

Strengthening Student Character in the Digital Era: Integrating Project-Based Learning and Open Innovation

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Abstract

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The rapid digitalization of education presents both opportunities and challenges for fostering student character, requiring innovative pedagogical approaches. Project-Based Learning (PjBL) and open innovation have emerged as effective strategies to enhance character education by integrating academic, social, and ethical competencies. This study aims to examine how PjBL and open innovation can be designed and implemented to strengthen character development in the digital era. A descriptive-qualitative literature study was conducted, reviewing relevant scientific articles published between 2020 and 2024, selected from national and international databases using keywords such as “project-based learning,” “open innovation in education,” and “character education.” Thematic analysis was applied to identify patterns, impacts, and challenges in implementing these approaches. Findings indicate that PjBL promotes responsibility, collaboration, and problem-solving, while open innovation encourages multi-stakeholder engagement, contextualized learning, and adaptive strategies. Successful implementation relies on teacher readiness, supportive policies, and equitable technological infrastructure. In conclusion, integrating PjBL and open innovation provides a robust framework to cultivate students who are

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academically competent, socially responsible, and ethically grounded in the digital era.

1. Introduction

The wave of digital transformation in education has served as a crucial driver for the renewal of learning practices on a global scale. This transformation goes beyond merely adopting technological tools in the classroom; it represents a fundamental pedagogical shift toward approaches that are student-centered, collaborative, and grounded in real-world contexts. In Indonesia, this momentum is further reinforced by the introduction of the Independent Curriculum, which grants greater autonomy for teachers and schools to design learning activities that align with students' individual needs and potentials. At the same time, the curriculum underlines the central role of character education as a core element of 21st-century learning. Character education in this sense is directed at nurturing values such as integrity, perseverance, social responsibility, and the capacity to think both critically and collaboratively (Dewi et al., 2023).

Aligned with this vision, one pedagogical model that has gained prominence is Project-Based Learning (PjBL). This approach situates students as active participants who engage in exploring, analyzing, and addressing authentic problems relevant to their daily lives. Learning within PjBL unfolds through teamwork, peer

collaboration, and open inquiry, all of which aim to generate tangible impacts within the community (Rahim & Ismaya, 2023). Unlike conventional teacher-centered methods, PjBL emphasizes learner autonomy, logical reasoning, and shared responsibility in accomplishing project objectives. Through such activities, students cultivate the ability to make ethical decisions, articulate ideas confidently, and reflect on their work within broader social contexts. Consequently, PjBL not only enhances academic achievement but also resonates strongly with the foundational principles of character education.

In its implementation, Project-Based Learning (PjBL) functions not only as a means to achieve cognitive objectives but also as a platform for nurturing students' social and emotional competencies. According to Yanti and Rahmad (2023), this approach enables learners to develop a stronger sense of responsibility, confidence in expressing their ideas, and the ability to collaborate effectively within diverse groups. Alongside the role of PjBL in reinforcing character education, the idea of open innovation in education has also begun to gain increasing attention. Open innovation, in this educational context, goes beyond the simple adoption of digital tools or the creation of new applications. Instead, it highlights a collaborative process in which teachers, students, parents, local communities, and digital platforms work together to co-design adaptive, contextual, and value-driven learning experiences (Yusgiantara et al., 2024). Through this collaborative spirit, open innovation offers opportunities for education to become more democratic, relevant to learners' realities, and better attuned to contemporary challenges.

The integration of PjBL with open innovation within the framework of character education policies can foster a dynamic and creative learning ecosystem. Collaborative projects developed by teachers and students, supported by community involvement, transform the learning process into a meaningful social experience. In this way, character education is no longer limited to theoretical values but becomes a lived experience that shapes students directly. Within the digital era, this integrated approach responds effectively to pressing challenges such as declining moral values due to excessive digital media exposure, weak learning motivation in passive instructional models, and the growing demand for digital and social literacy. As Urifah et al. (2024) point out, the pressures of globalization and digitalization often lead to identity crises and reduced student engagement unless balanced with more meaningful learning strategies. Nevertheless, the development of educational innovations remains constrained, both in scale and quality. Many educators continue to struggle with integrating technology appropriately, while systemic issues, such as time limitations and overloaded curricula, further hinder innovation efforts in schools.

The unequal distribution of digital access remains a significant barrier, particularly in the 3T regions (frontier, outermost, and disadvantaged areas). Without balanced infrastructure development, efforts to utilize technology as part of open innovation cannot be implemented fairly across different contexts, potentially widening the disparity in learning quality between regions. Against this backdrop, the present study becomes relevant in exploring how project-based learning and open innovation can be effectively integrated into character education policies that

are responsive to the challenges of the digital age. This research adopts a literature review method as its primary approach, analyzing 11 recent scholarly works that address the application of PjBL and open innovation within the Indonesian educational landscape. The analysis emphasizes three core aspects: the effectiveness of both approaches in fostering student character formation, their potential incorporation into national education policy, and the practical obstacles that must be addressed by educators and policymakers to ensure successful implementation.

2. Literature Review

2.1. Cultivating Character and Collaboration Through PjBL

Project-Based Learning (PjBL) has been widely recognized as a powerful method for developing 21st-century skills, particularly in relation to student character formation. One of the core strengths of this model is its focus on the learning journey rather than solely the outcomes of a completed project. Throughout this process, students are encouraged to design tasks, carry out investigations, make both individual and collective decisions, and engage in reflective practices that deepen their understanding. Such principles are strongly aligned with constructivist pedagogy, which asserts that knowledge is actively built through learners' engagement with authentic, real-world contexts. Empirical findings by Song et al. (2024) highlight that PjBL significantly enhances students' critical thinking and collaborative abilities, enabling them to better navigate the complexities of learning in the digital era. This demonstrates that PjBL fosters not only intellectual growth but also the social and emotional dimensions of student development.

In addition, the application of PjBL provides a valuable avenue for cultivating essential character traits, including responsibility, cooperation, and discipline. When students participate in group-based projects, they learn to negotiate conflicts, allocate roles fairly, and assume accountability for collective achievements. Kulsum (2024) emphasizes that the teamwork dynamics and inherent challenges of managing projects contribute meaningfully to the shaping of fundamental character values necessary for community life. Within the broader framework of character education, PjBL thus emerges as an effective strategy for embedding values across disciplines in ways that are both contextual and experiential, ensuring that learning becomes a more holistic and meaningful process.

2.2. Synergy and Challenges in Open Innovation for Education

Open innovation represents a collaborative paradigm in educational development, emphasizing the active involvement of diverse stakeholders in shaping learning practices. Within the realm of character education, this approach fosters synergy among teachers, students, technological platforms, and local communities to build learning environments that are inclusive, reflective, and adaptable to ongoing changes. Importantly, character education under this model is not seen as the sole responsibility of schools, but rather as a shared undertaking across the broader educational ecosystem. As highlighted by Pamuji et al. (2024), incorporating community perspectives into curriculum design expands opportunities for meaningful participation, ensuring that character education is closely aligned with students' cultural contexts, social realities, and practical needs.

Nevertheless, implementing open innovation in education presents notable challenges. Chief among them is the need to coordinate diverse actors who bring different resources, capacities, and interests to the table. Many teachers may lack the managerial expertise or access to innovation networks necessary to sustain such collaborative practices. Effective, inclusive leadership thus becomes crucial to navigate these complexities and maintain cohesion. In this regard, governmental support is indispensable. Mohamed Hashim et al. (2022) underline the role of strategic public policy in cultivating an innovation-oriented ecosystem for character education, particularly through investment in digital infrastructure, teacher professional development, and partnerships that span multiple sectors.

3. Methods

This research adopts a literature review or library research design with a descriptive-qualitative orientation. The choice of this method is based on the nature of the topic, namely, project-based learning design and open innovation in character education policies within the digital era, which requires a comprehensive exploration of theoretical foundations and empirical findings from prior studies. Through this approach, the study aims to identify, interpret, and critically analyze existing evidence to construct a solid conceptual framework and generate well-grounded recommendations for educational policy and classroom practice.

The data analyzed in this study consists of secondary sources, primarily drawn from scientific works published between 2020 and 2024. Google Scholar was selected as the main database due to its wide coverage of peer-reviewed national

journals, conference proceedings, and scholarly books. The search process employed a set of targeted keywords, such as “project-based learning,” “open innovation in education,” “character education,” “independent curriculum,” and “educational digitalization.” Articles were filtered systematically, considering title and abstract relevance, publication recency, and their direct relation to the core focus of the study, ensuring that only the most pertinent materials were included in the review.

Once the relevant articles were collected, the researcher carried out a thematic analysis to systematically organize information across multiple sources. This process began with a thorough reading of each text, highlighting pertinent sections, identifying recurring themes, and categorizing the data into sub-themes, including pedagogical approaches, effects on student character, challenges in implementation, and institutional policies. Following this, a critical interpretation was conducted by comparing and contrasting findings among different authors to detect consistencies, contradictions, and gaps in the current literature.

To ensure the validity of the analysis, the researcher employed triangulation by reviewing literature from diverse publication types, such as peer-reviewed journals, conference proceedings, and policy reports, and cross-referenced these findings with official guidelines from the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) concerning character education and the Merdeka curriculum. The rigor of the study was further enhanced by selecting sources that had undergone a peer-review process. Overall, this methodological approach provides a solid theoretical and empirical foundation for synthesizing

insights on the integration of project-based learning and open innovation within character education policies in the digital era.

4. Results and Discussion

4.1. Integrating Character Education and Technology in Project-Based Learning

Project-Based Learning (PjBL) is an instructional model that prioritizes students' active engagement in authentic, real-world projects, aiming to foster deeper comprehension and character development. Within the framework of character education, PjBL is particularly relevant as it nurtures essential values such as collaboration, responsibility, and independence. Working in teams to complete projects, students gain experience in decision-making, conflict resolution, time management, and equitable task distribution. These experiences contribute not only to cognitive growth but also to the cultivation of responsible behavior and social awareness, which are key components of holistic character education.

Research by Kulsum (2024) highlights the effectiveness of PjBL in Islamic Religious Education, demonstrating that project-based activities enhance both academic competencies and the internalization of spiritual and social values. Students learn through active participation rather than passive reception, applying ethical principles, empathy, and social responsibility throughout the project lifecycle. Yanti and Rahmad (2023) further emphasize the integration of Pancasila values into project execution, ensuring that every activity reflects foundational principles of nationalism and humanity, rather than remaining value-neutral.

Nevertheless, the application of Project-Based Learning (PjBL) faces several challenges. A key obstacle lies in teachers' preparedness to design and facilitate project-based learning experiences. Many educators lack sufficient training or prior experience in creating projects that effectively balance academic objectives with character development goals. Yusgiantara et al. (2024) note that a considerable number of teachers are accustomed to conventional, teacher-centered instruction and may feel uneasy when required to guide students through open-ended, flexible, and dynamic projects. This highlights that the effectiveness of PjBL strongly relies on the competence and readiness of teachers, who serve as primary facilitators of the learning process.

In the context of digital learning, PjBL has experienced significant evolution. Digital platforms such as Google Classroom, Padlet, and even artificial intelligence (AI) tools can facilitate collaboration, documentation, and reflective activities throughout project execution. Technology serves not merely as a support tool but also expands learning environments to be more interactive, open, and flexible. Consequently, digital-era PjBL represents a forward-looking pedagogy that adapts to technological advancements while reinforcing essential character values.

4.2. Open Innovation in Education: A Collaborative Approach to Character Development

Open innovation in education can be understood as a collaborative and participatory learning framework that engages multiple stakeholders in designing and implementing learning experiences. This approach brings together contributions from teachers, students, parents, local communities, and digital technologies to

create learning that is more contextually relevant, adaptive, and grounded in meaningful values. Within the scope of character education policies, open innovation presents an opportunity to integrate both local and global perspectives into educational practices.

Dewi et al. (2023) highlight that open innovation positions teachers and students as active curriculum designers rather than passive users. They are empowered to adapt learning activities to reflect local culture and values, aligning with the Independent Curriculum's goal of granting schools and educators greater autonomy. This approach enhances educational flexibility while ensuring that learning remains socially and culturally connected to students' lives. Additionally, Pamuji et al. (2024) demonstrate that involving communities in projects, such as environmental initiatives or digital literacy campaigns, can cultivate empathy, leadership, and social awareness among students, enriching both their character and civic engagement.

Learning today is no longer confined to the four walls of the classroom; it extends into real-life contexts, where students are encouraged to act as responsible citizens and demonstrate care for their communities. This highlights the crucial role of open innovation in translating character values into tangible experiences. However, implementing open innovation effectively requires a well-prepared educational system. Mohamed Hashim et al. (2022) stress that without sufficient structural support, such as flexible funding, ongoing professional development, and incentive mechanisms, teachers may struggle to sustain innovative practices consistently. Moreover, this approach demands coordinated efforts among multiple

stakeholders and inclusive educational leadership. In certain situations, educators may feel isolated, lacking networks that facilitate cross-sector collaboration. Additionally, open innovation carries inherent risks if it operates outside a strong ethical framework. Without clear moral guidance, the intended goals of character education may be undermined. Therefore, open innovation must be embedded within an explicit character curriculum to ensure that educational reforms remain aligned with desired moral and social values.

4.3. Challenges and Opportunities of Digitalization in Character Education

The rise of digitalization in education has significantly transformed both the ways students learn and how they interact socially. On one hand, technology provides vast opportunities for collaborative work, broader access to information, and the diversification of learning resources. On the other hand, it also presents challenges for character development, particularly due to exposure to digital content that may be inappropriate or misleading. This situation highlights the growing importance of character education as a guiding force to counterbalance the complexities of the digital environment. Urifah et al. (2024) note that uncontrolled exposure to digital content can negatively affect students' academic performance, underscoring the necessity of integrating digital ethics into character education.

Learning projects can be intentionally designed to generate constructive and educational digital outputs, such as videos promoting anti-bullying, infographics on digital literacy, or podcasts addressing tolerance and inclusivity. These initiatives not only cultivate responsible digital citizenship but also heighten students' awareness of the social consequences of their online actions. Simanjuntak et al. (2024) confirm

that digital projects aligned with Pancasila values effectively foster collective consciousness among Gen Z learners. In this sense, technology functions not only as an instructional tool but also as a cultural medium that shapes social identity and value formation in students.

When digital collaboration is properly facilitated, it can naturally foster values such as solidarity, empathy, and social responsibility among students. However, the persistent digital divide poses a significant obstacle to the effective implementation of this approach. Rahim and Ismaya (2023) point out that many schools in remote and underdeveloped areas still struggle with limited internet connectivity, insufficient digital devices, and a lack of adequate teacher training. These disparities can impede equal access to technology-enhanced character education and exacerbate regional inequalities in learning opportunities. Consequently, strategies for implementing technology-based character education must prioritize digital inclusion, ensuring that all educational institutions receive sufficient infrastructure and resources to support equitable learning experiences.

4.4. Empowering Teachers as Innovators in Character Education

Teachers hold a pivotal role in the effectiveness of character education, particularly when employing approaches such as Project-Based Learning (PjBL) and open innovation. In these contexts, educators function not only as instructors but also as facilitators, mentors, coordinators of learning communities, and even innovators of the curriculum. This expanded role demands high levels of professional expertise, social competence, and the autonomy to experiment and reflect on their teaching practices. Many teachers possess strong innovative

potential, they often lack adequate support and facilitation from the educational system. Consequently, educational policies must create opportunities for teachers to engage in reflective practices and experimentation, including through professional learning communities, collaborative instructional design training, and forums for sharing best practices. By providing such support, teachers are better equipped and motivated to implement innovative strategies that enhance character education in meaningful and impactful ways.

Moreover, teachers must possess the skills to design and implement cross-disciplinary learning experiences. In projects that focus on character development, educators can no longer operate in isolation within their own subjects. They need to collaborate with colleagues, communities, and even external stakeholders. For instance, a project on “local food innovation” could integrate contributions from science, social studies, and cultural arts teachers, alongside involvement from MSME practitioners and parents. This collaborative approach positions teachers as key facilitators of the holistic integration of knowledge, skills, and character values.

The strategic importance of teachers in this process is further highlighted by Potvin et al. (2024), who argue that character education reforms are more successful when teachers are treated as co-designers of policy rather than mere implementers. This entails involving educators in shaping curriculum decisions and strategies for character learning. When teachers are empowered and entrusted with this responsibility, educational transformations extend beyond formal documents into daily classroom practice. Expanding teachers’ roles as innovators is therefore essential to ensure the effectiveness and sustainability of project-based character

education and open innovation in the digital era. Empowered educators become agents of change, fostering a learning ecosystem that cultivates both intelligence and character.

5. Conclusion

Designing learning through project-based approaches combined with open innovation has shown significant potential in enhancing character education, particularly within the context of the digital era. Project-based learning fosters not only students' academic achievement and critical thinking abilities but also nurtures key character traits such as responsibility, collaboration, and social awareness. By actively participating in real-world, contextual projects, students gain a more authentic and meaningful learning experience. Meanwhile, open innovation facilitates collaboration among diverse actors including teachers, students, communities, and technology, allowing the development of inclusive and adaptive learning experiences. This approach promotes learning environments that are dynamic, participatory, and closely aligned with real-life challenges.

The effectiveness of these approaches, however, heavily depends on teacher preparedness, supportive education policies, and equitable access to technological infrastructure. In addressing the challenges posed by digital transformation and potential value erosion, integrating project-based learning with open innovation must be underpinned by policies that prioritize character development. Government initiatives are crucial in expanding teacher training, fostering collaborative platforms, and cultivating a culture of innovation in schools. When properly supported, this

integration can lay the foundation for producing a generation that is not only intellectually capable but also socially and morally grounded in the digital age.

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