

Research Article

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Author for correspondence:

Mobarac Dimasindel

✉ movz_20@yahoo.com

✉ Cotabato State University, College of Teacher Education – Mathematics Department, Philippines

Strategies of Secondary Mathematics Teachers in Module Development: The Case of Cotabato City

Mobarac Dimasindel 

Abstract

Background/purpose. Instructional modules are essential tools in supporting effective teaching and learning, particularly in mathematics education. Despite the increasing emphasis on learner-centered approaches, many teachers continue to adopt traditional strategies that prioritize content delivery over student engagement. This study was conducted to examine the strategies employed by secondary mathematics teachers in Cotabato City in developing instructional modules, to identify areas for improvement in instructional practices.

Materials/methods. An explanatory sequential mixed-methods design was used. The initial phase involved a survey of 25 secondary mathematics teachers and 40 mathematics education students using a validated 24-item questionnaire. This was followed by a series of focus group discussions guided by open-ended interview questions. Quantitative data were analyzed using descriptive statistics and Pearson's correlation coefficient (r) to determine relationships among variables, while qualitative responses were subjected to thematic analysis to further explain the survey results.

Results. The study found that teachers predominantly utilized strategies focused on explaining and evaluating, reflecting conventional approaches centered on knowledge transmission and assessment. In contrast, strategies associated with the 5E Instructional Model—such as engaging, exploring, and elaborating—were rarely employed. This indicates a lack of emphasis on inquiry-based and student-centered methods in module development.

Conclusion. The results highlight the need for professional development programs that equip teachers with practical skills in designing instructional modules based on active learning principles. Strengthening these areas may contribute to more meaningful learning experiences and improved outcomes for mathematics learners.



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1. Introduction

Mathematics is a discipline that focuses on patterns, logic, quantity, and structure (Hom & Gordon, 2021). It plays a pivotal role in developing students' logical reasoning, analytical thinking, and problem-solving abilities. As a key component of the school curriculum, mathematics is crucial for developing cognitive skills that enhance both academic and professional success. Over time, educational systems have evolved to meet changing needs, prompting teachers to refine their instructional strategies continually. These adaptations are necessary to align with curriculum reforms and to provide students with meaningful learning experiences that cater to their diverse needs.

One approach that has gained attention in recent years is contextualization. This instructional strategy aims to connect classroom content to students' lived experiences, social contexts, and cultural backgrounds, making learning more relevant and engaging. In connecting abstract mathematical concepts to their practical applications, contextualization helps students develop a deeper understanding of the material. Research on contextual learning suggests that well-designed, real-life-based modules can enhance the learning experience by making it more intuitive and relatable, thereby leading to improved student engagement (Crawford, 2001). Furthermore, Crawford (2001) suggest that contextualization motivates students intrinsically by linking academic content with their personal experiences.

Learning modules are an important component of this process. They serve not only as content summaries or practice tools but also as structured resources that support classroom instruction and foster academic growth (Hamdunah, Wardani, & Permatasari, 2016). Modules help identify and address knowledge gaps, reinforce foundational skills, and improve mastery of complex concepts (Gordon & Nicholas, 2013; Herrera & Dio, 2016). In this way, well-constructed modules play an integral role in enhancing the learning experience.

Despite the increasing focus on progressive, learner-centered teaching methods, many instructional materials still rely on traditional, teacher-centered approaches. These methods often prioritize rote memorization and direct instruction, which limits opportunities for student engagement and exploration. This gap raises concerns about how current instructional practices align with student-centered frameworks, such as the 5E Instructional Model. The 5E Model, which consists of the phases of engage, explore, explain, elaborate, and evaluate, encourages inquiry, curiosity, and critical thinking. However, the application of this model in mathematics education, particularly in secondary schools, has been inconsistent and warrants further examination.

This study seeks to investigate how secondary mathematics teachers in Cotabato City incorporate the 5E Instructional Model into their development of contextualized learning modules. Specifically, it explores how each phase of the 5E Model—engage, explore, explain, elaborate, and evaluate—is implemented in the modules developed by these teachers. Using an explanatory sequential mixed-methods design, the study combines quantitative and qualitative data to assess current practices, identify gaps, and provide recommendations for enhancing the development and utilization of contextualized modules in mathematics education.

The central research question guiding this study is: *To what extent do the instructional strategies of secondary mathematics teachers in Cotabato City reflect the 5E Instructional Model in the development of contextualized learning modules?* This research contributes to the existing literature by documenting the classroom practices of teachers in Cotabato City, a context that has not been extensively explored in prior research. The findings of this study will offer valuable insights that can inform curriculum development, teacher training, and policy initiatives aimed at strengthening the integration of contextualized, student-centered teaching strategies within the Philippine educational system.

2. Literature Review

The Related Literature of this study is classified into the Strategies Employed by Secondary Mathematics Teachers in Module Development, Integration of the 5E Instructional Model in Module Development, Development and Effectiveness of Contextualized Learning Modules, and the Challenges in Module Development and Implementation.

Strategies Employed by Secondary Mathematics Teachers in Module Development

Secondary mathematics teachers are playing a significant role in designing instructional materials due to the ever-evolving demands for learning tools. As noted by Paguirigan (2021), many teachers primarily rely on traditional methods, which include direct instruction and guided practice, when creating modules for their respective subjects. This is because traditional methods give more structure and clarity to them. However, what is often lacking is the touch of interaction, which is supposed to expose students to active learning. It is possible that these methods are potentially useful in certain aspects. However, they may also be considered inadequate in fully addressing the diverse needs of learners.

In contrast to this view, one interesting notion was that of Adose et al. (2022), who emphasized that utilizing constructivist approaches in module development has many benefits. This is so when students are actively engaged in constructing their own understanding of mathematical concepts. With this, teachers are given a wide latitude in conceiving deeper learning outcomes. As noted by Adose, when problem-solving tasks are integrated into mathematics learning materials, students are more likely to develop their critical thinking skills and increase their motivation. This view supports the findings of Lai and Hwang (2016), which suggest that teachers who incorporate collaborative learning into their instructional modules experience significant improvements in student performance.

However, Turan and Matteson (2021) claimed that teachers encounter challenges when transitioning from teacher-centered to student-centered approaches. This has been evident in their finding that while there are teachers who wish to incorporate more interactive strategies into their teaching, they usually struggle to balance the scope of the curriculum and the need for student engagement. This struggle is what drives the mathematics teachers to opt for traditional methods instead.

On the other hand, Ajayi and Owoseni (2023) investigated the role of teachers' expertise in developing modules and found that teachers with a strong understanding of the curriculum and subject matter are more likely to incorporate innovative strategies, such as inquiry-based learning and peer teaching, in module development. This is so because when these strategies are embedded in the instructional modules, student engagement and academic outcomes can be enhanced and improved. This suggests that continuous professional development is crucial in equipping teachers to design effective and engaging learning materials.

Ibrahim et al. (2021) explored the use of technology in module development. He noted that digital tools and multimedia resources can offer teachers new ways to engage students. As this study found, the use of interactive simulations, videos, and real-time feedback in instructional modules led to improved student performance. This means that the strategic integration of technology in module designing can allow students to experience engaging and effective learning.

Integration of the 5E Instructional Model in Module Development

Research has been conducted on the integration of the 5E Instructional Model (engage, explore, explain, elaborate, and evaluate) in Module Development, which suggests that it has the capability of making learning more engaging. As found by Adu and Folson (2023), the students in their study

demonstrated improvements in problem-solving skills and a deeper understanding of abstract mathematical concepts when teachers incorporated the 5E model into their instructional materials. In addition, they found out that the 5E model can encourage students' motivation and critical thinking. In fact, this approach is particularly practical for topics that students typically find challenging, such as algebra and calculus.

Bosome and Nabie (2022) further supported these findings by demonstrating that the 5E model can increase student motivation in mathematics. They claimed that the model can engage students in exploration and collaboration, which in turn helps them form stronger connections to mathematical concepts. In particular, they noted that the model's "explore" phase provides students with an opportunity to experiment with mathematical concepts in a safe and supportive environment, which leads to higher levels of engagement and retention.

However, despite the positive outcomes associated with the 5E model, Turan and Matteson (2021) have identified several challenges in this integration. They stated that many teachers have experienced difficulties in maintaining the right balance between providing guidance and allowing students to explore concepts independently. This has led to teachers reverting to more traditional methods of instruction. Another interesting research finding is that of Hernandez et al. (2021), who determined that students who learned through the 5E model performed better on tasks requiring critical thinking and application of concepts. They also found that the model's structure promotes a deeper understanding of mathematical principles.

Development and Effectiveness of Contextualized Learning Modules

Contextualized learning has been recognized as a powerful tool for improving student engagement and learning in mathematics education. Lai and Hwang (2016) argued that contextualized learning modules can make abstract concepts more accessible to students. In fact, by integrating real-world examples, teachers can help students see the relevance of mathematics in their everyday lives, which in turn increases learners' motivation to learn.

Madrazo and Dio (2020) found that the use of contextualized learning modules can help bridge students' learning gaps in mathematics, particularly in calculus and analytic geometry. Their study revealed that such modules enable students to apply mathematical principles to real world problems, thereby enhancing their problem solving skills and fostering independent learning. They also examined how contextualized learning modules can be used to improve the effectiveness of mathematics instruction. Notably, the study found that students demonstrated deeper understanding and greater motivation when learning materials incorporated examples that reflected their own cultural and geographical contexts. This is because contextualization allows learners to connect abstract concepts to their everyday experiences, making the content more meaningful and easier to grasp. Additionally, Pino (2022) investigated the experiences of junior high school mathematics teachers in developing instructional modules. Her study revealed that teachers encountered both challenges and motivations in the process and in employing various strategies to ensure the effectiveness of their modules. The findings emphasized that the development of mathematics modules is not only a technical task but also a reflective and adaptive process shaped by teachers' lived experiences during the modular learning implementation. However, Magno (2020) noted that the development of contextualized learning materials presents challenges. Teachers often face difficulties in finding appropriate local contexts that are responsive to the curriculum. Thus, they suggested the need for professional development and resources to support teachers in creating and implementing contextualized modules that meet the diverse needs of their students.

Challenges in Module Development and Implementation

Module development and implementation are challenging tasks for teachers for several reasons. Alegre and Adelantar (2022) claimed that teachers often struggle to meet the individual needs of students when teaching algebra through modular approaches. One of their findings is due to the lack of immediate feedback and interaction inherent in modular learning, which is aggravated by the limited opportunities provided for students to ask questions or seek clarification.

Additionally, resource constraints are identified as having a significant impact on the quality and delivery of modules. Alegre and Falle (2022) affirmed that the insufficiency of instructional materials is one of the challenges that teachers encounter. Teachers often face shortages of printing supplies and lack the necessary tools to produce and disseminate modules effectively. These logistical issues can lead to delays and inconsistencies in module availability, thereby hindering the learning process.

Time constraints are another critical issue. Refugio et al. (2020) found that teachers experience significant pressure due to tight schedules and the need to cover extensive curricula within limited timeframes. Accordingly, this pressure can lead to a focus on content delivery at the expense of deeper understanding and critical thinking.

The development of modules also requires a high level of expertise and collaboration. Pino (2022) emphasized that teachers often feel overwhelmed and underprepared when tasked with creating a module. He added that the lack of training and support in module development can lead to feelings of anxiety and uncertainty.

and feedback mechanisms within modular learning environments present further difficulties. A study in the Bicol Region of the Philippines revealed that teachers face challenges in evaluating student performance due to limited real-time interactions and the delayed submission of assignments (Sionicio & Besmonte, 2023). Accordingly, this gap in timely feedback can have the tendency to hinder or bar students' academic progress and even limit their opportunities for corrective instruction.

3. Methodology

This study utilized an explanatory sequential mixed-methods design, combining both quantitative and qualitative approaches to gain a comprehensive understanding of the instructional strategies employed by secondary mathematics teachers in developing their learning modules. The focus was on examining how the five phases of the 5E Instructional Model were integrated into these instructional modules. The mixed-methods design enabled the researcher to collect both numerical data, which assessed the extent of 5E Model integration, and qualitative data, which provided deeper insights into teachers' practices and experiences. This approach facilitated a thorough investigation of how the 5E Model is applied within actual classroom settings and module development processes.

The research was conducted in a set of secondary schools in Cotabato City, which were selected due to their representativeness of the region's educational landscape. Mathematics teachers from these schools participated in both the quantitative and qualitative phases of the study. The quantitative phase involved a larger group of teachers, while the qualitative phase focused on a selected group of teachers, chosen to provide in-depth insights into their instructional strategies.

In the first phase, quantitative data were gathered using a survey specifically designed for this research. The survey aimed to evaluate how mathematics teachers incorporated the five phases of the 5E Instructional Model in their module development. The instrument included a series of questions designed to assess teachers' practices in relation to each phase of the 5E Model. These questions were both closed-ended and Likert-scale, allowing respondents to indicate the frequency and extent of their use of each phase in the module development process.

The survey instrument underwent a pilot testing process, followed by feedback from experts in mathematics education and instructional design to ensure its validity and reliability. Descriptive statistical techniques were applied to analyze the survey data, including the calculation of mean scores to assess the frequency with which each phase of the 5E Model was implemented. The results from this phase provided a broad overview of the extent to which the 5E Model was employed in the development of learning modules across the sample of teachers.

Following the quantitative data collection, the qualitative phase aimed to deepen the understanding of the survey results. A purposive sampling technique was employed to select a subgroup of teachers who exhibited varied responses to the survey, ensuring a balance between those who demonstrated high integration and those who showed lower integration of the 5E Model. These selected teachers participated in semi-structured interviews, during which they were encouraged to share their experiences, challenges, and perspectives on incorporating the 5E phases into their modules.

The interview questions were designed to explore the teachers' perspectives on the practical aspects of module development, such as how they engage students, promote inquiry, and assess learning. The interviews were audio-recorded, transcribed, and coded for themes related to the application of the 5E phases. In addition to the interviews, the study also analyzed sample learning modules provided by the teachers. This content analysis aimed to verify the teachers' self-reported practices and to observe how the 5E phases were reflected in their instructional materials.

For the quantitative data, descriptive statistics were used to analyze the frequency with which each phase of the 5E Instructional Model was integrated into the teachers' modules. The mean scores for each phase were calculated to identify which strategies were most and least commonly used by the teachers.

In the qualitative phase, a thematic analysis approach was employed to examine the interview transcripts and module samples. The data were coded to identify recurring themes and patterns that illuminated the teachers' experiences and strategies related to the 5E Model. The thematic analysis enabled a deeper exploration of the practical challenges and successes that teachers encountered when implementing the model in their modules. The findings from both the quantitative and qualitative phases were triangulated to provide a comprehensive understanding of the instructional strategies used by the teachers.

The research adhered to ethical standards to ensure the protection of participants' rights and confidentiality. All participants were fully informed about the purpose of the study, the nature of their participation, and their right to withdraw at any time. Written informed consent was obtained from each participant prior to the commencement of data collection. The identities and responses of teachers were kept confidential, and no identifying information was included in the study findings. The data were securely stored to maintain privacy. Additionally, appropriate permissions were obtained from school administrators and other relevant authorities to ensure compliance with institutional research guidelines. The study adhered to ethical principles for conducting research involving human participants, prioritizing respect and confidentiality throughout the process.

4. Results

Strategies of Mathematics Teachers in Developing Modules

Table 1 presents the data on the strategies employed by mathematics teachers in developing instructional modules. The results indicate that teachers do not consistently incorporate the "engage" phase into their module development process. Specifically, the mean score for considering students' prior knowledge and misconceptions about mathematical concepts and terms as a basis for module design is low ($x = 1.21$ and 1.69 , respectively). Additionally, teachers seldom encourage

students to participate in brainstorming activities ($x = 1.21$), which would allow students to express their difficulties and share their thoughts on the module content.

What sets this study apart is its emphasis on examining how the 5E Instructional Model is used during the actual construction of instructional modules rather than during classroom instruction alone. This distinction provides a significant contribution to the literature by highlighting that teachers, while familiar with the 5E framework, may not necessarily apply all its components during module preparation. Specifically, the findings expose a notable gap in the application of the “engage” phase, a key element in constructivist learning that connects new concepts to students’ prior experiences and corrects misconceptions early in the learning process. These results reveal a disconnect between theoretical instructional design models and the practical realities of teaching in the field. This insight brings new depth to the understanding of how instructional models are operationalized by teachers, particularly in under-documented regions like Cotabato City.

Table 1. Mean Values Showing the Extent of Use of Engaging as Respondents’ Strategy in Module-Making

NO.	Statement	Mean	Standard Deviation	Description
1	I assess students’ prior knowledge of the subject matter to determine the approach in discussing the topics in the module.	1.21	0.43	Very Much Not Evident
2	I identify possible misconceptions of learners pertaining to concepts in the subject matter	1.69	0.51	Very Much Not Evident
3	I allow brainstorming among my students by asking questions to know their thoughts and attitudes on the subject.	1.21	0.45	Very Much Not Evident
4	I encourage students to fill-in graphic organizers such as K-W-L charts to record what they know, want to know, and have learned about mathematics.	1.09	0.36	Very Much Not Evident
	Over All Mean	1.30		Very Much Not Evident

Legend:

Scale	Range of Means	Description
5	4.21 – 5.00	Very Evident
4	3.41 – 4.20	Evident
3	2.61 – 3.40	Moderately Evident
2	1.81- 2.60	Not Evident
1	1.00- 1.80	Very Much Not Evident

Table 2 presents the data on the extent to which mathematics teachers incorporate hands-on activities, inquiry-based learning experiences, application exercises, and cooperative learning in their instructional modules. The results indicate that these strategies are seldom included in the teachers’ module development processes. Specifically, the mean score for providing hands-on experiences for

learners is low ($x = 1.89$), and similarly, the inclusion of inquiry-based experiences to encourage student exploration of learning content is minimal ($x = 1.29$). Moreover, the teacher-respondents reported that they rarely include sections in their modules where students can apply what they have learned, with a mean score of 1.24. Cooperative learning opportunities are also seldom provided, as evidenced by the mean score of 1.56.

The findings shed light on the underutilization of active learning strategies, particularly those associated with the "explore" and "elaborate" phases of the 5E Instructional Model, in self-contained instructional materials, such as teacher-made modules. While much of the existing literature emphasizes the importance of experiential and inquiry-based approaches in classroom instruction, this study highlights a significant gap in their application in module design. This discrepancy is especially relevant in contexts where modular instruction is a primary mode of delivery, such as in distance or blended learning environments. By documenting the limited presence of these strategies, the study highlights the need for enhanced teacher training that focuses on designing modules that not only present content but also engage students in constructing knowledge through interaction, collaboration, and application. In doing so, the study contributes empirical evidence to support curriculum and teacher development initiatives aimed at improving the quality and pedagogical depth of instructional modules in mathematics education.

Table 2. Mean Values Showing the Extent of Use of Exploring as Respondents' Strategy in Module-Making

No.	Statement	Mean	Standard Deviation	Description
1	I provide in the module a part where students can apply process skills such as observing, investigating, testing predictions, hypothesizing, and communicating with peers.	1.24	0.42	Very Much Not Evident
2	I design the activities in the module as inquiry-based to encourage students to develop skills and concepts.	1.29	0.40	Very Much Not Evident
3	I give clear instructions on activities for the students to work in a cooperative learning environment without direct instruction from their teachers.	1.56	0.47	Very Much Not Evident
4	I provide activities in the module where students can have hands-on experience of concepts before formal explanation of terms.	1.89	0.45	Not Evident
	Over All Mean	1.50		Very Much Not Evident

Legend:

Scale	Range of Means	Description
5	4.21 – 5.00	Very Evident
4	3.41 – 4.20	Evident
3	2.61 – 3.40	Moderately Evident
2	1.81- 2.60	Not Evident
1	1.00- 1.80	Very Much Not Evident

Table 3 presents the data on the extent to which mathematics teachers employ the "explain" strategy in their module development. The results show that "explaining" is the most commonly used

strategy, with a high mean score of 3.54, indicating that this strategy is evident in the teachers' module-making activities. Specifically, the teachers report that their modules enable students to describe their understanding of mathematical concepts and ask questions about the content they are exploring. Furthermore, the respondents claim that they include a section dedicated to the discussion of math concepts, as reflected by the high mean score of 4.52. However, while the strategy of explanation is evident, the teachers also indicate that they provide instructions on how students can describe their learning experiences in the modules, with a slightly lower mean score of 2.69.

This study indicates that among the phases of the 5E Instructional Model, the "explain" phase is the most heavily emphasized in mathematics module development. This finding reinforces earlier work that identifies a tendency among teachers to prioritize content transmission over learner-centered practices, particularly in resource-limited settings where printed or digital modules often replace live instruction. The data suggest that while teachers effectively structure content explanation, they may not fully support student-led meaning-making or reflection. This gap highlights an important area for improvement and innovation in modular instruction design. Moreover, the study enriches the literature on instructional material development and offers practical insights for teacher professional development, especially in terms of integrating reflective prompts and student-led inquiry into explanatory sections of modules.

Table 3. Mean Values Showing the Extent of Use of Explaining as Respondents' Strategy in Module-Making

No.	Statement	Mean	Standard Deviation	Description
1	I allow my students describe their understanding of math concepts they are exploring.	3.43	0.49	Evident
2	I encourage students to pose questions on math concepts they are exploring.	3.49	0.52	Evident
3	I provide directions in the module on how students will describe and discuss their exploration of learning experiences.	2.69	0.58	Moderately Evident
4	I provide a section in the module to introduce the scientific and technical information on math concepts	4.53	0.50	Very Evident
	Overall Mean	3.54		Evident

Legend:

Scale	Range of Means	Description
5	4.21 – 5.00	Very Evident
4	3.41 – 4.20	Evident
3	2.61 – 3.40	Moderately Evident
2	1.81- 2.60	Not Evident
1	1.00- 1.80	Very Much Not Evident

Table 4 presents the data regarding the use of the "elaborate" strategy in the development process of the mathematics teachers' module. The results indicate that the "elaborate" strategy is not evident, with a low mean score of 1.92. This suggests that teachers do not regularly incorporate

activities that encourage students to make connections between lessons or extend their understanding of the material. Specifically, the teacher-respondents report that they rarely include activities that allow students to connect lessons in the module, with a mean score of 1.69. Additionally, teachers do not consistently provide activities that require the use of technology, as reflected by an even lower mean score of 1.08.

This study emphasizes the underutilization of elaborative learning strategies in module-based mathematics instruction. While much of the existing research emphasizes the importance of elaboration in helping learners apply knowledge across contexts and disciplines, the current findings reveal that such practices remain largely overlooked, particularly in the development of practical modules. This absence may be attributed to limited access to digital resources, insufficient training on integrative teaching techniques, or a predominant focus on rote procedural instruction. This study provides a basis for rethinking professional development programs to emphasize the importance of elaborative strategies. It also provides empirical support for initiatives that aim to equip teachers with tools and frameworks to facilitate the integration of technology, real-life applications, and cross-lesson linkages within modular content design.

Table 4. Mean Values Showing the Extent of Use of Elaborating as Respondents' Strategy in Module-Making

No.	Statement	Mean	Standard Deviation	Description
1	I provide activities in the module that allow students to work with their peers to assess their new understanding of concepts.	2.52	0.57	Not Evident
2	Exercises are provided to allow students to conduct additional investigations, share ideas, and apply knowledge and skills to the real world.	2.37	0.62	Not Evident
3	I ensure that the activities integrated in the module provide great opportunities for students to interrelate the lessons.	1.69	0.61	Very Much Not Evident
4	Activities provided in the module integrate technology such as web-based research or WebQuests.	1.08	0.39	Very Much Not Evident
Overall Mean		1.92		Not Evident

Legend:

Scale	Range of Means	Description
5	4.21 – 5.00	Very Evident
4	3.41 – 4.20	Evident
3	2.61 – 3.40	Moderately Evident
2	1.81- 2.60	Not Evident
1	1.00- 1.80	Very Much Not Evident

Table 5 presents the data regarding the use of the "evaluate" strategy in the mathematics teachers' module development. The results show that "evaluating" is moderately evident, with a mean score of 2.81. This indicates that the teachers incorporate evaluation activities to some extent

in their module development process. Specifically, the teacher-respondents report that they consider formal and informal assessment activities, such as portfolios and performance-based assessments, at a moderate level, with a mean score of 3.12.

The study highlights the uneven application of the evaluation phase in the 5E Instructional Model within localized modular teaching contexts. While prior research emphasizes the importance of ongoing and authentic assessment for promoting reflective learning and feedback-driven improvement, this study finds that most modules still lean toward traditional summative assessments. The findings also suggest that opportunities for students to engage in self and peer - assessment are notably lacking - an observation that supports existing concerns about teacher-centered instruction in modularized education.

Table 5. Mean Values Showing the Extent of Use of Evaluating as Respondents' Strategy in Module-Making

No.	Statement	Mean	Standard Deviation	Description
1	I ensure that the module contains both formal and informal assessment activities.	3.12	0.79	Moderately Evident
2	In the module, I use assessment as an ongoing process where teachers observe their students as the latter apply new concepts and skills and look for evidence of change or modification of thinking.	2.28	0.75	Not Evident
3	There are sections provided for students to conduct self-assessment or peer assessment.	1.17	0.50	Very Much Not Evident
4	I ensure that the module includes summative experiences, such as chapter tests or writing exercises.	4.67	0.49	Very Evident
	Over-All Mean	2.81		Moderately Evident

Legend:

Scale	Range of Means	Description
5	4.21 – 5.00	Very Evident
4	3.41 – 4.20	Evident
3	2.61 – 3.40	Moderately Evident
2	1.81- 2.60	Not Evident
1	1.00- 1.80	Very Much Not Evident

Correlation Between the Strategies and the Extent of Use of Coping Mechanisms on Using Mathematics References

Table 6 presents the correlation between the strategies employed by mathematics teachers in module development and their coping mechanisms when using mathematics references. The results reveal that the strategies and the extent of use of coping mechanisms are not significantly correlated, as indicated by a p-value of 0.691, which exceeds the 0.05 level of significance. This suggests that the strategies used by the teachers in module making do not contribute significantly to their coping mechanisms for addressing challenges in utilizing mathematics references.

This finding contributes to the literature by highlighting a disconnect between the implementation of pedagogical strategies and the management of practical resources among mathematics teachers. While much of the existing research assumes a link between instructional design and teachers' adaptive strategies, the present study indicates that teachers may draw on separate sets of skills or considerations when addressing content delivery and resource limitations.

Table 6. Correlation Matrix Between the Strategies and the Extent of Use of Coping Mechanisms on Using Mathematics References

Strategies of the Respondents in Developing Modules	Problems of Mathematics Teachers in Using Mathematics References			
	r-value	p-value	Decision Rule	Interpretation
	.416	0.691	Accept Ho	Not Significant

Effectiveness of Strategies Employed by Mathematics Teachers in Coping with the Problems They Experience in Using Mathematics References

The table below presents two major themes that explain why the strategies employed by mathematics teachers in terms of "explaining" and "evaluating" are considered effective by the respondents. The identified themes include: (1) the use of economical alternatives to textbooks, and (2) the flexibility in making these strategies available for students.

Economical Alternative to Textbook: Respondents highlighted that the strategies they employ are effective because they often rely on alternatives to traditional textbooks, which are considered more affordable and accessible. These alternatives include digital resources, open-source textbooks, or other materials that do not require students to purchase expensive printed textbooks. Many teacher-respondents highlighted the advantages of using modules as an alternative to traditional textbooks. Participant A shared that, *"Using modules as instructional aids is much more economical for both students and teachers. It really makes teaching and learning more affordable."* Similarly, Participant B emphasized, *"Modules are way cheaper than textbooks, which is a huge advantage for my students, especially those who can't afford the high cost of printed textbooks."* The affordability of modules, particularly digital resources and open-source textbooks, was repeatedly highlighted as a critical factor in their effectiveness. One teacher noted, *"Textbooks can be very restrictive. With modules, I can adapt the content for different lessons without being limited by a fixed structure."* Another teacher echoed this sentiment, saying, *"I prefer digital resources because they are free and can be easily updated. Textbooks, on the other hand, tend to become irrelevant after a while."* Teachers also emphasized that, in their context, textbooks are sometimes unavailable or in limited supply, which makes the use of modules even more essential. As Participant C stated, *"In our school, textbooks are sometimes in short supply. However, modules can be shared digitally, or I can print them out, so every student has access to the material they need."*

Flexibility in Availability: The second theme revolves around the flexibility that teachers have in making instructional strategies available. Respondents emphasized that the ability to modify and adapt both the explanations and evaluation methods according to the needs of students makes these strategies more effective. This flexibility allows teachers to ensure that content is delivered in a way that is accessible and relevant to a diverse range of learners. Teachers highlighted how the ability to adapt content according to student needs makes these strategies more effective. Participant D explained, *"With modules, I can choose content that is relevant to my students' needs at any given time. It's great because it gives me more control over my teaching."* Similarly, Participant E stated, *"Modules allow me to pace the lessons according to how well my students understand the material. I can skip over topics they already know and focus on the areas where they need more help."* This flexibility was appreciated by many, as it enabled them to cater to a diverse range of learners. *"The*

flexibility that comes with modules allows me to adjust the teaching approach based on what my students are struggling with," said Participant F. Another teacher reflected, *"What I really like about modules is that I can adapt the content based on how my students are progressing. I can modify activities to help them better understand difficult concepts."* Furthermore, teachers appreciated how modules facilitated more engaging and hands-on learning. *"With modules, I can incorporate more hands-on activities that allow my students to explore math concepts actively, not just through reading or listening,"* shared Participant G. In addition, the use of modules allowed for continuity in learning, even outside the classroom. *"Even if I am not physically in class, my students can still learn because of the modules. I can provide them with materials to work on and they can continue learning independently,"* explained Participant H. This ability to offer continuous access to learning materials was seen as a significant advantage for student engagement and learning progress.

Table 7. Themes on the Effectiveness of Strategies Employed by Mathematics Teachers in Coping with their Problems

Theme	Major Statements
Economical Alternative to Textbook	Using module as instructional aid is economical for both students and teachers in teaching and learning. Module is not expensive compared to textbooks when making the lesson discussed to students. Textbooks are not practical unlike modules
Can be Flexibly Made Available	I can select contents based on needs. With modules, lessons can be simplified... My module helps me teach even when not physically present

5. Discussion

The findings of this study highlight several key strengths and weaknesses in the way mathematics teachers in Cotabato City design their instructional modules, particularly in relation to the 5E Instructional Model. The analysis reveals a noticeable gap in the use of certain phases, specifically the "engage," "explore," and "elaborate" phases, which significantly impacts the effectiveness of the modules in facilitating student learning and engagement.

One of the primary strengths identified in the modules is the consistent use of the "explain" phase. Teachers tend to include comprehensive sections that provide clear explanations of mathematical concepts, definitions, and procedures. This emphasis on structured content delivery aligns with traditional instructional models, where teachers are the central figures in transmitting knowledge. This approach is beneficial in ensuring that students are exposed to fundamental mathematical concepts, as evidenced by Participant A, who shared, "I ensure that all the key concepts are explained thoroughly so that students can follow the lesson and understand the fundamentals of mathematics." The inclusion of this phase ensures that learners receive a solid foundation in the subject, which is essential for building more complex skills and concepts later on. The study indicates that the "explain" phase is integral in helping students understand the core content and principles of the lessons. The strong emphasis on explanation is a notable strength, as it enables teachers to clarify complex concepts and reinforce students' understanding.

Furthermore, the "evaluate" phase was found to be somewhat effective, especially in terms of summative assessments. Teachers frequently incorporate chapter tests and written exercises into

their modules. Such assessments are essential for measuring student learning outcomes, and the inclusion of these activities reflects a traditional approach to evaluating student performance. According to Participant B, "The chapter tests are an essential part of the module. They allow me to gauge how well my students have understood the material." These types of assessments provide valuable feedback about student progress and enable teachers to measure the overall effectiveness of their instructional strategies. Despite their limitations, summative assessments offer a practical way to evaluate the extent to which students have absorbed the content. However, this reliance on summative assessments can also be seen as a limitation, as it does not fully account for the ongoing, dynamic nature of learning.

However, the study also reveals significant weaknesses in the implementation of the "engage," "explore," and "elaborate" phases. The findings suggest that these phases are underutilized, which may have detrimental effects on the depth of student learning and engagement. These phases are crucial for fostering an interactive and student-centered approach to learning, yet they are often overlooked or inadequately integrated into the module design. The absence of these key phases creates a more teacher-centered, lecture-based approach that may fail to capture students' attention and enthusiasm for the subject matter.

The lack of attention to the "engage" phase is a critical shortcoming. This phase is designed to activate students' prior knowledge, identify misconceptions, and spark their curiosity about the topic at hand. However, the data indicates that teachers rarely consider students' pre-existing knowledge or misunderstandings when designing their modules. This disconnect between prior knowledge and new content may hinder students' ability to build upon what they already know, limiting their ability to integrate new mathematical concepts effectively. Participant C expressed, "I don't always assess what students know before I begin a lesson, and sometimes this makes it harder for them to grasp new concepts." Without this crucial step of engaging students and connecting the new material to their existing knowledge, the modules fail to capitalize on the students' prior experiences. This lack of engagement in the initial stages of instruction suggests that students may not be adequately prepared for the learning process ahead, potentially leading to gaps in understanding and missed opportunities for deeper learning.

Moreover, the absence of strategies such as brainstorming or the use of graphic organizers further exacerbates the issue. These techniques are essential for fostering curiosity and stimulating active participation, which are key components of the "engage" phase. Bybee (2014) emphasized that the engagement phase should serve to ignite student interest and lay the foundation for deeper learning. However, without these techniques, the modules may fail to capture students' attention or inspire them to take ownership of their learning. Participant D noted, "I don't often incorporate activities like brainstorming or K-W-L charts. I focus more on the direct delivery of content, which may not be the best approach for engaging students." The absence of such strategies suggests that the modules may not be effectively setting the stage for active learning and inquiry, which could limit students' motivation and participation in the lesson.

Similarly, the "explore" phase, which involves experiential and inquiry-based learning, is largely absent from the modules. Students are seldom provided with opportunities to manipulate materials, test predictions, or engage in cooperative learning. Duran and Duran (2004) emphasized that exploration is crucial for helping students interact with the content in an active and collaborative manner. Without these opportunities, students miss the chance to develop critical process skills and conceptual understanding. Participant E shared, "My modules don't typically include activities where students can actively explore or investigate. I just give them the content to read and explain it to them directly." This lack of inquiry-based learning limits students' ability to engage in hands-on learning, which is essential for fostering deep understanding. Inquiry-based activities help students make connections between abstract concepts and real-world applications, which is essential in

developing higher-order thinking skills. Without these opportunities, students may struggle to retain the information and apply it meaningfully in future learning contexts.

Furthermore, the "elaborate" phase, which is designed to extend and deepen students' understanding, is also underrepresented in the modules. Few activities encourage students to apply mathematical concepts in real-world contexts or to connect ideas across lessons. The lack of such opportunities may inhibit the transfer of knowledge beyond the classroom. By not integrating real-life applications or interdisciplinary connections, teachers miss the chance to help students see the relevance of what they are learning in everyday life. Participant F commented, "I rarely include activities that allow students to connect math concepts with real-world problems. I focus mostly on theoretical aspects, which may limit their ability to apply what they learn outside the classroom." The absence of such real-world applications may make the learning experience feel disconnected from students' everyday lives, reducing their motivation to engage with the content meaningfully. The "elaborate" phase should help students make these connections, but this is often overlooked in favor of theoretical and abstract instruction.

Another area of weakness is the absence of collaborative learning opportunities in the modules. Collaborative activities are vital for developing social learning and critical thinking skills, as outlined by Vygotskian principles. These activities encourage students to communicate, share ideas, and learn from one another's perspectives. However, the modules in this study rarely included such activities. Participant G expressed, "I don't use much group work. Most of the learning happens individually, and I think this limits students' ability to collaborate and learn from each other." The lack of collaboration prevents students from discussing ideas, sharing insights, and collectively constructing knowledge, which limits the depth of their learning and reduces their ability to develop important interpersonal skills. Collaborative activities can also help students feel more connected to the learning process, which in turn can enhance their motivation and engagement.

In terms of evaluation, while summative assessments are included, formative assessment practices are largely neglected. Black and Wiliam (1998) argue that formative assessment is crucial for improving student achievement, as it provides ongoing feedback that can inform instruction. However, teachers in this study appear to focus primarily on summative evaluations, with little attention given to formative assessments that could guide students' learning progress. Participant H explained, "I mostly rely on tests and exercises at the end of the unit. I do not do much in terms of giving feedback during the learning process." Formative assessment is a powerful tool for identifying areas where students are struggling and providing targeted support. Its absence means that teachers may miss opportunities to adjust instruction and support students as they progress through the learning material.

Despite these weaknesses, the study suggests that the strategies teachers use in the "explain" and "evaluate" phases are effective in helping them adapt to resource limitations. Teachers emphasized the practicality and cost-effectiveness of using open-access materials and self-developed resources, which allow them to adjust instruction to fit the needs of their students without incurring additional financial burdens. This flexibility is particularly valuable in resource-constrained environments, where traditional textbooks and materials may be unavailable. However, as indicated by the lack of emphasis on other phases, there is a clear need for professional development that focuses on the holistic application of the 5E Instructional Model.

To address these gaps, professional development programs should provide teachers with the tools and strategies to incorporate all phases of the 5E Instructional Model effectively. Teachers need guidance on how to engage students actively in the learning process, offer opportunities for inquiry-based exploration, and provide activities that extend understanding and foster collaborative learning.

Such support would help teachers balance content delivery with interactive, student-centered strategies that promote deeper engagement and learning.

6. Limitations of the Study

This study was conducted to investigate the instructional strategies used by secondary mathematics teachers in Cotabato City in the development of their learning modules, particularly in relation to the 5E Instructional Model.

The study was confined to secondary schools in Cotabato City, and therefore, the findings may not reflect the experiences or practices of mathematics teachers in other divisions or regions with different institutional structures, resources, or policy directives. Generalizations beyond the local context should be approached with caution.

Additionally, the data gathered during the quantitative phase were based on self-reported responses. Although the survey instrument was carefully developed and reviewed for clarity and relevance, the accuracy of the responses depended on the honesty and self-awareness of the participants. As with many self-assessment tools, there is a possibility that some responses may have been influenced by personal bias or a desire to present oneself in a favorable light.

The qualitative phase, which involved interviews and document analysis, also presented certain constraints. Only a selected number of teachers were interviewed and a limited number of module samples were reviewed. While this was sufficient for identifying recurring themes and validating quantitative findings, it may not fully capture the breadth of strategies used by all mathematics teachers in the city. The study did not include classroom observations, which could have provided further insights into the actual implementation of strategies and alignment with what was reported in the surveys and interviews.

7. Suggestion

Considering the findings of this study, it is recommended that mathematics teachers in Cotabato City consider adopting the 5E Instructional Model to enhance the relevance, engagement, and effectiveness of their instructional modules. Shifting from traditional, teacher-centered methods to more interactive and student-centered learning approaches can better meet the diverse learning needs of students. In incorporating the five phases of the 5E Model, they can create a more dynamic learning environment that promotes critical thinking and deeper conceptual understanding.

Furthermore, teachers should undergo training to familiarize themselves with the 5E Instructional Model. Professional development initiatives focused on this model will enable teachers to enhance their ability to design engaging and comprehensive modules. Training programs can equip teachers with the skills needed to effectively incorporate each phase of the model, ensuring that modules are both engaging and educational.

It is also crucial that teachers integrate hands-on activities, inquiry-based learning, and cooperative learning opportunities into their instructional modules. These strategies can help students actively engage with mathematical content, allowing them to explore ideas more deeply and develop a stronger understanding of concepts. Including such interactive elements in lessons will foster a more dynamic and engaging learning environment.

Incorporating technology into the module design is another important recommendation. Teachers should consider utilizing online resources, educational apps, and interactive assessments to create a more engaging and accessible learning experience. Technology not only supports student engagement but also provides opportunities for personalized learning, giving students more control over their learning process.

Also, teachers should use a variety of assessment methods, such as formative assessments, self-assessments, and peer assessments, to monitor student progress throughout the learning process. These assessments provide valuable feedback that can help teachers and students identify areas of improvement. Diversifying assessment practices can also enhance student engagement and ensure a more accurate understanding of their progress.

It is essential for teachers to assess students' prior knowledge and identify any misconceptions at the beginning of lessons. This can be achieved through the use of diagnostic tools and class discussions that help shape the design of the instructional modules. Tailoring lesson content to students' existing knowledge will help make new material more accessible and ensure that it is built on a solid foundation.

Teachers should also be encouraged to collaborate with their peers to share ideas, resources, and strategies for module development. This collaborative approach can create a professional learning community that supports the exchange of best practices and helps overcome challenges in teaching. Schools should promote this type of peer support, which can lead to improved teaching practices and better learning outcomes for students.

Moreover, it is important for schools to provide teachers with the necessary time and resources to review and refine their instructional modules. Regular professional development, feedback sessions, and opportunities for reflection are critical in ensuring that modules remain effective and responsive to the needs of students. By supporting teachers in this way, schools can foster continuous improvement in teaching practices, ensuring that instructional materials are both relevant and effective.

Declarations

Author Contributions. Mobarac R. Dimasindel is the sole author of this study and was responsible for the conceptualization, literature review, methodology, data collection, data analysis, manuscript writing, and final review. All work was completed independently.

Conflicts of Interest. The author declares no conflict of interest.

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Ethical Approval. While a fully established ethics committee is not yet in place, an in-house review was conducted by a designated committee appointed by the University President. This committee, which is currently applying for formal accreditation and developing its manual of operations, reviewed the ethical aspects of this study to ensure adherence to research standards.

Data Availability Statement. The data supporting the findings of this study are available from the author upon reasonable request.

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During the preparation of this work, the author used [the AI TOOL / SERVICE] to check grammar and redundancy, and observe consistency of wordings in the paper's contents. The author declares that he reviewed and edited the final output as needed and take(s) full responsibility for the content of the published article.

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About the Contributor(s)

Mobarac Dimasindel, Cotabato State University, College of Teacher Education - Mathematics Department, Philippines

Email: movz_20@yahoo.com

ORCID: <https://orcid.org/0000-0003-2047-593>

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