Jiang, B. et al. (Eds.) (2025). Proceedings of the 33rd International Conference on Computers in Education. Asia-Pacific Society for Computers in Education

Analysis and Comparative of the Academic Draft on Coding and Artificial Intelligence Education in Indonesia Primary and Secondary Schools

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Abstract: This study evaluates Indonesia's 2025 Academic Draft on Coding and Artificial Intelligence (AI) Education for primary and secondary schools through a qualitative policy review. Using SWOT analysis, cross-national comparison with India, and benchmarking against UNESCO's AI Competency Framework (2024), the analysis highlights both philosophical strengths and operational weaknesses. The draft demonstrates strong alignment with national visions, alongside a flexible modular curriculum and early integration of coding and AI. It also places value on ethical awareness and computational thinking, showing potential to prepare students for a digital future. However, the findings reveal critical challenges in implementation. The draft lacks a phased roadmap, structured teacher competency framework, enforceable data ethics guidelines, and targeted strategies to reduce the digital divide in underserved "3T" regions. Comparative insights from India suggest that modular teacher training programmes, adaptive assessment systems, and public–private partnerships offer practical models Indonesia could adapt. The study concludes that while the draft presents a progressive vision, its success depends on translating ambition into actionable, context-sensitive policies. Strengthening teacher readiness, equity, and governance is essential to ensure inclusive and sustainable AI and coding education.

Keywords: Artificial Intelligence education, coding curriculum, policy analysis, AI Indonesia, educational equity, comparative education, teacher readiness, AI literacy

1. Introduction

The rapid integration of Artificial Intelligence (AI) is reshaping education, with the World Economic Forum (2023) predicting that workforce demands will change by 2027, requiring early digital competence. UNESCO's AI Competency Framework 2024 emphasizes AI literacy, computational thinking, and ethical citizenship (Mutawa & Sruthi, 2025), and many countries have embedded AI and coding in school curricula. While Singapore and India have advanced policies, Indonesia faces a shortage of nine million skilled workers by 2030 (World Bank, 2021) and has only recently introduced the 2025 Academic Draft on Coding and AI Education. The draft outlines curriculum integration from Grade 5, teacher training, and ethical awareness (Basyir, 2014), but lacks clear strategies for underserved *"3T area" (Frontier, Outermost, Underdeveloped)* regions, data ethics, child safety, and teacher readiness. These regions face specific challenges, including a lack of reliable digital infrastructure and insufficient support for educators, which could widen the digital divide. Without an enforceable framework and targeted solutions like investments in inclusive infrastructure and context-sensitive teacher development programs, the scalability and policy alignment of the draft remain limited. This study employs SWOT, comparative analysis with India, and a gap analysis against international benchmarks to assess the draft's strengths, weaknesses, and opportunities for improvement, with a focus on proposing actionable recommendations to bridge these gaps.

2. Literature Review

2.1 Frameworks for Analyzing AI in Education Policies

A growing body of research highlights the importance of analyzing both national and supranational AI policies, particularly in education, as countries differ in how they frame AI competence development within their strategies (Wang et al., 2025; Shi, 2025), offering valuable lessons for Indonesia. Ethical considerations are central to this debate, with Nguyen et al. (2023) and Badawy et al. (2024; 2025) stressing the need for transparent frameworks that safeguard data privacy, ensure algorithmic accountability, and guide responsible AI use in learning environments, all of which must be adapted to the developmental and cultural contexts of young learners. Equally important are competence development and curriculum design, where tools such as the TAICS scale (Chiu et al., 2025) can assess teacher readiness and self-determination theory can enhance educators' motivation to strengthen digital skills. Practical insights, such as Dai et al.'s (2023) collaborative curriculum model, demonstrate how international approaches can be localized, while systemic challenges including assessment integrity, institutional preparedness (Luo, 2024; Jiang et al., 2025), and infrastructure expansion (Williamson, 2019; Luan et al., 2020) must also be addressed. For Indonesia, the literature points to six urgent priorities: scalable teacher training, age-appropriate ethical guidelines, coherent curriculum integration, safeguards against academic dishonesty, equitable access across diverse regions, and long-term policy evaluation. A SWOT analysis informed by these considerations can help reveal gaps and support the development of an inclusive, ethical, and context-sensitive AI and coding education framework for primary and secondary schools.

2.2 Perspectives on AI and Coding Education

The integration of Artificial Intelligence (AI), particularly generative AI tools such as ChatGPT, into coding education offers both transformative opportunities and pressing challenges. Recent studies indicate that AI can support personalized learning by providing real-time feedback, generating code examples, and offering corrective guidance. For instance, Haindl and Weinberger (2024) and Cubillos et al. (2025) show that AI tools, when used effectively, enhance student autonomy and engagement while reducing perceived cognitive load. Similarly, Li et al. (2024) report that AI-driven feedback and automated assessment deliver consistent and accurate results, enabling teachers to concentrate on higher-order instructional tasks. These findings suggest that AI has the potential to expand access to quality coding education when it is thoughtfully integrated into curriculum design. However, concerns persist regarding plagiarism, overreliance on AI-generated outputs, and the potential erosion of critical thinking and academic integrity (Rahman & Watanobe, 2023; Güner et al., 2025). Reliability issues also remain, especially in complex areas such as object-oriented programming (Fernandez-y-Fernandez et al., 2024), and Ouyang et al. (2024) caution that outcomes often vary between human-guided and AI-assisted instruction, highlighting the need for human oversight. Inequalities in digital access and AI literacy further risk widening educational divides, particularly in socioeconomically diverse settings (Zipf et al., 2025; Wang et al., 2024). In the Indonesian context, these challenges are especially relevant as the country begins to implement AI and coding education in schools. The effectiveness of these initiatives will rely on sustained teacher professional development (Moorhouse & Kohnke, 2024), culturally responsive curriculum design (Dai et al., 2023), and policies that promote ethical and equitable AI use. Addressing linguistic and infrastructural diversity will also be crucial, as success depends on balancing technological innovation with inclusive practices to improve learning outcomes for all students.

3. Method

This study addressed three central research questions: (1) What are the strengths, weaknesses, opportunities, and threats (SWOT) in Indonesia's AI and coding education policy? (2) How does Indonesia's approach compare to that of India? and (3) What gaps remain unaddressed within the current academic framework? To answer these questions, a qualitative design was employed, combining content analysis, comparative case study, and critical literature review. The main source of data was the Indonesian Ministry of Education's academic draft *Naskah Akademik Pembelajaran Koding dan Kecerdasan Artifisial Pada Pendidikan Dasar dan Menengah* (Academic Draft on Coding and Artificial Intelligence Learning in Primary and Secondary Education)[1], which was examined through iterative readings to extract policy-relevant insights. For cross-national comparison, official documents from India, including the National Education Policy 2020[2], the National Strategy for AI 2018[3], and related programs, were analyzed to highlight similarities and differences. The gap analysis was benchmarked against global standards, specifically the UNESCO AI Competency Framework for Students and Teachers (UNESCO, 2024)[4], which outlines knowledge, skills, and ethical considerations necessary for AI literacy. This framework provided a reference point for assessing the Indonesian draft's coverage of technical, ethical, and pedagogical dimensions. Gemini 2,5 Pro, a Generative AI tool, was used in this study to assist with comparative policy analysis. Specifically, the prompt *"Comparative Analysis: Indonesia and India in AI and Coding Education Policy" was* used to generate structured comparisons, which were then critically reviewed and validated by the authors against official policy documents.

4. Result

4.1 SWOT Analysis of Academic Draft Indonesia's AI and Coding Education Policy

Figure 1. SWOT Analysis AI and Coding Education Policy

[1] https://kurikulum.kemdikbud.go.id/file/1741766787_manage_file.pdf
[2] https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf
[3] https://www.niti.gov.in/sites/default/files/2023-03/National-Strategy-for-Artificial-Intelligence.pdf
[4] https://www.unesco.org/en/articles/ai-competency-framework-teachers and https://unesdoc.unesco.org/ark:/48223/pf0000391105 (ai competency framework student)

4.2 Comparative Analysis: Indonesia and India

Table 1. *Comparison Between Indonesia and India*

Feature	India	Indonesia
National Strategy/Policy	- National Education Policy (NEP) 2020: Explicitly includes AI & coding. - National Strategy for AI (2018): Identifies education as key. - "India AI Mission" & "Viksit Bharat 2047": Strong government push for AI leadership.	- Finalizing AI & Coding Curriculum: Targeting 2025/2026 rollout. - "Indonesia Artificial Intelligence National Plan": Focus on AI-driven learning. - Recent high-level push: Aiming to compete globally.
Curriculum Integration	- Coding from Grade 6: As per NEP 2020. - AI as Elective: CBSE offers it in secondary & senior secondary. - Focus: Experiential learning, real-world projects.	- Elective Subjects: AI & coding from Grade 5/6 (Elementary) to High School. - Approach: Blend of device-based and non-device-based learning planned. - Phased Rollout: Likely starting in select 'project schools'.
Teacher Training	- Recognized Challenge: Significant gap in AI-trained teachers. - Initiatives: CBSE training, IBM Skills Build, Google AI for Teachers, Microsoft. - Focus: Upskilling existing teachers, EdTech platform involvement.	- Major Partnership: Google to train at least 1 million teachers in AI & coding (like Gemini Academy). - Involvement: Leveraging private universities & coding providers. - Focus: Rapid, large-scale upskilling via collaboration.
Digital Infrastructure & Access	- "Digital India" Program: Aims for nationwide connectivity & literacy. - Challenge: Ensuring last-mile connectivity and device access, especially in rural areas.	- Digital Literacy Programs: Government initiatives, often with partners. - Challenge: Bridging the digital divide, particularly across its vast archipelago. - Risk Focus: Addressing misinformation & online safety.
Industry Partnerships	- Thriving EdTech Ecosystem: Many platforms offering AI/coding education. - Multiple Collaborations: Government, academia, and industry (MNCs & domestic) work together.	- Strategic Collaborations: Key partnership with Google is central. - Open to Providers: Welcomes involvement from coding service providers and developers. - University Links: Encouraging ties with industry.
Key Challenges	- Infrastructure Gaps - Teacher Readiness Scale - Curriculum Standardization & Flexibility - Equity & Inclusion (Urban-Rural Divide) - Ethical Considerations (Bias, Privacy)	- Infrastructure Gaps (esp. remote islands) - Teacher Readiness Scale - Curriculum Implementation & Standardization - Equity & Inclusion (Access) - Ethical Considerations
Overall Approach & Outlook	- Early Mover: Formalized policy structure. - Leverages Domestic Strength: Strong IT & EdTech sectors. - Goal: Global AI leadership.	- Rapid Mover: Determined push to implement quickly. - Leverages International Partnerships: Key strategy for scaling. - Goal: Global competitiveness & "Golden Indonesia 2045".

4.3 Gap Analysis of the Academic Draft

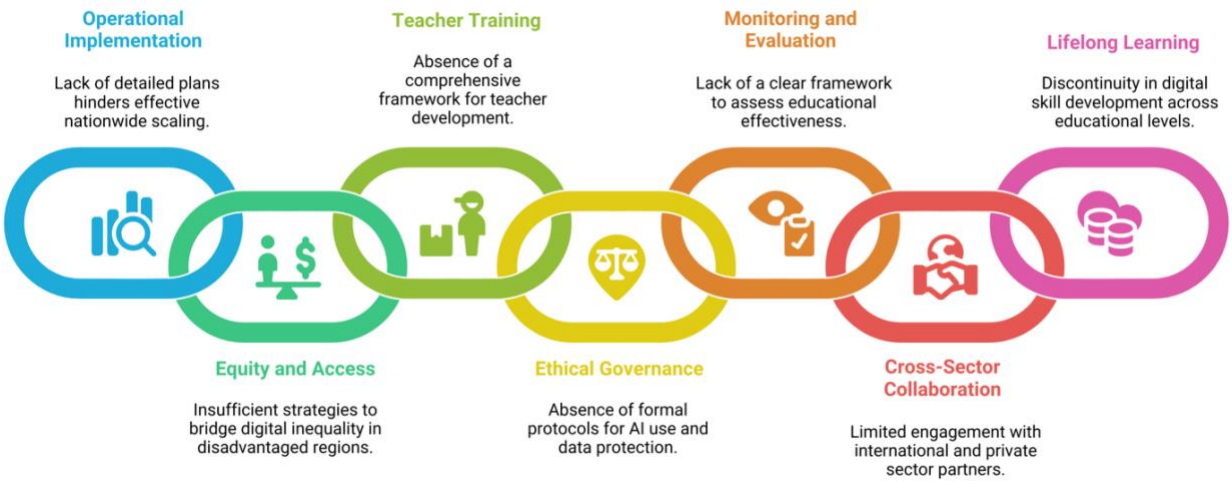

Figure 2. Gap Analysis

5. Discussion and Conclusion

The findings confirm that Indonesia's 2025 Academic Draft on Coding and Artificial Intelligence Education is a forward-looking policy aligned with RPJPN 2025–2045 and Society 5.0, reflecting strong philosophical grounding in Pancasila and a modular curriculum design that is both adaptable and pedagogically relevant (Mutawa & Sruthi, 2025; UNESCO, 2023; Basyir, 2014). Nevertheless, the analysis reveals significant gaps in operational readiness. While the draft acknowledges the importance of teacher training, it lacks a structured competency framework with measurable indicators for teacher preparedness and student outcomes. This gap is evident when compared with India's centralized, certification-based programmes, which provide clear benchmarks for scalability (Wang et al., 2025). Similarly, the policy's commitment to equity is weakened by the absence of concrete strategies to bridge the digital divide in "3T" (Terdepan, Terluar, Tertinggal) regions, raising concerns of deepening educational inequality (Tiwari et al., 2021). Furthermore, its broad mention of data ethics and digital safety remains insufficient without enforceable legal guidelines, potentially limiting both public trust and effective protection for learners.

This study therefore argues that the draft's ambitious vision can only be realised through a stronger emphasis on implementation and equity. Recommended measures include adopting a phased implementation roadmap, establishing certified teacher competency frameworks adapted from international models, investing in infrastructure for low-connectivity regions, and introducing enforceable data ethics guidelines to safeguard learners and build public confidence (UNESCO, 2023). Such reforms would ensure that foundational readiness—particularly teacher training and digital inclusion—precedes large-scale deployment. While the study provides valuable insights, it is limited by its reliance on secondary policy documents and the absence of primary data from teachers, students, and policymakers, which restricts perspectives on local readiness. Future research should therefore combine policy analysis with field-based evidence to strengthen contextual understanding. In conclusion, the draft represents a progressive step toward digital transformation, but its success depends on translating visionary intent into actionable, context-sensitive strategies that guarantee inclusivity and sustainability.

6. Acknowledgement

We thank the Ministry of Education of Indonesia for providing the 2025 Academic Draft on Coding and Artificial Intelligence Education in Primary and Secondary Schools, which guided this study. While this article was written in May 2025, the policy has since been formally launched under *Permendikdasmen No. 13 Tahun 2025*, established on 15 July 2025.

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