactive, collaborative learning materials.

In mathematics education, technology-based tools have increasingly been recommended to make abstract concepts more visible and easier to understand. Dynamic mathematics software such as GeoGebra allows students to manipulate figures, observe changes, and explore relationships in real time, thereby supporting conceptual understanding and spatial thinking. Prior studies have shown that GeoGebra can improve students' achievement, motivation, and visualization skills in mathematics, including geometry (Zengin, 2012; Hohenwarter & Fuchs, 2004). At the same time, collaborative learning strategies such as Think-Pair-Share (TPS) have also been found to promote active participation, verbal reasoning, and deeper understanding by allowing students to think individually, discuss with a partner, and then share with a larger group (Gillies, 2016; Lyman, 1981). Through this process, students are given structured opportunities to explain their thinking, compare ideas, and refine their understanding. These features are especially useful in geometry, where students often need time, support, and discussion to make sense of abstract concepts.

Although both technology-based approaches and collaborative learning have been widely recommended, the literature suggests that they are often implemented separately rather than combined into a coherent instructional resource. Existing studies tend to focus either on GeoGebra's effectiveness as a digital tool or on the classroom value of cooperative strategies such as TPS. There remains limited attention to the development of supplementary learning materials that intentionally integrate these two approaches in ways that are aligned with curriculum goals and classroom realities. This gap is important because learning materials serve as a direct bridge between theory and practice. Without well-designed learning materials that embody research-based strategies, the potential benefits of technology integration and collaborative pedagogy may remain difficult for teachers to apply consistently in actual lessons. Thus, there is a need for context-responsive, theory-informed, and teacher and expert-validated learning materials that can help teachers supplement geometry lessons in a more engaging, scaffolded, and conceptually meaningful way.

Anchored in constructivist and social constructivist learning theories, this study was conceptualized on the assumption that students learn geometry more effectively when they are actively involved in exploring ideas, visually representing concepts, and discussing their reasoning with peers. The integration of GeoGebra and Think-Pair-Share in a Supplementary Learning Material (SLM) is therefore not only a practical learning material choice but also a theoretically grounded response to the learning demands of geometry. In line with this, the present study aimed to develop and validate a Supplementary Learning Material for teaching geometry to Grade 8 students that integrates technology through GeoGebra and collaborative learning through the Think-Pair-Share method. Specifically, it sought to answer the following research question:

The research addresses five key objectives:

- (1) Determining the level of validity of the developed Supplementary Learning Material as evaluated by teacher and expert validators in terms of its content quality, instructional quality, technical quality, and other findings.

- (2) Determining the level of acceptability as evaluated by teacher and expert validators in terms of clarity, usefulness, suitability, adequacy, timeliness, language, style, and format, illustrations, and presentation.
- (3) Exploring the difference between teacher and expert validators' validation ratings regarding the overall validity of the developed Supplementary Learning Material (SLM).
- (4) Exploring the difference between teacher and expert validators' validation ratings regarding the overall acceptability of the developed Supplementary Learning Material (SLM)

The study is significant because it addresses a practical and scholarly need in mathematics education. Practically, it offers teachers validated supplementary learning materials that may help improve the teaching of geometry under the MATATAG Curriculum. For learners, it may provide more engaging, visual, and collaborative experiences that support a deeper understanding of geometric concepts. Scholarly, the study contributes to the literature on learning material development by showing how theory, pedagogy, and technology can be combined into a single resource for geometry learning. In doing so, it helps clarify how constructivist and social constructivist principles may be operationalized in the design of supplementary learning materials for mathematics learning and provides a basis for future research on the classroom use and effectiveness of such materials.

Methodology

Research Design

This study used developmental research with descriptive and comparative elements to design, develop, and validate a Supplementary Learning Material (SLM) for Grade 8 geometry under the MATATAG Curriculum. Developmental research was appropriate because the study focused on producing and refining a learning material through a systematic process of planning, development, validation, and revision (Richey & Klein, 2014; Seels & Richey, 1994). The descriptive element was used to present the SLM's content, instructional, and technical quality, as well as other findings and acceptability. The comparative element was used to assess whether there was a significant difference in ratings between teacher validators and expert validators. This evaluation sought to confirm the alignment of educational content with the curriculum objectives and to effectively address students' learning needs at this level.

Development of Learning Material

Research underscores the critical role of geometry in nurturing logical thinking and abstract reasoning skills, which are pivotal for advanced mathematics and practical applications (Fiantika, 2018). Moreover, contemporary studies indicate that learning geometry enhances modeling and visualization skills, particularly when augmented by technology-based tools, such as dynamic software, thereby contributing to deeper conceptual understanding and greater engagement in mathematics. Thus, geometry transcends mere content knowledge, serving as a cognitive training domain that cultivates analytical and spatial intelligence among learners (Ziatdinov, 2022). The focus on grade 8 junior high school students as the target audience for the developed learning material is informed by the understanding that learners aged 13-14 typically reach the formal operational stage of cognitive development, as outlined by Piaget (1972). At this stage, students begin to engage in abstract thinking, comprehend relationships among variables, use formulas, and generalize concepts. This cognitive readiness positions grade 8 students to progress from concrete geometric visualization (shapes and figures) to abstract reasoning (deriving and applying formulas). This progression is consistent with curricular expectations, which require students to derive volume formulas, connect two-dimensional concepts (area) to three-dimensional measurements (volume), and solve multi-step, real-world problems involving solids.

In response to the analysis's findings, a series of targeted lessons and associated activities was developed. This learning material was designed to foster deeper understanding and engagement among students. To achieve this goal, the innovative Think-Pair-Share (TPS) strategy was employed. This collaborative learning method not only encourages individual reflection but also facilitates peer interaction, allowing students to articulate their thoughts and enhance their comprehension of the subject matter. Moreover, technology integration was a pivotal aspect of the lesson design process. The incorporation of digital tools and resources is expected to enhance students' learning experiences by providing opportunities to explore geometric concepts in a dynamic, interactive environment. As illustrated in the accompanying table, which outlines the educational framework, the researcher identified six specific learning competencies to be systematically developed and validated throughout this instructional initiative. Each competency represents a crucial element of the curriculum, designed to ensure that students not only acquire theoretical knowledge but also develop practical skills essential to their academic

growth in mathematics. This systematic approach underscores the commitment to fostering an enriched learning environment that promotes inquiry, collaboration, and the effective application of mathematical principles.

Table 1. Mathematics MATATAG Curriculum 2023 Grade 8 – Quarter 2		
Content Domain	Content Standards	Learning Competencies
Measurement and Geometry (MG)	<i>The learners demonstrate knowledge and understanding of...</i> volume of pyramids (other than square and rectangular pyramids), cones, and spheres	<i>The learners...</i> Lesson 1: Explore the volume of pyramids other than square and rectangular pyramids. Lesson 2: Find the volume of pyramids other than square and rectangular pyramids. Lesson 3: Solve problems involving the volume of pyramids. Lesson 4: Explore the volumes of cones and spheres inductively, leading to their formulas. Lesson 5: Find the volumes of cones and spheres. Lesson 6: Solve problems involving the volume of cones and spheres.
Performance Standards By the end of the quarter, the learners can find the volume of pyramids (other than square and rectangular pyramids), and the volumes of cones and spheres. (MG)		

Table 1 presents a comprehensive overview of the learning competencies in Mathematics, specifically designed for eighth grade and selected second-quarter geometry competencies, guided by the innovative MATATAG Curriculum of 2023. This curriculum framework reflects a progressive approach to mathematics education, aiming to enhance students' understanding and application of mathematical concepts and skills. The identified learning competencies serve as a foundational criterion for developing supplementary learning materials tailored to meet students' diverse learning needs. By aligning the content of these supplementary learning materials with the specified learning competencies, educators can ensure that these resources not only complement the existing curriculum but also reinforce and enhance the knowledge and skills students are expected to acquire thrduringis critical period of their education. Using these competencies as a guide, the supplementary learning materials are designed to foster a more effective and engaging learning environment in mathematics for eighth graders.

The selection of these competencies is not arbitrary; rather, it is strongly supported by empirical studies highlighting persistent student difficulties in geometry and the need for conceptual and application-based learning. The first and fourth competencies—exploring inductively the volumes of pyramids, cones, and spheres—are grounded in constructivist learning principles. Suryani et al. (2025) revealed that students commonly develop misconceptions when introduced directly to formulas without prior conceptual exploration. The study emphasized that inductive and guided discovery approaches significantly improve understanding of volume relationships. This supports the need for SLM activities that allow learners to explore and derive formulas rather than memorize them. The second and fifth competencies—finding the volumes of pyramids, cones, and spheres—address procedural fluency, which remains essential in mathematics learning. However, studies indicate that procedural knowledge alone is insufficient. According to Sieng (2024), students often fail to correctly apply formulas due to weak conceptual understanding and poor visualization skills. This highlights the importance of integrating conceptual and procedural learning within SLMs. Furthermore, the third and sixth competencies—solving problems involving volumes—are critical in developing higher-order thinking skills. According to Shi et. al. (2023), students who engage in problem-solving tasks supported by interactive and experiential learning demonstrate significantly improved performance compared to those exposed to traditional lecture-based instruction. This finding underscores the importance of including application-based competencies in the SLM. From an international perspective, the systematic review by Weigand et. al. (2025) highlighted that spatial reasoning, visualization, and understanding of three-dimensional objects are among the least developed skills of students worldwide. The study recommended using structured learning materials that integrate exploration, computation, and application to improve geometry learning outcomes.

The selection of competencies involving pyramids other than square and rectangular pyramids is also significant. Research indicates that students tend to rely heavily on familiar examples and struggle to generalize concepts to non-routine figures. By including a variety of pyramid types, learners are encouraged to develop deeper conceptual understanding rather than relying on memorized procedures.

Overall, the reviewed literature consistently supports the inclusion of the six learning competencies in the development of the SLM for the following reasons:

- a. Addressing Conceptual Gaps – Students struggle to understand volume concepts due to a lack of conceptual grounding and an overreliance on memorization.
- b. Promoting Inductive Learning – Exploration-based competencies help learners construct knowledge and derive meaningful formulas.
- c. Developing Procedural Fluency – Competencies on finding volumes ensure accuracy and efficiency in computation.
- d. Enhancing Problem-Solving Skills – Application-based competencies develop higher-order thinking and real-life problem-solving abilities.
- e. Improving Spatial Reasoning – Learning tasks involving three-dimensional figures strengthen visualization and analytical skills.
- f. Responding to Diverse Learning Needs – SLMs provide interactive, engaging, and learner-centered approaches that traditional methods may lack.

In summary, the inclusion of these six competencies as the coverage of the developed SLM is strongly justified by both local and international studies. These competencies are essential in addressing persistent learning difficulties in geometry, promoting deeper understanding, and improving students' overall performance in mathematics.

The second phase was development. In this phase, the project transitioned to the crucial development phase, during which a comprehensive array of supplementary learning materials (SLM) was meticulously crafted. This material primarily consisted of visually engaging slides and PowerPoint presentations, expertly designed using LaTeX. This choice of typesetting not only ensured high-quality formatting and typographical precision but also facilitated the effective representation of complex mathematical concepts. The culmination of this meticulous process was the generation of outputs in the widely accepted Portable Document Format (PDF), allowing for easy distribution and access across various platforms. In addition to the foundational presentations, the development phase incorporated sophisticated mathematical visualization tools to enhance the learning experience. Software applications such as GeoGebra and Desmos were integrated into the SLM to provide interactive capabilities, enabling learners to visualize mathematical relationships and manipulate variables in real-time. This interactive approach deepens students' comprehension of abstract mathematical ideas by allowing them to engage with the material in dynamic ways.

Furthermore, to cater to students' diverse learning preferences, relevant YouTube links were carefully reviewed and embedded in the learning materials. These multimedia resources were specifically selected to support audio-visual learners, enhancing their grasp of the subject matter by providing additional context and illustrative examples. This multifaceted approach aimed to solidify understanding through both visual and auditory stimuli, thereby accommodating various learning modalities. Moreover, the pedagogical framework adopted during this phase included implementing the Think-Pair-Share strategy within lesson activities. This collaborative approach was designed to foster an environment of active participation, encouraging students to engage in shared reasoning and discourse. By promoting dialogue among peers, the Think-Pair-Share strategy not only aids in the development of individual conceptual understanding but also cultivates a sense of community within the learning environment. Through this collaborative approach, students were able to articulate their thoughts, reflect critically on their knowledge, and benefit from their peers' insights, thereby enhancing their overall learning experience.

From the first round, validators recommended the following: (1) give examples and make sure that the examples are in different level of understanding and of possible real-life examples since it is a geometry; (2) that there must be audio-visual illustration in the slides in order to cater all the learning style of the students; and (3) it would enhance the material if the illustration on showing that three pyramids/cones can perfectly fit on prism/cylinder, these suggestions are shown in the Table 2, which is included in the second or the final validation. The revision process played a critical role in refining the SLM. Feedback from the first round of validation informed targeted improvements in educational clarity, visual presentation, and task structure. These revisions resulted in a more coherent and user-friendly material, as reflected in improved ratings during the second validation phase. The third phase was evaluation, validation, and revision. In this phase, the SLM underwent two rounds of expert review. Feedback from the first round was used to revise the material, while the second round was conducted to

determine whether the revised SLM had reached a level of validity and quality acceptable to supplement students' learning needs.

Table 2. *Summary of Validator Feedback, Identified Issues, and Revisions Made on the SLM*

Validators Comments	Issues Identified	Revisions Made	Improvement Outcome
Give examples and make sure they are at different levels of understanding and from real life, since it is geometry.	Limited variation in examples and activities, lack of differentiated instruction across levels of understanding, and insufficient real-life situations and applications.	Incorporated tiered examples that are suitable for different cognitive levels of learners, such as basic, intermediate, and advanced, in each lesson. Added real-life context, such as designing container, cone-shaped ice cream, water tanks (cylinders), and pyramidal structures (roof designs). With guided examples and guided practice, followed by independent practice and real-life applications.	Improved the geometric conceptual understanding and learner engagement by addressing diverse ability levels and connecting abstract concepts to concrete real-world situations.
If possible, adding audio will enhance the SLM and help auditory learners.	Lack of different learning styles, particularly for auditory learners.	Integrated with audio-visual support by embedding YouTube videos and links to address the issues identified.	Enhanced accessibility and inclusivity of the material, supporting diverse learning styles and making the material more suitable for auditory learners.
It would enhance the material if the illustration on showing that 3 pyramids/cones can perfectly fit on a prism/cylinder.	Lack of concrete visual demonstrations of volume relationships, for example, the 3:1 relationship between pyramid and prism, and cone and cylinder.	Added illustrative diagrams and guided activities demonstrating that three congruent pyramids or cones can fill one prism or cylinder of the same base and height. Included step-by-step visual explanation and reflective questions.	Strengthened conceptual understanding of volume formulas by providing concrete visual justification, reducing reliance on memorization.

Table 2 summarizes how validator feedback was systematically used to improve the supplementary learning material (SLM). The comments primarily highlighted the need for more varied and real-life examples, the inclusion of audio support, a reduction in content length, and stronger visual demonstrations of geometric concepts. In response, the material was revised to incorporate tiered and contextualized examples, audio-visual resources, a streamlined content structure, and illustrative diagrams showing volume relationships. These revisions resulted in enhanced conceptual understanding, improved accessibility for diverse learners, increased usability, and stronger visualization of mathematical ideas, thereby making the SLM more effective and learner-centered.

Research Participants

The study participants were 44 validators selected through purposive sampling. Purposive sampling was used because the study required participants with specific knowledge and experience relevant to evaluating learning material (Creswell & Creswell, 2017). Of the 44 validators, 23 were teacher validators, and 21 were expert validators. The teacher validators were secondary mathematics teachers with at least three years of experience teaching geometry. They also held a degree in Mathematics Education or a related field. Their participation was important because they could assess the validity and acceptability of the SLM. The expert validators were selected based on their specialization in instructional materials development, mathematics education, ICT integration, collaborative learning strategies such as Think-Pair-Share, and language and technical evaluation. Their role was to assess the SLM from professional and content-based perspectives. Only those who met the inclusion criteria were invited to participate. All validators completed the evaluation forms and provided written comments to support the revision of the material.

Research Instruments

Two instruments were used in the study to assess the SLM. For validity, the researcher used the evaluation rating sheet from the Department of Education Learning Resource Management and Development System (DepEd LRMDs). This instrument assessed the learning material in terms of content quality, instructional quality,

technical quality, and other findings. The tool used a four-point rating scale. This instrument was chosen because it is commonly used to evaluate learning resources and is aligned with established quality standards for learning materials.

For acceptability, the researcher used the evaluation instrument developed by Salavaria (2014). This tool assessed the acceptability of the SLM with respect to clarity, usefulness, suitability, adequacy, timeliness, language, format, illustrations, and presentation. It used a five-point Likert scale. Both instruments also allowed validators to provide written comments and suggestions. These comments were used to identify areas that needed revision. To ensure the rigor of the instruments used in this study, both validity and reliability procedures were conducted. A pilot test was conducted prior to the main data collection, involving a small group of participants with characteristics similar to those of the actual validators. The purpose of the pilot testing was to check the clarity, relevance, and consistency of the items in the evaluation instruments. Feedback from the pilot participants led to minor revisions in wording and item structure to improve clarity and alignment with the study objectives.

For reliability, internal consistency was measured using Cronbach's alpha. The results showed that the DepEd LRMSD evaluation tool obtained a Cronbach's alpha coefficient of 0.98, while the acceptability instrument adapted from Salavaria (2014) yielded a Cronbach's alpha of 0.94. These values indicate acceptable to high reliability, based on commonly accepted thresholds in educational research (e.g., $\alpha \geq 0.70$). Regarding validity, content-related validity was assessed by comparing the instruments with the structure established by established evaluation tools, particularly the DepEd LRMSD framework, which is widely used to assess learning resources in educational settings.

Data Gathering Procedure

Before data collection, the researcher secured the necessary permissions and informed the validators of the study's purpose. Afterward, the SLM and evaluation forms were distributed to the selected teachers and expert validators. The materials were provided in printed and digital formats to make participation more convenient. The first round of validation lasted for one week. During this period, the validators reviewed the SLM using the assigned evaluation tools and wrote comments and suggestions. After the forms were retrieved, the researcher summarized the results and revised the SLM in light of the feedback. The revised version of the SLM was then returned to the same validators for a second round of validation, which also lasted for one week. After the second set of forms was collected, the researcher compiled the ratings and comments for final analysis. The entire procedure focused only on the development and validation of the material and did not involve classroom experimentation or treatment of learners.

Data Analysis

The quantitative data were obtained from ratings provided by the teacher and expert validators. These data were encoded and analyzed using the Statistical Package for the Social Sciences (SPSS). A weighted mean was used to assess the validity and acceptability of the SLM across the criteria in the evaluation tools. The Mann-Whitney U test was used to assess whether there was a significant difference in ratings between teacher validators and expert validators. The level of significance used in the analysis was 0.05. The qualitative data were derived from the validators' written comments and suggestions. These comments were reviewed, grouped according to common concerns, and used to guide the revision of the SLM. The qualitative findings helped explain the quantitative results and identified specific areas that needed improvement in content, instructional design, and technical presentation.

Ethical Considerations

Participation in the study was voluntary. All teachers and expert validators were informed about the purpose of the study, the nature of their participation, and their right to withdraw at any time without penalty. To protect their privacy, the researcher used coded identifiers instead of personal names in the records and reports. All collected data were stored securely and handled in accordance with the Data Privacy Act of 2012 (Republic Act No. 10173). The study did not involve minors or other vulnerable groups, and it did not expose participants to physical, psychological, or social harm. The researcher also declared no conflict of interest in conducting the study.

Results and Discussion

Evaluation of the Level of Validity of SLM

In Terms of Content Quality

Table 3 shows that the Supplementary Learning Material (SLM) received high content quality ratings from both teacher validators ($M = 39.48$) and expert validators ($M = 38.34$), with both scores exceeding the set benchmark. This indicates that the material has strong content validity and is consistent with the topics in the Learning Competencies (LC) for the subject and grade level for which it was intended. In validation studies, expert judgment is an important basis for establishing whether a material adequately represents the intended content domain and meets standards of relevance, clarity, and appropriateness (Polit & Beck, 2006; Almanasreh et al., 2019). The favorable ratings from both teachers and experts, therefore, suggest that the SLM is academically sound. This finding is important because high-quality learning materials are expected to demonstrate sound design and curriculum alignment (Tomlinson, 2012; Garay Abad & Hattie, 2025).

Table 3. Evaluation of the Level of Validity of SLM in Terms of Content Quality

Indicators	Teacher Validators		Expert Validators	
	Mean	Interpretation	Mean	Interpretation
1. The content is consistent with the topics and skills in the DepEd Learning Competencies for the intended grade or year level.	4.00	VS	3.81	VS
2. The concepts contribute to enrichment, reinforcement, or mastery of the identified learning objectives.	3.96	VS	3.90	VS
3. The content is accurate.	3.91	VS	3.81	VS
4. The content is up-to-date.	3.96	VS	3.81	VS
5. The content is logically developed and organized.	3.96	VS	3.76	VS
6. The content is free from cultural, gender, racial, or ethnic bias.	3.91	VS	3.81	VS
7. The content stimulates and promotes critical thinking.	4.00	VS	3.86	VS
8. The content is relevant to real-life situations.	3.91	VS	3.86	VS
9. The language and vocabulary are appropriate for the target learners.	3.96	VS	3.86	VS
10. The content promotes positive values that support formative growth.	3.91	VS	3.86	VS
Column Mean/Interpretation	3.94	VS	3.83	VS
Overall Result	39.48	Passed	38.34	Passed

The high ratings further imply that the SLM was able to translate Grade 8 Geometry competencies into learning tasks that are accurate and meaningful. This is a notable strength because well-designed mathematics materials can improve learner engagement and support deeper conceptual understanding, especially when lessons are connected to familiar or meaningful contexts (Kaminski & Sloutsky, 2020; Gebremeskel et al., 2025). In the same way, contextualized learning tasks have been found to promote higher-order and critical thinking by requiring learners to connect ideas, analyze situations, and solve problems in meaningful settings (Kurniati et al., 2015; Suryawati & Osman, 2018).

Although slightly lower ratings were noted in content organization and in some aspects of accuracy and inclusivity, these remained within the “Very Satisfactory” range. Rather than weakening the material, these minor differences point to specific areas for improvement before the material is used more widely. This pattern remains constructive because it helps identify targeted revisions while preserving the material's overall strength.

As a result, the material was developed to ensure the content is consistent with the topics and skills in the DepEd Learning Competencies for the intended grade level, and the concepts contribute to enrichment, reinforcement, or mastery of the identified learning objectives, as shown in Figure 1 below.

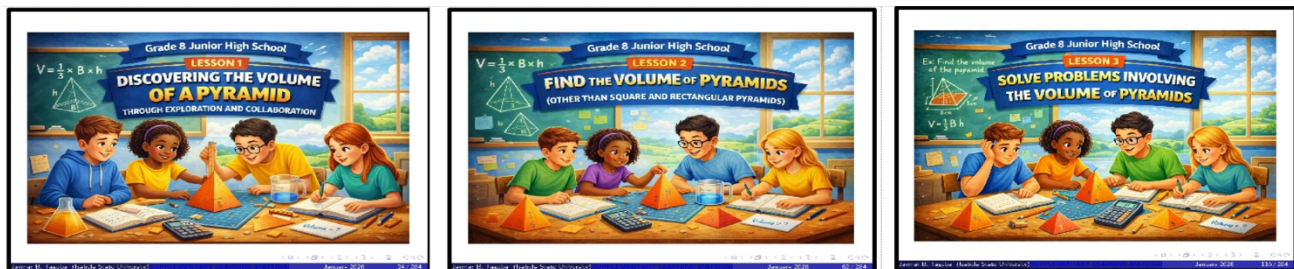


Figure 1. Learning Competencies Aligned in MATATAG Curriculum

Figure 1 presents the six topics in the MATATAG Curriculum (2023) aligned with the Grade 8 Geometry learning competencies for the second quarter under the Measurement and Geometry domain.

In Terms of Instructional Quality

Table 4 shows that the Supplementary Learning Material (SLM) obtained a Very Satisfactory rating from both teacher validators ($M = 39.22$) and expert validators ($M = 38.41$), with both scores well above the minimum threshold of 30. This pattern suggests that the material's purpose is well-defined. In particular, the high ratings for clarity of purpose and alignment with learning goals indicate that the material reflects the principles of well-structured educational design, where learning outcomes, activities, and expected performance are clearly connected. This is consistent with constructive alignment, which emphasizes that effective learning materials should clearly link intended outcomes with learning tasks and assessment expectations (Biggs, 2014). Likewise, clearly stated learning objectives help students understand the purpose of the developed material, organize their effort, and engage more meaningfully with activities (Orr et al., 2022).

Table 4. *Evaluation of the Level of Validity of SLM in Terms of Instructional Quality*

Indicators	Teacher Validators		Expert Validators	
	Mean	Interpretation	Mean	Interpretation
1. The purpose of the material is well defined.	3.96	VS	3.90	VS
2. The material achieves its defined purpose.	3.91	VS	3.95	VS
3. The learning objectives are clearly stated and measurable.	3.91	VS	3.86	VS
4. The level of difficulty is appropriate for the target users.	3.78	VS	3.71	VS
5. Graphics, colors, and sounds are used for appropriate instructional purposes.	3.96	VS	3.90	VS
6. The material is enjoyable, stimulating, challenging, and engaging.	3.91	VS	3.76	VS
7. The material effectively stimulates the creativity of the target users.	3.96	VS	3.76	VS
8. Feedback on learners' responses is effectively provided.	3.87	VS	3.81	VS
9. The target user can control the rate and sequence of presentation and review.	4.00	VS	3.90	VS
10. Instruction is integrated with the target user's previous experience.	3.96	VS	3.86	VS
Column Mean/Interpretation	3.92	VS	3.84	VS
Overall Result	39.22	Passed	38.41	Passed

Another important finding is the high rating of learner control over pacing; this is further illustrated in Figure 2. This suggests that the SLM supports a more learner-centered approach by allowing students to process content at a manageable rate. From a theoretical perspective, this is important because learner autonomy is closely tied to students' capacity to take greater control over their own learning (Benson, 2011). In the same way, research on self-paced learning shows that giving learners some control over how they allocate time and effort can improve learning, especially when the material is structured to help them focus on areas that need more attention (Tullis & Benjamin, 2011). Thus, the present result implies that the SLM does not merely present information; it also creates conditions that can support self-regulation, independent learning, and more thoughtful engagement with Grade 8 Geometry concepts.

At the same time, the relatively lower ratings for engagement and creativity, although still within the Very Satisfactory range, indicate areas where the material can be improved. These results suggest that while the SLM is clear and functional, some activities may benefit from richer opportunities for exploration, discussion, and student-generated thinking. This matters because engagement is strengthened when learners are supported through motivating and scaffolded activities rather than being limited to task completion alone. Prior work has shown that scaffolding can enhance emotional engagement, interest, and students' sense of success in learning tasks (Acosta-Gonzaga & Ramirez-Arellano, 2022). In addition, collaborative strategies such as Think-Pair-Share help make classrooms more interactive and participatory, while also improving students' confidence and willingness to contribute ideas (Mundelsee & Jurkowski, 2021). In mathematics settings, the Think-Pair-Share has also been associated with stronger problem-solving performance than more traditional approaches (Alsmadi et al., 2023). For this reason, the lower ratings for engagement and creativity do not weaken the overall quality of the SLM; rather, they identify specific aspects that may be strengthened by adding more open-ended tasks, varied prompts, collaborative discussion points, and better scaffolding for higher-order thinking.

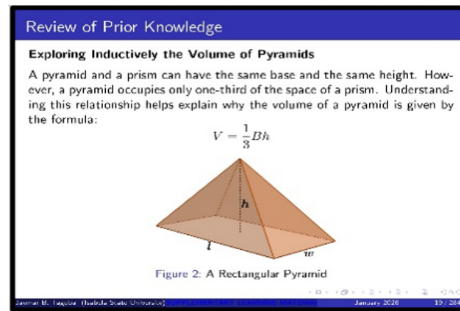


Figure 2. Learner Control Over Instructional Pacing

Figure 2, learner control over instructional pacing, illustrates the extent to which students regulate the pace of their learning.

In Terms of Technical Quality

Table 5 shows that the Supplementary Learning Material (SLM) obtained a Very Satisfactory rating from both teacher validators ($M = 50.66$) and expert validators ($M = 50.19$), with both mean scores exceeding the minimum threshold of 39. This indicates that the SLM's technical design is valid. The small difference between teacher and expert ratings is also important for design quality.

Table 5. Evaluation of the Level of Validity of SLM in Terms of Technical Quality

Indicators	Teacher Validators		Expert Validators	
	Mean	Interpretation	Mean	Interpretation
1. The audio enhances understanding of the concepts.	3.74	VS	3.81	VS
2. The speech and narration (pacing, intonation, and pronunciation) are clear and easy to understand.	3.87	VS	3.76	VS
3. The audio is fully synchronized with the visuals, if any.	3.91	VS	3.86	VS
4. Music and sound effects are appropriate and effective for instructional purposes.	3.83	VS	3.86	VS
5. Screen displays (text) are uncluttered, easy to read, and visually appealing.	3.91	VS	3.90	VS
6. Visual presentations (non-text) are clear and easy to interpret.	3.91	VS	3.86	VS
7. Visuals sustain interest without distracting the learners' attention.	3.96	VS	3.86	VS
8. Visuals accurately represent the concepts discussed.	3.96	VS	3.95	VS
9. User support materials, if any, are effective.	3.96	VS	3.86	VS
10. The design allows the target user to navigate freely through the material.	3.96	VS	3.81	VS
11. The material can be used easily and independently.	3.91	VS	3.90	VS
12. The material runs with minimum system requirements.	3.83	VS	3.90	VS
13. The program is free from technical problems.	3.91	VS	3.86	VS
Column Mean/Interpretation	3.90	VS	3.86	VS
Overall Result	50.66	Passed	50.19	Passed

The particularly high ratings for visuals, ease of navigation, usability, and system compatibility deserve closer attention because these are not merely surface-level design features. From the perspective of the Cognitive Theory of Multimedia Learning, well-designed visuals help learners process information more effectively when words and graphics are organized to guide attention and reduce unnecessary cognitive load. This means that the strong visual and interface ratings likely support clearer presentation of concepts and more efficient learning. Broader reviews of educational technology likewise show that structured and usable digital tools are more likely to support student engagement. Thus, the high ratings on these indicators suggest that the SLM is technically configured to promote comprehension, engagement, and learner independence (Mayer, 2024; Zaharias & Poylymenakou, 2009; Bond et al., 2020).

Although the audio-related indicators were still rated Very Satisfactory, their relatively lower scores compared with the other components point to an area that may require refinement. This finding is meaningful because multimedia learning research suggests that audio contributes most effectively to learning when narration is clear, well-paced, and well-integrated with visual information. The modality principle holds that spoken words can enhance learning when paired effectively with graphics, while the voice principle suggests that the quality and character of narration can influence how learners respond to multimedia lessons. Viewed in this way, the lower audio scores do not weaken the overall technical validity of the SLM, but they do identify a specific design feature

that may still be optimized. Improving clarity of narration, pacing, pronunciation, and overall audio consistency may further strengthen learners' attention and reduce potential distractions during independent study (Mayer, 2024; Dincer, 2022).

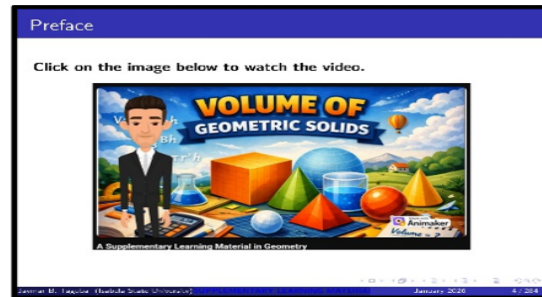


Figure 3. Visual Design, Usability, and System Compatibility of the SLM

Figure 3. visual design, ease of navigation, usability, and system compatibility, highlighting critical factors that extend beyond surface-level design and significantly influence the validity of the learning material.

In Terms of Errors

Table 6 shows that the Supplementary Learning Material (SLM) was largely free from conceptual, factual, grammatical, typographical, and technical errors, as reflected in the ratings of teacher validators ($M = 16.00$) and expert validators ($M = 16.00$), both interpreted as Not Present. These results suggest that the material had high accuracy and textual control, a key marker of quality in instructional resources. In materials evaluation, the absence of major errors matters because learning materials are expected to present accurate information, consistent explanations, and dependable representations of concepts. Teacher and expert reviews are also widely recognized as important steps in establishing content-related validity and refining educational materials before classroom use (Dinnesen et al., 2020; Elangovan & Sundaravel, 2021). In this case, the very high ratings from both groups indicate that the SLM meets that standard and is academically sound.

Table 6. Evaluation of the Level of Validity of SLM in Terms of Errors

Indicators	Teacher Validators		Expert Validators	
	Mean	Interpretation	Mean	Interpretation
1. Conceptual Errors	4.00	NP	4.00	NP
2. Factual Errors	4.00	NP	4.00	NP
3. Grammatical and Typographical Errors	4.00	NP	4.00	NP
4. Other Errors	4.00	NP	4.00	NP
Column Mean/Interpretation	4.00	NP	4.00	NP
Overall Result	16.00	Passed	16.00	Passed

The perfect score given by teacher validators for other findings, such as conceptual errors, factual errors, grammatical and typographical errors, and other errors, is especially important because it suggests that the mathematical content, computations, visuals, and supporting information were viewed as accurate and up to date. Prior work on curriculum materials has emphasized that error analysis is crucial because learning materials are expected to provide learners with accurate information (Bansiong, 2019). Likewise, expert-panel approaches to validation stress that specialist feedback helps identify weaknesses and improve the relevance, clarity, and accuracy of educational interventions before they are implemented (Dinnesen et al., 2020). Viewed in this light, the present findings are highly valid in relation to other findings.

Evaluation of the Level of Acceptability of SLM

In Terms of Clarity

Table 7 shows that the Supplementary Learning Material (SLM) was rated Very Much Acceptable in terms of clarity by both teachers ($M = 4.74$) and expert validators ($M = 4.81$). These results suggest that the material communicates ideas clearly and presents lessons in a way that is easy for learners to follow, similar to the technical quality. The highest ratings were given to the logical arrangement of concepts within each activity, indicating that the SLM is organized in a coherent sequence that supports a better understanding of Geometry concepts. High ratings for clarity, simplicity, and comprehensible language further show that the material is accessible and learner-friendly. This supports existing literature emphasizing that clearly written and well-organized learning

materials improve comprehension, engagement, and ease of use among learners (Bond et al., 2020; Zydney & Warner, 2016). Although the suitability of some information to the learners' comprehension level received slightly lower ratings, these scores remained very high, suggesting only minor revisions are needed to better address differences in learners' abilities.

Table 7. *Evaluation of SLM Acceptability in Terms of Clarity*

Indicators	Teacher Validators		Expert Validators	
	Mean	Interpretation	Mean	Interpretation
1. The information is clear and simple.	4.74	VMA	4.81	VMA
2. The language used is clear and easy to understand.	4.74	VMA	4.81	VMA
3. The concepts for each activity are arranged logically.	4.83	VMA	4.86	VMA
4. The information suits the student's level of comprehension.	4.65	VMA	4.76	VMA
Column Mean/Interpretation	4.74	VMA	4.81	VMA

Note: I - Interpretation; 4.21 - 5.00 - Very Much Acceptable; 3.41 - 4.20 - Much Acceptable; 2.61 - 3.40 - Acceptable; 1.81 - 2.60 - Less Acceptable; 1.00 - 1.80 - Least Acceptable

To support this finding of the SLM, it was logically arranged, as illustrated in Figure 5, from motivation, pre-test, review, introduction, lesson proper, to post-test. It helps the learners to follow several activities.

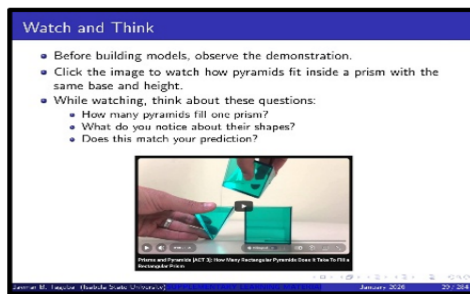


Figure 5. *The Developed SLM was Logically Arranged*

In Terms of Usefulness

Table 8 shows that the Supplementary Learning Material (SLM) was rated Very Much Acceptable by both teacher validators ($M = 4.90$) and expert validators ($M = 4.79$), indicating strong agreement on its learning purposes. The highest teacher rating, given to the item on stimulating analytical thinking ($M = 4.96$), suggests that the material supports reasoning and higher-order thinking. Likewise, the high expert rating for promoting active involvement in learning activities ($M = 4.90$) shows that the SLM aligns well with participatory teaching approaches such as Think-Pair-Share. These results support the view that structured and engaging learning tasks can improve students' analytical thinking, participation, and conceptual understanding (Liljedahl, 2023; Yan & Poole, 2023).

Table 8. *Evaluation of SLM Acceptability in Terms of Usefulness*

Indicators	Teacher Validators		Expert Validators	
	Mean	Interpretation	Mean	Interpretation
1. It encourages students to think logically and critically.	4.83	VMA	4.76	VMA
2. It is simple and comprehensible.	4.87	VMA	4.67	VMA
3. It contains content that increases students' knowledge, understanding, and proficiency.	4.87	VMA	4.76	VMA
4. It provides opportunities for the development or enhancement of mathematical skills.	4.91	VMA	4.81	VMA
5. It includes learning content that provides adequate information on the topics presented.	4.91	VMA	4.86	VMA
6. It encourages students to become actively involved in the learning activities.	4.91	VMA	4.90	VMA
7. It stimulates the learners' analytical thinking skills.	4.96	VMA	4.81	VMA
8. It presents activities that relate new concepts to previously learned ones.	4.91	VMA	4.71	VMA
Column Mean/Interpretation	4.90	VMA	4.79	VMA

Although two indicators received slightly lower ratings – relating new concepts to prior knowledge and simplicity of presentation – both still fell within the Very Much Acceptable range. This suggests that the material is already highly usable, with only minor areas for improvement in clarity and lesson bridging. Overall, the findings confirm that the Geometry SLM is highly acceptable as a learning resource and has strong potential to support skill development, active participation, and meaningful mathematics learning. Figure 6 illustrates the activities that

students encourage in active learning.

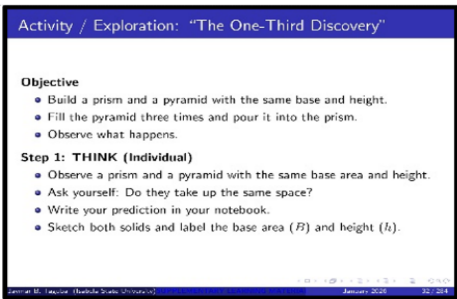


Figure 6. Promotion of Active Student Engagement in Learning Activities

Figure 6 demonstrates the promotion of active student engagement in learning activities, helping students learn more and more effectively.

In Terms of Suitability

Table 9 shows that the Supplementary Learning Material (SLM) was rated Very Much Acceptable by both teacher validators (M = 4.78) and expert validators (M = 4.74), indicating strong agreement that the material is appropriate for the target learners. The highest ratings were given to the activities' relevance, interest, and motivating nature, suggesting that the SLM can effectively promote student engagement and active participation. This supports the view that meaningful and engaging learning tasks enhance motivation and improve learning outcomes (Hattie, 2023, as cited in Yan & Poole, 2023). The high expert ratings for lesson alignment and consideration of learner diversity also suggest that the SLM is responsive to diverse learning needs, consistent with Tomlinson's (2014) emphasis on differentiated learning activities.

Table 9. Evaluation of SLM Acceptability in Terms of Suitability

Indicators	Teacher Validators		Expert Validators	
	Mean	Interpretation	Mean	Interpretation
1. The activities consider the varying attitudes and capabilities of the learners.	4.78	VMA	4.76	VMA
2. The activities are suited to the topic.	4.78	VMA	4.76	VMA
3. The activities are relevant, interesting, and self-motivating.	4.91	VMA	4.71	VMA
4. The enrichment activities are adaptable to classes with large numbers of students.	4.65	VMA	4.71	VMA
Column Mean/Interpretation	4.78	VMA	4.74	VMA

Although all indicators remained within the Very Much Acceptable range, slightly lower ratings were noted for the adaptability of enrichment activities for large classes. This suggests that the material is generally suitable for learners' characteristics, needs, and context. Overall, the findings affirm that the Geometry SLM, which integrates Think-Pair-Share and technology-based strategies, is effective. Figure 7 below illustrates that the activities are relevant, interesting, and self-motivating, which supports the reinforcement and enhancement of the SLM.

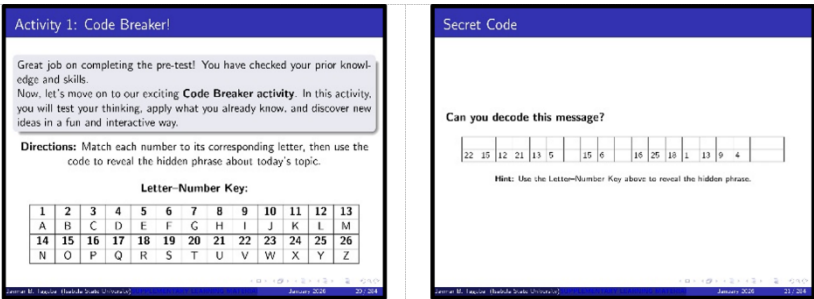


Figure 7. The Activities are Relevant, Interesting, and Self-Motivating

In Terms of Adequacy

Table 10 shows that the Supplementary Learning Material (SLM) was rated Very Much Acceptable by both teacher

validators ($M = 4.85$) and expert validators ($M = 4.77$), indicating strong agreement that the material adequately covers the intended competencies and learning outcomes. The highest rating for defining important terms is especially meaningful because vocabulary support helps learners understand subject content more clearly, and knowledge of academic vocabulary has been linked to better school performance. Likewise, the high ratings for learning outcomes, content adequacy, and learning activities suggest that the SLM reflects sound alignment of learning materials, with content and tasks clearly connected to intended learning goals. Such alignment is important because it helps guide student learning and supports deeper engagement with lesson content.

Table 10. *Evaluation of SLM Acceptability in Terms of Adequacy*

Indicators	Teacher Validators		Expert Validators	
	Mean	Interpretation	Mean	Interpretation
1. It covers all the topics in the Second quarter of the mathematics MATATAG curriculum guide.	4.78	VMA	4.67	VMA
2. It provides sufficient information on each topic.	4.87	VMA	4.71	VMA
3. It presents the expected learning outcomes.	4.83	VMA	4.81	VMA
4. It defines important terms for reinforcement.	4.91	VMA	4.86	VMA
5. It provides enough activities to enhance students' knowledge, skills, and attitudes.	4.87	VMA	4.81	VMA
6. It explains and applies concepts and principles.	4.83	VMA	4.76	VMA
Column Mean/Interpretation	4.85	VMA	4.77	VMA

Although coverage of all curriculum topics received the lowest mean among the indicators, it remained within the Very Much Acceptable range. This suggests that the SLM is already comprehensive, but some parts may still be expanded to strengthen its coverage of the full curriculum. Overall, the findings show that the material is not only acceptable in form but also adequate in content, structure, and learner support, making it a dependable resource for reinforcing and enhancing learning in geometric concepts. Figure 8 illustrates that the terms used are defined for reinforcement of learning Geometry, particularly in the volumes of solids.

Term	Definition
Pyramid	A solid figure with a polygonal base and triangular faces that meet at a common vertex.
Prism	A solid figure with two parallel, congruent polygonal bases connected by rectangular faces.
Base Area (B)	The area of the base of a solid (e.g., triangle, square, or other polygon).
Height (h)	The perpendicular distance from the base to the vertex (for pyramids) or between the two bases (for prisms).
Volume (V)	The measure of the space occupied by a solid figure, usually expressed in cubic units.
GeoGebra	A dynamic mathematics software for geometry, algebra, and interactive graphing.
Desmos	An online graphing calculator used to model and explore mathematical problems interactively.

Figure 8. *Terms are Defined for Reinforcement*

Figure 8 illustrates the key terms defined for reinforcement and enhancement, the primary purposes of developing this SLM.

In Terms of Timeliness

Table 11 shows that the Supplementary Learning Material (SLM) was rated Very Much Acceptable by both teacher validators ($M = 4.96$) and expert validators ($M = 4.76$), indicating strong agreement that it is responsive to current, relevant, and appropriate for the learning timetable. The highest ratings for supporting quality learning experiences and for giving students opportunities to apply concepts are especially important because effective learning materials work best when learning outcomes, activities, and expected performance are clearly aligned.

Table 11. *Evaluation of SLM Acceptability in Terms of Timeliness*

Indicators	Teacher Validators		Expert Validators	
	Mean	Interpretation	Mean	Interpretation
1. It serves as a tool for quality learning.	5.00	VMA	4.81	VMA
2. Teachers are encouraged to produce materials that make teaching and learning more effective.	4.96	VMA	4.76	VMA
3. Students need instructional materials where they can apply what has been discussed in class.	4.91	VMA	4.71	VMA
Column Mean/Interpretation	4.96	VMA	4.76	VMA

The strong rating for application-based learning further suggests that the SLM supports understanding beyond simple recall. This is important in mathematics, where opportunities to apply ideas can strengthen conceptual learning. Although the indicator on encouraging teachers to develop effective learning materials received the lowest rating, it remained within the Very Much Acceptable range, suggesting only minor room for improvement. Overall, the findings affirm that the SLM is timely, relevant, and useful for contemporary Geometry learning.

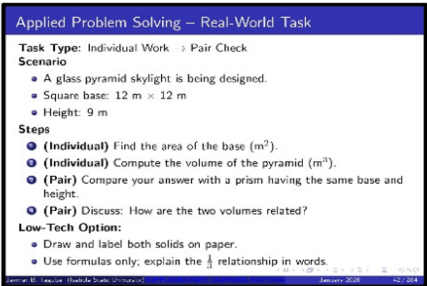


Figure 9. The Developed SLM Serves as a Tool for Quality Learning

Figure 9 illustrates that the developed SLM serves as a tool for quality learning, reinforcing and enhancing students’ learning of geometric concepts.

In Terms of Language, Style, and Format

Table 12 shows that the Supplementary Learning Material (SLM) was rated Very Much Acceptable by both teacher validators (M = 4.89) and expert validators (M = 4.80), indicating strong agreement on its language and presentation quality. The high ratings for correct grammar, clarity, organization, and familiar vocabulary suggest that the material is easy to read and follow. This is important because clear, well-structured learning materials help learners focus on the lesson content rather than confusing wording or layout, thereby supporting comprehension and reducing unnecessary cognitive load.

Table 12. Evaluation of SLM Acceptability in Terms of Language, Style, and Format

Indicators	Teacher Validators		Expert Validators	
	Mean	Interpretation	Mean	Interpretation
1. It uses appropriate illustrations.	4.87	VMA	4.76	VMA
2. It has proper spacing of items.	4.91	VMA	4.81	VMA
3. It uses an optimal print size.	4.78	VMA	4.81	VMA
4. It varies the placement of response sections.	4.87	VMA	4.71	VMA
5. It observes correct grammar.	4.96	VMA	4.86	VMA
6. It uses clear and comprehensive language.	4.91	VMA	4.86	VMA
7.It uses sufficiently familiar vocabulary to support learning.	4.91	VMA	4.76	VMA
8. It employs appropriate structure, style, and format for the target level.	4.87	VMA	4.86	VMA
Column Mean/Interpretation	4.89	VMA	4.80	VMA

The slightly lower ratings for print size and variation in the response sections, although still within the Very Much Acceptable range, indicate minor formatting areas that can still be improved. This matters because readability is influenced not only by language but also by visual presentation, including font, spacing, and text layout, which can affect ease of reading and learner engagement. Overall, the findings affirm that the SLM is learner-friendly, readable, and well-presented, with only small formatting refinements needed to further strengthen its usability.

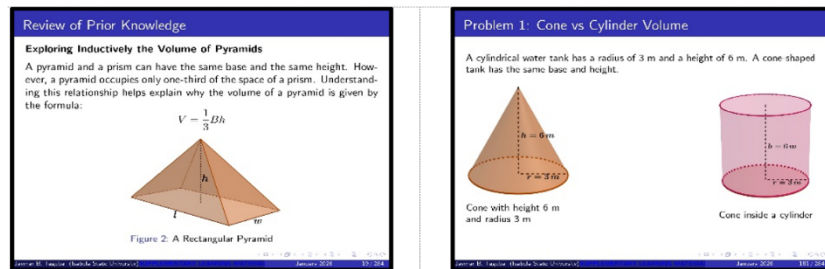
In Terms of Illustration

Table 13 shows that the Supplementary Learning Material (SLM) was rated Very Much Acceptable by both teacher validators (M = 4.88) and expert validators (M = 4.84), indicating strong agreement that its illustrations are relevant, clear, and useful for meaning learning. The high ratings for relevance and for providing concrete visual clues are especially important because well-designed visuals help learners process ideas more meaningfully when words and graphics work together to support attention, organization, and understanding. This is consistent with multimedia learning theory, which posits that carefully selected visuals can improve comprehension and reduce unnecessary cognitive load, and with recent evidence in mathematics education showing that visualization interventions positively affect student learning across topics and age groups (Mayer, 2024; Schoenherr et al., 2024).

Table 13. *Evaluation of SLM Acceptability in Terms of Illustration*

Indicators	Teacher Validators		Expert Validators	
	Mean	Interpretation	Mean	Interpretation
1. The illustrations used are clear and simple.	4.87	VMA	4.81	VMA
2. The illustrations used arouse students' interest, making learning effective and enjoyable.	4.83	VMA	4.81	VMA
3. The illustrations provide concrete visual clues.	4.87	VMA	4.90	VMA
4. The illustrations guide students to follow directions.	4.87	VMA	4.81	VMA
5. The illustrations are relevant to the topic.	4.96	VMA	4.86	VMA
Column Mean/Interpretation	4.88	VMA	4.84	VMA

Although student engagement received slightly lower ratings, it still remained within the Very Much Acceptable range, suggesting only minor room for improvement. This implies that the illustrations already support learning well, but they may become even more effective if made more interactive or attention-grabbing. Overall, the findings affirm that the SLM uses illustrations in ways that are not merely decorative but pedagogically meaningful, making the material a strong support for mathematics learning.

**Figure 11.** *Relevant Illustrations in the SLM*

In Figure 11, the illustrations are relevant to the topics, arouse students' interest, make learning effective and enjoyable, and provide concrete visual cues to support a better understanding of the topics.

In Terms of Presentation

Table 14 shows that the Supplementary Learning Material (SLM) was rated Very Much Acceptable by both teacher validators ($M = 4.86$) and expert validators ($M = 4.83$), indicating strong agreement that its presentation is clear and organized. The high ratings for logical sequencing and clarity of directions are especially important because well-structured materials help learners follow content more easily and reduce confusion during task completion. This supports the principle of constructive alignment, which emphasizes that learning materials are more effective when content, activities, and intended outcomes are clearly organized and connected (Biggs, 1996). Clear presentation also supports comprehension by reducing unnecessary cognitive load and helping learners focus on the lesson itself rather than on how to navigate the learning material (Mayer, 2024).

Table 14. *Evaluation of SLM Acceptability in Terms of Presentation*

Indicators	Teacher Validators		Expert Validators	
	Mean	Interpretation	Mean	Interpretation
1. The topics are logically and sequentially arranged.	4.87	VMA	4.81	VMA
2. Directions are concise, readable, and easy to follow.	4.87	VMA	4.86	VMA
3. Topics follow the prescribed subject sequence.	4.83	VMA	4.81	VMA
Column Mean/Interpretation	4.86	VMA	4.83	VMA

Although topic sequencing and alignment received slightly lower ratings, they still remained within the Very Much Acceptable range, suggesting only minor areas for refinement. Overall, the findings affirm that the SLM is coherent, easy to follow, and suitable for individual use, with strong potential to support effective learning.

Difference in Evaluation of Teachers and Experts

In Terms of Validity

Table 15 shows that there was no statistically significant difference between teacher and expert ratings of the SLM across content, instructional, technical, and error-related factors ($p > .05$ in all cases). This suggests that both groups viewed the material similarly, strengthening the claim that the SLM is valid in terms of teacher and expert standards. In content validation, agreement between the teacher and experts is important because it shows that a

material is both accurate and relevant to actual users and contexts (Elangovan & Sundaravel, 2021; Dinnesen et al., 2020).

Table 15. *Difference Between Teachers' and Experts' Ratings on SLM Validity*

Areas	U	z	p
Content Quality	191.50	1.39	.16
Instructional Quality	198.00	1.12	.26
Technical Quality	233.00	0.23	.82
Other Findings	241.50	0.00	1.00

Note: Level of significance $\alpha = 0.05$

This consistency also supports the SLM's validity, as rated by teachers and experts. The Mann-Whitney U test results comparing teachers' and experts' ratings of the SLM's validity across four domains. For content quality, the computed values ($U = 191.50$, $z = 1.39$, $p = .16$), for instructional quality, the results ($U = 198.00$, $z = 1.12$, $p = .26$). In terms of technical quality, the obtained values ($U = 233.00$, $z = 0.23$, $p = .82$). Lastly, for other findings, the results ($U = 241.50$, $z = 0.00$, $p = 1.00$). All the areas indicate no statistically significant difference between the teacher and expert validators' evaluation ratings. In educational design research, quality materials are expected to show relevance, internal consistency, and practicality in real learning settings, not only theoretical soundness. The similar ratings from teachers and experts therefore suggest that the SLM meets professional expectations while remaining appropriate for Grade 8 Geometry, reinforcing and enhancing students' learning of geometric concepts (van den Akker et al., 2006/2007).

In Terms of Acceptability

Table 16 shows that there were no statistically significant differences between the ratings of teacher validators and expert validators across all acceptability dimensions of the SLM, since all p-values were greater than .05. This suggests strong agreement between the two groups on the material's clarity, usefulness, suitability, adequacy, timeliness, language, illustrations, and overall presentation. Such consistency is important because it shows that the SLM is viewed as acceptable not only from an expert design perspective but also from the standpoint of actual classroom practice.

Table 16. *Difference Between Teachers' and Experts' Ratings on SLM Acceptability*

Areas	U	z	p
Clarity	203.00	1.05	.29
Usefulness	229.00	0.34	.74
Suitability	209.00	0.87	.38
Adequacy	214.50	0.77	.44
Timeliness	209.50	1.12	.26
Language, Style, and Format	194.50	1.31	.19
Illustrations	230.00	0.35	.73
Presentation	219.50	0.77	.44

Note: Level of significance $\alpha = 0.05$

This finding strengthens the claim that the Geometry SLM is highly acceptable. The Mann-Whitney U test results examining the differences between teachers' and experts' ratings on the acceptability of the SLM across multiple criteria. For clarity, the computed values ($U = 203.00$, $z = 1.05$, $p = .29$), for usefulness yielded ($U = 229.00$, $z = 0.34$, $p = .74$), and suitability showed ($U = 209.00$, $z = 0.87$, $p = .38$). In terms of adequacy, the results ($U = 214.50$, $z = 0.77$, $p = .44$). Timeliness registered ($U = 209.50$, $z = 1.12$, $p = .26$), while language, style, and format obtained ($U = 194.50$, $z = 1.31$, $p = .19$). Furthermore, illustrations ($U = 230.00$, $z = 0.35$, $p = .73$) and presentation ($U = 219.50$, $z = 0.77$, $p = .44$) all the components of acceptability demonstrate no statistically significant differences between teacher and expert validators ratings.

When teachers and experts evaluate learning materials similarly, it suggests that the material meets professional standards and addresses the real needs of learners and teachers in the learning and teaching process. This interpretation is consistent with previous studies emphasizing that agreement between practitioner and expert validation supports the credibility, quality, and relevance of learning materials (Van den Akker, 2007; Yan & Poole, 2023; Mayer, 2020; Agarwal & Bain, 2024). Overall, the results affirm that the SLM is highly acceptable.

Conclusion

This study contributed to mathematics education by developing and validating a Supplementary Learning Material (SLM) for selected geometry learning competencies, particularly volume. The findings showed that the material was highly valid in terms of content, instruction, technical quality, and other findings, and also highly acceptable in terms of clarity, usefulness, suitability, adequacy, timeliness, language, style and format, illustrations, and presentation, as assessed by teachers and expert validators. This suggests that the SLM is valid and highly acceptable for enhancing and reinforcing students' mastery of geometric concepts. The study also showed that combining the Think-Pair-Share strategy with technology integration can support active participation, collaboration, and better understanding of geometry lessons. The study further highlights the value of designing supplementary learning materials that are carefully planned, theory-based, and tested by both teachers and experts. In this way, the SLM may help supplement learners' understanding of geometry concepts under the MATATAG Curriculum. Future studies may test the actual effect of the material on student achievement, critical thinking, and engagement using experimental or quasi-experimental methods. Overall, by integrating theory, pedagogy, and practice, the established SLM not only addresses gaps in learners' knowledge of geometric ideas but also provides a scalable framework for producing future instructional materials and driving innovation in mathematics education.

Contributions of Authors

Author 1: conceptualization, data gathering, data analysis

Author 2: data analysis, data gathering

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Conflict of Interests

The researcher also declared that there was no conflict of interest in conducting the study.

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