Pathway Construction and Practical Exploration of Postgraduate Integrity Education in the Context of Educational Digital Transformation

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Abstract: While the digital transformation of education presents new opportunities for postgraduate integrity education, it also poses challenges, such as technological misuse and difficulties in conveying values. Based on the principle that "digitalisation is the means, integrity is the standard, and quality is the goal," this study constructs a comprehensive framework for postgraduate integrity education, with the "multi-dimensional integrity portfolio" at its core. It further establishes three synergistic safeguarding mechanisms—ethical constraints, dynamic optimisation, and whole-staff participation—to ensure the systematic and sustainable implementation of the proposed pathways. By incorporating the architectural design of the "undergraduate-postgraduate integrated platform" in a sample institution and validating it against existing operational systems, the study confirms the feasibility of the framework and identifies its phased implementation characteristics. Empirical evidence, including the steady rise in thesis originality compliance rates and the reflective case of AIGC tool misjudgment, supports the relevance of the mechanisms. This research provides both a theoretical foundation and actionable strategies to help higher education institutions transition integrity education from a focus on technological application to a deeper, value-based integration. The approach provides theoretical foundations and practical guidance to help higher education institutions advance integrity education from tool application towards value integration.

Keywords: Postgraduate Education; Integrity Education; Digital Transformation; Integrity Portfolio; Pathway Construction

1. Introduction

Practical challenges in integrity education for postgraduate students amidst digital transformation. The digitalisation of education is reshaping the postgraduate ecosystem. While it expands educational boundaries and enhances governance efficiency, it also presents novel challenges for integrity education.

1.1 Policy Imperatives and Institutional Requirements for Systematic Integrity Education

As integrity education is a core component in fulfilling the fundamental task of fostering virtue through education and ensuring the quality of innovative talent cultivation, its conceptual framework, implementation pathways, and evaluation mechanisms urgently require systematic reconstruction. At the national level, China's Degree Law establishes a 'zero-tolerance' principle for academic misconduct, setting a legal baseline for academic conduct. The Opinions on Improving the Social Credit System extend integrity building beyond academic spheres to encompass all facets of social conduct. This establishes a policy framework for a multidimensional credit evaluation system that encompasses academic pursuits, research activities, and professional development. Meanwhile, the ongoing focus on professional ethics and research standards across industries further highlights the need for integrity education to be fully integrated into professional practice and career development. These institutional arrangements impose heightened demands on the systematic, comprehensive, and practical nature of integrity education within higher education institutions.

1.2 Dual Challenges of Technological Misuse and Governance Limitations in the Digital Context

The deep application of digital technology in driving educational innovation has also spawned multiple compound challenges. Technological advantages have been exploited to facilitate dishonesty, manifesting as concealed plagiarism, technical data tampering, and the blurring of originality boundaries through the misuse of AI-generated content. Technological governance tools possess inherent limitations, such as the high misjudgment rate of AI-generated content (AIGC) detection. This exposes algorithmic flaws while revealing the systemic risks of relying solely on technical determinations. Traditional oversight mechanisms exhibit structural lag, with outcome-oriented, post-incident enforcement models struggling to address the dynamic and covert nature of emerging forms of academic misconduct.

1.3 Literature Review: Limitations of Current Research Pathways and the Need for Integration

A systematic review of the existing literature reveals that the current research and practice concerning postgraduate integrity education primarily follow two pathways. There is a clear distinction between 'technological application' and 'value-based education'. The first pathway is the technology-enabled governance approach. This approach focuses on enhancing the efficiency and scope of integrity oversight by utilizing digital tools. Research in this area began earlier overseas, focusing on the development and application of text similarity detection systems, online invigilation tools, and similar technologies to establish 'technical defences' [1,2]. In recent years, domestic scholars have followed suit, exploring the use of big data to construct early-warning models of academic behaviour [3-6] and demonstrating the potential of blockchain technology for traceability and tamper-proofing of research data [7-10]. While such research provides a strong instrumental rationale for identifying and preventing academic misconduct, it tends to focus excessively on external oversight. It pays insufficient attention to the reliability and adaptability of the technological tools themselves. This risks reducing integrity education to a mere 'monitoring-evasion' game and failing to promote the internalisation of academic norms effectively. Secondly, there is the value-oriented educational approach. This approach emphasises permeating integrity values and shaping academic culture. It advocates for cultivating scholarly conduct through academic ethics courses, exemplary conduct by mentors, and the development of an academic community culture [11]. However, in highly digitised research and learning environments, traditional value education models encounter difficulties. Their unidimensional indoctrination methods hold diminishing appeal for the 'digital native' generation, making it challenging to implement and deepen educational outcomes. Consequently, there is an urgent need to develop an integrated approach underpinned by digital technology and centred on value guidance to enhance quality. This will drive a paradigm shift in postgraduate integrity education, transitioning from passive oversight to active cultivation and development.

2. Theoretical Framework: Integration of Instrumental and Value Rationality

The digital transformation of postgraduate integrity education constitutes a profound dialogue between technological empowerment and educational values. To address the core questions of 'how digital technology serves integrity' and 'how integrity safeguards quality', this study proposes a theoretical framework that encompasses 'means-standards-goals', shifting the focus of integrity education from external discipline to endogenous cultivation.

2.1 Constructing an Integrated "Means-Standards-Goals" Theoretical Framework

Technological mediation theory reveals the non-neutral impact of technology on human behaviour and cognition, offering dual insights into 'digital as a means' [12]. On the one hand, digital technology can reconstruct educational processes, shifting paradigms from post-event punishment to process-oriented guidance. On the other hand, when devoid of values, it may become a tool for surveillance, eroding trust between teachers and students. Consequently, digital tools must be anchored in educational principles and defined by ethical constraints. The failure to implement AIGC detection tools in sample schools due to excessive misjudgment rates highlights the necessity of this mechanism. Value education theory emphasizes that core values progress through a gradual process, from normative cognition to

emotional identification and finally to behavioral self-awareness [13]. Integrity education in digital environments should not simply translate norms into platform rules. Instead, it must cultivate immersive educational scenarios. By establishing a digital ecosystem in which 'trustworthiness yields benefits while dishonesty incurs restrictions' and by developing interactive scenarios based on real-world cases, integrity standards can evolve from external constraints into intrinsic motivations for postgraduate students. The CIPP evaluation model provides a systematic methodology for achieving 'quality objectives' [14], integrating the effectiveness of digital transformation into the entire talent cultivation process. This encompasses indicators such as aligning educational background with strategic positioning, matching resource investment with institutional safeguards, integrating technology application with value internalisation, and enhancing academic integrity and innovation outcomes.

2.2 An Integrated Explanatory System for Addressing Practical Challenges

This framework integrates three theoretical strands to create a coherent explanatory system. The efficacy of 'digital tools' is based on ethical constraints, the implementation of 'integrity standards' relies on internalisation mechanisms, and the achievement of 'quality objectives' is based on systematic evaluation. Together, these elements form a digitally transformed integrity education solution for postgraduate students that addresses practical challenges while maintaining theoretical rigour.

3. A Practical Approach: A Three-Dimensional Framework of Digital Empowerment, Value Embedding, and Quality Orientation

Building upon the theoretical framework, this study establishes a tripartite pathway for postgraduate integrity education comprising digital empowerment, value embedding, and quality orientation, to forge a highly adaptive educational ecosystem through systematic synergy.

3.1 Digital Empowerment: Constructing a Traceable Data Governance System

The Digital Empowerment pathway transforms the concept of a 'Comprehensive Integrity Record' into a data management system. Currently, the sample institutions have established an integrated system that connects the Degree Management Platform with the Postgraduate Achievement Recognition Platform. This system interfaces with the Ministry of Education's platforms for thesis plagiarism detection and academic credentials, facilitating student registration and the management of qualification records. This integration enables standardised data management and traceability of processes across critical stages of educational development. The future development of an 'undergraduate-postgraduate integrated platform' will allow the fusion of multi-system data via API interfaces. This will establish a standardized data governance system encompassing five dimensions, including academic, scholarly, and behavioral. It will also ensure technological reliability.

3.2 Value Embedding: Integrating Regulations and Education for Value Internalization

The value embedding pathway focuses on overcoming barriers to value transmission in the digital environment. Existing platforms have embedded regulatory requirements and key technical nodes by fully integrating the Degree Management Platform with the 'Intelligent Plagiarism Detection' service of the Achievement Platform. This creates a dual support system of regulations and courses that complement the implementation of the Revised Regulations on Postgraduate Thesis Management and the thesis writing standardisation curriculum. Subsequent efforts will explore embedding mandatory validation processes at the rule level within the platform while advancing integrity education based on student profiling to facilitate the internalisation of integrity values.

3.3 Quality Orientation: Establishing a Progressive and Integrated Assessment System

The quality-oriented pathway establishes a tiered, progressive assessment system. Currently, data from the front-end of the platform underpins both summative and formative evaluations. Metrics such as thesis duplication rates and review conclusions validate the efficacy of integrity safeguards. In

contrast, behavioral data — including supervisor reviews and revision tracking — measures the efficiency with which compliance is implemented. Looking ahead, we will construct a deeply integrated assessment loop by leveraging the refinement of the 'Undergraduate-Postgraduate Integration Platform'. This will involve the dynamic monitoring of competency development through the correlation analysis of questionnaire data and behavioural trajectories, as well as multi-source diagnostics of the academic ecosystem, to continuously optimise the quality of talent cultivation.

4. Safeguard Mechanisms: The Synergistic Evolution of Ethical Constraints, Dynamic Optimisation, and Full Participation

To ensure the robust operation and sustainable development of the pathway system, the three safeguard mechanisms—ethical constraints, dynamic optimisation, and full participation—established in this study have already laid a solid practical foundation within the sample institutions. The development of an integrated platform will further enhance these mechanisms. The first, the ethical constraints mechanism is embedded within the existing quality supervision system. It establishes a technical baseline for academic integrity via the Ministry of Education's thesis quality monitoring platform, anonymous review, and plagiarism detection systems. When combined with the 'one-vote veto' policy for academic conduct and a comprehensive supervision system, it effectively constrains the behaviour of both staff and students. Drawing on the Science and Technology Office's experience in ethical review, an adaptive ethical assessment procedure will be introduced to clarify the ethical boundaries of educational applications further, before the application of technical tools. The second, the dynamic optimisation mechanism, underpinned by a closed-loop teaching supervision cycle of 'inspection-feedback-improvement' and the continuous iteration of degree platform data, has significantly enhanced the efficacy of quality management. This is evidenced by the steady increase in the pass rate for thesis plagiarism checks, which has risen to 96.19% over the past three years. Moving forward, we will establish a digital management process based on integrated platform data, comprising 'monitoring-evaluation-decision-optimisation', to enable precise assessment and iteration of technical tools and educational strategies throughout their lifecycle. The third, the whole-staff participation mechanism is based on the full implementation of the Sample Institution's 'Three-All Education' Comprehensive Reform Implementation Plan and the Supervisor Management Regulations. This clarifies the rights and responsibilities of supervisors, staff, students, and administrators, thereby creating a collaborative accountability system. The existing mechanism emphasises institutional transmission and delineation of responsibility. In the future, it will use the platform to create a 'distributed execution network', converting institutional requirements into a normalised collaborative governance ecosystem through task-driven approaches and data sharing.

Together with the pathways mentioned above, these three mechanisms form a deeply coupled organic system. Digital empowerment provides the technological and data foundation, value embedding establishes value standards, and quality orientation clarifies the developmental direction. Meanwhile, ethical constraints ensure technological compliance, dynamic optimisation enhances system adaptability, and comprehensive participation sustains operational momentum. This multidimensional synergy endows the system with the capacity to improve itself in the face of the challenges posed by digital transformation.

5. Case Validation: Practical Exploration Based on Sample School Platform Development

To validate the feasibility of the constructed pathway, this study focuses on the 'Undergraduate-Postgraduate Integrated Management Platform' developed by the sample school. By examining its existing system operations and academic integrity monitoring practices, the study analyzes the practical challenges and developmental directions within digital transformation.

5.1 Platform Architecture and Functional Design

Currently in the functional design phase, the platform provides a crucial validation scenario for the theoretical framework. The platform architecture centres on a ‘Multi-Dimensional Integrity Archive’ as its core module, with

defined data structure standards across five dimensions, including completed studies, academic performance, and campus conduct. Plans for API integration with existing degree and research achievement platforms lay the technical groundwork for automated integrity data aggregation and pathway implementation. This demonstrates the initial realisation of the digital empowerment pathway, from concept to practice. A schematic model is presented in Figure 1.

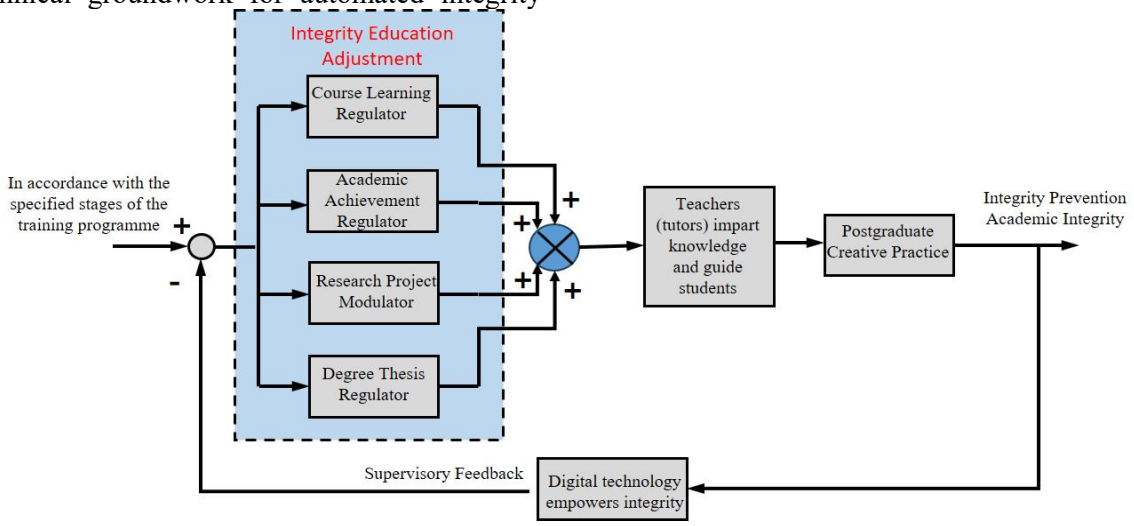

Figure 1. Core Model of the Digital, Integrated Graduate Integrity Education Closed-Loop System

5.2 Pilot Application and Limitations of AIGC Detection Tools

The pilot implementation of AI-generated content (AIGC) detection tools in the 2024 master's thesis review process at the sample institution revealed limitations in the application of technology. Cases in which the system incorrectly flagged students' original theses as '70% AI-assisted writing' highlighted the current limitations of technology in distinguishing between human-generated and AI-generated content. This experience highlights the risks of relying solely on technical tools for academic integrity assessment. It reinforces the necessity of the ethical constraints and dynamic optimisation mechanisms emphasised in this study. It highlights the importance of integrating technological measures with manual review and scholarly judgement.

5.3 Current Dual-Track Quality Assurance Model and Future Enhancement Strategies

Currently, the sample institution's thesis quality assurance relies on a dual-track model that combines CNKI's text duplication ratio detection with anonymous expert reviews from the Ministry of Education's Degree Centre. This forms an effective management loop. This 'technical screening + expert evaluation' mechanism, coupled with a supervision system covering the entire teaching process, ensures rigorous academic assessment, reflecting the fact that the digital transformation of integrity education is still in its developmental stages. The platform can be enhanced by building on this progress. First, a precise, multi-dimensional technical identification system will overcome the limits of single tools. Second, integrity oversight should shift to the formative stage of education, allowing full recording and guidance through a 'behavioural chain'. Ultimately, a collaborative ecosystem that integrates technology, values, and institutional safeguards will involve both staff and students.

Experience shows that digital transformation must be approached step by step, with technological applications undergoing thorough validation before being rolled out steadily. The experiences of the sample institutions confirm the necessity of integrating technological tools into a systematic educational framework, as well as the practical value of the 'trinity approach' and its safeguarding mechanisms, as proposed in this study. The digital transformation of postgraduate integrity education can only yield tangible results through the synergistic interplay of clear conceptual guidance, solid foundational work, robust institutional safeguards, and a well-defined development plan.

6. Conclusions

This study has established a systematic approach to postgraduate integrity education, based on the principle that digital tools are a means to an end, with integrity as the standard and quality as the objective. The top-level architecture design for the 'undergraduate-postgraduate integrated platform' at the sample institution has also been completed. The findings indicate that the digital transformation of integrity education must be based on practical operational foundations and recognise the complexity and long-term nature of technological implementation. The sample institution's application of technical tools and its process-oriented management approach demonstrates the significant practical value of integrating ethical constraints, dynamic optimisation, and whole-institution participation mechanisms into system design.

In theory, this work marks a paradigm shift from technology-driven implementation to value-based guidance. By introducing technology mediation theory, the study reveals the dual effect of digital technologies in integrity education. Integrating value education theory overcomes the dichotomy between 'technological governance' and 'value indoctrination'. Using the quality-oriented framework derived from the CIPP evaluation model enables the translation of abstract educational objectives into measurable indicators, thereby organically unifying instrumental and value rationality. At a practical level, it proposes a highly adaptable systemic solution that is firmly rooted in reality. This framework integrates existing effective practices within higher education institutions and provides a clear evolutionary pathway for future digital transformation. Within the framework's current state-planning structure, institutions can identify suitable implementation routes tailored to their own stages of digital development and disciplinary characteristics. This enables the incremental construction and continuous optimisation of integrity education systems.

Future research should address three key areas. Firstly, it should leverage platform operational data to validate the framework's effectiveness through longitudinal studies that explore the intrinsic linkages between integrity and academic performance. Secondly, it should conduct cross-institutional comparative research to test the framework's universality and analyse contextual factors and adaptation mechanisms in its implementation. Thirdly, it is essential to remain vigilant about how emerging technologies, such as generative AI, are reshaping the essence of academic integrity and its governance approaches.

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