

A Comparative Analysis of Primary Mathematics Curricula in Indonesia and Singapore: Framework, Content Progression, and Pedagogical Approach

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Abstract

Mathematics achievement differs markedly between Indonesia and Singapore, and the primary school curriculum is often discussed as one of the factors behind this gap. This study compares the primary mathematics curricula of Indonesia (Kurikulum Merdeka) and Singapore (the 2021 Primary Mathematics Syllabus) to identify similarities, differences, and lessons that may inform curriculum development in Indonesia. A qualitative descriptive-comparative document analysis was conducted on official curriculum documents, national regulations, international assessment reports, and peer-reviewed studies. The curricula were compared across six dimensions: governance, aims and framework, content organisation and progression, pedagogical approach, assessment and support, and international performance. The findings show that both curricula cover number, algebra, measurement, geometry, and data, and both treat problem solving as a key process. The main differences lie in the explicitness of the framework (a single five-component framework centred on problem solving in Singapore versus content and process elements within learning outcomes in Indonesia), the grain size of progression (level by level versus two-year phases), the specification of pedagogical tools such as the Concrete–Pictorial–Abstract approach and the model method, and differentiated pathways in the upper primary levels. Indonesia's curriculum gives schools and teachers wide flexibility, which places a heavy demand on teacher capacity. The article concludes with implications for clearer progression guidance, explicit heuristics and representations, broader attention to metacognition and attitudes, and systematic teacher support. The findings are limited to the intended curriculum and should be complemented by classroom-based research.

Keywords: Curriculum Comparison, Primary Mathematics, Kurikulum Merdeka, Singapore Mathematics, Problem Solving, Concrete-Pictorial-Abstract Approach.



A. INTRODUCTION

Mathematics in the primary years lays the conceptual and procedural foundation on which later learning depends, so the way a national curriculum organises this foundation is a matter of policy as well as pedagogy (Al-Rushidi, 2025). International assessments have made differences between education systems highly visible. In PISA 2022, Singapore achieved a mean mathematics score of 575 points, significantly higher than all other participating countries and economies, while Indonesia scored 366 points

against an OECD average of 472 (OECD, 2023). At the primary level, Singapore's Grade 4 pupils also obtained the highest average mathematics score in TIMSS 2019, at 625 points (Mullis et al., 2020). These figures have encouraged many Indonesian researchers and policymakers to look at Singapore as a reference point for improving mathematics education.

Both countries have recently revised or consolidated their primary mathematics curricula. Singapore introduced a revised Primary Mathematics Syllabus that was implemented level by level, beginning with Primary 1 in 2021 and reaching Primary 5 in 2025 and Primary 6 in 2026 (Ministry of Education, Singapore, 2020). Indonesia introduced Kurikulum Merdeka as an optional curriculum in 2022 and then established it as the national curriculum through Permendikbudristek Number 12 of 2024 (Kemendikbudristek, 2024a), which also allows schools that have not yet implemented it to continue the 2013 Curriculum only for a transitional period. The learning outcomes (Capaian Pembelajaran, CP) for mathematics in this curriculum are determined by the Curriculum, Standards, and Assessment Agency (BSKAP) (Kemendikbudristek, 2022).

Comparative studies of Indonesian and Singaporean mathematics education have examined textbooks, problem solving in the curriculum, and secondary-school curricula. For example, Fan and Zhu (2007a) compared how textbooks from China, Singapore, and the United States represent problem-solving procedures, and Siregar et al. (2025) reviewed the place of problem solving in the Singaporean and Indonesian mathematics curricula. In the literature reviewed for this article, fewer studies offer a structured comparison of the whole primary mathematics curriculum—its governance, framework, content progression, pedagogical orientation, and support structures—based on the current documents of both countries. Such a comparison is timely because both curricula have only recently entered a new stage of implementation.

This article therefore compares the primary mathematics curricula of Indonesia and Singapore. It addresses two questions: (1) what are the main similarities and differences between the two curricula in terms of governance, aims and framework, content organisation, pedagogical approach, and assessment and support; and (2) what implications can be drawn for the development and implementation of the primary mathematics curriculum in Indonesia. The analysis is intended to inform curriculum developers, teacher educators, and teachers. It does not suggest that one system can simply be transplanted into another.

B. METHOD

This study used a qualitative, descriptive-comparative design based on document analysis. The comparison followed the four stages of Bereday's (1964) comparative method: description of each curriculum, interpretation of the descriptions in their policy context, juxtaposition of the information along common dimensions, and comparison to draw out similarities, differences, and implications.

The data comprised four groups of documents. For Indonesia, they were Permendikbudristek Number 12 of 2024 and the BSKAP decisions on learning outcomes in Kurikulum Merdeka, including the mathematics learning outcomes for Phases A to C, which correspond to Grades 1–6 (Kemendikbudristek, 2022, 2024a). For Singapore, the main document was the Ministry of Education's Mathematics Syllabus for Primary One to Six (Ministry of Education, Singapore, 2020). The third group was international assessment reports (Mullis et al., 2020; OECD, 2023), and the fourth was peer-reviewed studies on Singapore's pedagogical approaches and on cross-country curriculum comparison (Fan & Zhu, 2007a, 2007b; Kaur, 2019; Ng & Lee, 2009; Siregar et al., 2025).

Six comparison dimensions were established in advance: (1) governance and implementation status; (2) aims and curriculum framework; (3) content organisation and progression; (4) pedagogical approach; (5) assessment, differentiation, and support; and (6) international performance. Each document was read and coded against these dimensions, and the results were arranged in comparison matrices, two of which are presented as Table 1 and Table 2. International assessment results are used only as background, because they reflect many factors beyond the curriculum. The main limitation is that the study analyses the intended curriculum as written in official documents; it does not observe classroom practice. The Indonesian learning outcomes have also been revised since 2022, and later revisions were not analysed in detail.

C. RESULT AND DISCUSSION

1. Governance and Implementation Status

Singapore's primary mathematics curriculum is defined centrally by the Ministry of Education through a single syllabus document covering Primary 1 to Primary 6. The document sets out the aims, the mathematics framework, guidance on learning, teaching, and assessment, and the content for each level (Ministry of Education, Singapore, 2020). Its implementation was staged level by level, which allowed each cohort to move through the revised syllabus in sequence.

In Indonesia, the legal basis is Permendikbudristek Number 12 of 2024. It defines Kurikulum Merdeka as a curriculum for early childhood, primary, and secondary education that offers flexibility and focuses on essential material in order to develop learners who are lifelong learners with Pancasila character (Kemendikbudristek, 2024a). The curriculum framework and structure are set nationally, whereas the sequencing of learning objectives and the design of teaching modules are carried out by schools and teachers on the basis of the learning outcomes. Mathematics learning outcomes are written for three phases rather than six grade levels (Kemendikbudristek, 2022). Both systems are therefore centrally governed, but Singapore specifies content level by level, while Indonesia specifies outcomes by phase and delegates much of the sequencing to schools.

2. Aims and Curriculum Framework

The Singapore Mathematics Framework places mathematical problem solving at the centre. Problem-solving ability is supported by five interrelated components: concepts, skills, processes, attitudes, and metacognition. The primary syllabus aims to enable pupils to acquire mathematical concepts and skills for everyday use and continuous learning, to develop thinking, reasoning, communication, application, and metacognitive skills through a mathematical approach to problem solving, and to build confidence and interest in mathematics (Ministry of Education, Singapore, 2020). Fan and Zhu (2007b) note that problem solving became the central focus of Singapore's national school mathematics curriculum in 1990, and that the emphasis on heuristics developed over the following years. The present framework is thus the product of several decades of continuity.

The Indonesian mathematics learning outcomes organise the subject into five content elements—number, algebra, measurement, geometry, and data analysis and probability—and five process elements. The process elements describe the mental activities involved in learning mathematics, such as reasoning, problem solving, representation, and making connections (Kemendikbudristek, 2022). These sit within the broader aim of developing learners who have the Pancasila character defined in the national curriculum regulation (Kemendikbudristek, 2024a).

Both curricula therefore separate what is to be learnt (content) from how mathematics is done (processes), and both treat problem solving as a key process. The difference is one of emphasis and explicitness. In Singapore, problem solving is the declared centre of the whole framework, and metacognition and attitudes are named as components in their own right. In the Indonesian documents reviewed, problem solving is one of five process elements, and the affective and metacognitive dimensions appear to be addressed mainly through the general profile of Pancasila learners rather than as components of the mathematics framework itself. Siregar et al. (2025) reached a comparable conclusion in their literature review: the Singaporean curriculum is built around five interconnected components, whereas in Indonesia problem solving appears both as a learning outcome and as a learning approach. Table 1 summarises the main features of the two curricula.

Table 1. Comparison of Key Features of the Indonesian and Singaporean Primary Mathematics Curricula

Dimension	Indonesia (Kurikulum Merdeka)	Singapore (2021 Primary Mathematics Syllabus)
Policy basis	Permendikbudristek No. 12/2024; learning outcomes set by BSKAP decisions (e.g., 008/H/KR/2022 and 033/H/KR/2022)	Ministry of Education Mathematics Syllabus, Primary One to Six (2021 syllabus; Primary 1 in 2021, Primary 5 in 2025, Primary 6 in 2026)
Curriculum focus	Flexibility and essential material; learners with Pancasila character	Mathematical problem solving as the central focus

Framework	Five content elements and five process elements	Five interrelated components: concepts, skills, processes, attitudes, and metacognition
Content organisation	Number; Algebra; Measurement; Geometry; Data Analysis and Probability	Number and Algebra; Measurement and Geometry; Statistics
Progression	Three phases: A (Grades 1–2), B (Grades 3–4), C (Grades 5–6); schools sequence content	Level by level (Primary 1–6) with a spiral approach
Pedagogical orientation	Concrete-to-abstract transition stated in outcomes; method chosen by teachers; differentiated and project-based learning encouraged	Structured Concrete–Pictorial–Abstract sequence; model method; explicit heuristics
Differentiation	Single curriculum; differentiation is carried out by teachers and schools	Standard and Foundation Mathematics in Primary 5–6
Monitoring	National Assessment (Asesmen Nasional) and Education Report Card (Rapor Pendidikan)	National examination at the end of primary school

3. Content Organisation and Learning Progression

Both curricula cover the same broad territory of primary mathematics. The Indonesian outcomes use five content elements. Algebra appears as a separate element from Phase A under the label of non-formal algebra, for example identifying, imitating, and extending number patterns, and the data element includes both data analysis and the notion of uncertainty and chance (Kemendikbudristek, 2022). Singapore groups content into three strands—Number and Algebra, Measurement and Geometry, and Statistics (Ministry of Education, Singapore, 2020). The difference in strand names largely reflects different groupings of similar content rather than a difference in the topics that are taught.

The more consequential difference is the grain size of progression. Indonesian outcomes are written for two-year phases. By the end of Phase B, for instance, pupils are expected to show number sense for whole numbers up to 10,000, and the outcomes describe Phase B as a transition from concrete to abstract understanding (Kemendikbudristek, 2022). Singapore defines content for each level and uses a spiral approach in which topics such as whole numbers are revisited in successive levels with larger number ranges (Ministry of Education, Singapore, 2020). Table 2 illustrates this contrast with the whole-number range as an example.

Table 2. Indicative Whole-Number Ranges in the Indonesian Phases and Singaporean Levels

Grade/Level	Indonesia (End-Of-Phase Outcome)	Singapore (Level Content)
Grades 1–2	Phase A: whole numbers up to 100	Primary 1: up to 100; Primary 2: up to 1,000
Grades 3–4	Phase B: whole numbers up to 10,000	Primary 3: up to 10,000; Primary 4: up to 100,000
Grades 5–6	Phase C: whole numbers up to 1,000,000	Primary 5: up to 10,000,000; Primary 6: consolidation and extension

The phase structure has a clear rationale: it gives schools room to sequence content according to pupils' readiness and local context, which is consistent with the flexibility emphasised in the national curriculum regulation (Kemendikbudristek, 2024a). It also means, however, that expectations for a particular grade are not specified in the national document, so schools and textbook authors must interpret them. In Singapore, level-by-level specification supports consistency across schools but leaves less room for local sequencing. Neither design is inherently superior; they distribute responsibility for sequencing differently between the national level and the school.

4. Pedagogical Approaches

The Singapore syllabus specifies not only what to teach but also how mathematics is to be learnt. Three features stand out. First, the Concrete–Pictorial–Abstract (CPA) approach structures the learning sequence: pupils begin with manipulatives and real objects, move to pictorial representations, and then to abstract symbols. This sequence is consistent with Bruner's (1966) enactive, iconic, and symbolic modes of representation. Second, the model method, introduced into the primary curriculum in 1983, teaches pupils to draw diagrams that represent relationships among quantities in word problems (Kaur, 2019; Kumar, 2026). Ng and Lee (2009) describe it as a heuristic that gives higher-ability children, who do not yet have access to letter-symbolic algebra, a means to represent and solve algebraic word problems. Third, pupils are taught explicit heuristics, in line with Pólya's (1945) model of problem solving, so that problem solving is treated as something that can be taught rather than only assessed (Ministry of Education, Singapore, 2020).

The Indonesian outcomes also recognise the value of concrete experience. The outcomes refer to representing numbers with concrete objects, pictures, and mathematical symbols, and Phase B is described as a transition from concrete to abstract understanding (Kemendikbudristek, 2022). However, the documents reviewed do not prescribe a particular instructional sequence or a standard set of representational tools; the choice of method is left to teachers. Kurikulum Merdeka instead stresses flexible, differentiated, and project-based learning, and teachers are supported through the Merdeka Mengajar platform (Kemendikbudristek, 2024c).

This is an important difference. The Singaporean curriculum reduces uncertainty for teachers by supplying a shared instructional language—CPA, model drawing, and heuristics—that can be carried through textbooks, teacher guides, and teacher education. The Indonesian curriculum grants autonomy but depends on teachers' pedagogical content knowledge to realise concrete-to-abstract learning in practice. Fan and Zhu (2007a) show that the way problem-solving procedures are represented in textbooks differs across countries, and textbooks are one of the main channels through which curriculum intentions reach classrooms. Where a curriculum leaves methods open, the

guidance embedded in textbooks and teacher resources becomes correspondingly more important.

5. Assessment, Differentiation, and Support

Singapore provides differentiated pathways within the curriculum. From Primary 5, pupils follow either the Standard Mathematics syllabus or the Foundation Mathematics syllabus (Ministry of Education, Singapore, 2020). Differentiation is therefore designed into the curriculum itself, which gives pupils who need more time on core concepts a structured route while keeping the same overall framework.

Kurikulum Merdeka uses a single curriculum for all primary pupils, and differentiation is the task of teachers and schools through differentiated learning (Kemendikbudristek, 2024a). The quality of learning is monitored through the National Assessment and the Education Report Card, which provide feedback to schools and local governments. The Ministry reported that schools implementing Kurikulum Merdeka showed improvements in literacy and numeracy scores in the National Assessment (Kemendikbudristek, 2024b). Such figures are encouraging, but they were reported by the policy owner and cannot be treated as causal evidence of curriculum effectiveness.

6. International Performance and Interpretation

Figure 1 shows the mean mathematics scores of Singapore, Indonesia, and the OECD average in PISA 2022. Singapore's 575 points were significantly higher than those of all other participating countries and economies, and Indonesia's 366 points were below the OECD average of 472 (OECD, 2023). Between PISA 2018 and 2022, Indonesia's mean mathematics score decreased by 13 points, in a period when the OECD average fell by almost 15 points, which the OECD described as unprecedented in the history of the assessment (OECD, 2023).

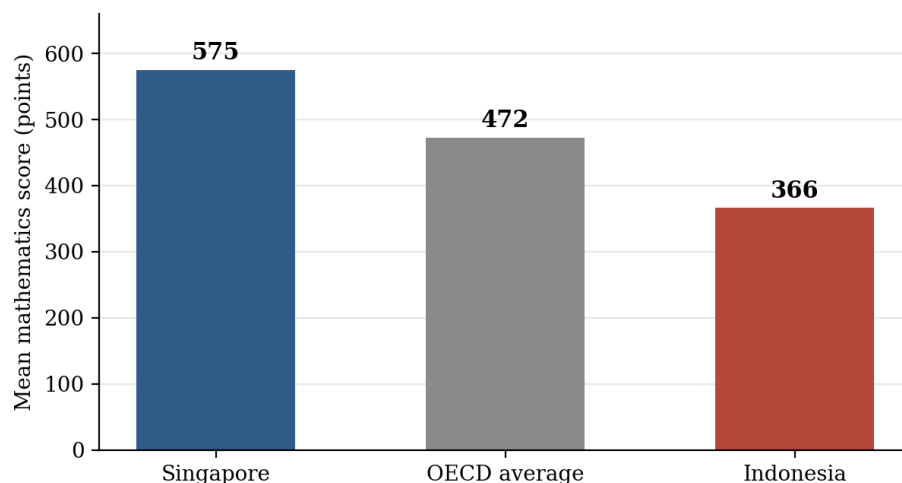


Figure 1. Mean Mathematics Scores in PISA 2022 (OECD, 2023)

These results cannot be attributed directly to the curriculum. PISA assesses 15-year-olds and therefore reflects cumulative experience of primary and secondary schooling together with out-of-school factors, and the 2022 cycle took place after widespread pandemic-related disruption. The distinction between the intended, implemented, and attained curriculum used in IEA studies is useful here (Mullis et al., 2020). This article analyses the intended curriculum, whereas test results reflect the attained curriculum, mediated by what happens in classrooms. The comparison is nevertheless informative about where the intended curriculum may support or constrain implementation: a curriculum that is explicit about progression and pedagogical tools provides more direct support to teachers, while a flexible curriculum requires more from teachers and from the system that supports them.

7. Implications for Indonesian Primary Mathematics

Several implications can be drawn for Indonesia, with the caution that practices must be adapted rather than copied. First, within the existing phase structure, non-binding progression maps for each grade could accompany the learning outcomes. Such maps would preserve flexibility while reducing variation in how schools and textbook authors interpret expectations. Second, representational tools and heuristics could be made explicit in teacher guides and textbooks. The Indonesian outcomes already refer to concrete objects, pictures, and symbols; teacher resources could operationalise this through CPA sequences and diagram-based representations of word problems, adapted to Indonesian contexts and language.

Third, the mathematics framework could give more explicit attention to metacognition and productive attitudes, for example by building self-monitoring and reflection into problem-solving tasks. Fourth, because curricular flexibility demands strong pedagogical content knowledge, systematic teacher support is essential, including professional learning communities and practical resources that show how concrete-to-abstract sequences work in real lessons. Fifth, early identification of and support for pupils with weak foundations would help prevent gaps from accumulating across phases. Finally, Indonesia's flexibility and emphasis on contextual and project-based learning is an asset: environment-based tasks and local contexts can enrich problem solving, provided that they are connected to clear mathematical learning goals.

D. CONCLUSION

This article compared the primary mathematics curricula of Indonesia and Singapore across governance, framework, content progression, pedagogy, and support. Both curricula share a common content base and treat problem solving as a key process. They differ mainly in the explicitness of the framework, the grain size of progression, the specification of pedagogical tools, and the way differentiation is organised. Singapore's

curriculum is more explicit and level specific, while Indonesia's curriculum is more flexible and relies more heavily on school and teacher interpretation.

The analysis is limited to official documents and therefore to the intended curriculum, and the Indonesian learning outcomes continue to be revised. Future research should combine document analysis with textbook analysis, classroom observation, and teacher interviews, and should examine how Indonesian teachers interpret phase-based outcomes in practice. Longitudinal studies of pupils' learning under the different curricular arrangements would also help to clarify which features of curriculum design matter most.

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