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A comprehensive analysis of Indonesia's education quality development across infrastructure, curriculum, teacher competence, technology, and character education

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ABSTRACT

Education is the main foundation in building quality and competitive human resources (HR) in the global era. The quality of education is an important indicator in determining a nation's ability to face technological developments, global competition, and the demands of 21st century competencies. This study aims to describe the policy of developing the quality of education in Indonesia through several main aspects, namely strengthening infrastructure, revitalizing the curriculum, improving the quality of teachers, utilizing educational technology, character education, and learning from international practices. The study was carried out through a literature study of policy documents, government reports, and previous research. The results of the study show that education policies in Indonesia have moved towards a more adaptive direction, including the implementation of the Independent Curriculum, the Teacher Driving program, school digitalization, and strengthening the Pancasila Student Profile. However, challenges such as infrastructure inequality, teacher competency gaps, low digital literacy, and uneven implementation of P5 are still obstacles. This article contributes theoretically and practically to education policy studies in Indonesia by providing an integrative analytical framework for evaluating policy directions in education quality improvement and offering strategic insights to support evidence-based and sustainable policy formulation. It is necessary to strengthen governance, equitable distribution of facilities, increase teacher capacity, and cross-sector collaboration to support the sustainable development of education quality.

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INTRODUCTION

Education is a strategic component in the development of a country because it functions as the main foundation in creating quality, productive, and competitive human resources (HR) (Ningsih et al., 2022). Through quality education, a nation can build a society that is advanced, independent, adaptive, and able to compete globally. The quality of education itself is an important indicator to assess the success of an education system in achieving sustainable development goals, especially the fourth point of the Sustainable Development Goals (SDGs), namely Quality Education (Luthfi et al., 2025). Education quality is defined as a set of standards and criteria that show the extent to which the learning process and outcomes meet the needs of students, society, and the demands of the times (Gorgy et al., 2022). In the era of globalization marked by rapid technological developments, Indonesia faces a major challenge in improving the quality of education. The flow of globalization requires the presence of human resources who are not only academically superior, but also have 21st century skills, such as critical thinking, creativity, collaboration, communication, and digital literacy. This condition demands a policy of developing education quality that is more adaptive, innovative, and responsive to change. Efforts to improve the quality of education in Indonesia have been realized through various strategic policies that include strengthening educational infrastructure, improving curriculum, improving teacher competence, utilizing learning technology, and strengthening character education (Deffinika et al., 2021).

Despite these efforts, the implementation of education quality development policies continues to face substantial obstacles. Infrastructure disparities between regions, particularly between urban areas and disadvantaged, frontier, and outermost (3T) regions, remain a major challenge to equitable access to quality education. Although school digitalization programs, infrastructure development, and expanded internet access through collaboration with BAKTI have been introduced, access to quality educational services remains uneven across educational units. Limitations in facilities such as adequate classrooms, laboratories, and technological devices directly contribute to unequal learning opportunities (Valmay et al., 2024).

In addition to infrastructure issues, other challenges come from curriculum implementation. The Merdeka curriculum is designed to provide flexibility and creativity space for students through project-based learning (Sain et al., 2024). Although this approach is aligned with global demands and has shown positive results in some driving schools, the gap in teacher and school readiness is an obstacle in its implementation. Some of the top schools were able to adapt quickly, but small schools still faced limitations in training, mentoring, and understanding of new pedagogies (Anggini & Husna, 2024). In addition, some teachers are still used to using traditional approaches that emphasize memorization rather than meaningful learning. Another factor that greatly determines the quality of education is the quality of teachers. The Teacher Mobilization Program, Teacher Professional Education (PPG), and digital training conducted by the government with global partners have increased teacher capacity.

However, the competency gap between teachers still occurs, especially between teachers who have access to continuous training and teachers in areas with limited infrastructure and academic assistance. The use of educational technology is also a priority in education quality improvement policies. The implementation of the Learning Management System (LMS), Smart School, and the trial use of artificial intelligence (AI) in learning show that Indonesia is starting to move towards a smart education paradigm. However, the digital divide between urban and rural schools is still a crucial issue. Uneven internet infrastructure, low digital literacy, and limited devices result in the use of technology that is not optimal and has the potential to create new quality gaps. In addition to the academic aspect, strengthening character education through the Pancasila Student Profile (P5) is also an integral part of efforts to improve the quality of national education. This program emphasizes six character dimensions that must be built from primary to secondary education. Although its implementation has shown a positive impact in shaping students' social and moral values, its implementation is still uneven and often only administrative

in nature. This shows the need for a policy strengthening strategy so that P5 can be truly integrated into daily learning. Furthermore, lessons learned from international education best practices show that highly competitive countries such as the United States, China, and Malaysia have succeeded in improving the quality of education through innovation, education system reform, industrial collaboration, and diversification of education funding. The integration of digital technology in Pancasila Education learning can further strengthen the development of the Pancasila Student Profile, encompassing dimensions such as faith, noble character, independence, mutual cooperation, critical thinking, and global diversity (Armianti et al., 2024; Prasetiyo et al., 2024).

Despite the growing body of education policy studies in Indonesia, most existing research tends to focus on single policy dimensions, such as curriculum reform, teacher professional development, or digitalization, examined in isolation and primarily at a descriptive level. Consequently, there remains a limited understanding of how infrastructure, curriculum, teacher quality, educational technology, character education, and international best practices interact systemically to shape education quality in a sustainable and globally competitive manner. Addressing this gap, a comprehensive and multidimensional analysis of Indonesia's education quality development policies is needed to capture education quality as an interconnected policy ecosystem rather than fragmented interventions. Based on this context, a comprehensive analysis of Indonesia's education quality development policies is needed to identify achievements, obstacles, and directions for its development in the future. This article aims to analyze Indonesia's education quality development policy through six main aspects: (1) educational infrastructure, (2) curriculum, (3) teacher quality, (4) educational technology, (5) character education, and (6) international comparative studies. This study is expected to contribute academically by strengthening the theoretical understanding of integrated education policy development and practically by providing evidence-based policy recommendations for the government and education stakeholders to support sustainable improvement in national education quality.

RESEARCH METHODOLOGY

This study employs a descriptive qualitative approach using a narrative literature review to analyze Indonesia's education quality development policies. The analysis draws on peer-reviewed journal articles, national education policy documents, and reports from international institutions such as UNESCO, OECD, and the Indonesian Ministry of Education, Culture, Research, and Technology. The author's midterm exam (UTS) document was used solely as an initial conceptual reference to structure the analysis and identify key policy themes. Its academic validity was ensured through systematic comparison and verification with authoritative policy documents and scholarly literature; only findings supported by external sources were included in the final analysis. Literature selection followed a structured screening process to reduce subjectivity. Inclusion criteria comprised relevance to education quality policy in Indonesia, coverage of at least one analytical dimension (infrastructure, curriculum, teacher quality, educational technology, character education, or international comparison), publication between 2015–2025, and academic or institutional credibility. In total, 45 documents were analyzed, including scientific articles, national policy regulations, and international reports. Data were analyzed using qualitative content analysis, involving data reduction, categorization, interpretation, and thematic synthesis. Analytical credibility was strengthened through source triangulation and consistent coding procedures. The analysis was guided by an education quality framework referencing SDG 4, 21st-century skills, national education indicators, and international best practices. The transparent description of data sources, selection criteria, and analytical procedures enables replication by other researchers.

RESULTS AND DISCUSSIONS

The results of the study show that the development of the quality of Indonesian education is a very complex process because it involves various interrelated policy dimensions, ranging from educational infrastructure, curriculum, teacher competence, technology utilization, to character education and learning from international practices. All of these dimensions have a significant contribution to shaping the quality of human resources and the nation's competitiveness in the global era. The government has implemented various policies and strategic programs to strengthen the quality of national education, but its implementation still faces various challenges that need to be critically evaluated. From the infrastructure aspect, the education quality development policy shows that the equitable distribution of facilities and infrastructure is still a big job. Although the government through the Ministry of Education and Culture has implemented the School Digitalization program and the construction of educational facilities in 3T areas, the reality is that there is still a significant gap between regions. Many schools in remote areas do not have proper classrooms, science labs, libraries, and even adequate internet access.

This condition is in line with UNESCO's findings that infrastructure inequality is the main cause of inequality in the quality of education in developing countries, because the quality of facilities greatly determines the learning process. The provision of internet access to more than 12,000 schools through collaboration with BAKTI is a progressive step, but without a maintenance system, digital assistance, and equitable distribution of devices, its utilization will not be optimal. Thus, despite the increase in access to infrastructure, inequality remains a fundamental challenge that needs to be addressed through equity-based policies and long-term investment in educational infrastructure.

In addition to infrastructure, curriculum reform through the implementation of the Independent Curriculum is an important milestone in the transformation of national education. The curriculum is designed to address the needs of 21st century learning by emphasizing flexibility, project-based learning, and holistic development of learners' competencies. This approach is critical for cultivating digital literacy, critical thinking, problem-solving skills, and adaptability, which are essential for navigating an increasingly complex global landscape (Ayas & Charles, 2024; Siagian & Iskandar, 2020). Furthermore, an integrated curriculum is vital for equipping students with the capacity to engage with global and local changes effectively, ensuring their preparedness for future challenges and opportunities (Rini et al., 2023, p. 21). This necessitates a curriculum that is responsive to global and technological changes, accommodating the diverse needs of students and fostering internationally recognized professional qualifications (Kabanda, 2021; Rini et al., 2023). This responsiveness extends to the continuous consideration of evolving job market demands and educational trends at local, national, and international levels, thereby making the curriculum dynamic and relevant (Kabanda, 2021). Moreover, this dynamic curriculum must actively integrate 21st-century skills such as critical thinking, creativity, and teamwork, as these are increasingly recognized as necessities for contemporary education and workforce readiness (Herlinawati et al., 2024). These skills, often categorized into frameworks like the 6Cs (Critical Thinking, Collaboration, Communication, Creativity, Citizenship/Culture, and Character Education/Connectivity), are crucial for producing graduates who can thrive in a digital age and contribute to knowledge societies (Anisa, 2022). The implementation of the Independent Curriculum has shown positive results, for example through an organic waste treatment project that increases students' science literacy and environmental awareness. However, its implementation faces various obstacles such as the gap in readiness between schools, the unpreparedness of some teachers in implementing differential learning, and the lack of academic assistance in non-driving schools. This indicates that curriculum reform cannot be effective without the support of continuous training, academic supervision, and systematic collaboration with the industrial world and society. Curriculum development should be seen as an ongoing process that involves evaluation, innovation, and adaptation to fit social dynamics and global technological

developments. This study further reveals an integrative relationship among policy aspects, where weaknesses in one dimension directly constrain the effectiveness of others. For instance, curriculum reform and technology integration are highly dependent on infrastructure readiness, while improvements in teacher competence require institutional support, access to digital tools, and manageable administrative workloads. The findings suggest that education quality policies function as an interconnected system, in which partial implementation limits overall policy impact.

The quality of teachers is a factor that greatly determines the quality of education. The Government's Teacher Driving Program, PPG, and digital-based training have had a significant impact on improving teachers' pedagogic skills. Based on data from the Secretary of the Directorate General of Teachers and Education Personnel, Ministry of Education and Culture-Research and Technology, there are 92,888 teachers who have passed the driving teacher education (PGP) program, and the data also shows that more than 75,000 teachers have been trained and experienced improvements in pedagogic skills and digital literacy (Nurhidayat, 2024). Teachers who graduated from PGP, some of whom are appointed as principals or supervisors, are expected to bring managerial and pedagogical transformation in schools, improve the quality of learning, facilitate the adaptation of new curriculum, and improve the student learning environment to be more dynamic and responsive. Importantly, this study highlights that an increase in the number of trained teachers does not automatically translate into improved learning quality. The analysis shows that training outcomes are highly contingent on contextual factors such as school infrastructure, digital access, mentoring continuity, and leadership support. Without these enabling conditions, the pedagogical transformation expected from teacher training programs remains limited and uneven across region.

In addition, the digital literacy training launched by the Ministry of Education and Culture by involving external partners (edutech, ICT training providers) indicates that the government is aware of the demands of the times where teachers' ability to use information technology, online learning platforms, and digital media is increasingly crucial. The global literature supports this view. The transformation of education in the 21st century relies heavily on the professionalism of teachers and the ability of teachers to manage modern learning. However, challenges remain, empirical studies show that in many schools, especially in remote or underdeveloped areas, teachers have not received adequate digital training, ICT devices and internet infrastructure are not yet available, and the digital literacy of teachers and students is still low. This means that the positive impact of programs such as PGP and digital training can vary between regions. In schools with good access and trained teachers, the quality of learning is likely to improve while in schools with limited infrastructure, transformation will still be hampered. Thus, although national data show great progress in the number of trained teachers, policy effectiveness is highly dependent on equitable access, sustainability of training, and support for educational infrastructure and management. To ensure long-term success, teacher competency improvement programs must be balanced with policies of equitable distribution of facilities/infrastructure, implementation monitoring, and evaluation of learning outcomes in various school contexts.

Although various teacher competency improvement programs such as PGP, PPG, and digital literacy training have shown promising results, the reality on the ground shows that teacher quality improvement has not occurred evenly. Differences in access to technology, learning resources, and professional development opportunities are factors that create skills gaps between teachers. Teachers in urban areas tend to be more ready to implement innovative learning due to infrastructure support and adequate access to training, while teachers in 3T areas still face limited facilities, internet networks, and lack of professional assistance. This discrepancy contributes to a persistent digital divide, where rural educators often lack the essential technological resources and professional development opportunities prevalent in urban settings, thereby impeding the effective integration of digital tools in classrooms (Mustafa et al., 2024). This disparity is particularly pronounced in mathematics education, where the effective implementation of digital resources can

significantly enhance learning outcomes. The challenges faced by rural schools, including limited internet access, fewer technological devices, and insufficient teacher training, significantly hinder their capacity to leverage these advancements effectively. This gap extends beyond mere resource availability to encompass significant disparities in Technological Pedagogical Content Knowledge proficiency and attitudes toward technology integration among mathematics teachers in urban versus rural environments (Li, 2025). In addition, various studies also note that the high administrative burden often limits the space for teachers' creativity in developing meaningful learning strategies. This condition emphasizes the importance of teacher quality improvement policies that not only focus on training, but also equal access, provision of ongoing support, and simplification of administrative tasks so that teachers can focus on an effective and student-friendly learning process.

The use of educational technology is one of the most rapidly developing aspects of national education policy. The Merdeka Teaching Platform, learning management system (LMS), and pilot integration of artificial intelligence (AI) in learning show that Indonesia has led to a smart education paradigm. The use of LMS, such as in the case study of SMAN 1 Surabaya, has been proven to increase learning effectiveness because teachers can monitor student progress in real time and adjust learning strategies based on data**.** However, the biggest challenge in digitizing education is the digital divide that is still high. Many schools do not have adequate devices or stable internet access. Digital literacy of teachers and students is also still relatively low. This reinforces UNESCO's finding that the digitalization of education must go hand in hand with the equitable distribution of infrastructure and digital literacy, so that technology truly becomes a tool of empowerment and not just a symbol of modernization. Thus, the government needs to strengthen digital governance of education, create a comprehensive digital literacy curriculum, and encourage collaboration with the edutech industry to develop AI-based learning content that is relevant to the Indonesian context (*Smart School Project - Platform Digitalisasi Sekolah Terbaik Indonesia*, 2025; Yulfianti & Dewi, 2021).

In addition to the technical aspect, character education through the Pancasila Student Profile (P5) is an important dimension in the national education quality policy. The P5 program is designed to build six main character dimensions, namely faith and piety, independence, cooperation, critical reasoning, creativity, and global personality. This study found that the implementation of P5 has had a positive impact in several schools, such as the anti-bullying project at SMK Negeri 1 Denpasar which improved students' empathy and communication skills. However, the implementation of P5 in many schools is still symbolic and has not been systemically integrated in learning. Teachers often find it difficult to design contextual, character-based activities, and some schools position P5 as an add-on program rather than an integrated part of the curriculum. In order for character education to run effectively, a policy that emphasizes the integration of Pancasila values in all subjects, not just through projects, is needed. In addition, the development of the Character School Index can be an instrument to evaluate the extent to which schools are successfully implementing character values in their learning culture (Azis et al., 2025; Prasetiyo et al., 2024).

The results of the study also show that international comparative studies provide valuable insights for national education reform. The United States provides an example of success through research-based innovation, multiculturalism, and academic freedom. China emphasizes transformation towards knowledge-based industries and strong collaboration between universities and industry. Malaysia shows how academic research relevant to the job market can improve the quality of higher education and economic competitiveness. Lessons learned from these countries show that quality education requires an integrated system of research, innovation, technology, and international cooperation. Indonesia needs to adopt these principles by encouraging applied research, strengthening industry involvement in vocational education, and providing greater space for innovation in higher education (Ardakani et al., 2016). The United States, China, and Malaysia

were selected for comparison because they represent different education system orientations relevant to Indonesia's policy direction: innovation-driven education (United States), state-led human capital development linked to industry (China), and regional contextual adaptation within Southeast Asia (Malaysia). However, this comparative analysis is limited to policy orientation and strategic lessons, and does not imply direct policy transfer due to differences in governance structures, socio-economic conditions, and levels of educational investment.

From a practical policy perspective, this study suggests several implementable actions: prioritizing equity-based infrastructure allocation, integrating teacher training with school-based mentoring systems, aligning curriculum reform with digital readiness, and reducing administrative burdens that limit instructional innovation. These steps can be directly operationalized within existing education governance frameworks. Overall, the results and discussion show that although the government has made many innovations in the development of education quality, its implementation still faces various limitations. The biggest challenges lie in infrastructure inequality, teacher readiness, digital literacy, and character education integration. However, with consistent, collaborative, and science-based policies, Indonesia has a great opportunity to build an inclusive, adaptive, and globally competitive education system. Quality education not only produces a generation that is academically intelligent, but also characterful, creative, innovative, and able to contribute to the development of the nation.

CONCLUSION

This study demonstrates that improving the quality of education in Indonesia requires an integrated and multidimensional policy approach that connects infrastructure, curriculum reform, teacher capacity development, educational technology, and character education within a coherent governance framework. The main scientific contribution of this research lies in its integrative policy perspective, which conceptualizes education quality as a policy ecosystem rather than isolated interventions. From a policy standpoint, the findings highlight the urgency of reducing regional infrastructure disparities, strengthening teacher competencies, improving digital literacy, and ensuring the substantive implementation of the Pancasila Student Profile (P5) across schools. However, this study is limited by its reliance on secondary data and a narrative literature review approach. Future research is recommended to employ empirical or mixed-methods designs to examine policy implementation and impacts at the school and regional levels.

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