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Coding and Artificial Intelligence Education in Indonesia's 2025 Curriculum Reform: A Document-Based Policy Analysis

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Abstract: Integrating Coding and Artificial Intelligence (AI) into school curricula has become a strategic priority for preparing learners for a rapidly evolving digital society. In Indonesia, this reform is codified in the Ministerial Regulation of Primary and Secondary Education No. 13 of 2025, which introduces Coding and Artificial Intelligence as elective subjects within the national curriculum. This study analyzes the regulatory design, curricular positioning, and governance logic of this policy using qualitative document analysis of the 2025 ministerial regulation and its official annexes. The findings show that Coding and AI are formally embedded as elective subjects aimed at cultivating computational thinking, logical reasoning, problem-solving, and ethical technological literacy while accommodating diverse school readiness through phased, optional adoption. However, readiness-based flexibility risks widening digital learning disparities between well-resourced and underserved schools unless paired with targeted teacher training, computing infrastructure, and equitable resource allocation.

Keywords: Curriculum Policy; Coding Education; Artificial Intelligence; Computational Thinking; Indonesia

1. Introduction

Accelerating digital transformation and rapid breakthroughs in generative and predictive artificial intelligence have compelled education systems worldwide to rethink the core competencies required for future citizenship and economic participation [1]–[3]. Digital literacy, computational thinking, and critical understanding of intelligent systems are increasingly recognized as foundational capabilities alongside traditional literacy and numeracy [4]–[6]. Accordingly, national curriculum reforms across diverse jurisdictions increasingly seek to cultivate learners who are not merely passive consumers of digital platforms, but critical, creative, and ethical problem solvers in technology-rich environments [2], [7], [8].

Within international curriculum scholarship, coding and artificial intelligence (AI) play distinct yet complementary pedagogical roles [9]–[11]. Coding develops algorithmic logic, pattern recognition, decomposition, and structured computational thinking applicable across disciplinary boundaries [4], [12], [13]. Meanwhile, AI education introduces students to data-driven modeling, automation, human-centered system design, and algorithmic ethics [10], [11], [14]. Integrating both domains into K–12 schooling therefore reflects a broader pedagogical shift from rote knowledge transmission toward competency-oriented, future-ready learning [7], [15], [16].

Indonesia has advanced this curriculum modernization agenda through the promulgation of Ministerial Regulation of Primary and Secondary Education (Permendikdasmen) No. 13 of 2025, which amends Ministerial Regulation No. 12 of 2024 on the national curriculum for early childhood, primary, and secondary education [17], [18]. A centerpiece of the 2025 amendment is the formal introduction of Coding and Artificial Intelligence (Koding dan Kecerdasan Artifisial) as elective subjects within the national curriculum structure [17]. Rather than mandating immediate nationwide adoption, the regulation establishes a readiness-based elective pathway designed to accommodate substantial heterogeneity in school infrastructure, teacher capacity, and local governance across Indonesia's archipelago [1], [2], [17].

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Despite considerable public and policy attention surrounding the 2025 curriculum reform, systematic scholarly analyses of its regulatory architecture remain scarce [17], [18]. Existing literature predominantly examines general technological trends, classroom AI applications, or international competency frameworks [9], [10], [19], rather than analyzing how Indonesia's statutory text codifies subject status, curricular objectives, cross-pathway coverage, and implementation governance [17]. To address this gap, this study conducts a document-based policy analysis of Permendikdasmen No. 13 of 2025 [17]. Specifically, the study aims to: (1) examine the formal statutory positioning of Coding and AI within Indonesia's 2025 curriculum structure; (2) analyze the pedagogical and competency objectives articulated in the regulation; (3) evaluate the governance logic and equity tensions of its readiness-based elective strategy; and (4) derive actionable policy implications for equitable implementation across Indonesian schools [1], [2], [20].

2. Methodology

2.1. Research Design

This study employed a qualitative document-based policy analysis design to examine the regulatory design and curricular framing of Coding and Artificial Intelligence in Indonesia's 2025 curriculum reform [17], [19]. Qualitative document analysis is a rigorous policy research methodology for systematically interpreting statutory texts, regulatory amendments, and official curriculum frameworks to uncover institutional priorities, governance mechanisms, and underlying pedagogical philosophies [2], [19].

Because Permendikdasmen No. 13 of 2025 establishes the formal legal mandate for curriculum delivery across Indonesia, analyzing the regulatory text as primary policy evidence provides essential baseline clarity prior to empirical classroom evaluations [17], [18]. Consistent with policy document analysis conventions, this study explicitly delimits its scope to statutory framing and governance design rather than measuring school-level adoption rates, teacher instructional practices, or student achievement outcomes [1], [17].

2.2. Data Source and Documentary Corpus

The primary documentary corpus comprised Ministerial Regulation of Primary and Secondary Education (Permendikdasmen) No. 13 of 2025 concerning Amendments to Ministerial Regulation No. 12 of 2024 on the Curriculum for Early Childhood, Primary, and Secondary Education, together with its official statutory annexes detailing curriculum structure, instructional load allocations, and subject implementation provisions [17], [18].

To contextualize the Indonesian regulatory text against global curriculum benchmarks, the analysis also referenced international policy frameworks on AI and computing education issued by UNESCO, the OECD, UNICEF, the European Commission, the International Society for Technology in Education (ISTE), and the Computer Science Teachers Association (CSTA) [2], [5], [6], [8]–[10].

2.3. Analytical Procedure

Documentary analysis followed a structured four-stage qualitative content and thematic coding protocol [17], [19]:

First, statutory extraction and textual mapping were conducted by identifying every article, clause, and annex table in Permendikdasmen No. 13 of 2025 referencing Coding and Artificial Intelligence, establishing their formal legal status, elective classification, and instructional time arrangements relative to the baseline 2024 curriculum [17], [18].

Second, inductive-deductive thematic coding was applied to categorize regulatory provisions across four analytical dimensions: (a) curricular positioning and formal status, (b) pedagogical and competency objectives, (c) readiness-based implementation governance, and (d) cross-pathway curriculum integration [2], [17].

Third, cross-pathway structural comparison was performed to examine how Coding and AI are articulated across primary education (SD), junior secondary education (SMP), senior secondary education (SMA), vocational secondary education (SMK), special education, and non-formal equivalency pathways [17], [18]. Fourth, policy synthesis and equity critique were undertaken by evaluating the regulatory design against international digital education governance standards to identify structural opportunities, implementation risks, and institutional support requirements [1], [2], [11].

3. Results and Discussion

The documentary analysis of Permendikdasmen No. 13 of 2025 demonstrates that Indonesia's 2025 curriculum reform embeds Coding and Artificial Intelligence through an adaptive, competency-oriented

governance model [17]. Table 1 synthesizes the four core regulatory dimensions identified across the policy text and its annexes.

Table 1. Analytical Synthesis of Regulatory Provisions for Coding and AI in Permendikdasmen No. 13 of 2025

Analytical Dimension	Regulatory Provision in 2025 Policy	Curricular & Governance Implication
Curricular Status	Formally codified as an elective subject (mata pelajaran pilihan) within the intra-curricular structure	Grants official academic legitimacy and instructional time allocation without imposing universal coercion
Pedagogical Objectives	Aligned with graduate competency dimensions: critical reasoning, creativity, collaboration, independence, communication	Frames Coding & AI as cross-disciplinary cognitive tools rather than narrow vocational programming
Implementation Strategy	Readiness-based adoption contingent on school human resources, digital infrastructure, and local capacity	Prevents unfunded mandates in under-resourced schools, but risks uneven spatial diffusion
Pathway Adaptability	Differentiated articulation across SD, SMP, SMA, SMK, special education, and equivalency pathways	Allows developmental progression and contextual tailoring across diverse schooling tracks

3.1. Statutory Positioning of Coding and AI in the 2025 Curriculum

A foundational finding of the documentary analysis is that Permendikdasmen No. 13 of 2025 embeds Coding and Artificial Intelligence as an official elective subject (mata pelajaran pilihan) inside the formal intra-curricular structure, rather than relegating them to informal extracurricular clubs [17]. By codifying Coding and AI within the statutory curriculum tables amending Permendikdasmen No. 12 of 2024, the policy grants schools formal institutional authority to allocate scheduled instructional hours, design syllabi, and mobilize operational budgets for digital learning [17], [18].

Equally significant is the policy's deliberate avoidance of a uniform mandatory mandate [17]. Unlike core compulsory subjects required immediately across all schools nationwide, the elective classification empowers school leaders to introduce Coding and AI progressively in accordance with institutional readiness specifically teacher availability, computing facilities, and managerial capacity [1], [2], [17]. Furthermore, cross-pathway comparison reveals that the regulation adapts subject positioning across primary (SD), junior secondary (SMP), senior secondary (SMA), vocational (SMK), special education, and equivalency programs, reflecting sensitivity to developmental stages and institutional mandates [17], [18].

3.2. Pedagogical Objectives and Competency Orientation

The regulatory text situates Coding and AI squarely within the broader competency goals of Indonesia's 2025 curriculum reform, which prioritizes critical reasoning, creativity, collaboration, independence, communication, and adaptability in rapidly changing technological environments [17], [20]. Rather than defining Coding and AI solely as narrow technical or vocational skills aimed at software engineering careers, the regulation frames them as cognitive and problem-solving instruments that enrich broader student learning [4], [12], [17].

Specifically, Coding is positioned to cultivate computational thinking encompassing algorithmic sequencing, decomposition, abstraction, and logical debugging skills that strengthen analytical reasoning across mathematics, science, and social studies [4], [12], [13]. Concurrently, Artificial Intelligence is positioned to build foundational awareness of intelligent systems, data patterns, automation, and responsible human–AI interaction in everyday society [9]–[11], [17]. This conceptualization aligns closely with international frameworks such as UNESCO's AI competency guidance and the ISTE/CSTA standards, which emphasize human agency, critical inquiry, and ethical citizenship alongside technical fluency [5], [6], [9].

3.3. Readiness-Based Implementation Strategy and Equity Tensions

From an educational management perspective, the regulation's readiness-based elective strategy represents a pragmatic response to Indonesia's stark institutional heterogeneity [1], [17]. Across more than 220,000 primary and secondary schools nationwide, educational institutions vary dramatically in computer laboratory availability, broadband reliability, electricity stability, and teacher digital proficiency [1], [3], [17]. By permitting schools to adopt Coding and AI once foundational prerequisites are met, the regulation avoids triggering superficial or tokenistic compliance in under-equipped schools [2], [17].

However, as illustrated in the policy governance model in Figure 1, readiness-based flexibility generates a dual-edged equity dynamic [1], [3]. While flexible adoption protects under-resourced schools from unfunded

mandates, it simultaneously creates the risk of a widening curricular divide: affluent urban schools with established ICT infrastructure and specialist teachers can adopt Coding and AI rapidly, whereas rural, remote, and low-income schools risk prolonged exclusion from emerging digital competencies [1], [3], [15]. Consequently, statutory flexibility can only advance educational equity if paired with compensatory public investments in teacher capacity building, school computing hardware, open-access Indonesian-language instructional modules, and technical mentoring [2], [10], [16].

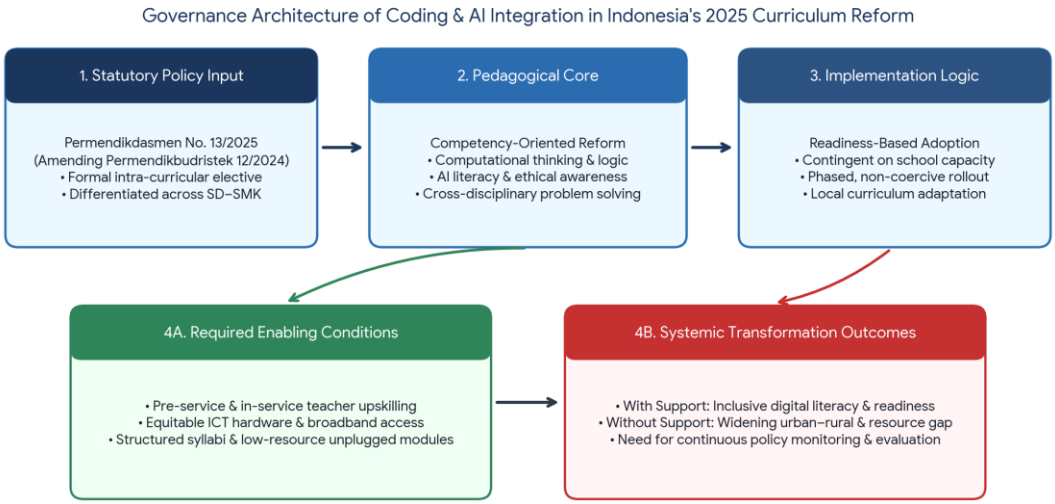

Figure 1. Conceptual governance model of Coding and Artificial Intelligence integration in Indonesia's 2025 curriculum reform (Source: Authors' synthesis of Permendikdasmen No. 13 of 2025 [17]).

3.4. Policy Implications, Research Contributions, and Limitations

To translate the statutory vision of Permendikdasmen No. 13 of 2025 into equitable educational practice [17], educational policymakers and school leaders should prioritize three governance actions. First, teacher professional development programs (such as Pendidikan Profesi Guru and continuous professional learning communities) should integrate computational thinking pedagogy and AI ethics modules so teachers across disciplines not solely computer science specialists can facilitate Coding and AI electives [2], [9], [16]. Second, the Ministry of Primary and Secondary Education should develop tiered, low-infrastructure curricular guidelines including "unplugged" computational thinking activities alongside device-based coding so schools with limited hardware can initiate foundational learning without widening access disparities [1], [3], [12]. Third, targeted capital grants and broadband subsidies should prioritize rural and underserved schools to prevent elective flexibility from reinforcing existing digital divides [1], [15], [16].

Scholarly, this study contributes an early statutory baseline and analytical governance model (Table 1 and Figure 1) explaining how Indonesia's 2025 curriculum reform balances centralized curriculum modernization with decentralized school readiness [2], [17]. Two limitations define the scope of this work: (1) as a document-based policy analysis, the findings capture formal regulatory intent rather than empirical classroom practices or student learning gains [17], [19]; and (2) secondary technical guidelines and school-level implementation reports emerging after 2025 warrant longitudinal tracking [2], [16]. Future empirical studies using mixed-methods school surveys, classroom observations, and teacher readiness assessments are recommended to evaluate how schools operationalize Coding and AI electives in practice [1], [2], [16].

4. Conclusion

This document-based policy analysis examined how Indonesia's 2025 curriculum reform codified in Ministerial Regulation of Primary and Secondary Education No. 13 of 2025 integrates Coding and Artificial Intelligence into the national education framework [17]. The findings show that the regulation embeds Coding and AI as formal intra-curricular elective subjects aimed at fostering computational thinking, critical reasoning, creativity, problem solving, and ethical technological literacy while preserving implementation flexibility aligned with school readiness [17], [18].

While this adaptive design accommodates Indonesia's diverse institutional capacities and avoids coercive

unfunded mandates, its long-term contribution to educational equity depends on sustained investments in teacher training, computing infrastructure, low-resource pedagogical resources, and targeted support for underserved schools [1], [2], [16]. Empirical field investigations examining school-level implementation, teacher preparedness, and student competency outcomes are essential next steps to inform continuous curriculum evaluation.

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