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Comparative Analysis of Mathematics Education Among Southeast Asian Nations

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Abstract

The aim of this research was to explore the significant differences in content structure, pedagogical strategies, and evaluation processes in the mathematics curricula of selected Southeast Asian nations to ensure more responsive and effective curriculum development. The research was conducted through a comparative qualitative research method with a reliance on the systematic literature review as the most appropriate research method. The research was carried out exclusively through systematically identified and screened secondary sources, including peer-reviewed journal articles, international assessment reports and, curriculum frameworks to ensure methodological rigor, transparency, credibility, and consistency. The findings reveal significant differences in the structure, delivery, and evaluation processes in the mathematics curricula in Southeast Asia. The findings show that Singapore has a highly coherent curriculum with significant conceptual depth in its curriculum, with more focus on mastering and progressing to advanced levels of mathematical thinking. In contrast, the Philippines, Cambodia, Indonesia, and Brunei have more focus on mastering basic skills with contextual learning, with less systematic coverage of advanced levels of thinking in mathematics. The pedagogical strategies employed in the region range from highly structured mastery learning to student-centered and contextualized learning strategies. The evaluation processes in the region range from formative evaluation to mastery learning to more summative evaluation processes. The findings show that highly coherent, rich, and aligned curricula are critical in providing highly effective mathematics education in Southeast Asia.

Keywords: Mathematics education curriculum, Curriculum structure, Pedagogical approaches, Assessments Practices.

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1. Introduction

Curriculum plays an essential role in the development of mathematics education. Various scholars with different theoretical lenses define curriculum. Curriculum is seen as part of the universal right to inclusive and equitable quality education, which is focused on lifelong learning and competencies. Borji and Farsani (2023) defined curriculum as the planned sequence of learning experiences that occur during instruction, which is embodied through written curriculum documents and materials. Mathematics curriculum, in the context of the Merdeka curriculum of Indonesia, is a structured plan within a broader national curriculum that balances values, competencies, and academic skills. In comparison with the K-12 curriculum of the Philippines, which is academic-focused and standardized, the Merdeka curriculum of Indonesia is character-focused and flexible.

Borji and Farsani (2023) highlighted mathematics education as a formal plan that specifies what students should learn. Syomwene (2020) emphasized mathematics education curriculum as a multi-layered system connecting policy, teaching, and student outcomes. Mathematics education curriculum as a holistic framework that goes beyond rote learning and connects mathematics to real-world challenges and global competitiveness. It plays a central role in forming students' critical, analytical, and logical thinking abilities, which are essential foundations for intellectual development and problem-solving skills (Hadar & Tirosh, 2019).

Mathematics education curricula vary from country to country, particularly in Southeast Asian Countries. Ocumen and Callaman (2025) state that Singapore's curriculum is focused on mastery progression with great emphasis on depth, while the Philippines follows a much broader spiral progression with a strong emphasis on progressive skill development. Both offer a different perspective on how the mathematics education curriculum is implemented. The Merdeka curriculum of Indonesia is focused on project-based and contextual learning in improving students' literacy and numeracy skills, while China's mathematics curriculum is heavily focused on mastering strong foundational mathematical concepts (Sumliyah et al., 2025). Thailand's mathematics curriculum is heavily focused on data representation for elementary students, while Indonesia introduces data representation together with probability and uncertainty in the later grades.

Although several studies have compared national mathematics curricula across Southeast Asian countries, most analyses primarily emphasize broad curriculum goals, progression models, or competency standards. There is still limited research that systematically identifies and examines the key differences in three critical dimensions of curriculum implementation: content structure, pedagogical approaches, and assessment practices. While existing literature notes variations in academic focus, flexibility, and competency integration, few comparative studies provide a detailed exploration of how mathematical content is organized, how teachers operationalize curriculum through instructional strategies, and how learning is evaluated across Southeast Asian countries. This gap limits a deeper understanding of how these curriculum dimensions shape students' learning experiences and outcomes. Thus, this study aims to identify and analyze the key differences in content structure, pedagogical approaches, and assessment practices in the mathematics curricula among Southeast Asian countries to inform more responsive and effective curriculum development (Sumliyah et al., 2025).

Specifically, this study will seek to answer the following questions:

- a. How does the content structure of mathematics curriculum differ among the ASEAN countries in terms of scope and depth of mathematical concepts?

- b. What differences exist in the pedagogical approaches of mathematics curriculum among the ASEAN countries?
- c. How do the assessment practices differ among the ASEAN countries?

2. Method/Approach

Research Design

This study makes use of a Systematic Literature Review (SLR) design in undertaking a thorough and comparative analysis of the state of mathematics education in the countries within the Southeast Asian region. The study design is anchored on the methodological framework developed by Barbara Kitchenham (2004), which provides a systematic and rigorous method of identifying and synthesizing relevant literature and academic studies on the chosen subject matter or theme. The study design is characterized by the systematic undertaking of procedures and processes that are in accordance with the PRISMA guidelines to ensure the systematic identification and inclusion of relevant literature and academic studies on the subject matter or theme.

By the systematic undertaking of the processes and procedures in the study design, the study is able to gather all the necessary and relevant information from diverse literatures and academic sources across the world to arrive at valid and evidence-based conclusions and recommendations on the subject matter or theme. The study design makes use of a systematic and rigorous method to gather all the necessary and relevant information from diverse literatures and academic sources across the world to arrive at valid and evidence-based conclusions and recommendations on the subject matter or theme.

Data Sources

The sources of data for this research were identified through a thorough and meticulous search of prominent international academic databases to ensure breadth, credibility, and research rigor. The primary databases used for this research were Scopus, Google Scholar, ERIC, and Web of Science, as these platforms feature prominent, high-impact factor journals in education, curriculum studies, and comparative education. To ensure breadth, the research was limited to studies published between 2020 and 2025. The research also includes official curriculum documents, policy reports, and national education reports retrieved from government portals of Southeast Asian nations, as well as reports from international assessment agencies such as the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS).

To ensure research rigor, a systematic Boolean search was conducted using combinations of search terms such as “mathematics education,” “curriculum structure,” “pedagogical approaches,” “assessment strategies,” “comparative education,” and “Southeast Asia.” The search terms were systematically combined using Boolean operators such as AND and OR to ensure relevance. The search was limited to only peer-reviewed journal articles, empirical research, policy reports, and official curriculum documents written in English. The titles were further filtered using predetermined inclusion and exclusion criteria before moving to the next phase of the research.

To ensure research rigor, all the studies identified were subjected to a quality appraisal process to evaluate their research design, methodological quality, data validity, and research analysis. To ensure research rigor, a data extraction matrix was used to extract relevant information such as country context, curriculum features, pedagogical strategies, assessment

models, and research findings. The systematic and transparent data sourcing process helped to ensure that the research was grounded in reliable, diverse, and internationally recognized literature.

Data Collection

The data collection procedure for this comparative study involved the systematic and rigorous identification and retrieval of official documents and academic texts. This methodological approach was adopted to minimize selection bias and maintain the integrity of the subsequent qualitative content analysis.

The process began with the systematic identification of studies and official curriculum documents from various research databases, governmental ministry websites, and academic repositories. Search terms were strategically constructed to capture literature directly related to the mathematics curriculum, pedagogy, and assessment practices in the target Southeast Asian countries, ensuring relevance to the study's scope. This systematic searching minimized selection bias and guaranteed that the collected texts provided adequate information for a comprehensive comparative analysis.

A rigorous selection process was implemented, focusing solely on the mathematics curriculum documents and related scholarly texts. Only documents explicitly detailing content structure, pedagogical approaches, and assessment practices were admitted into the final data corpus. This ensured that the final corpus of data was fit-for-purpose, directly addressing the three critical comparative domains required by the research questions.

Data Analysis

The analysis component of this research employed Qualitative Content Analysis (QCA), which provides a structured and iterative method for analyzing textual data. This methodology involved systematically reviewing and coding the content of all collected sources to extract data related to the curricula's philosophical underpinnings, content structure, pedagogical approaches, and assessment practices (Shava et al., [2021](#)). The QCA procedure followed established steps, beginning with open coding to identify descriptive elements, followed by axial coding to group elements into analytical categories, and concluding with selective coding to identify overarching themes for comparison.

The primary analytical step was the comparative analysis of the coded data, which focused on synthesizing the findings to highlight not only surface-level differences but also deeper systemic differences in philosophical and pedagogical emphasis. This process allowed for the identification of best practices and specific areas for curriculum improvement across the compared nations. Codes were continuously compared across national documents to ensure consistency and to develop stable, grounded categories that accurately reflected the data (Glaser & Strauss, [1967](#)).

To enhance the trustworthiness and academic rigor of the findings, triangulation was implemented. This involved incorporating insights derived from multiple sources—including official curriculum documents, policy papers, and academic research—to ensure that the thematic interpretations were supported by converging lines of evidence (Thurmond, [2001](#)). This multi-faceted validation process ensured that the conclusions drawn are robust and academically defensible.

Scope and Limitations

The scope of the research is strictly limited to the comparison of studies that focus on written mathematics curricula across Southeast Asian countries. The investigation is narrowly confined to analyzing curriculum documents across three critical domains: content structure,

pedagogical approaches, and assessment practices. By focusing solely on these formal, written documents, the study remains manageable and directly addresses the core research questions derived from the curriculum's intended objectives.

A critical limitation of this study pertains to the data type and analysis focus: the research will only focus on written curricula. This means the investigation is restricted to the intended curriculum—what is officially documented and mandated—rather than the implemented curriculum or the achieved curriculum. Consequently, the findings cannot account for the fidelity of curriculum implementation, the influence of teacher training, school resources, or the actual day-to-day practices of making or enacting the curriculum. While this limitation is inherent to a systematic literature review design, the reliance on official texts ensures the study maintains focus and controls for variables related to local pedagogical variation, leading to conclusions directly applicable to policy and curriculum design.

Another significant limitation is the reliance on secondary data published between 2020 and 2025, which includes published journals, published research articles, and international assessment results. While this provides a contemporary view of the subject, the study is inherently dependent on the quality, accessibility, and translation accuracy of the official documents and academic research available in the public domain. The analysis is limited by the specific perspectives and thematic coverage prioritized by the source documents themselves.

3. Results and Discussion

This section presents the results and discussion of the comparative analysis of mathematics education among selected Southeast Asian nations. The findings highlight similarities and differences in curriculum structure, instructional approaches, student performance, and educational outcomes across the region. By examining these patterns, the analysis provides insights into how national policies, teaching practices, and socio-cultural contexts influence mathematics learning. The discussion further interprets these results in relation to existing literature and regional benchmarks, offering implications for improving mathematics education and informing future educational reforms in Southeast Asia.

As shown in [Table 1](#), Singapore's mathematics curriculum demonstrates the broadest scope of topics among the selected ASEAN countries. It encompasses content ranging from basic arithmetic to advanced mathematical areas such as algebra, trigonometry, and calculus. This wide coverage reflects a curriculum design that emphasizes conceptual depth and progressive complexity, allowing learners to develop strong foundational skills before advancing to higher-level mathematical concepts. The inclusion of advanced topics at earlier stages supports higher-order thinking and problem-solving skills, positioning Singapore as a benchmark for comprehensive mathematics content structure in the region.

On the other hand, Philippine curriculum generally focuses on foundational topics, including arithmetic, algebra, and geometry. While these areas provide essential mathematical grounding, the scope of higher-level topics is comparatively limited. This suggests that the curriculum prioritizes mastery of basic competencies and real-life applications rather than extensive exposure to advanced mathematical concepts. As a result, learners may have fewer opportunities to engage with complex mathematical ideas within the basic education cycle.

Table 1. Content Structure in terms of the Scope of Topics

ASEAN Country	Description
Singapore	Singapore's curriculum is intentionally progressive and vertically coherent, designed to build conceptual depth before procedural drills.
Philippines	The national curriculum aims for conceptual understanding and real-life application, but existing literature notes that the curriculum has fewer advanced topics and less depth in higher-order mathematics, which may lead to inconsistencies in students' conceptual development.
Cambodia	Cambodia's mathematics curriculum is focused mainly on basic and foundational topics (arithmetic, basic algebra, geometry) with less development of higher-level topics such as functions, trigonometry, or advanced problem solving. Educational reports indicate challenges in scope expansion due to systemic limitations in teacher preparation and resources.
Brunei	Brunei has a structured national curriculum that covers foundational and intermediate topics (e.g., arithmetic, algebra, geometry). As a result, a significant focus remains on core numeracy and procedural fluency before introducing advanced topics later.
Indonesia	Indonesia's curriculum strongly focuses on arithmetic, basic algebra, and geometry. It has some intermediate topics, but with relatively limited emphasis on advanced mathematical thinking (e.g., trigonometry, functions, statistics) in basic education.

Moreover, [Table 1](#) indicates Cambodia's mathematics curriculum as primarily centered on basic and fundamental mathematical topics, such as arithmetic and introductory algebra and geometry. The scope of topics is relatively narrow, with limited inclusion of higher-level mathematics. This content structure suggests a curriculum designed to strengthen essential numeracy skills, which is crucial in contexts where access to instructional resources and trained mathematics teachers may be constrained.

Brunei's mathematics curriculum, as presented in [Table 1](#), shows a strong emphasis on core mathematical areas, particularly arithmetic, algebra, and geometry. However, similar to Cambodia and the Philippines, the curriculum includes fewer advanced mathematical topics. This indicates a focus on ensuring solid foundational knowledge before introducing higher-level concepts, which may be addressed at later stages of education rather than within the basic curriculum.

In addition, Indonesia's mathematics curriculum concentrates largely on foundational and intermediate topics, such as arithmetic, algebra, and geometry. The limited presence of higher-level mathematical subjects suggests that the curriculum prioritizes breadth of basic competencies across learners. While this approach supports national standards in numeracy, it may also limit early exposure to advanced mathematical reasoning and abstract thinking.

In conclusion, [Table 1](#) highlights clear differences in the scope of mathematics content across the selected ASEAN countries. Singapore exhibits a comprehensive curriculum that

Table 2. Content Structure in terms of Depth of Concepts

ASEAN Country	Description
Singapore	It has an extremely high level of depth with a well-structured progression to help students fully master each topic prior to moving on to the next most complex topic. It focuses on spiral curriculum with recursive deepening, mastery before progression, and high emphasis on reasoning and problem solving.
Philippines	It has a moderate amount of depth in master's level Mathematics but places an emphasis on using mathematical skills for real life situations. It focuses on moderate depth of core concepts, strong real-world application focus, and flexible progression among topics.
Cambodia	Cambodia's mathematics curriculum places emphasis on foundational conceptual understanding during the early years. It focuses on strong foundational depth at early levels, emphasis on reasoning over rote learning, and limited exposure to advanced conceptual depth due to system constraints.
Indonesia	Indonesia's mathematics curriculum strives for a balance between foundational competence and deeper conceptual understanding, especially through its focus on problem solving and creativity within mathematics learning. It focuses on balanced foundational and conceptual focus, encourages problem-solving strategies, and depth in topics often varies by teacher implementation.
Brunei	Brunei's national mathematics curriculum has a solid focus on foundational conceptual understanding in early grades, similar to many ASEAN systems, but also places importance on developing critical thinking and 21st-century competencies. It focuses on strong emphasis on foundational mathematics, moderate progression into advanced topics, and alignment with broader 21st-century competency goals.

spans from basic to advanced topics, while the Philippines, Cambodia, Brunei, and Indonesia place stronger emphasis on foundational mathematics with limited higher-level content. These differences in scope reflect varying educational priorities and capacities and have important implications for students' mathematical preparedness and progression across education systems.

In [Table 2](#), the level of depth, the manner in which it is organized, and the level of emphasis on reasoning, problem-solving, and real-life applications differ from one nation to another. Singapore is notable for its extremely deep and well-structured curriculum that makes sure that the student understands the subject matter thoroughly before moving on to the next level of difficulty. The curriculum is also notable for its spiraling method, which revisits the material at increasing levels of difficulty and emphasizes reasoning, problem-solving, and conceptual understanding.

In the case of the Philippines, the level of depth is moderate at the master's level, with a strong emphasis on the real-life applications of the subject matter. The basic concepts are developed with a good level of understanding, and the sequence of the topics is flexible enough to accommodate the context in which the student learns.

Table 3. Content Structure in terms of Curriculum Coherence and Progression

ASEAN Country	Description
Singapore	The curriculum in Singapore has a tightly structured spiral progression with strong vertical coherence across grades. It stresses mastery in certain areas while preparing learners for the skills needed in the 21st century.
Philippines	The curriculum in the Philippines includes a wide range of subjects with moderate coherence in its sequencing. It offers flexibility in its progression to cater to different learners. It stresses application to real-life situations.
Cambodia	The curriculum in Cambodia is divided into education cycles with increasing levels of coherence. It includes a progression map across grades, with basic subjects combined with electives in the upper grades.
Indonesia	The curriculum in Indonesia includes flexible sequencing and progression with adaptations to suit the country. It balances coherence with student-centric learning.
Brunei	The curriculum in Brunei, known as SPN21, includes a structured progression with high levels of coherence in its curriculum. It stresses broad skills, national values, and preparation for the future.

For Cambodian math, there is a strong focus on the conceptual level of understanding, especially in the early years. The focus is on reasoning and conceptual understanding rather than memorization, and the student gets a good foundation in the subject matter before moving on to the next level of difficulty. The exposure to the next level of difficulty is usually slow due to the limitations in the system.

In Indonesia, the main goal is to ensure students have a solid foundation in the basics and a deeper understanding of the concepts. In problem-solving and creativity, students use reasoning skills to go beyond memorization and get involved in mathematics. However, the depth of the topics covered varies due to differences in implementation and the availability of resources among teachers and schools. This affects the extent to which students achieve a deeper understanding of the concepts.

Additionally, in Brunei, the mathematics curriculum is designed to ensure students have a solid foundation in the basics in the early years of study, similar to the mathematics curricula in the rest of ASEAN nations. It gradually introduces students to critical thinking and 21st-century skills. It ensures students have a solid foundation in the basics before introducing them to more advanced topics. The mathematics curricula in the Philippines and Brunei combine a solid foundation in the basics and the practical applications of the concepts. In addition, they cover other important skills required for the 21st-century student. In Cambodia, the mathematics curriculum ensures students have a solid foundation in the basics and use reasoning skills in the early years of study. It covers limited topics in advanced mathematics. In Indonesia, the mathematics curriculum ensures students have a solid foundation in the basics and use problem-solving skills and creativity.

In conclusion, all the mathematics curricula in the Southeast Asian nations aim to ensure students have a deeper understanding of the concepts and use reasoning skills in problem-solving. However, the approaches adopted in the mathematics curricula vary from country to country.

Table 3 shows the content structures in terms of Curriculum Coherence and Progression. In Singapore, the math curriculum has a very tight, spiraling progression. This means that things stay nicely aligned from grade to grade. The topics are arranged in such a way that prior knowledge is used as a basis for new concepts, enabling students to master concepts before

they get more difficult. It covers conventional math skills, as well as 21st-century skills such as problem-solving, reasoning, and critical thinking, which are very important for higher education and beyond.

Meanwhile, in the Philippines, the math curriculum covers a wide range of topics with moderate, flexible sequencing. This means that the topics change as the pace of the students differs. It also focuses on the application of concepts, which enables critical thinking and problem-solving. However, mastery of concepts can vary because of the wide range of topics and flexible sequencing.

Cambodian math curriculum is arranged based on separate education cycles, which become more coherent as the students get older. The early years of education concentrate on the basics, with later years offering elective courses for more specialized studies. The progression map ensures continuity of learning, but coherence can vary because of resource and implementation issues.

In Indonesia, the curriculum provides flexibility in the sequence and progression that can be adapted to regional and local contexts. The curriculum seeks to balance the need to be coherent and at the same time accommodate student-centered approaches to teaching and learning, allowing teachers to adapt and accommodate individual student needs within a coherent and structured whole.

In the case of Brunei's SPN21, it can be noted that this is a very structured and coherent system that provides vertical coherence to the teaching and learning process, where there is a clear and grade-level sequence to the process. Emphasis is given to basic and advanced mathematical skills, along with other skills and values that can be considered on a national level and that can be used to address future challenges that may be encountered by students.

From the five countries that were analyzed, it can be noted that there is a wide range of approaches to teaching and learning mathematics, from a very coherent and structured system like that found in Singapore and Brunei to a more flexible and adaptive system found in the Philippines and Indonesia, and a move towards a more coherent system found in Cambodia.

All these curricula seek to develop basic skills and conceptual understanding and to apply these to the real world and to future needs in a variety of ways to meet the needs of the students and to develop a sense of mathematical understanding and 21st-century skills in students.

The results in [Table 4](#) highlight clear differences in how ASEAN countries design and structure their mathematics curricula, reflecting varying educational priorities and pedagogical philosophies.

Singapore's curriculum stands out for its high level of coherence and systematic design. The spiral, mastery-based progression ensures that concepts are revisited at increasing levels of complexity, allowing learners to develop deep conceptual understanding before moving on. This strong alignment between content, sequence, and learning outcomes supports sustained mathematical proficiency and has been widely associated with strong student performance.

In contrast, the Philippines adopts a broad K–12 curriculum that distributes mathematical content across multiple learning areas. While this structure allows flexibility and wide coverage, it also results in less coherence in progression. The spread of topics may limit opportunities for in-depth mastery, as students are required to engage with many concepts within limited instructional time.

Cambodia's curriculum design reveals challenges in coherence, particularly in the sequencing of geometry topics. Weak alignment between intended learning outcomes and instructional content suggests gaps in curricular continuity, which may affect students' ability to build mathematical understanding systematically across grade levels.

Table 4. Pedagogical Approaches in terms of Curriculum Design and Structure

ASEAN Country	Description
Singapore	A highly coherent and sequenced spiral model provides a pathway for students to progress through a mastery-based process. Emphasis is on vertical alignment across grade levels, incorporating concrete-pictorial-abstract (CPA) progressions, model drawing, heuristics, reasoning, and metacognitive strategies. The focus here is on students developing a solid conceptual foundation before progressing to more complex topics.
Philippines	A K-12 framework that covers various subjects and allows for different progressions to accommodate different students provides a broad spectrum for students to progress through. The level of sequencing provides a moderate level of coherence, and the teaching focus emphasizes applications to everyday life, problem-solving, and critical thinking.
Cambodia	A series of education cycles that gradually increases in coherence as students progress through grade levels provides a pathway for students to follow. Initially, students focus on basic subjects before progressing to electives. The teaching focus here is on student-centered active learning, which incorporates hands-on activities and teamwork to promote student engagement and understanding. Reasoning skills take precedence over memorization, although this level of coherence may be more evident in some areas, such as geometry, and less evident in other areas.
Indonesia	The curriculum changes its order in line with regional and cultural factors. It focuses on student-oriented, culturally relevant education—celebrating ethnomathematics—yet also stresses character development and social values. The content coverage in terms of depth and comprehensiveness depends on the pedagogical strategies of the teacher.
Brunei	The curriculum in SPN21 offers a clear progression of content in line with grades. It focuses on basic competencies and critical learning outcomes such as reasoning, problem-solving, and application of learning. The pedagogical strategies encourage critical thinking, reflection, and contextual problem-solving in line with curriculum standards to ensure

Indonesia's curriculum places stronger emphasis on character development and social values than on mastery of mathematical concepts. While this holistic orientation aligns with national education goals, it may reduce the focus on structured content progression and depth of mathematical learning, especially in higher-level competencies.

Brunei's curriculum emphasizes core competencies and clearly defined essential outcomes. Beyond content knowledge, students are expected to demonstrate mathematical processes such as reasoning and problem solving. This outcomes-based structure reflects a balance between conceptual understanding and skill development, positioning mathematics learning within broader cognitive competencies.

The comparison shows a spectrum of curriculum design approaches in ASEAN countries. These differences suggest that curriculum coherence, alignment, and emphasis on essential outcomes play a significant role in shaping the quality and focus of mathematics education across the region.

Table 5. Pedagogical Approaches in terms of Teaching-Learning Approach

ASEAN Country	Description
Singapore	The Singaporean curriculum is highly coherent and systematic. It has a spiral approach to learning, which is mastery-based. The Singaporean curriculum revisits key concepts of varying levels of complexity. It is highly focused on learning outcomes, with an emphasis on understanding, reasoning, and problem-solving skills. The Singaporean approach also includes 21st-century competencies, which include critical thinking, collaboration, and independent learning.
Philippines	The Philippine K-12 curriculum has a broad range of learning subjects that are grouped into five learning areas. It is highly flexible when it comes to content sequencing. The Philippine curriculum is moderately coherent. The sequencing of learning content is dependent on teacher discretion. The Philippine approach is highly focused on learning outcomes. It has a variety of learning pathways, especially in senior high school, which include STEM, HUMSS, and TVL.
Cambodia	Cambodia has a curriculum with structural cycles for primary and secondary education. However, there is a lack of coherence, particularly with regards to specific topics such as geometry. Despite the efforts to improve alignment and learning results, there is inconsistency with regards to progression. There are also efforts to ensure the integration of major subjects, life skills, and ICT skills.
Indonesia	Indonesia has a curriculum that focuses on character building, social values, and holistic education, rather than content mastery. It also has flexibility, which allows schools to adjust content to suit their environments under the concept of “Merdeka Belajar” or free learning. This encourages active engagement and student-centered activity. It is competency-based, which means that there is an integration of cognitive, social, and emotional skills. Progression is also based on competency.
Brunei	Brunei has an SPN21 curriculum that focuses on major competencies and basic results for all levels. This ensures that students develop content mastery and higher-order skills such as reasoning, problem-solving, and mathematical skills. The curriculum has coherence, which means that there is a structured sequencing, strong progression, and strong emphasis on national values, citizenship, and 21st-century skills.

The results presented in [Table 5](#) illustrate notable variations in the teaching–learning approaches adopted in mathematics education across selected ASEAN countries, reflecting differences in instructional philosophies and classroom practices.

Singapore demonstrates a highly structured and well-defined teaching–learning approach, with strong emphasis on problem solving and mathematical reasoning. The use of the Concrete–Pictorial–Abstract (CPA) framework supports learners’ conceptual development by guiding them from hands-on experiences to visual representations and finally to abstract symbols. This structured instructional model promotes clarity, coherence, and depth of understanding in mathematics learning.

In the Philippines, the teaching–learning approach aligns with the broad K–12 framework, where content is distributed across multiple learning areas. While this allows flexibility in instruction and integration of varied learning experiences, it may also result in

Table 6. Pedagogical Approaches in terms of Problem Solving

ASEAN Country	Description
Singapore	Central to pedagogy; model drawing, heuristics, metacognitive strategies emphasized across grade levels.
Philippines	Problem solving is a core competency across all grade levels. Emphasis is on higher-order thinking and real-world applications.
Cambodia	Problem solving is context-based and linked to daily life. Emphasis is on understanding concepts before procedures.
Indonesia	Realistic mathematics and ethnomathematics used to support conceptual reasoning.
Brunei	Problem-solving framework recently introduced; aims to shift from routine tasks to authentic modeling.

less coherent progression in classroom practice. Teachers often need to balance coverage of content with depth of understanding, which can affect the consistency of instructional approaches across grade levels.

Cambodia's mathematics instruction is characterized by student-centered and active learning strategies. Teachers employ activities that engage learners directly, using hands-on experiences to help students construct mathematical understanding. This approach supports learner participation and conceptual development, particularly in foundational skills, although its effectiveness may depend on teacher capacity and available resources.

Indonesia's teaching-learning approach remains largely rote-based, with memorization and repetition playing a significant role. However, the integration of ethnomathematics serves as an important strategy to contextualize learning by connecting mathematical concepts to students' cultural and daily experiences. This contextualization may enhance relevance, although the dominance of rote methods can limit opportunities for higher-order thinking.

Brunei adopts a contextual and problem-solving-oriented approach through the RECCE-MODEL, which emphasizes real-life applications of mathematics. This model reflects a shift toward learner-centered and inquiry-based instruction. However, the findings suggest that teachers are still in the process of developing the necessary pedagogical skills to fully implement this approach effectively in classroom settings.

In general, the results indicate a continuum of teaching-learning approaches in mathematics across ASEAN countries, ranging from highly structured and problem-solving-focused instruction to more flexible, activity-based, or culturally contextualized practices. These differences highlight the influence of national education goals, teacher preparation, and curriculum support on the enactment of mathematics teaching and learning in the classroom.

The findings in [Table 6](#) reveal both shared priorities and distinct emphases in how selected ASEAN countries integrate problem solving into their mathematics education curricula.

In the Singaporean curriculum, problem-solving is at the heart of mathematics education, with systematic development of problem-solving skills at all grade levels. Students are encouraged to use model drawing, heuristics, and metacognitive skills to solve problems, which enables them to solve complex problems using systematic reasoning. This is integrated with a well-structured curriculum that ensures progressive development of skills.

Moreover, problem-solving in the Philippines is identified as a basic competence in the K-12 curriculum. The curriculum focuses on higher-order thinking skills in problem-solving. Students are encouraged to analyze, evaluate, and create rather than memorize. This enables

Table 7. Assessment Practices in terms of Alignment to the Curriculum

ASEAN Country	Description
Singapore	Continuous, mastery-aligned assessments integrated into curriculum standards; supports progression and conceptual mastery.
Philippines	Spiral content but inconsistent depth limits assessment coherence
Cambodia	Fragmented curriculum progression causes uneven assessment alignment.
Indonesia	Values- and competency-oriented frameworks influence assessment structure.
Brunei	Curriculum-aligned assessments emphasize competency mastery and learning outcomes, though alignment varies due to ongoing transitions toward outcome-based education.

them to develop critical thinking skills that can be applied in real-life situations. However, it is also important to ensure that all students master problem-solving skills with the guidance of teachers.

Additionally, Cambodian mathematics education focuses on the context-based student-centered approach. The curriculum is based on the idea of linking mathematics to real life. The idea of mathematics in real-life situations is used to encourage children to develop a deeper conceptual understanding of mathematics. The curriculum focuses on conceptual understanding before procedural skills. The student-centered approach enables children to develop deeper conceptual understanding of mathematics through practical experiences.

In Indonesia, problem-solving skills are encouraged through realistic mathematics and ethnomathematics. The curriculum focuses on the application of mathematics in real-life situations. Ethnomathematics encourage children to use reasoning skills in problem-solving. Although rote learning is also used in Indonesia, problem-solving skills encourage children to develop reasoning skills that can be applied in real-life situations.

Brunei has a structured problem-solving framework that has recently been introduced. The framework focuses on moving children from procedural tasks to real-world modeling problems. The framework also encourages critical and reflective thinking skills. The framework enables children to develop cognitive and metacognitive skills. Although the framework has recently been introduced, teachers are still in the process of learning how to use the new framework.

In five countries, problem-solving is the core concept in the teaching and learning of mathematics. Although the process to problem-solving is different in the five countries, with Singapore and the Philippines focusing on the mastery and thinking level, and Cambodia and Indonesia focusing on the real-world context, and finally Brunei moving towards the real-world modeling of the problem, the focus is on the balance between the conceptual, procedural, and practical aspects to develop the reasoning and critical thinking capabilities of the learners.

The findings in [Table 7](#) reveal notable differences in how assessment practices align with curriculum objectives across ASEAN mathematics education systems. Alignment between curriculum intent, instruction, and assessment plays a critical role in supporting meaningful learning and monitoring student progress.

Singaporean assessments are the core of the learning process, a constant and ongoing process that includes mastery and is present in every teaching session. Assessments, both formative and final, do not only aim to determine the level of knowledge students have acquired; they also determine the methods by which the students should be taught, to ensure they have mastered the subject before advancing to a harder topic of discussion.

Table 8. Assessment Practices in terms of Assessment Tools and Methods

ASEAN Country	Description
Singapore	A structured system including school-based assessments, performance tasks, reasoning-focused tests, and problem-solving evaluations.
Philippines	Applies nationally standardized tests and traditional written exams.
Cambodia	Relies mainly on paper-and-pencil tests and teacher-made assessments, with limited use of performance-based or formative tools.
Indonesia	Uses ICT-supported assessments and diverse teacher-created tools.
Brunei	Uses mixed assessment methods, combining written examinations with performance tasks and formative assessments aligned to competencies.

In the Philippines, the K-12 curriculum has adopted the spiral method of teaching and learning, where the same topics appear in different years of study. However, the level of detail and scope of these topics varies, making the level of assessments conducted somewhat erratic. Teachers use both formative and summative assessments to determine the level of knowledge students have acquired, although these assessments do not entirely determine the level of understanding and the ability of the students to think critically.

For Cambodian mathematics, the level of fragmentation in the progression of the students has a negative impact on the level of alignment of the learning objectives and the assessments conducted. In this country, although there is the presence of both formative and final assessments, these assessments focus only on the skills of the students and not their general ability.

In Indonesia, the process is a combination of both value- and competency-based approaches. It involves the study of what students know and the character they're trying to build. Expect a variety of traditional evaluations, hands-on activities, and problem-solving scenarios. The idea is to help students develop practical skills as well as solid concepts. However, there are some challenges in the regions. Teacher training and proficiency in competency-based approaches vary. This makes student performance data less consistent and more difficult to compare.

Assessments in Brunei mirror the curriculum and emphasize competency development and learning outcomes. These evaluations attempt to measure students' understanding of the subject matter and their ability to solve problems and apply what they know in practical situations. This is similar to the country's transition to outcome-based education. While the schools all align in terms of the new approach, teachers still need to get used to the new frameworks.

Overall, the findings suggest varying degrees of curriculum–assessment alignment across ASEAN countries, with Singapore demonstrating the most coherent integration. Differences in alignment reflect broader systemic factors, including curriculum design, assessment literacy, and institutional readiness for reform.

The findings in [Table 8](#) reveal both shared practices and notable differences in the assessment tools and methods used in mathematics education across selected ASEAN countries. While all systems employ a combination of formal and informal assessment strategies, the range, purpose, and sophistication of these tools vary substantially.

Singapore employs a comprehensive and structured assessment system that integrates school-based assessments, performance tasks, reasoning-focused tests, and problem-solving evaluations. These tools are intentionally aligned with curriculum standards and are designed to capture students' conceptual understanding, procedural fluency, and mathematical

Table 9. Assessment Practices in terms of the Overall Assessment Orientation

ASEAN Country	Description
Singapore	Continuous, mastery-aligned assessments integrated into curriculum standards; supports progression and conceptual mastery.
Philippines	Strong summative orientation with heavy reliance on final examinations.
Cambodia	Often summative and high stakes; many systems rely on national examinations to measure broad content mastery
Indonesia	Balanced orientation combining formative, summative, and competency-based assessment.
Brunei	Transitional orientation shifting from exam-centered assessment toward competency-based evaluation.

reasoning. The diversity of assessment methods allows for continuous monitoring of learning progression and supports the mastery-oriented philosophy of Singapore's mathematics curriculum.

In the Philippines, assessment practices rely predominantly on nationally standardized tests and traditional written examinations. Although classroom-based assessments are mandated within the K–12 framework, written tests remain the primary means of evaluating student achievement. This reliance on conventional tools often prioritizes procedural knowledge and factual recall, which may limit opportunities to assess higher-order thinking and problem-solving skills.

Cambodia's assessment tools are largely limited to paper-and-pencil tests and teacher-developed examinations. Performance-based assessments and formative tools are less frequently utilized, reflecting constraints related to assessment training and resource availability. As a result, assessment practices tend to focus on measuring basic content mastery rather than deeper conceptual understanding or reasoning processes.

Indonesia employs a wider variety of assessment tools, including ICT-supported assessments, teacher-created instruments, portfolios, and project-based tasks. These methods align with the curriculum's emphasis on creativity, contextual learning, and student autonomy. However, the effectiveness of these tools varies across schools, as teachers differ in their capacity to design and implement quality assessments.

Brunei utilizes a mixed-method assessment approach that combines written examinations with performance tasks and formative assessments aligned to competency-based learning outcomes. This approach reflects ongoing efforts to balance traditional assessment practices with more authentic and process-oriented evaluation methods. Nevertheless, the consistency of implementation remains a challenge as the system continues to transition toward outcome-based assessment.

Overall, the comparison indicates varying levels of diversification and sophistication in assessment tools across ASEAN mathematics education systems. While Singapore demonstrates a well-integrated and multifaceted assessment framework, other countries rely more heavily on traditional methods or are in transitional stages of assessment reform. These differences underscore the influence of curriculum alignment, teacher assessment literacy, and systemic support on the effective use of assessment tools in mathematics education.

The findings in [Table 9](#) illustrate contrasting assessment orientations across ASEAN mathematics education systems, ranging from mastery-oriented and formative approaches to predominantly summative and examination-driven models.

Singapore adopts a continuous and mastery-oriented assessment framework, where formative assessment plays a central role in supporting learning progression. Regular feedback

is used to diagnose misconceptions and guide instruction, reinforcing assessment as a tool for learning rather than solely for accountability.

The Philippines maintains a largely summative assessment orientation, with strong reliance on final examinations to determine student achievement. Although formative assessment is encouraged in policy, high-stakes testing continues to dominate classroom practice, influencing both teaching strategies and learner priorities.

Cambodia's assessment system is primarily summative and high-stakes, with national examinations serving as the main indicator of student performance. This orientation emphasizes content coverage and procedural proficiency, often at the expense of formative feedback and diagnostic assessment.

Indonesia presents a more balanced assessment orientation, combining formative, summative, and competency-based approaches. The curriculum encourages reflective and process-oriented assessment; however, the extent of implementation varies across regions and schools.

Brunei is undergoing a transition from an examination-centered assessment system toward a competency-based orientation. This shift reflects national efforts to align assessment with 21st-century skills, though the transition remains ongoing and uneven.

In summary, assessment orientations across ASEAN countries differ substantially in purpose and practice. While some systems prioritize formative assessment and mastery, others remain driven by summative evaluation. These differences highlight the influence of policy priorities, accountability structures, and teacher assessment capacity on mathematics assessment practices.

4. Conclusion

This study analyzed certain Southeast Asian countries' mathematics educational systems and their various math education curricula; comparing their math curriculum using the systematic literature review, with an emphasis on three main areas: content structure, pedagogy, and how students are assessed. The research findings indicate significant discrepancies among these countries with respect to each of their curriculum purposes to develop foundational math competencies. The four countries, Philippines, Cambodia, Indonesia and Brunei all emphasize basic skill acquisition, contextual approaches to learning and broader educational goals; however, their student's understanding of math as conceptual and their moving through the curriculum at comparable rates vary greatly. Singapore's math curriculum was also found to have a significant amount of vertical coherence, depth of conceptual understanding, a focus on developing mastery in mathematics and a seamless integration of problem solving, reasoning and continual assessment throughout the entire curriculum.

The findings suggest that the overall consistency and coherence of mathematics education will depend on how aligned different aspects of math education, especially curriculum content, teaching strategies, and assessment practices. Differences in how pedagogical approaches are implemented across the region reflect the degree to which national educational philosophies, teacher preparation, and systemic support have influenced these types of practices. Similarly, assessment practices differ widely throughout many education systems; while some rely heavily on exams and test results to measure students' progress or ability level, other systems are shifting toward more competency-based and formative assessment methods.

The significance of curriculum consistency (coherent) and in-depth concepts (conceptual knowledge), as well as their relationship (alignment) with mathematics learning and higher order thinking skills, is demonstrated through the results of this study. This report is limited to reviewing the written materials but gives curriculum developers, policymakers and educators

useful insights on how to move forward in developing stronger mathematics programs in Southeast Asia. Future curriculum reform initiatives will be improved if foundational skills and deeper understanding of mathematical concepts and the assessment practices that allow students to have a long-lasting understanding and ability to solve problems with math are considered.

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Declarations

Author Contribution : Author 1: Conceptualization; Methodology; Formal Analysis; Writing – Original Draft; Visualization; Author 2: Writing – Review & Editing; Data Curation; Investigation; Resources; Author 3: Validation; Supervision; Project Administration; Author 4: Data Curation; Writing – Review & Editing; Preparation of Tables and Figures; Author 5: Literature Review; Writing – Original Draft (selected sections); Editing and Formatting

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5. References

- Blair-Walcott, K. (2023). Comparative analysis. In *Varieties of qualitative research methods* (pp. 79–84). Springer. https://doi.org/10.1007/978-3-031-04394-9_13
- Borji, V., & Farsani, D. (2023). Intended mathematics curriculum in grade 1: A comparative study. *Eurasia Journal of Mathematics, Science and Technology Education*, 19(3), em2237. DOI: <https://doi.org/10.29333/ejmste/12977>
- Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Aldine Publishing Company.
- Hadar, L. L., & Tirosh, M. (2019). Creative thinking in mathematics curriculum: An analytic framework. *Thinking Skills* <https://doi.org/10.1016/j.tsc.2019.100585>

- Hafizah, M. H., & Kamarudin, N. (2019). Creativity in mathematics: Malaysian perspective. *Bulletin of the* 10.13189/ujer.2020.081609
- Kitchenham, B. (2004). *Procedures for performing systematic reviews* (Joint Technical Report TR/SE-0401). Keele University & National ICT Australia.
- Morgan, H. (2022). Conducting a qualitative document analysis. *The Qualitative Report*, 27(1), 64–77. <https://doi.org/10.46743/2160-3715/2022.5044>
- Mullis, I.V.S., Martin, M.O., Foy, P., Kelly, D.L. and Fishbein, B. (2020) TIMSS 2019 International Results in Mathematics and Science. Boston College, TIMSS & PIRLS International Study Center. <https://timssandpirls.bc.edu/timss2019/international-results/>
- Ocumen, M. R., & Callaman, R. A. (2021). Understanding the mathematics curriculum of the Philippine and Singapore education systems: A comparative analysis. *Journal of Research and Innovation in Social Science*.
- OECD. (2021). *Mathematics teaching and learning in Finland*. OECD Publishing.
- Prahmana, R. C. I., & D'Ambrosio, U. (2020). Learning geometry and values from patterns: Ethnomathematics on the Batik patterns of Yogyakarta, Indonesia. *Journal on Mathematics Education*, Volume 11, pp. 439-456. <https://doi.org/10.22342/jme.11.3.12949.439-456>
- Sasaki, M. (2004). Comparative research. In M. S. Lewis-Beck, A. Bryman, & T. F. Liao (Eds.), *Encyclopedia of social science research methods* (pp. 152–154). *SAGE Publications*, Inc. <https://doi.org/10.4135/9781412950589.n141>
- Shahrill, M., Wood, K., & Morsidi, N. M. H. (2020). The teaching and learning of mathematics practices in the 21st century: Empowering the need to change.
- Shava, G., Hleza, S., Tlou, F., Shonhiwa, S., & Mathonsi-Tshuma, E. (2021). Qualitative content analysis. *International Journal of Social Science Research*, 9(2), 2454–6186.
- Sieng, V., & Takuya, B. (2020). Analysis of geometry units in the mathematics curriculum of Cambodia from the perspective of coherence. *Journal of Science and Education*
- Sumliyah et al. (2025). *Mathematical Literacy: A Comparative Analysis of School Mathematics Curricula in Indonesia*, <https://doi.org/10.35438/inomatika.v3i1> Singapore, and China. DOI: <https://doi.org/10.35438/inomatika.v3i1>
- Thurmond, V. A. (2001). The point of triangulation. *Journal of Nursing Scholarship*, 33(3), 253–258.
- Van, Leap, Mao, Sokalyan, & Cnudde, Veerle (2018). Improving pedagogical knowledge on rational numbers of Cambodian teacher trainers. *Global Education Review*, 5 (3), 196-211.