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Research on Personalized Graduate Training Model in the Digital-Intelligent Era from the Perspective of Constructivist Learning Theory

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Abstract

The digital intelligence era presents unprecedented opportunities and challenges for higher education. As a critical link in cultivating top-notch innovative talents, graduate education urgently needs to transition toward personalization and precision. Grounded in the core tenets of constructivist learning theory, this paper reexamines the prevalent issues of homogenization and unidirectionality in current graduate training curricula. To address these challenges, we propose a "Five-in-One" personalized training model centered on "collaborative agency, adaptive content, interactive modalities, contextualized practice, and value-added evaluation." This model emphasizes a graduate-centered approach, leveraging big data and artificial intelligence to foster a novel educational ecosystem that supports active knowledge construction and personalized development, thereby offering an innovative paradigm for graduate education reform in the new era.

Keywords

Constructivist learning theory; Digital intelligence era; Graduate education; Personalized training.

1. Introduction

Since the 20th National Congress of the Communist Party of China, the digitalization of education has become a key strategic initiative in the national education reform agenda. In 2023, General Secretary Xi Jinping emphasized during the Fifth Collective Study of the Political Bureau of the CPC Central Committee that "the digitalization of education represents a critical breakthrough for China to open a new track for educational development and to cultivate new advantages in educational progress." The China Education Modernization 2035 blueprint further highlights the imperative to "utilize modern technologies to accelerate the reform of talent cultivation models and achieve an organic integration of mass education and personalized training." This strategic direction precisely addresses the crucial pulse of higher education development in China, particularly in graduate education.

However, to a certain extent, the traditional model of graduate education in China remains characterized by pronounced homogenization. As the world enters the digital intelligence era—marked by artificial intelligence, big data, cloud computing, and other emerging technologies—societal demand for talent has become increasingly diversified, rendering the obsolescence of the traditional training model ever more evident [1]. While this assembly-line approach to graduate education enhances efficiency, it inevitably stifles graduate students' academic aspirations, critical thinking, and innovative potential, thus failing to meet the core requirements of diversity and creativity in the digital intelligence era. This era not only calls for personalized training approaches but also provides, through its own technological clusters—such as learning analytics, adaptive engines, generative artificial intelligence, and virtual simulations—robust technical support and solutions for realizing personalized training in its true sense. Nevertheless, current practical explorations largely remain at the level of applying "technological tools," unilaterally pursuing

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algorithmic recommendations of learning resources for students [2]. This essentially represents an externally imposed, technology-driven form of personalization. Such an approach neglects learners' agency and sociality, potentially leading to new forms of technological discipline and algorithmic echo chambers, thereby alienating personalized graduate training into a more refined standardization and deviating from its original purpose of stimulating students' intrinsic potential and fostering innovative spirit [3].

Against this backdrop, constructivist learning theory—as an important branch of cognitive theory—emphasizes that knowledge is actively constructed by learners through interaction with their environment, rather than passively received. Its core tenets—that learning is a process of actively constructing meaning, that learning is context-dependent, and that learning is a social, collaborative activity—are highly congruent with the intrinsic requirements of personalized graduate training in the digital intelligence era, and furthermore provide a solid theoretical foundation for understanding and supporting personalized graduate learning.

2. Coupling Logic between Constructivist Learning Theory and Personalized Graduate Training in the Digital-Intelligent Era

Constructivist learning theory is rooted in cognitive development theory, and its intellectual trajectory has been profoundly shaped by the seminal ideas of scholars such as Jean Piaget and Lev Vygotsky. Piaget's theory of cognitive construction through assimilation and accommodation provided the foundational framework for constructivism, while Vygotsky's emphasis on the critical role of sociocultural context in cognitive processes further enriched the theoretical depth of constructivism. In essence, constructivist learning theory posits that knowledge acquisition does not rely on unidirectional transmission from teachers; rather, it is achieved through learners' active meaning-making processes within authentic contexts, facilitated by multiple forms of support from teachers and peers, and utilizing diverse learning resources.

2.1. Goal Coupling: From Knowledge Transmission to Meaning Construction

Traditional educational paradigms view knowledge as an objective entity that can be packaged and transmitted, with teachers serving as the authority and transmitters of knowledge and students as passive recipients. In contrast, constructivism posits that knowledge is an internal representation actively constructed by individuals through their interaction with the external world. The essence of learning is the process by which learners generate meaning and construct understanding through a two-way interaction between new and existing experiences. In the digital intelligence era, the rate of knowledge renewal is increasing exponentially, and the value of mere memorization and reproduction of knowledge is rapidly declining. Yu Wensen notes that the goal of education must shift from a knowledge-based orientation to a competency-based orientation—that is, cultivating students' abilities to adapt to complex situations, solve authentic problems, and create new knowledge. This represents the advanced form of meaning construction advocated by constructivism. The ultimate goal of personalized training empowered by digital intelligence should not be to enable students to receive predetermined knowledge more quickly and in greater quantities, but rather to leverage technology to create rich and open learning environments that support them in autonomously and personally constructing their professional knowledge systems and innovative thinking patterns through the process of exploring and solving authentic problems [4]. The role of technology here is to empower construction, not to replace thinking.

2.2. Process Coupling: From Standardized Procedures to Contextualized Participation

Constructivist learning theory emphasizes contextualized learning and social interaction. The theory of "situated learning: legitimate peripheral participation," proposed by Lave and Wenger, indicates that learning is a social process that moves from peripheral to full participation within a

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community of practice. Effective learning occurs in authentic, complex, and challenging contexts and is deepened through interaction and collaboration with mentors and peers. Digital intelligence technologies have greatly expanded the boundaries and depth of context and interaction. With regard to contextualized learning, virtual reality (VR), augmented reality (AR), and metaverse technologies can construct highly realistic simulated experimental environments, historical archaeological sites, or macroeconomic sandboxes. For example, medical graduate students can conduct high-risk dissection or surgical simulations in a simulated environment without any real risk, while archaeology graduate students can "visit" archaeological sites anywhere in the world for investigation. These immersive contexts make abstract knowledge concrete and provide enabling conditions for students' active exploration and knowledge construction. With regard to social interaction, intelligent collaboration platforms can transcend spatial and temporal barriers, facilitating deep discussions between mentors and students, among peers, and even across disciplines, institutions, and countries. This effectively supports the social construction process emphasized by Vygotsky.

2.3. Paradigm Coupling: From Technology-Centeredness to Human-Machine Collaboration

Many current applications of digital intelligence in education are driven by a technology-centered mindset, attempting to fully define and prescribe learning pathways through algorithmic models. In this process, learners are objectified as data streams, and their agency is overlooked. In contrast, digital intelligence empowerment from a constructivist perspective advocates for a new paradigm of human-machine collaboration. For instance, generative artificial intelligence (AIGC) can serve as a powerful research collaborator. When a graduate student proposes a preliminary research idea [5], AI can assist in conducting literature reviews, generating research hypotheses, designing experimental protocols, and even drafting the initial version of a paper. This does not replace the student's thinking but rather frees them from tedious information screening, allowing them to focus more on higher-order critical thinking. Simultaneously, formative assessment systems based on big data can perform real-time analysis on every assignment, report, and experimental data point generated by a student, providing immediate and precise feedback on their knowledge construction process. This helps students identify cognitive blind spots and adjust their learning strategies in a timely manner, thereby making their active construction process more targeted and effective.

Based on the above analysis, exploring pathways to realize personalized graduate training in the digital intelligence era through the lens of constructivist learning theory is not an unattainable goal. Constructivism's emphasis on learners actively constructing knowledge in context is highly compatible with the personalized training objectives supported by digital intelligence technologies. Nevertheless, the application of constructivist learning theory in contemporary graduate education practices still faces numerous challenges. The long-standing standardized and proceduralized graduate training system has significantly suppressed the creativity of graduate students. Therefore, there is an urgent need to inject greater vitality into the process of personalized graduate training and to provide graduate students with a freer and more creative learning space.

3. Challenges and Reflections on Personalized Graduate Training in the Digital-Intelligent Era

General Secretary Xi Jinping has emphasized that “China attaches great importance to the profound impact of artificial intelligence on education, actively promoting the deep integration of AI and education to foster transformative innovation.” In the intelligent era, achieving strategic advantage in the new wave of technological and industrial transformation requires a robust talent pipeline, demanding proactive reform in higher education [6]. As previously discussed, although digital-intelligent technologies offer unprecedented opportunities and support for reforming graduate

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education, a lack of clear conceptual grounding or improper application may create a new risk of technological regression. Indeed, the high efficiency enabled by technology can inadvertently reinforce and exacerbate existing systemic shortcomings.

3.1. Monolithic Training Actors and Lack of Collaborative Education Mechanisms

The traditional model of graduate education relies excessively on the individual guidance of supervisors, forming a rigid "master-apprentice" single-subject structure. While this model may be useful for deep cultivation within a specialized field, its shortcomings—namely, narrow knowledge horizons and limited resource channels—have become increasingly pronounced in the digital intelligence era, characterized by interdisciplinary integration and accelerating industrial transformation. Digital intelligence technologies should serve as a powerful tool to break down these barriers; however, in reality, collaborative education mechanisms are often severely lacking. Thick organizational barriers exist among various training subjects, with cooperation often remaining at the level of signed agreements, lacking the deep integration, incentives, and institutional safeguards necessary to form a cohesive training force. Professor Xie Weihe of Tsinghua University once noted, "The key to graduate education lies in fostering an 'academic community' atmosphere." The current predicament, however, is that the scope of this community has not been effectively expanded. Students are confined to the singular perspective of a single supervisor, making it difficult to receive multidimensional, multifaceted guidance on complex, real-world problems. Although the Opinions on Accelerating the Reform and Development of Graduate Education in the New Era explicitly calls for "improving the collaborative education mechanism integrating science and education as well as industry and academia," transforming this principle into concrete, actionable, incentivizable, and evaluable implementation plans remains a formidable challenge for universities and regions across the country.

3.2. Standardized Curriculum and Neglect of Individual Development

At present, the curriculum design and teaching content of graduate programs in many universities are updated slowly, failing to promptly incorporate cutting-edge technological achievements and the rapidly evolving real-world demands of industries. If the application of digital intelligence technologies merely digitizes standardized paper-based textbooks or converts traditional classroom lectures into videos, it amounts to nothing more than "new wine in old bottles." Furthermore, if algorithm-driven personalized learning platforms lack fine-grained instructional design and a diverse content ecosystem, they may actually compromise graduate students' time and space for pursuing personalized learning. Given the vast differences in graduate students' academic interests and knowledge backgrounds, standardized training content clearly cannot meet the diverse development needs of contemporary graduate students. Monolithic and rigid recommendation algorithms can easily confine students to known domains or narrowly defined areas prescribed by their supervisors, running counter to the original intent of graduate education as emphasized in China's Education Modernization 2035—namely, cultivating innovative spirit. Professor Cai Sanfa has pointed out, "The 'one-size-fits-all' training program is becoming an invisible shackle that stifles the academic individuality and innovative potential of graduate students." The true value of digital intelligence technologies lies in constructing a vast, open, and dynamically updated knowledge graph that supports students in autonomously building their own personalized knowledge systems based on their interests and developmental pathways, thereby facilitating the transition from passive reception to active learning, and ultimately, from being knowledge-storing talents to capability-iterating talents.

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3.3. Unidirectional Training Approaches and Obstructed Constructive Learning

Currently, much of online teaching practice is merely a digital replica of traditional lecture-based, teacher-centered instruction. This model severely lacks targeted interactive components, deep-thinking discussion tasks, and authentic projects that stimulate collaboration. Not only does it violate the cognitive interaction advocated by constructivist learning theory, but it also fails to adhere to the student-centered educational philosophy upheld in university teaching management. Teachers remain in a position of active transmission, while students are relegated to the terminal end of passive information reception. Consequently, students' crucial abilities for active exploration and collaborative construction remain underdeveloped. New challenges urgently need to be addressed, such as: how to cultivate students' core competencies that surpass machines, including aesthetic ability, imagination, and critical thinking; how to facilitate students' transformation from passive recipients to active participants; and how to assist teachers in transitioning from knowledge transmitters to learning guides. If the application of technology merely aims to increase the efficiency of knowledge transmission without addressing—let alone changing—its unidirectional nature, then the core process advocated by constructivist learning theory—that "knowledge is not passively received but actively constructed by learners"—will be severely obstructed.

3.4. Disconnection from Practical Contexts and Limited Transferability

The disconnection between graduate education—particularly for practice-oriented professional degree programs—and real-world industrial practice is a long-standing issue. In the digital intelligence era, this pain point has acquired new dimensions. Although technologies such as VR/AR and digital twins can simulate highly realistic virtual contexts, providing unprecedented tools for practical teaching, they cannot completely replace the complexity, uncertainty, interpersonal dynamics, and non-technical factors inherent in authentic research and engineering environments. The current widespread predicament is that university-industry cooperation is often superficial—more symbolic agreements than substantive projects—and practice bases are poorly developed, lacking stable funding, systematic guidance schemes, and effective mechanisms for translating outcomes into practice. As a result, the theoretical knowledge students acquire, along with the skills they practice in virtual environments, cannot be smoothly transferred to real-world work settings, leading to a notable deficiency in their "practical capability" to solve complex, authentic problems.

3.5. Instrumentalized Assessment and Neglect of Developmental Growth

The current graduate education evaluation system overemphasizes the quantification of academic outcomes while neglecting students' personalized development and cultivation of creative abilities. Under this evaluation model, students invest substantial energy in academic tasks that conform to external standards, leaving insufficient time and space for personalized academic exploration and innovation. The core goals of education—cultivating students' independent thinking, innovative capacity, and autonomous learning spirit—are gradually being overlooked. With the advent of the digital intelligence era, these technologies should provide powerful tools for developmental and value-added evaluation of graduate students. However, if the underlying evaluation philosophy itself does not undergo a fundamental transformation, advanced digital intelligence technologies will merely become more sophisticated screening devices rather than tools for promoting students' holistic development. The renowned American investor Charlie Munger once observed, "To the man with a hammer, everything looks like a nail." Now that the graduate education system in the digital intelligence era possesses the more powerful hammer of big data, it must be vigilant against using it to hammer every student into the same specification. Therefore, the reform of the graduate education evaluation system in the digital intelligence era must prioritize conceptual change

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first, with technology playing a supporting role. Technology should be used to empower evaluation systems that align with educational principles and support personalization, rather than allowing technology to define or even distort the purpose of evaluation.

4. Design of the " Five-in-One " Personalized Graduate Training Model from the Perspective of Constructivist Learning Theory

In the digital-intelligent era, the fundamental mission of graduate education is to cultivate high-level, personalized talent capable of driving innovation and responding effectively to complex challenges. Whether this goal can be achieved depends directly on the advancement and scientific soundness of the training model adopted. As stated in the Outline of the Plan for Building a Strong Education Nation (2024–2035), "graduate education is pivotal to the cultivation of high-level innovative talent and to supporting scientific and technological self-reliance and self-strengthening." However, the current graduate training system remains constrained by imbalances across multiple dimensions, including training actors, curricular content, and instructional approaches, which undermine its capacity to fulfill this crucial mission. In response, and as discussed above, it is both necessary and feasible to draw on constructivist learning theory and the core principles of higher education pedagogy to develop a "Five-in-One" personalized training model that integrates collaborative participation among multiple actors, adaptive content design, interactive modes of learning, contextualized practice, and value-added assessment. Such a model aims to establish an integrated developmental ecosystem that supports graduate students' active knowledge construction, situated learning, and social interaction, thereby providing a systematic pathway for personalized graduate education in the digital-intelligent era.

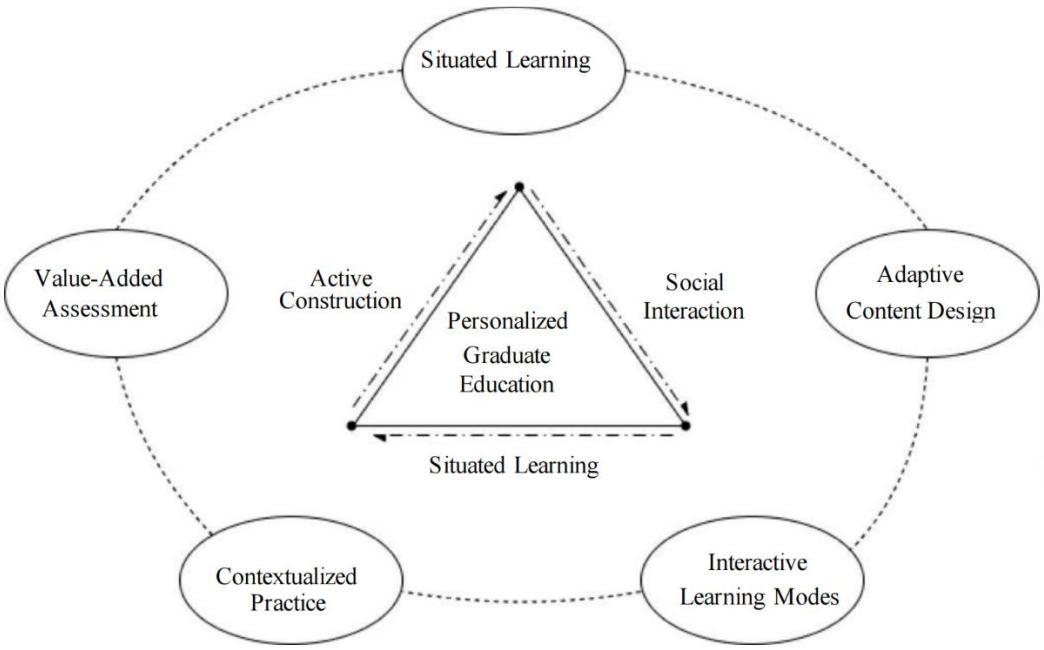

Figure 1. "Five-in-One" Personalized Graduate Training Model

4.1. Collaborative Subject Participation: Institutional Co-construction through Collective Intelligence

Constructivist learning theory posits that knowledge is constructed within a learning community. Therefore, it is imperative to break the limitations of the single-supervisor system and establish a diversified, open collaborative mentoring framework. The current predominant model of individual supervisor responsibility in graduate education tends to lead to concentrated academic resources, restricted mentoring perspectives, and insufficient

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interdisciplinary capacity. To address this, the training people need to shift from individual responsibility to collaborative co-education. Collaborative agency emphasizes the establishment of a multi-supervisor team mechanism with clear structures and well-defined roles and responsibilities. The team, led by a principal supervisor, may include interdisciplinary faculty, industry experts, postdoctoral researchers, and others, forming a multi-dimensional support network encompassing academic guidance, methodological training, and application-oriented translation. It is important to note that the team's operation must be supported by institutional safeguards, clarifying member responsibilities, collaboration procedures, and rules for recognizing contributions. Digital platforms can be used to document the mentoring process, ensuring traceability and evaluability. Furthermore, the effectiveness of collaborative mentoring should be incorporated into faculty promotion, performance evaluation, and resource allocation systems to incentivize active participation and avoid the formalistic tendency of "nominal collaboration without substantive integration." Only with the dual support of organizational mechanisms and incentive systems can the collaborative efforts of multiple agents be truly realized, forming a cohesive educational force.

4.2. Adaptive Content – Knowledge Graph-Driven, Intelligent Adaptation to Learning

John Dewey, a foundational figure in modern education, noted that "all genuine learning comes from experience." Digital intelligence technologies now make it possible to dynamically adjust learning content. Current graduate curricula commonly suffer from outdated content, structural rigidity, and insufficient personalization. Some so-called intelligent recommendations merely push resources based on simple behavioral data, which can inadvertently restrict students' academic horizons. Adaptive content requires the construction of knowledge graphs based on big data and artificial intelligence. While retaining the characteristics of being structured, procedural, and intelligent, these knowledge graphs can be further integrated with AI technologies to structure and intelligently process vast amounts of online educational resources. This not only improves resource quality but also, through detailed analysis of knowledge point associations, provides graduate students with more precise recommendations for personalized learning resources. On this basis, machine annotation, crowdsourcing, and human-machine collaborative annotation can be employed to clearly articulate the intrinsic relationships between educational resources and knowledge points, thereby establishing a dynamic "resource-knowledge point-graph" mapping model. This model lays a solid foundation for the intelligent aggregation and personalized recommendation of educational resources, ensuring that students receive the learning resources and pathways best suited to their needs. Ultimately, this facilitates a shift from a unified syllabus to instruction tailored to individual aptitude, and from passive reception to active construction, aligning with the constructivist emphasis on learner autonomy.

4.3. Interactive Modalities – In-depth Dialogue, Stimulating Thought through Interaction

"Learning without discussion leads to shallowness." Learning should occur within social interaction, and digital intelligence technologies can greatly enrich the forms and depth of such interaction. Traditional training methods are often characterized by one-way knowledge transmission, with low-frequency and superficial teacher-student interaction lacking intellectual exchange and critical reflection. Even when online platforms are introduced, they are often used merely for material distribution and assignment submission, failing to leverage technology's potential to support deep learning. "Interactive modalities" focuses on increasing the frequency, depth, and diversity of exchanges. Alongside online learning, small-scale, high-frequency, in-depth dialogic activities—such as academic seminars, paper workshops, and thesis defenses—should be encouraged among teachers and students, as well as among peers,

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to promote the exchange of ideas and iterative thinking. Virtual meeting systems, collaborative editing tools, and intelligent annotation platforms should be fully utilized to support both asynchronous and synchronous interaction. At the same time, the cognitive value of informal communication scenarios should be recognized, and institutional design should reserve space for such interactions. The role of technology is to extend, not replace, human interaction.

4.4. Contextualized Practice – Authentic Engagement, Promoting Knowledge through Action

Tao Xingzhi, a renowned Chinese educator, famously stated, "Life is education, and society is school," which resonates with the constructivist principle that learning cannot be separated from authentic contexts. However, some graduate students' learning and development remain disconnected from real-world needs, exhibiting a decontextualized character that undermines the practical value of research outcomes and fails to meet the expectations of the digital intelligence era. "Contextualized practice" emphasizes embedding the graduate training process in authentic settings, encouraging students to participate in major national research projects, university-industry collaborative R&D, policy consulting, and other real-world tasks. Through solving complex problems, students can continuously enhance their academic competence and refine their comprehensive abilities. For fields where hands-on conditions are limited, technologies such as virtual simulation can be used to create realistic training environments, improving both authenticity and safety. All practical components must be designed with clear objectives, process documentation, and feedback mechanisms to ensure their educational function is effectively realized.

4.5. Value-Added Evaluation – Growth Tracking, Assessing Quality through Process

The graduate education evaluation system plays a significant role in motivating and guiding higher education reform. Constructivist learning theory emphasizes attention to learners' developmental processes. While digital intelligence technologies have enhanced the feasibility of process-oriented and developmental evaluation in graduate education, problems persist, including over-reliance on quantitative output indicators (e.g., publication counts, impact factors), neglect of individual starting points and developmental gains, and the promotion of utilitarian-oriented and performative learning behaviors. "Value-added evaluation" advocates for a shift toward a growth-centered assessment system that focuses on graduate students' substantive improvements across multiple dimensions—including knowledge structure, practical ability, ways of thinking, and academic character—rather than solely on research output. To this end, e-portfolios can be used to document the entire learning process, including progressive drafts of papers, depth of project participation, and periodic reflective reports. A multi-participant review mechanism should be established, involving diverse stakeholders in periodic developmental diagnostics to ensure objectivity and authority. External evaluators, such as industry advisors or educational auditors, may also be engaged to conduct independent reviews and mitigate internal evaluation biases. The evaluation system itself should undergo periodic retrospective assessments to refine indicator weights and data collection methods, thereby enhancing its scientific rigor and adaptability.

This model is designed to break away from the excessive homogenization and standardization prevalent in traditional graduate training models, thereby promoting a shift from uniformity to personalization in graduate education. However, in implementing this personalized graduate training pathway grounded in constructivist learning theory, several critical issues require particular attention:

First, at the conceptual level, the greatest pitfall is the erosion of educational authenticity by techno-centrism. This manifests as an overemphasis on technological solutions, equating

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digital intelligence with the mere installation of platforms, data collection, and algorithm use, resulting in a situation where "heavy emphasis is placed on construction, while light emphasis is placed on application." The crucial implicit dimensions of education—emotional communication, value cultivation, and academic character development—are thereby neglected, leading to a dehumanization of the training process. Therefore, it is essential to adhere to the principle of "learner-centeredness with technology as an enabler," making clear that the fundamental purpose of introducing any technology is to serve the holistic and personalized development of individuals. In system design, high-quality face-to-face interactions between teachers and students, as well as among peers—such as mandatory offline seminars, academic salons, and mentor-mentee dialogues—must be preserved and strengthened.

Second, at the ethical and privacy level, risks arise from the overgeneralization of data collection and the hidden biases of algorithms. Developing personalized graduate training programs requires the continuous, multi-dimensional collection of data on students' learning behaviors and social interactions. Students may experience anxiety due to the perception of being under constant data surveillance, which can inhibit their courage to explore and express themselves academically. Moreover, algorithms based on historical data may perpetuate existing biases within social and academic systems. For example, they may systematically favor research directions or mentoring models that conform to traditional templates of success, thereby imposing covert discrimination and restrictions on students with non-mainstream academic interests or those from non-advantaged backgrounds. Consequently, it is imperative to clearly define the scope, purpose, storage duration, and ownership of collected data, and to promote algorithmic transparency, ensuring that technological empowerment does not devolve into a new form of technological discipline.

Third, at the agent level, the primary implementation obstacles are the difficulty of mentor role transformation and the hollowing out of multi-agent communities. Some graduate mentors remain accustomed to traditional supervisory models and lack the capacity and motivation to design personalized programs or coordinate diverse teams. Furthermore, the existing evaluation system continues to prioritize research output—focusing solely on mid-term and end-term assessments of scientific publications—while failing to adequately recognize the complexity and innovativeness of mentoring work, thereby diminishing mentors' intrinsic motivation for deep engagement. At the same time, multi-mentor communities risk becoming formalistic due to cross-departmental evaluation barriers, difficulties in time coordination, and the absence of clear mechanisms for sharing rights, responsibilities, and benefits. They may exist only on paper as "joint listings" without forming a genuine collaborative force in mentoring. Therefore, further reform of the faculty evaluation system is necessary. Indicators such as "effectiveness of personalized mentoring, contributions to interdisciplinary collaboration, and innovations in teaching" should be incorporated into promotion and performance assessment systems. Concurrently, the functioning of communities should be institutionalized, supported by corresponding resources and incentive mechanisms.

Fourth, at the evaluation level, the complexity and perceived credibility of developmental evaluation pose challenges to its implementation. First, constructing digital profiles of graduate students' personalized learning and collecting outcome evidence requires substantial time investment from both teachers and students for recording, organizing, and interpreting data, which may lead to evaluation fatigue. Second, how can process-oriented data be standardized? How can consistency be ensured in the interpretation of the same behavioral data by different mentors? How can performative learning—where students engage in activities merely to "beautify their profiles"—be prevented? These issues may call into question the fairness and authority of developmental evaluation. Therefore, internal monitoring mechanisms should be employed to track implementation in real time, and external evaluators—such as educational

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experts or industry advisors—should be engaged to examine system operation from multiple perspectives. Additionally, the overall effectiveness of the evaluation system should be subjected to periodic retrospective reviews, with recommendations for improvement derived from assessment data. Task weights and evaluation methods should be flexibly adjusted to ensure the system's scientific rigor and adaptability.

5. Conclusion

General Secretary Xi Jinping has emphasized that "education is the cornerstone of national rejuvenation and social progress." This important insight profoundly reveals the foundational role of education in driving national development and social progress. The transformation of graduate education in the digital intelligence era is not merely a matter of superimposing technological tools onto traditional models; rather, it requires systematic reshaping and restructuring under the guidance of advanced learning theories. Drawing on constructivist theory as a lens, the "Five-in-One" training pathway model constructed in this study aims to liberate graduate students from the assembly line of standardized production and place them within a vibrant ecosystem supported by multiple agents, intelligent content, immersive modalities, authentic contexts, and developmental evaluation.

Looking ahead, the dissemination and optimization of personalized graduate training pathways based on constructivist learning theory in practice will need to remain closely aligned with the realities of education, while continuously exploring innovative pathways that accommodate diverse student needs. In the process of concrete implementation, emphasis should be placed on sustaining the ongoing interaction and refinement between theory and practice, ensuring that the training system genuinely meets the demands of the times and is capable of stimulating students' individual potential, creativity, and sense of social responsibility. In so doing, education can play an even more significant role in serving society, promoting cultural inheritance, and enhancing national competitiveness.

References

[1] Fang L, Zhou X. From Tool to Co-Learner: Exploring Student Engagement With GenAI Through the Lens of Social Constructivism [J]. Evaluation review, 2025, 193841X251411618.

[2] Pham L X, Nguyen T D, Nguyen H N L, et al. A constructivist-based interactive learning management system leveraging Google Codelabs [J]. Interactive Learning Environments, 2025, 33(9):5287-5305.

[3] Aoonlamai N, Kwangmuang P. Integrating digital tools and constructivist learning: a ubiquitous learning framework for enhancing creativity in music education [J]. BMC Psychology, 2025, 13(1):1064-1064.

[4] Saad B R, Garcia L A, Garcia C M J. Mapping Constructivist Active Learning for STEM: Toward Sustainable Education [J]. Sustainability, 2025, 17(13):6225-6225.

[5] Kim K S, Kim Y T, Kim K. Development and effectiveness verification of AI education data sets based on constructivist learning principles for enhancing AI literacy [J]. Scientific Reports, 2025, 15(1):10725-10725.

[6] Wang M X, Huang T X, Han H Y, et al. Promoting students' creative self-efficacy, critical thinking and learning performance: An online interactive peer assessment approach guided by constructivist theory in maker activities [J]. Thinking Skills and Creativity, 2024, 52101548-.