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Developing 5es-Based Strategic Intervention Materials (5es-Based Sims) in Geometry 7

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Abstract
This study aimed to develop 5Es-based Strategic Intervention Materials in Geometry 7 to help students master the least learned competencies identified in the third-quarter examination. A developmental research design was used, and the ADDIE model guided the creation of the materials. Means and weighted means were employed to analyze and interpret data gathered from students, observers, and experts. Item analysis of the third-quarter examination identified the least learned skills and the students who required remediation. The developed 5Es-based materials were evaluated as well-designed, engaging, and appropriate for Grade 7 learners. The objectives emphasized essential mathematical skills, the integration of concepts into personal and social contexts, and a logical lesson sequence. The content offered simple tasks suited to learners' levels of understanding, promoted higher-order thinking, and avoided any inappropriate material. The learning activities were varied, clearly explained, gender-sensitive, and encouraged participation and collaboration. They also provided opportunities for students to relate mathematical ideas to their experiences and communities. The findings indicated that item analysis helped identify the least learned competencies and that the 5Es model can serve as a strong foundation for developing effective intervention materials. The study may support future research and guide the development of instructional materials to improve learning outcomes in mathematics.

Keywords: 5Es-based SIM; item analysis; developmental design; ADDIE model; mathematics learning

1. Introduction

Mathematics is a discipline focused on quantities, shapes, logic, and patterns. It serves as the language of science, expressing ideas through symbols, notations, and systematic rules. In the Philippine K to 12 curriculum, students are expected to develop mathematical knowledge and critical thinking skills that enable them to understand key concepts in numbers, geometry, measurement, probability, data analysis, patterns, functions, and algebra (Department of Education, 2016). The goal of mathematics education in the Philippines includes developing students' analytical, problem-solving, and reasoning skills, preparing them for real-world situations and higher-education challenges (DepEd, 2016).

Geometry plays a significant role in Grade 7 because it introduces foundational concepts necessary for higher mathematics. These competencies include representing geometric figures, illustrating angle relationships, constructing shapes, and applying inductive reasoning to solve problems. However, many students find geometry difficult due to limited mastery of prerequisite concepts, weak problem-solving

abilities, and a lack of meaningful learning experiences. Research on attitudes, learning styles, and teaching strategies among Filipino learners indicates that mathematics performance is significantly influenced by students' attitudes toward math, their learning styles, and the teaching strategies used (Pizon & Ytoc, 2021). Motivation issues also persist: some learners show low interest in mathematics, which can negatively affect their performance.

To address low performance in mathematics, the Strategic Intervention Material (SIM) has been used as a remediation tool to help learners master essential skills (Hernandez, Guiang, & Jornales, 2019; Dumigsi & Cabrella, 2019). For example, SIM has been shown to improve basic mathematical skills among elementary pupils significantly. Likewise, remediation through SIM helped Grade 9 students improve their performance in solving quadratic-function problems.

Recent educational efforts also highlight the 5E Instructional Model (Engage, Explore, Explain, Elaborate, Evaluate) as a learner-centered, inquiry-based approach promoting understanding through active engagement with concepts. Empirical studies have tested 5E in mathematics classrooms and found that it supports student learning (Magsalay, Luna, & Tan, 2019). Internationally, 5E-based teaching of geometric concepts and mathematical modeling has also shown benefits for student interest and conceptual understanding (Tezer & Cumhur, 2017).

Despite the promise of SIM and the 5E instructional approach, national mathematics performance suggests serious systemic issues. In its first participation in PISA (2018), the Philippines scored 353 in Mathematical Literacy, far below the OECD average of 489, placing among the lowest globally (DepEd, 2019; OECD report, 2018). Similarly, in the 2019 TIMSS for Grade 4 mathematics and science, Filipino students scored 297 in math and 249 in science, the lowest among 58 participating countries (GMA News; OneNews; TIMSS 2019 results). These findings underscore a persistent gap in mathematics proficiency and highlight an urgent need for practical, context-appropriate remedial and instructional interventions.

Although SIM and 5E instructional approaches show promise for improving learning, there remains a gap in research specifically integrating these interventions in Grade 7 Geometry. This gap underscores the need to develop learning materials that combine the structured remediation of SIM with the active, student-centered 5E model.

Therefore, this study develops a 5E-Based SIM to enhance mastery of the least learned competencies in Mathematics 7. The study aims to identify remediation competencies, design and develop a 5E-based SIM, and assess its implementation in improving student learning outcomes.

2. Literature Review

2.1 Strategic Intervention Materials

Strategic Intervention Materials (SIM) are targeted teaching resources designed to help learners who struggle with material presented in regular classroom lessons. SIMs aim to close learning gaps through focused, competency-aligned activities that concentrate on the least mastered skills. Empirical studies in the Philippines have shown that SIMs improve learners' understanding and achievement when used as remediation tools (Dumigsi & Cabrella, 2019; Suarez & Casinillo, 2020). Limbago-Bastida (2022) also reported that SIM improved learning outcomes for senior high school students in a quasi-experimental design, demonstrating SIM's adaptability across grade levels.

Beyond the Philippines, meta-analytic and quasi-experimental evidence supports SIM-like targeted remediation approaches: focused, scaffolded instructional materials that isolate weak subskills tend to produce larger learning gains than broad, unfocused remediation (see general findings summarized in

quasi-experimental development studies; Dumigsi & Cabrella, 2019). SIM also promotes independent learning and can increase learners' motivation by reintroducing concepts in scaffolded, simplified steps (Suarez & Casinillo, 2020). Teacher reports and local development studies emphasize that SIM packages are most effective when aligned with curriculum competency indicators and include clear assessment and feedback components (Dumigsi & Cabrella, 2019; Limbago-Bastida, 2022).

2.2 SIM as an Effective Teaching Strategy

Multiple quasi-experimental and developmental studies in the Philippines show that SIMs significantly improve academic performance in mathematics and science. Dumigsi and Cabrella (2019) documented significant posttest gains among Grade 9 students remediated with SIM on quadratic problems. Suarez and Casinillo (2020) reported improved science achievement for pupils using SIM in elementary settings. Limbago-Bastida and Bastida (2022) extended evidence of SIM effectiveness to senior high school students in physical science, again using a quasi-experimental design with control groups.

Researchers also examined different delivery formats. Several development papers and local projects describe electronic or teacher-made SIMs (e-SIMs) that leverage digital delivery to support individualized remediation, particularly in contexts with device access (Dumigsi & Cabrella, 2019; Limbago-Bastida & Bastida, 2022). These studies indicate that when SIMs are well-designed, focused on the least-learned competencies, and paired with brief assessments, they produce measurable improvements in procedural fluency and conceptual understanding.

2.3 Developed Strategic Intervention Materials

SIMs have been developed in multiple formats, including printed teacher-made modules, enhanced digital versions, and subject-specific intervention materials. Local studies show that teacher-created SIMs are effective when they are systematically validated and aligned with assessment data (Dumigsi & Cabrella, 2019; Suarez & Casinillo, 2020). Limbago-Bastida and Bastida (2022) also demonstrated the successful development of a SIM for senior high school students, emphasizing the importance of usability and clarity in activity cards, assessments, and enrichment tasks.

Recent remediation studies in mathematics support the development of specialized intervention materials using digital tools. For instance, Azucena et al. (2022) implemented a GeoGebra-based intervention and reported improved student performance and more positive attitudes toward geometry concepts. Likewise, Bloron (2022) presented evidence that technology-supported intervention materials enhance students' understanding of geometric theorems. These studies, while not SIMs in the traditional printed sense, show that digital and structured intervention materials aligned with SIM principles can significantly strengthen students' conceptual learning.

These development studies highlight the flexibility of SIM formats and reinforce the importance of well-designed, learner-centered remedial materials in mathematics education.

2.4 The 5Es Instructional Model

The 5Es Instructional Model (Engage, Explore, Explain, Elaborate, Evaluate) is grounded in constructivist learning theory and widely used to structure inquiry-based lessons. Empirical studies have applied 5E in mathematics classrooms and reported benefits in engagement, problem solving, and conceptual understanding (Tezer & Cumhur, 2017; Magsalay et al., 2019). Lam et al. (2022) described a flipped-5E variant that leverages pre-class materials and in-class inquiry to support deeper problem-solving, a promising adaptation for contexts with limited contact time.

Philippine comparative and development studies that investigated 5E-based modules also show positive results when teachers implement the model with fidelity and receive appropriate support (Magsalay et al.,

2019). However, systematic reviews of 5E variants note that effect sizes vary with implementation quality, subject matter, and assessment design; practical 5E lessons require careful scaffolding and assessment alignment (Lam et al, 2022; Tezer & Cumhur, 2017).

2.5 Literature Gap and Synthesis

The literature shows strong evidence that SIMs are effective for remediation (Dumigsi & Cabrella, 2019; Suarez & Casinillo, 2020; Limbago-Bastida, 2022) and that the 5E model promotes inquiry, engagement, and conceptual understanding in mathematics (Tezer & Cumhur, 2017; Magsalay et al., 2019; Lam, 2022). Studies specific to geometry learning also highlight persistent challenges in students' reasoning and in their interpretation of theorems. Azucena et al. (2022) demonstrated that technology-enhanced intervention improved learning outcomes in geometry, while Bloron (2022) showed similar gains in understanding geometric theorems. These studies emphasize the need for well-designed remediation materials in geometry.

However, existing research generally examines SIM and 5E separately. No identified studies combine a competency-based SIM with the inquiry-driven 5E learning cycle specifically for Grade 7 Geometry. This lack of integrated research represents a notable gap, given the documented difficulties learners face in geometric reasoning.

Thus, this study addresses the gap by developing and evaluating a 5E-based Strategic Intervention Material to enhance mastery of least-learned competencies in Mathematics 7 and provide teachers with a structured, inquiry-based remediation tool aligned with curriculum standards.

Conceptual Framework

The study used the ADDIE Model as the main framework for creating the 5Es-based Strategic Intervention Material. The ADDIE Model has five stages: Analysis, Design, Development, Implementation, and Evaluation. It provides a clear and organized way to create materials that help students learn better. Salvador (2021) explained that the model helps teachers design lessons that align with learners' needs and the skills they need to develop. In this study, the ADDIE Model helped ensure that each step in making the 5Es-based material focused on the competencies that students found difficult. In the Analysis Phase, the researcher reviewed the third-quarter examination results to identify the least mastered skills in Mathematics 7. These skills served as the basis for creating the material. In the Design Phase, the researcher prepared the first version of the 5Es-based material. The content and activities were arranged according to the 5Es: Engage, Explore, Explain, Elaborate, and Evaluate. After creating the first draft, the material was reviewed by the adviser and then by three experts. Their comments guided the improvements for the next stage. In the Development Phase, the researcher revised and improved the material based on the experts' suggestions. The experts checked the revised version again to ensure the corrections had been applied and that the material was ready for use. In the Implementation Phase, the final version of the material was used during remediation sessions. Two teachers facilitated the sessions, while an experienced teacher, a master teacher, and a head teacher observed how the material was used in each part of the 5Es process. In the Evaluation Phase, the researcher assessed the material's explicitness, usefulness, and acceptability. The observers evaluated the material's quality, and the students provided feedback on how helpful it was during remediation.

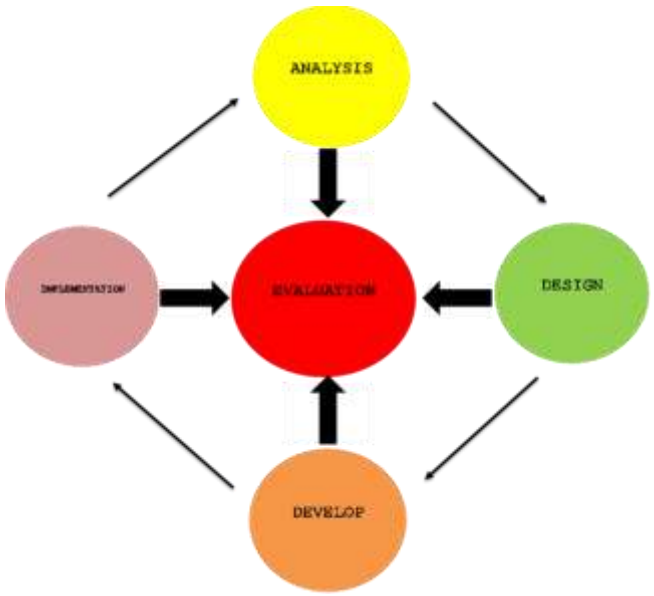

Figure 1. Paradigm of the Study

Statement of the Problem

This study aimed to develop a 5Es-based strategic intervention material (SIM) for Grade 7 Mathematics. Specifically, this study attempted to answer the following questions:

1. How may the least learned competency be analyzed in terms of students' scores in the third quarter exam?
2. How may the 5Es-based SIM be designed in terms of the following:

2.1. format;
2.2. learning objectives;
2.3. learning content; and
2.4. learning activities?

3. How may the 5Es-based SIM be developed in terms of the following:

3.1. format;
3.2. learning objectives;
3.3. learning content; and
3.4. learning activities?

4. How may the 5Es-based SIM be implemented based on the execution of parts:

4.1. Engage;
4.2. Explore;
4.3. Explain;
4.4. Elaborate; and
4.5. Evaluation?

5. How may the developed 5Es-based SIM be evaluated in terms of:

5.1. acceptability;
5.2. manner of presentation; and
5.3. usefulness?

Scope and Delimitation

The study focused on developing 5Es-based strategic intervention material (5Es-based SIM) for geometry 7 using a developmental research design and the ADDIE Model during the S.Y. 2021-2022 at Eduardo L. Joson Memorial High School, Quezon, Nueva Ecija, in the Division of Nueva Ecija.

The study also focused on identifying the least mastered competencies from the third-quarter learning competencies. These competencies included representing points, lines, and planes using concrete and pictorial models; illustrating subsets of a line; classifying different kinds of angles; deriving relationships of geometric figures through measurements and inductive reasoning; understanding supplementary angles, complementary angles, congruent angles, vertical angles, adjacent angles, linear pairs, perpendicular lines, and parallel lines; deriving relationships among angles formed by parallel lines cut by a transversal using measurement and inductive reasoning; using a compass and straightedge to bisect line segments and angles and construct perpendiculars and parallels; illustrating polygons with emphasis on (a) convexity, (b) angles, and (c) sides; demonstrating the circle and related terms such as radius, diameter, chord, center, arc, central angle, and inscribed angle; constructing triangles, squares, rectangles, regular pentagons, and regular hexagons; and solving problems involving sides and angles of a polygon.

The test results from the third-quarter exam were used to identify the least learned skills and students who need extra help. The least-learned skills identified served as the basis for creating 5Es-based SIMs. However, the 5Es (Engage, Explore, Explain, Elaborate, and Evaluate) were integrated with the SIMs.

These 5Es-based SIMs included objectives, learning content, and learning activities. These elements were distributed across the 5Es-based SIMs (engage, explore, explain, elaborate, and evaluate).

3. Methodology

3.1 Research Design

The study used a quantitative developmental research design. It involves systematically designing, developing, and evaluating instructional programs, processes, and products to ensure they meet standards of internal consistency and effectiveness (Galman & Del Rosario, 2021). Since the main goal of this study is to create a 5Es-based SIM, a developmental research approach is suitable for the task.

To develop the 5Es-based SIM, the researcher used the ADDIE instructional design model, a systematic framework. The development of the SIM followed the ADDIE phases.

3.2 Sampling

Purposive sampling was employed to select participants based on their level of involvement.

A total of 87 students from the Science, Technology, and Engineering program, the Special Program in the Arts, and the Special Program in Information and Communication Technology took the third-quarter examination. Of these students, 66 scored 60 percent or higher, while 21 scored below 60 percent. The results indicated that several learners experienced difficulty with the assessed concepts. Consistent with DepEd Order No. 8, s. 2015, a remediation program was implemented for learners who scored 60 percent or lower on any summative assessment. The 21 students who did not meet the proficiency level were identified as the study's respondents.

The twenty (21) student-participants took part in remediation sessions using the 5Es-based Strategic Intervention Materials under their teacher's supervision. They also completed an evaluation checklist independently to determine the usefulness and effectiveness of the 5Es-based materials.

The observers in the implementation phase were an experienced teacher, a master teacher, and a head teacher in mathematics. The experienced teacher had been teaching for more than five years. These

observers monitored the execution of each part of the 5Es-based Strategic Intervention Materials. They also evaluated the acceptability and the manner of presentation of the intervention.

The study also involved three experts with extensive backgrounds in education, curriculum development, and instructional design. Their primary role was to evaluate the quality of the 5Es-based Strategic Intervention Materials developed for the study. Using their specialized expertise, they assessed the content, structure, and instructional alignment of the materials to ensure that they met high standards of validity and served as an effective intervention for learners.

3.3 Instruments

3.3.1 Third Quarter Examination. The third quarter exam was a 20-item multiple-choice test designed to evaluate students' mastery of the skills taught during the quarter. It was created by seventh-grade math teachers in accordance with the district requirement for a standardized 20-item multiple-choice exam, reviewed by the head math teacher, and approved by the principal. Each correct answer earned one point, and the total score was used to identify the least-mastered competencies and determine which students needed remediation.

3.3.2 Evaluation Checklist for the Designed and Developed 5Es-Based SIMs. This instrument assessed the format, learning objectives, content, and activities of the 5Es-based SIMs, with each section containing ten items and several components adapted from Salvador's (2021) instrument. The researcher drafted the checklist, which was reviewed by the adviser and validated by experts, resulting in a validity rating of 4.62 (strongly agree) and a reliability coefficient of 0.73. It used a 5-point Likert scale (Excellent to Poor) to interpret expert responses, with the descriptors.

3.3.3 Experienced teachers, master teachers, and head teachers used the observation checklist during the implementation of the 5Es-based SIMs, which included rubric-based indicators aligned with the engage, explore, explain, elaborate, and evaluate phases. The researcher created the checklist based on its intended purpose, and it was reviewed by the adviser before expert validation, resulting in a validity rating of 4.62 (strongly agree) and a reliability coefficient of 0.74. Scoring employed a 4-point rating scale to reflect different levels of student engagement and performance in each phase, with detailed descriptions.

3.3.4 Evaluation Checklist for the Evaluation Phase of the 5Es-Based SIM. This instrument measures the acceptability, manner of presentation, and usefulness of the 5Es-based SIMs, consisting of five items each for acceptability and presentation, and six items for usefulness. The researcher drafted the instrument, which was reviewed by the adviser and validated by experts, resulting in a validity rating of 4.77 (strongly agree) and a reliability coefficient of 0.71. It employed a 5-point Likert scale (Strongly Agree to Disagree Strongly) to evaluate responses from observers and student-participants, with the rating descriptions.

3.3.5 5Es-Based Strategic Intervention Materials (SIMs). The 5Es-based SIMs served as the primary instructional resources for the remedial sessions. They included discussions, examples, guided tasks, and assessment activities structured around the engage, explore, explain, elaborate, and evaluate phases. The engage phase activated students' prior knowledge, the explore phase provided guided activities, the explain phase allowed students to articulate their understanding, the elaborate phase extended learning through additional examples and discussion, and the evaluate phase assessed mastery with a summative multiple-choice test. These materials were designed to support conceptual understanding and improve learners' performance in the targeted competencies.

3.4. Data Analysis Technique

The study employed descriptive statistical methods to analyze the quantitative data collected from the item analysis, expert validation, classroom observations, and student evaluations. The mean percentage score (MPS) was computed to identify the least learned competencies in Grade 7 Mathematics. Competencies with an MPS below 60% were classified as least learned and interpreted using the mastery-level performance categories. These results guided the development of the 5Es-based Strategic Intervention Materials (SIMs).

To evaluate the quality and implementation of the SIMs, the mean and weighted mean were calculated from the expert validators', observers', and students' rating scales. Expert evaluation results were interpreted using the quality standards, while classroom observations during implementation were analyzed using the descriptors. Student evaluation data were likewise summarized using weighted means and interpreted according to the verbal descriptors. These analyses provided evidence of the overall quality, usability, and effectiveness of the developed SIMs.

4. Results and Findings

4.1 Analyzing the Least Learned Competencies in Terms of Students' Scores in the Third Quarter Exam

Table 1. Summary of the item analysis in the third quarter exam

Items	Learning Competencies	Total Number of students who got the correct answer	PL	VI
1	illustrates subsets of a line.	53	61%	NM
2	classifies the different kinds of angles.	80	92%	FM
3	solves problems involving the sides and angles of a polygon.	62	71%	M
4	solves problems involving the sides and angles of a polygon.	79	91%	FM
5	illustrates polygons: (a) convexity; (b) angles; and (c) sides.	**53**	**57%**	**LM**
6	illustrates a circle and its related terms: radius, diameter, chord, center, arc, central angle, and inscribed angle.	56	64%	NM
7		68	78%	M
8	represents points, lines, and planes using concrete and pictorial models.	**30**	**34%**	**LM**
9	constructs triangles, squares, rectangles, regular pentagons, and regular hexagons.	57	66%	NM
10	derives relationships of geometric figures using measurements and inductive reasoning; supplementary angles, complementary angles, congruent angles, vertical angles, adjacent angles, linear pairs, perpendicular lines, and parallel lines.	**47**	**54%**	**LM**
11		**50**	**57%**	**LM**
12		**51**	**59%**	**LM**
13		**21**	**24%**	**NoM**

14	derives relationships among angles formed by parallel lines cut by a transversal using measurement and inductive reasoning.	58	67%	NM
15	uses a compass and straightedge to bisect line segments and angles and construct perpendiculars and parallels.	71	82%	NFM
16	illustrates polygons: (a) convexity; (b) angles; and (c) sides.	79	91%	FM
17	derives relationships among angles formed by parallel lines cut by a transversal using measurement and inductive reasoning.	**52**	**59%**	**LM**
18		**52**	**59%**	**LM**
19	uses a compass and straightedge to bisect line segments and angles and construct perpendiculars and parallels.	57	66%	NM
20	constructs triangles, squares, rectangles, regular pentagons, and regular hexagons.	56	75%	M

Legends: *FM-Full Mastery; NFM-Near Full Mastery; M-Master; NM-Near Master; LM-Low Mastery; NoM-No Master; PL-Performance Level; and VI-Verbal Interpretation.*

4.2 The Evaluation of the Experts in the Designed 5Es-based SIMs in Terms of the Format, Learning Objectives, Learning Contents, and Learning Activities

4.2.1 The Evaluation of the Designed 5Es-based SIMs in Terms of the Format

Table 2. Summary of the evaluation of the designed 5Es-based SIMs in terms of format.

The format of the designed 5Es-based SIM in Mathematics 7…	**Mean Scores**					**WM**	**VI**
	SIM1	**SIM2**	**SIM3**	**SIM4**	**SIM5**		
is readable (font).	4.00	4.00	4.00	3.33	4.00	3.87	**VG**
is attractive (title cover).	4.33	4.33	4.33	4.33	5.00	4.47	**E**
is relevant (design).	4.00	4.33	4.33	4.33	4.33	4.27	**E**
catches the learner's attention (design).	4.33	4.33	4.33	4.33	5.00	4.47	**E**
is appropriate to the grade level of the learner (design).	4.33	4.33	4.33	4.33	4.33	4.33	**E**
is pleasing to the eye (design).	4.33	4.00	4.00	3.67	4.33	4.07	**VG**
is sequentially presented.	4.33	4.00	4.00	4.00	4.33	4.13	**VG**
is well organized (each part of 5Es).	4.33	4.00	4.00	4.00	4.33	4.13	**VG**
is well constructed (the overall construction of 5Es-Based SIM)	4.33	3.67	3.67	4.33	4.00	4.00	**VG**
engages the learner to do an activity (design).	4.00	4.33	4.33	4.33	4.33	4.27	**E**
GRAND MEAN						**4.20**	**VG**

Legends: *E-Excellent; VG-Very Good; G-Good; F-Fair; P-Poor; WM-Weighted Mean; and VI-Verbal Interpretation.*

4.2.2 The Evaluation of the designed 5Es-based SIMs in terms of learning objectives

Table 3. Summary of evaluation of the designed 5Es-based SIMs in terms of learning objectives

The learning objectives of the designed 5Es-Based SIM in Mathematics 7…	Mean Scores					WM	VI
	SIM1	SIM2	SIM3	SIM4	SIM5		
are parallel to the objectives set in the Most Essential Learning Competencies (MELCs) in Curriculum Guide of the K to 12 Curriculum.	4.33	4.33	4.33	4.33	5.00	**4.47**	**E**
emphasize the desired skills be developed and knowledge to be acquired.	4.33	4.33	4.33	4.33	5.00	**4.47**	**E**
incorporate mathematics in personal, social, economic, and values in life.	3.00	3.67	3.33	4.00	3.67	**3.53**	**VG**
help develop learners' interest and active participation in classroom discussions.	4.33	4.33	4.00	4.33	5.00	**4.40**	**E**
help learners to reflect on the purpose and importance of the activity.	3.33	4.00	4.00	4.33	4.33	**4.00**	**VG**
arouse learners' curiosity to study and appreciate mathematics.	4.33	4.33	4.33	4.33	4.33	**4.33**	**E**
are relevant and appropriately sequenced to the content of the subject.	4.33	4.33	4.33	4.33	5.00	**4.47**	**E**
are clearly stated the expected outcome or result.	4.33	4.33	4.33	4.33	4.33	**4.33**	**E**
are stated in a language that is understandable to the learners.	4.33	4.33	4.33	4.33	5.00	**4.47**	**E**
help the learners express and organize their ideas and information in oral, visual, or written forms using diagrams or models.	3.67	4.00	3.67	4.00	4.33	**3.93**	**VG**
GRAND MEAN						**4.44**	**E**

Legends: *E-Excellent; VG-Very Good; G-Good; F-Fair; P-Poor; WM-Weighted Mean; and VI-Verbal Interpretation.*

4.2.3 The evaluation of the designed 5Es-based SIMs in terms of learning contents.

Table 4. Summary of the evaluation of the designed 5Es-based SIMs in terms of learning contents

The learning contents of the designed 5Es-Based SIM in Mathematics 7…	Mean Scores					WM	VI
	SIM1	SIM2	SIM3	SIM4	SIM5		
provide tasks that are simple and easy to understand.	4.33	4.33	4.33	4.33	5.00	**4.47**	**E**
are based on the level of understanding of a Grade 7 learners.	4.33	4.33	4.33	4.33	5.00	**4.47**	**E**
avoid contents that may be offensive to a learner or a particular group.	4.33	4.33	4.33	4.33	4.33	**4.33**	**E**

explore issues in the community and make learners evaluate them and create sound judgment.	3.67	4.00	3.67	4.00	3.67	**3.80**	**VG**
provide questions or tasks that stimulate higher order thinking skills (HOTS).	3.00	3.33	4.00	3.33	3.67	**3.47**	**VG**
create an activity or task where learners will separate things, categorize them, and put these things together for them to understand how they are related to each other.	4.33	4.00	4.00	4.00	4.33	**4.13**	**VG**
are systematically present the concepts in a manner that make learners easily understand the topic.	4.33	4.33	4.33	4.33	4.33	**4.33**	**E**
enable learners to develop his/her creativity and skills of self-expression.	4.00	4.00	4.33	4.00	4.00	**4.07**	**VG**
observe the coherence of contents of its objectives.	4.33	4.00	4.00	4.00	4.33	**4.13**	**VG**
help learners to design something useful for the first time through the use of their imagination or experimentation.	3.67	4.00	4.00	4.00	3.67	**3.87**	**VG**
GRAND MEAN						**4.11**	**VG**

Legends: *E-Excellent; VG-Very Good; G-Good; F-Fair; P-Poor; WM-Weighted Mean; and VI-Verbal Interpretation.*

4.2.4 The evaluation of the designed 5Es-based SIMs in terms of learning activities

Table 5. Summary of the evaluation of the designed 5Es-based SIMs in terms of learning activities

The learning activities of the designed 5Es-Based SIM in Mathematics 7…	**Mean Scores**					**WM**	**VI**
	SIM1	**SIM2**	**SIM3**	**SIM4**	**SIM5**		
provide a sufficient number of tasks or activities.	4.33	3.67	3.67	4.00	4.00	**3.93**	**VG**
are clearly explained.	4.33	4.00	3.67	4.33	4.33	**4.13**	**VG**
are varied to meet the needs of diverse learners.	3.33	4.00	3.67	4.33	4.00	**3.87**	**VG**
provide strategies and techniques to validate learners' relevant personal and social experiences in his/her community.	4.00	3.67	3.67	4.00	3.67	**3.80**	**VG**
encourage participative and collaborative learning.	4.33	4.00	4.00	4.33	4.00	**4.13**	**VG**
entice higher order thinking skills (HOTS).	3.33	4.00	3.67	4.00	4.00	**3.80**	**VG**
let learners share ideas through drawing, labelling pictures, and acting things out.	4.33	4.00	4.33	4.33	4.00	**4.20**	**VG**
engage learners in an activity that is gender sensitive and relevant in the subject matter.	4.33	4.33	4.33	4.33	4.00	**4.27**	**E**

involve learners to explore learning within the context of one's own experiences and observation.	4.33	4.00	4.33	4.00	4.00	**4.13**	**VG**
help learners appreciate the materials in their community that can be used in the teaching-learning process.	4.00	4.00	4.33	4.33	3.67	**4.07**	**VG**
GRAND MEAN						**4.03**	**VG**

Legends: *E-Excellent; VG-Very Good; G-Good; F-Fair; P-Poor; WM-Weighted Mean; and VI-Verbal Interpretation.*

4.3 The Evaluation of the Experts in the Developed 5Es-based SIMs

4.3.1 The evaluation of the developed 5Es-based SIMs in terms of format

Table 6. Summary of the evaluation of the developed 5Es-based SIMs in terms of the format

The format of the developed 5Es-based SIM in Mathematics 7…	**Mean Scores**					**WM**	**VI**
	SIM1	**SIM2**	**SIM3**	**SIM4**	**SIM5**		
is readable (font).	4.33	5.00	5.00	4.33	5.00	4.73	**E**
is attractive (title cover).	5.00	5.00	5.00	4.33	5.00	4.87	**E**
is relevant (design).	4.00	4.33	4.33	4.33	5.00	4.40	**E**
catches learner's attention (design).	5.00	4.33	4.33	4.33	5.00	4.60	**E**
is appropriate to the grade level of the learner (design).	5.00	4.33	4.33	4.33	5.00	4.60	**E**
is pleasing to the eye (design).	4.33	5.00	5.00	4.33	5.00	4.73	**E**
is sequentially presented.	5.00	5.00	5.00	4.33	5.00	4.87	**E**
is well organized (each part of 5Es).	5.00	5.00	5.00	4.33	5.00	4.87	**E**
is well constructed (the overall construction of 5Es-Based SIM)	5.00	4.33	4.33	4.33	5.00	4.60	**E**
engages the learner to do an activity (design).	5.00	5.00	5.00	4.33	5.00	4.87	**E**
TOTAL WEIGHTED MEAN						**4.71**	**E**

Legends: *E-Excellent; VG-Very Good; G-Good; F-Fair; P-Poor; WM-Weighted Mean; and VI-Verbal Interpretation.*

4.3.2 The evaluation of the developed 5Es-based SIMs in terms of learning objectives

Table 7. Summary of evaluation of the developed 5Es-based SIMs in terms of learning objectives

The learning objectives of the developed 5Es-Based SIM in Mathematics 7…	**Mean Scores**					**WM**	**VI**
	SIM1	**SIM2**	**SIM3**	**SIM4**	**SIM5**		
are parallel to the objectives set in the Most Essential Learning Competency (MELCs) in Curriculum Guide of the K to 12 Curriculum.	4.33	5.00	5.00	5.00	5.00	4.87	**E**
emphasize the desired skills to be developed and knowledge to be acquired.	4.33	5.00	5.00	5.00	5.00	4.87	**E**

incorporate mathematics in personal, social, economic and values in life.	4.33	4.00	4.33	4.33	5.00	4.40	**E**
help develop learner's interest and active participation in classroom discussion.	4.33	4.33	4.33	4.33	5.00	4.47	**E**
help learners to reflect about the purpose and importance of the activity.	4.33	4.33	4.33	4.33	5.00	4.47	**E**
arouse learner's curiosity to study and appreciate mathematics.	5.00	4.33	4.33	4.33	5.00	4.60	**E**
are relevant and appropriately sequenced to the content of the subject.	5.00	4.33	4.33	4.33	5.00	4.60	**E**
are clearly state the expected outcome or result.	4.33	4.33	4.33	4.33	5.00	4.47	**E**
are stated in a language that is understandable to the learners.	4.33	4.33	4.33	4.33	5.00	4.47	**E**
help the learners express and organize their ideas and information in oral, visual, or written forms using diagrams or models.	4.33	4.33	4.33	4.33	5.00	4.47	**E**
GRAND MEAN						**4.57**	**E**

Legends: *E-Excellent; VG-Very Good; G-Good; F-Fair; P-Poor; WM-Weighted Mean; and VI-Verbal Interpretation.*

4.3.3 The evaluation of the developed 5Es-based SIMs in terms of learning contents

Table 8. Summary of evaluation of the developed 5Es-based SIMs in terms of learning contents

The learning contents of the developed 5Es-Based SIM in Mathematics 7…	**Mean Scores**					**WM**	**VI**
	SIM1	**SIM2**	**SIM3**	**SIM4**	**SIM5**		
provide tasks that are simple and easy to understand.	5.00	4.33	4.33	4.33	5.00	4.60	**E**
are based on the level of understanding of a Grade 7 learners.	5.00	4.33	4.33	4.33	5.00	4.60	**E**
avoid contents that may be offensive to a learner or a particular group.	5.00	5.00	5.00	4.33	5.00	4.87	**E**
explore issues in the community and make learners evaluate them and create sound judgment.	5.00	4.33	4.33	4.00	4.67	4.47	**E**
provide questions or tasks that stimulate higher order thinking skills (HOTS).	5.00	4.00	4.33	4.00	5.00	4.47	**E**
create an activity or task where learners will separate things, categorize them, and put these things together for them to understand how they are related to each other.	5.00	4.33	4.33	4.33	4.33	4.47	**E**

are systematically present the concepts in a manner that make learners easily understand the topic.	5.00	5.00	5.00	4.33	4.33	4.73	**E**
enable learners to develop his/her creativity and skills of self-expression.	5.00	5.00	5.00	4.33	4.33	4.73	**E**
observe the coherence of contents of its objectives.	5.00	5.00	5.00	4.33	5.00	4.87	**E**
help learners to design something useful for the first time through the use of their imagination or experimentation.	5.00	4.33	5.00	4.33	5.00	4.73	**E**
GRAND MEAN						**4.65**	**E**

Legends: *E-Excellent; VG-Very Good; G-Good; F-Fair; P-Poor; WM-Weighted Mean; and VI-Verbal Interpretation.*

4.3.4 The evaluation of the developed 5Es-based SIMs in terms of learning activities

Table 9. Summary of the evaluation of the developed 5Es-based SIMs in terms of learning activities

The learning activities of the developed 5Es-Based SIM in Mathematics 7…	**Mean Scores**					**WM**	**VI**
	SIM1	**SIM2**	**SIM3**	**SIM4**	**SIM5**		
provide a sufficient number of tasks or activities.	4.33	4.33	4.67	4.33	5.00	4.53	**E**
are clearly explained.	4.33	4.33	4.67	4.33	5.00	4.53	**E**
are varied to meet the needs of diverse learners.	4.33	4.00	4.67	4.33	5.00	4.47	**E**
provide strategies and techniques to validate learners' relevant personal and social experiences in his/her community.	4.33	4.33	4.67	4.33	4.67	4.47	**E**
encourage participative and collaborative learning.	4.33	4.00	4.67	4.33	5.00	4.47	**E**
entice higher order thinking skills (HOTS).	4.33	4.33	4.33	4.33	5.00	4.47	**E**
let learners share ideas through drawing, labelling pictures, and acting things out.	4.33	4.33	4.67	4.33	5.00	4.53	**E**
engage learners in an activity that is gender sensitive and relevant in the subject matter.	4.33	4.33	4.67	4.33	5.00	4.53	**E**
involve learners to explore learning within the context of one's own experiences and observation.	4.33	4.33	4.67	4.33	5.00	4.53	**E**
help learners appreciate the materials in their community that can be used in the teaching-learning process.	4.33	4.33	4.67	4.33	5.00	4.53	**E**
GRAND MEAN						4.51	**E**

Legends: *E-Excellent; VG-Very Good; G-Good; F-Fair; P-Poor; WM-Weighted Mean; and VI-Verbal*

Interpretation.

4.4 The observation of the observers in the Implementation of the Developed 5Es-based SIMs

4.4.1 The observation of the engage part of the developed 5Es-based SIMs

Table 10. Summary of ratings on the implementation of the engage part of the developed 5Es-based SIMs

	Mean Scores					WM	Verbal Description
	SIM1	SIM2	SIM3	SIM4	SIM5		
Engage Part	4.00	4.00	4.00	4.00	4.00	4.00	The student engaged in the motivational activity, which highly elicited their prior knowledge.

Legend: *WM-Weighted Mean*

4.4.2 The observation of the explore part of the developed 5Es-based SIMs

Table 11. Summary of ratings on the implementation of the explore part of the developed 5Es-based SIMs

	Mean Scores					WM	Verbal Description
	SIM1	SIM2	SIM3	SIM4	SIM5		
Explore Part	4.00	4.00	4.00	4.00	4.00	4.00	The student highly participated in the exploration activity.

Legend: *WM-Weighted Mean*

4.4.3 The observation of the explain part of the developed 5Es- based SIMs

Table 12. Summary of ratings on the implementation of the explain part of the developed 5Es-based SIMs

	Mean Scores					WM	Verbal Description
	SIM 1	SIM 2	SIM 3	SIM 4	SIM 5		
Explain Part	4.00	4.00	4.00	4.00	4.00	4.00	The students explained well the questions provided.

Legend: *WM-Weighted Mean*

4.4.4 The observation of the elaborate part of the developed 5Es- based SIMs

Table 13. Summary of ratings on the implementation of the elaborate part of the developed 5Es-based SIMs

	Mean Scores					WM	Verbal Description
	SIM 1	SIM 2	SIM 3	SIM 4	SIM 5		
Elaborate Part	4.00	4.00	4.00	4.00	4.00	4.00	The student highly enhanced his understanding of the topic.

Legend: *WM-Weighted Mean*

4.4.5 The observation of the evaluate part of the developed 5Es- based SIMs

Table 14. Summary of ratings on the implementation of the evaluate part of the developed 5Es-based SIMs

	Mean Scores					WM	Verbal Description
	SIM 1	SIM 2	SIM 3	SIM 4	SIM 5		
Evaluate Part	4.00	4.00	4.00	4.00	4.00	4.00	The student highly applied his/her learning in the previous parts.

4.5 The evaluation of the observers in the acceptability and manner of presentation, and the evaluation of the students in the usefulness of the 5Es-based SIMs

4.5.1 The evaluation of the observers in the acceptability of the 5Es-based SIMs

Table 15. Summary of the evaluation of the acceptability of the 5Es-based SIMs

Acceptability	Mean	VI
The 5Es-based SIM is easy to use by the students and teachers.	5.00	**SA**
The 5Es-based SIM is designed in a way that facilitates learning and engagement for the students.	5.00	**SA**
The 5Es-based SIM is accurate, up-to-date, and free of errors.	4.33	**SA**
The 5Es-based SIM is inclusive and respectful of diverse cultures and perspectives.	5.00	**SA**
The 5Es-based SIM can be adopted by the teachers.	5.00	**SA**
Weighted Mean	**4.87**	**SA**

Legends: *SA- Strongly Agree; A- Agree; MA-Moderately Agree; D-Disagree; SD-Strongly Disagree; and VI-Verbal Interpretation*

4.5.2 The evaluation of the observers in the manner of presentation of the 5Es-based SIMs

Table 16. Summary of evaluation in the manner of presentation of the 5Es-based SIMs

Manner of Presentation	WM	VI
The 5Es-based SIM is readable and appealing to the eye.	5.00	**SA**
The presentation is engaging and clear.	5.00	**SA**
The 5Es-based SIM is organized.	5.00	**SA**
The flow of thoughts is logical and smooth.	5.00	**SA**
Sentences are suited to the student's degree of comprehension.	5.00	**SA**
Weighted Mean	5.00	**SA**

Legends: *SA- Strongly Agree; A- Agree; MA-Moderately Agree; D-Disagree; SD-Strongly Disagree; and VI-Verbal Interpretation*

4.5.3 The evaluation of the students on the usefulness of the 5Es- based SIMs

Table 17. Summary of the evaluation of the usefulness of the 5Es-based SIMs

Usefulness	Mean	VI
As a student, I find the 5Es-based SIM to be relevant to my needs and interests.	4.81	**SA**
I appreciate how the 5Es-based SIM is designed to capture and hold my attention.	4.86	**SA**
Through the 5Es-based SIM, I am encouraged to actively and meaningfully engage with the content.	4.67	**SA**
I appreciate the variety of options available to me to access and engage with the content, including text, and interactive elements.	4.76	**SA**
It's great that the 5Es-based SIM is inclusive and useful to all students, including those with disabilities.	4.76	**SA**
The 5Es-based SIM helps me to master the least learned competency.	4.81	**SA**
Weighted Mean	**4.78**	**SA**

Legends: *SA- Strongly Agree; A- Agree; MA-Moderately Agree; D-Disagree; SD-Strongly Disagree; and VI-Verbal Interpretation*

5. Discussion

The study aimed to identify the least-learned competencies in Grade 7 Mathematics and to assess the quality and effectiveness of the developed 5E-based Strategic Intervention Materials (SIM). The item analysis showed that several competencies related to polygons, points and lines, angle relationships, and parallel lines were least mastered by students. These findings indicate that students struggled with fundamental geometric concepts, a difficulty frequently observed in studies reporting that geometry and other relational, abstract mathematical topics often require additional scaffolding and targeted remediation to achieve mastery (Magsalay et al., 2019; Cartilla & Rondina, 2020).

The evaluation of the designed 5E-based SIMs showed that experts generally viewed the materials as well-constructed in terms of format, learning objectives, content validity, and appropriateness of learning activities. After revisions, the materials received strong evaluations across all criteria. This outcome aligns with research suggesting that thoughtfully designed instructional materials, especially those grounded in a structured learning framework, are more likely to support effective teaching and learning, especially in mathematics (Cartilla & Rondina, 2020; Turan & Matteson, 2021).

During the implementation phase, students and observers consistently rated the SIMs as engaging, interactive, and supportive of active learning. Observers noted high student engagement during the Engage and Explore phases. Prior knowledge was activated, and students began constructing new understanding. This supports findings that inquiry-based instruction and 5E-structured lessons increase student engagement, participation, and motivation in mathematics by making learning more student-centered and interactive (Turan & Matteson, 2021; Bernido & Boyon, 2020). In addition, inquiry-based learning improved mathematics achievement and reduced math anxiety among lower secondary students, supporting the effectiveness of inquiry-driven, 5E-aligned interventions like the SIMs used in this study (Yanakit & Kaewsaiha, 2021).

Students also demonstrated a stronger ability to explain and elaborate on geometric concepts, suggesting that the SIMs promoted deeper conceptual processing. This corresponds with research showing that the Explain and Elaborate phases in 5E lessons contribute to improved conceptual understanding, reflection, and application of mathematical ideas (Bernido & Boyon, 2020; Santos & Boyon, 2019).

In the evaluation phase, learners also applied their learned concepts to new situations, indicating effective knowledge transfer and improved problem-solving skills. The literature on 5E-based STEM instruction reports that such instructional designs can lead to significant gains in academic achievement and in scientific or mathematical reasoning, supporting the notion that 5E-based remediation can foster both conceptual understanding and procedural fluency (Learning & Individual Differences, 2022). Students furthermore rated the SIMs as helpful, accessible, and relevant to their needs, reflecting the importance of learner-centered, well-structured instructional materials in accommodating diverse learner profiles (Magsalay et al., 2019; Cartilla & Rondina, 2020).

The findings suggest that the developed 5E-based SIMs effectively addressed least-learned competencies while enhancing student engagement, comprehension, and performance. The combination of inquiry (Engage, Explore), guided explanation, scaffolded practice, and application provided a more interactive and meaningful learning experience, well-suited for diverse learners. However, the study acknowledges certain limitations: the sample was limited to a single group of students, and long-term retention and performance beyond the immediate post-test were not measured. Future research should replicate the study with larger and more diverse samples, track long-term retention, explore digital or blended versions of SIM, and consider pairing SIM with other instructional innovations (e.g., problem-posing, game-based learning).

The results support the continued development and use of 5E-based SIMs to strengthen mathematics instruction, close learning gaps in geometry, and help students achieve mastery of complex mathematical concepts through structured yet student-centered remediation.

6. Conclusion

Item analysis is an effective tool for identifying the least learned competencies, enabling teachers to pinpoint areas that require additional support. The components of format, learning objectives, content, and learning activities can serve as essential elements in designing strategic intervention materials. These least learned competencies provide a strong foundation for developing instructional resources that directly address student needs. Incorporating the 5Es instructional model into the development of intervention materials further enhances their structure and effectiveness. Overall, the use of 5Es-based Strategic Intervention Materials helps students master the competencies they find most challenging.

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