

# Peer Support as a Strategic Lever for Addressing Indonesia's Higher Education Completion Crisis

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## Abstract

Indonesia faces a critical higher education completion crisis, with only 28.7% of students graduating on time, a stark contrast to the OECD average of 68%. This challenge is intensified by a recent policy reducing the maximum study period to five years. While institutional responses have predominantly focused on top-down, resource-intensive infrastructure, a fundamental resource remains critically underutilized: structured peer support. This commentary argues that peer support is not a peripheral activity but a central, cost-effective strategic lever for improving graduation rates. Grounded in House's (1981) Social Support Theory and informed by contemporary evidence from educational psychology, neurobiology, and digital culture, this paper bridges global best practices with the Indonesian context. Critically, we identify a specific gap in the literature: while the efficacy of peer support is globally recognized, there is a lack of a culturally-adapted framework that systematically integrates Indonesia's collectivist values (*gotong royong*) with the digitally-native behaviors of Gen Z students. By analyzing the four dimensions of missing support emotional, instrumental, informational, and appraisal this article highlights the unique alignment between peer support mechanisms and Indonesia's socio-cultural landscape. It concludes with actionable policy recommendations for institutions, national policymakers, and student organizations to leverage this scalable solution to transform the nation's higher education landscape.

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## 1. Introduction

Higher education completion is not merely an individual achievement; it is a global economic and social imperative. The inability of students to graduate on time imposes a significant economic burden, with estimated productivity losses reaching \$75 billion annually in the United States alone (Carnevale et al., 2020). This issue is further compounded by a "pandemic hangover," a phenomenon characterized by widespread student disengagement and declining mental health, which continues to challenge higher education systems globally (OECD, 2024). While OECD countries report an average on-time undergraduate completion rate of approximately 68%, this benchmark underscores a universal public policy priority (OECD, 2023).

Within this global landscape, Indonesia stands at a critical juncture. Data from the Indonesia Higher Education Database (Pangkalan Data Pendidikan Tinggi, 2023) reveals a stark reality: only 28.7% of undergraduate students complete their studies on time. This situation is rendered more urgent by Minister of Education and Culture Regulation No. 3 of 2020, which caps the study period. More alarmingly, Indonesia significantly lags behind its regional peers, such as Malaysia (78%), Thailand (65%), and Vietnam (72%) (The World Bank, 2022). This disparity points to systemic failures, exacerbated by the pandemic's long-term impacts, which a UNESCO (2023) report warns has created a "lost generation" vulnerable to academic attrition. Conventional institutional responses, heavily reliant on expanding physical infrastructure and formal student services, have shown limited efficacy, often overlooking the rich, pre-existing social capital within the student body.

This challenge is compounded by fundamental shifts in generational and cultural contexts. Currently, over 70% of Indonesia's student population belongs to Generation Z (Badan Pusat Statistik, 2023). As digital natives, they inherently seek information and form support networks through digital platforms. Recent studies confirm that Gen Z actively leverages technology not just for entertainment, but to form "digital learning communities" as a vital survival mechanism in higher education (Cahyadi & Wijaya, 2024). This generational preference aligns uniquely with Indonesia's deeply ingrained collectivist culture and the principle of *gotong royong* (mutual cooperation) (Hofstede Insights, 2023). Ironically, higher education policies and practices have failed to

capitalize on the powerful synergy between these generational behaviors and cultural strengths, representing a significant strategic blind spot.

While the global literature on peer support is extensive, a critical gap exists in its application to the Indonesian context. Specifically, there is a scarcity of models that are not merely imported from the West, but are systematically adapted to leverage the unique convergence of Indonesia's collectivist DNA and the digitally-mediated collaboration habits of Gen Z. This paper addresses this gap by arguing that structured peer support is not an auxiliary program but a core strategic imperative. Through the interdisciplinary lens of Social Support Theory (House, 1981) and communication frameworks like the Coordinated Management of Meaning (Pearce & Cronen, 1980), this article offers a critical analysis of why peer support is a uniquely potent lever for Indonesia. It aims to provide deep insights and actionable recommendations for policymakers, institutional leaders, and students to harness this overlooked collective power in addressing the national graduation crisis.

## **2. A Critical Synthesis of the Scientific Foundations for Peer Support Effectiveness**

The theoretical justification for peer support is anchored in House's (1981) Social Support Theory, a foundational framework positing that interpersonal resources are vital for coping with stress and enhancing well-being. House identified four core dimensions emotional, instrumental, informational, and appraisal support operating through two primary mechanisms: the buffering hypothesis, where support mitigates stress, and the direct effect hypothesis, where support inherently improves well-being (Cohen & Wills, 1985). While this foundational theory remains robust, a contemporary synthesis reveals that its application must evolve to address the complexities of the digital-native, collectivist student population in Indonesia. A critical examination of each dimension through the lens of modern research exposes the limitations of conventional approaches and illuminates a path toward a more sophisticated model.

### **2.1. The Neurobiological Underpinnings: A Critical Re-evaluation in the Digital Age**

The justification for peer support extends into the realm of neurobiology. Positive social interactions trigger the release of oxytocin, which reduces anxiety and fosters trust (Heinrichs et al., 2009), while simultaneously lowering cortisol, the primary stress hormone (Dickerson & Kemeny, 2004). However, the rise of digital peer support necessitates a critical re-evaluation of these mechanisms. The assumption that all social support is neurologically equal is being dismantled by modern neuroscience. A seminal 2024 review in *Nature Reviews Neuroscience* demonstrates that the brain processes digital and face-to-face social cues along overlapping but distinct neural pathways. Digital interaction, while activating core social cognition networks, often fails to fully engage the neural circuits responsible for building deep trust and rapport, which are heavily reliant on non-verbal synchrony and co-presence (Falk & O'Donnell, 2024). This creates a fundamental tension for Indonesian universities: while digital platforms are essential for scaling peer support, they may be neurologically suboptimal for providing the deep emotional and appraisal support needed to navigate high-stakes challenges like thesis completion. The implication is clear: effective programs must intentionally blend digital efficiency with strategically placed, high-touch, in-person or video-based interactions to fully leverage the neurobiology of bonding.

### **2.2. Educational Psychology: From Peer Tutoring to AI-Augmented Feedback**

The empirical evidence for peer-assisted learning is formidable. Seminal meta-analyses have consistently demonstrated its positive impact on academic achievement (Topping, 1996; Acheson et al., 2021). However, the literature has evolved far beyond simple peer tutoring to a complex ecosystem of feedback augmented by Artificial Intelligence. A cutting-edge 2024 systematic review reveals that AI is no longer a futuristic concept but a present-day tool that can augment peer feedback processes. AI can help students phrase feedback more constructively, identify potential biases in peer comments, and even summarize feedback from multiple sources (Lee & Cai, 2024). This presents a double-edged sword for Indonesia. On one hand, AI offers a scalable solution to train thousands of students in giving high-quality feedback, directly addressing the quality control problem that plagues informal peer support. On the other hand, it risks undermining the very human, trust-based relationships that underpin effective support, especially in a collectivist culture that values personal connection. The challenge is to integrate AI not as a replacement for human interaction, but as a scaffold to enhance its quality and efficiency, thereby elevating peer support from informal chat to a structured, high-impact pedagogical practice.

### **2.3. Cross-Cultural Validity: Navigating the Harmony-Critique Paradox**

Evidence strongly suggests that peer support is particularly potent in collectivist societies. A cross-cultural study by Chen et al. (2018) found that the positive effects of social support on psychological well-being were

significantly stronger in East Asian countries. Indonesia, with one of the world's highest collectivism scores (Hofstede Insights, 2023), possesses a cultural DNA intrinsically aligned with the principles of *gotong royong* (Geertz, 1962). Yet, this cultural strength presents a critical pedagogical challenge: the harmony-critique paradox. A 2024 review on cross-cultural feedback dynamics confirms that in collectivist cultures, feedback is often indirect and coded to avoid causing loss of face, which can lead to ambiguity and a lack of actionable critique (Sullivan & Kelloway, 2024). This creates a direct conflict with the academic requirement for rigorous, critical appraisal support. Therefore, an effective Indonesian model of peer support cannot simply be imported; it must be built upon a new cultural contract that reframes critical feedback not as an attack on an individual, but as an act of collective responsibility for upholding academic standards a modern, academic manifestation of *gotong royong*.

## 2.4. Digital Enhancement: Designing for Affordances, Not Just Access

For Generation Z, peer support is inextricably linked to digital technology. Platforms like WhatsApp and Telegram enable 24/7 support, overcoming temporal and spatial barriers (Manca, 2020). The critical question is no longer if technology mediates peer support, but how specific technological affordances can be harnessed to maximize its four dimensions. A comprehensive systematic review on Computer-Supported Collaborative Learning (CSCL) identifies key affordances such as shared virtual whiteboards for co-construction (instrumental support), and structured discussion forums for eliciting diverse perspectives (informational support) that can be deliberately designed into learning environments (Järvelä et al., 2023). However, the same review warns that without proper scaffolding and regulation by instructors or peers, these tools can lead to chaos and cognitive overload. This underscores that institutional strategy must move from passive allowance of digital platforms to the active, pedagogically-informed design of digital peer support ecosystems that guide students toward productive and critical collaboration.

## 2.5. A Communication Science Lens: The Expertise of the Student

While other fields explain why social support is important, communication science provides a critical lens for understanding how it is dynamically constructed and negotiated. Theories like the Coordinated Management of Meaning (CMM) reveal that peer conversations are active co-constructions of reality, where students build narratives of resilience (Pearce & Cronen, 1980). Uncertainty Reduction Theory (URT) explains why students turn to peers for "unwritten rules" to navigate ambiguous academic systems (Berger & Calabrese, 1975). Media Richness Theory clarifies why students intuitively choose "richer" media for sensitive feedback and "leaner" media for quick checks (Daft & Lengel, 1986). This sophisticated, intuitive media selection underscores a key insight: students are already expert communicators of support. The institutional failure, therefore, lies not in the students' capabilities, but in the absence of a formal structure that recognizes, validates, and scales these existing, culturally-grounded communication practices. The opportunity is to move from viewing student communication as background noise to seeing it as a strategic asset to be cultivated.

## 3. The Four Dimensions of Missing Support: A Symptom of Systemic Blindness in Indonesian Higher Education

While the scientific foundation for peer support is robust, the reality on the ground in Indonesia reveals a stark disconnect. The four dimensions of social support identified by House (1981) are not merely underutilized; their absence is a symptom of a systemic blindness within institutional strategies. This failure to recognize and integrate the natural support mechanisms of students is a critical oversight that directly contributes to the nation's alarmingly low on-time graduation rates. Each missing dimension represents a specific failure of the formal system, forcing students to create their own ad-hoc, and often insufficient, solutions.

### 3.1. Emotional Support: The Overwhelmed Formal System and the Rise of Peer-Based Mental Health Navigation

The mental health crisis among university students is a global emergency, intensified by the "pandemic hangover" of anxiety and burnout (OECD, 2024). In Indonesia, this crisis is particularly acute. A 2024 systematic review and meta-analysis revealed a staggering prevalence of anxiety and depression among Indonesian university students, far exceeding global averages (Kurniawan & Hidayat, 2024). This public health challenge is met with formal support systems that are critically under-resourced and culturally ill-equipped to handle the scale of the problem. The persistent stigma surrounding mental health, coupled with a shortage of counselors, creates a significant care gap. From a CMM perspective, the failure of formal systems to provide a "safe conversational space" pushes students into informal digital networks where they co-construct narratives of shared struggle. While these peer groups offer vital validation, they lack the professional expertise to address serious mental health issues, creating a dangerous vacuum where untrained peers become the first, and often only, line of defense.

### **3.2. Instrumental Support: The Widening Skill Gap and the Failure of Formal Instruction**

Final-year students in Indonesia face a profound chasm between the academic skills required for independent research and the instruction they receive. High student-to-faculty ratios make personalized, intensive guidance a luxury (Jalal & Musthafa, 2021). The formal curriculum often focuses on theoretical knowledge while neglecting the practical, instrumental skills needed for thesis completion, such as advanced research methods, data analysis software proficiency, and academic writing. This institutional failure creates a "skills vacuum" that students are forced to fill through their own initiative. A 2024 systematic review confirms that collaborative peer learning is highly effective in fostering precisely these practical competencies (Chan & Pow, 2024). Consequently, Indonesian students are creating their own de facto instrumental support systems through "study streams" on TikTok and collaborative sessions on Discord, effectively crowdsourcing the skill development that their institutions have failed to provide. This is a clear indictment of a curriculum that is not aligned with the practical realities of student success.

### **3.3. Informational Support: The Bureaucratic Labyrinth and the Primacy of Peer Information Networks**

Academic bureaucracy is often a confusing and ever-changing labyrinth of procedures, deadlines, and unwritten rules. Official university communication is frequently top-down, ambiguous, and slow, leaving students adrift in a sea of uncertainty. This institutional failure to provide clear, timely, and accessible informational support is a primary driver of student anxiety and delays. From an Uncertainty Reduction Theory (URT) perspective, students' reliance on peer information networks is not a preference but a rational survival strategy. A 2024 systematic review highlights how students increasingly turn to social media and peer networks to navigate the complexities of academic life, as these sources offer immediate, experience-tested, and contextually relevant information (Rienties & Toetenel, 2024). In Indonesia, this manifests as a deep-seated trust in "infographic summary" created by seniors in WhatsApp groups over lengthy official announcements. The formal system's informational opacity has inadvertently ceded its authority to the informal, yet highly efficient, peer-to-peer information economy.

### **3.4. Appraisal Support: The Crisis of Academic Identity and the Search for Validation in Digital Echo Chambers**

Working in isolation on a major project like a thesis can trigger profound self-doubt and imposter syndrome. Students lack reliable benchmarks to assess their progress and the quality of their work. The formal system offers appraisal support infrequently, often in high-stakes, summative settings like thesis defense, which is too late to be formative. This lack of ongoing, low-stakes appraisal creates a crisis of academic identity, where students question their competence and belonging. A 2024 study reveals that high-achieving students increasingly turn to social media to navigate this identity crisis, seeking validation and community in curated online spaces (Park & DiPierro, 2024). While platforms like Instagram's "close friends" feature can provide a safe space for sharing progress, they also risk creating "echo chambers" where feedback is uniformly positive and lacks the critical edge necessary for genuine academic growth. From a Media Richness Theory perspective, students intuitively seek richer media for appraisal but are often constrained by the available platforms. The institutional failure lies in not providing structured, formative appraisal opportunities, forcing students to seek validation in digital spaces that may prioritize emotional support over critical rigor.

## **4. Beyond Importation: Critically Adapting Global Models for Indonesian Innovation**

The identification of four critical gaps in student support does not imply a lack of solutions. Internationally, several well-established peer support models demonstrate consistent positive outcomes. However, the path forward for Indonesia is not one of simple importation. A critical analysis reveals that direct transplantation of Western models without deep cultural adaptation is a recipe for failure. Instead, Indonesia stands at a unique juncture where it can learn from global best practices to forge its own innovative path, one that is uniquely suited to its cultural and generational strengths.

### **4.1. A Critical Examination of Proven Global Models**

Several peer support models have been widely implemented with documented success. The Supplemental Instruction (SI) model from the U.S., adopted by over 1,500 institutions, has been shown in a recent meta-analysis to significantly improve student grades and persistence in high-risk courses (Wilcox & Fyvie, 2023). Similarly, Australia's Peer Assisted Study Sessions (PASS) model is a near-universal standard, praised for its formal structure and focus on collaborative learning rather than remediation. The UK model often emphasizes formal recognition and accreditation for peer mentors, professionalizing the role. However, a 2024 systematic review highlights a critical challenge: these models, developed in individualistic Western contexts, often face significant barriers when implemented in Asian educational systems without substantial adaptation. Challenges

reported include student reluctance to volunteer as leaders, difficulties in fostering open critical dialogue, and a mismatch between collaborative ideals and competitive grading systems (Kaur & Noman, 2024). This underscores that the "what" (peer support) is transferable, but the "how" (implementation) is deeply culturally contingent.

## 4.2. Indonesia's Unique Opportunity: The Convergence of Culture, Generation, and Technology

Indonesia is not a blank slate but possesses a unique constellation of assets that, if strategically leveraged, can create a world-class peer support ecosystem. This opportunity arises from the convergence of three powerful forces.

**First, the deep-seated cultural foundation of *gotong royong*.** Unlike Western models that must actively build a culture of collaboration from scratch, Indonesia's collectivist orientation provides a fertile, pre-existing social soil. Research confirms that in collectivist cultures, peer mentoring can be particularly effective for building a sense of belonging and shared identity, especially for students who may feel marginalized (O'Shea et al., 2024). The challenge is not to instill the value of mutual aid, but to channel this existing cultural impulse toward specific academic goals. This requires reframing *gotong royong* from a general community value into a targeted academic strategy: *gotong royong* to complete undergraduate thesis.

**Second, the demographic reality of a digitally-native Gen Z.** As established, Indonesian students are not just using technology; they are "collaboration natives" who instinctively form digital learning communities (Cahyadi & Wijaya, 2024). This is a profound advantage. While Western institutions often struggle to encourage students to engage with digital collaboration tools, Indonesian students are already there. The institutional opportunity is to move from being a passive observer of this phenomenon to an active architect. By providing scaffolding, training, and integration into the formal curriculum, universities can transform these spontaneous, informal groups into powerful, high-impact learning engines.

**Third, the ready-made digital infrastructure.** With smartphone penetration among students reaching 89% (APJII, 2023), the technological foundation for scaling peer support is already in place. The focus shifts from resource-intensive infrastructure projects to smart, low-cost digital interventions. The convergence of these three forces cultural predisposition, generational behavior, and digital readiness creates a unique opportunity for Indonesia to leapfrog the West. Instead of merely adapting outdated models, Indonesia can pioneer a "Digital-Age Gotong Royong" model: a hybrid system that blends the best of structured international programs with the organic, digitally-mediated, and collectivist spirit of its own student body. This is not just about solving a graduation crisis; it is an opportunity for Indonesia to become a global leader in culturally-responsive, digitally-enhanced peer learning.

## 5. Policy Implications and Recommendations: A Roadmap for a "Digital-Age Gotong Royong"

The preceding analysis has illuminated a critical failure in Indonesian higher education and a unique opportunity for transformative change. Bridging this gap requires more than well-intentioned advice; it demands a concrete, multi-stakeholder roadmap. The following recommendations are designed to operationalize the "Digital-Age Gotong Royong" model, moving from concept to implementation. They are targeted at the three primary pillars of the Indonesian higher education ecosystem: institutions, national policymakers, and students themselves.

### 5.1. For Higher Education Institutions: From Passive Allowance to Active Architecture

Institutions must shift their role from being passive observers of student-led initiatives to active architects of a structured peer support ecosystem.

**Strategic Integration and Resourcing:** Universities must formally embed peer support into their core strategic plans. This involves more than a verbal endorsement; it requires the creation of a dedicated Center for Peer Learning and Community Engagement with a protected budget, dedicated staff, and a clear mandate to design, implement, and evaluate peer support programs. As experts in quality assurance argue, such initiatives must be integral to the institution's core mission, not peripheral activities, to be effective and sustainable (Eaton, 2024).

**Pilot Hybrid "Thesis Support Pods":** Move beyond generic pilots by launching a "Thesis Support Pod" program. These pods would be small, discipline-specific groups of 5-7 students, blending digital efficiency with human connection. The model would include:

- a. Weekly digital check-ins via a dedicated platform (e.g., Discord or a university LMS channel) for informational and instrumental support.
- b. Bi-weekly face-to-face or video-conference workshops focused on challenging aspects like data analysis or receiving critical feedback, directly addressing the neurobiological need for rich-media interaction (Falk & O'Donnell, 2024).
- c. AI-augmented feedback training modules to help students provide high-quality, constructive comments, leveraging the potential of AI to enhance pedagogical quality (Lee & Cai, 2024).

**Formal Recognition through Micro-Credentials:** Transform peer mentorship from a voluntary role into a recognized leadership experience. Institutions should offer a "Peer Mentorship and Academic Leadership" micro-credential or digital badge. This modern approach to skills validation is more flexible and directly tied to employability than traditional course credits, signaling to students and employers that these skills are highly valued (Oliver & Jorre de St Jorre, 2023).

## 5.2. For National Policymakers: Creating an Enabling Environment for Systemic Change

National-level action is crucial to scale successful initiatives and ensure quality and equity across the archipelago.

**Integrate into Accreditation Frameworks:** The Ministry of Education, Culture, Research, and Technology must work with the National Accreditation Board for Higher Education to introduce a specific, weighted indicator for "Structured Peer Support Implementation" in the accreditation standards. This indicator should assess not just the existence of a program, but also its budget allocation, training protocols, and evidence of impact on student retention and well-being.

**Develop a National Peer Mentorship Certification:** To ensure quality and consistency, the government should facilitate the development of a National Peer Mentorship Certification Framework. This framework, created in collaboration with leading universities and psychological associations, would establish core competencies, training standards, and a code of ethics for peer mentors, professionalizing the role and ensuring student safety.

**Fund a National Longitudinal Study:** Move beyond simple data collection by allocating targeted research funds for a national longitudinal study on the impact of structured peer support programs on on-time graduation rates, mental health outcomes, and post-graduation employability. This evidence would be invaluable for refining policies and justifying continued investment. This aligns with global strategies that emphasize data-driven policymaking to enhance student success (European Commission, 2024).

## 5.3. For Students and Student Organizations: From Grassroots Initiatives to a National Movement

Students are the engine of this change. Their role is to innovate from the ground up and demand systemic support from their institutions.

**Organize a National Peer Support Network:** Student organizations should collaborate across universities to create a "National Consortium for Peer Support." This consortium could host an annual summit, share best practices, and develop open-source toolkits for starting and running peer support programs, creating a powerful student-led movement for change.

**Launch Branded, Scalable Programs:** Instead of isolated initiatives, student organizations can adopt and scale a branded program like "Buddy Skripsi Kita". This program would provide a clear structure (pairing senior and junior students, regular check-in schedules, shared goal-setting templates) that can be easily replicated across different faculties and universities, turning a good idea into a nationwide movement.

**Champion Participation as Professional Development:** Students should actively frame their participation in peer support not as extracurricular activity, but as a critical component of their professional development. They should demand that these experiences be formally recognized in career fairs, alumni networks, and university transcripts, building a strong case for the tangible value of these "soft skills" in the 21st-century workplace.

## 6. Conclusion

Indonesia stands at a rare and pivotal convergence. On one side lies a pressing graduation crisis, a systemic failure that jeopardizes the nation's economic future and the aspirations of millions of students. On the other side lies an unprecedented opportunity, a unique alignment of cultural DNA, generational behavior, and digital readiness. This is not a mere coincidence; it is a strategic inflection point demanding a profound paradigm shift. This article has argued that the lever for this transformation is not a new, expensive infrastructure project, but the deliberate and strategic cultivation of a resource that has always existed: the power of peer support, reimagined for the digital age.

The journey through this analysis has revealed that the conventional, top-down, individualistic approaches to student success are fundamentally mismatched with the Indonesian context. The missing dimensions of support emotional, instrumental, informational, and appraisal are symptoms of a systemic blindness to the rich social capital within the student body. By synthesizing insights from neuroscience, psychology, communication, and cross-cultural studies, we have demonstrated that a "Digital-Age Gotong Royong" model is not just a viable alternative but a superior one. It is a model that acknowledges the neurobiological need for human connection, leverages AI to enhance pedagogical quality, reframes critical feedback as a collective responsibility, and scales through the very digital platforms that Gen Z students already inhabit.

This is Indonesia's opportunity for profound educational innovation. By embracing this model, Indonesia can do more than just solve its domestic graduation crisis. It can challenge the dominant, Western-centric paradigms of higher education and pioneer a new approach that is more collaborative, more humane, and more culturally resonant. It can transform its campuses from arenas of competitive individualism into ecosystems of collective flourishing. In doing so, Indonesia will not only be modernizing a cherished cultural value but exporting a new template for 21st-century education to the world a testament to the enduring power of gotong royong in the academic sphere. The time for talk is over; the time for strategic, collective action is now.

## Author Contributions

The manuscript was originally conceived and drafted by Hanifah Qonita Mutmainnatul Qolbi, who also led the investigation and literature review. The work was carried out under the primary supervision of Ira Mirawati, who provided the initial conceptual guidance, managed the project administration, and secured necessary resources. Kismiyati El Karimah, as co-promotor, contributed critical expertise in strengthening the manuscript's methodological and theoretical framework. Both supervisors were integral to the iterative review and editing process, providing substantive feedback to refine the final article. All authors have read and agreed to the published version of the manuscript.

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## Declaration on AI Use

To enhance the clarity and linguistic quality of this manuscript, the authors employed artificial intelligence (AI) tools during the revision process. Specifically, large language models (LLMs), including Claude Sonnet 4.5 (by Anthropic) and GLM-4.6 (by Z.ai), were utilized to assist with grammar correction, sentence rephrasing for academic tone, and improving overall readability. These tools were used strictly as language assistants and did not contribute to the conceptualization, analysis, or generation of the original research content. The authors have thoroughly reviewed, edited, and approved the final manuscript and take full responsibility for its intellectual content, arguments, and conclusions.

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