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A Dual-Driven Experimental Teaching Model for Gerontology: Integrating Industry and AI Technology

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Abstract: *China's aging population and the emergence of smart elderly care present significant pedagogical challenges for gerontology education. Current experimental teaching approaches in this recently established undergraduate field frequently misalign with industry requirements. This research introduces an innovative "industry-education integration and AI technology dual-driven" teaching model. By examining pedagogical limitations and industry developments, we develop a "three-tier progressive, four-dimensional integration" framework for experimental curriculum reform. Our model seeks to connect theoretical learning with practical applications, developing students' competencies for technology-enhanced elderly care environments.*

Keywords: *Gerontology; Industry-Education Integration; Artificial Intelligence; Experimental Teaching; Smart Elderly Care*

1. Introduction

China is experiencing an unprecedented demographic shift, with its population aged 60 and above reaching 297 million by 2023, or 21.1% of the total [1]. This transition coincides with rapid technological advancement, fundamentally reshaping the elderly care industry ecosystem and creating new paradigms for service delivery. National policies, such as the "14th Five-Year Plan," explicitly promote smart elderly care formats, mandating a comprehensive digital transformation of services [2]. This evolving landscape requires a workforce possessing not only traditional caregiving skills but also advanced technological literacy, data analysis capabilities, and innovative problem-solving abilities to navigate increasingly complex care environments.

Gerontology as an undergraduate major, formally approved in China only in 2019, represents an emerging interdisciplinary field that lacks mature pedagogical precedents, particularly in experimental teaching methodologies. Unlike established disciplines with decades of pedagogical development, gerontology education must simultaneously address traditional academic rigor while responding to rapidly evolving industry demands. The integration of artificial intelligence and smart technologies into elderly care services has created an urgent need for educational innovation that can bridge theoretical knowledge with technological competencies.

The advent of sophisticated AI technologies offers unprecedented opportunities to redesign educational models in gerontology [3]. However, this technological potential exists within a complex theoretical landscape that requires careful consideration. The proposed educational model is grounded in two primary theoretical domains that provide complementary perspectives on learning and professional development. First, industry-education integration theory, with roots in European vocational training models [4], emphasizes learning through practice in authentic contexts [5]. In China, this concept has evolved from simple "school-enterprise cooperation" to a more comprehensive "industry-education integration community," focusing on the organic connection between educational, talent, and industrial chains to optimize resource allocation and ensure graduate employability [6].

Second, the application of ai in education draws from established learning theories that provide frameworks for understanding how technology can enhance human learning processes. Connectivism, for instance, posits that learning is fundamentally a process of forming network connections—connections between concepts, experiences, and knowledge domains—a process that AI can optimize through sophisticated data analysis and pattern recognition [7]. The rise of generative AI has further enabled the large-scale production of personalized learning content, adaptive assessment

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systems, and intelligent tutoring capabilities that can respond to individual learner needs in real-time [8].

However, the effective application of these technological tools requires a structured pedagogical framework that addresses inherent risks and challenges. These include the potential for over-reliance on technology at the expense of critical thinking development, the need to maintain human-centered care principles in an increasingly digital environment, and the importance of ensuring that technological enhancement serves rather than supplants core educational goals [9]. The integration of AI tools must be carefully balanced with pedagogical approaches that foster creativity, ethical reasoning, and interpersonal skills—competencies that remain fundamentally human and essential for gerontological practice.

Despite the significant potential of both industry-education integration and AI-enhanced learning, there exists a theoretical and practical void in how to systematically integrate these approaches within the specific context of gerontology education. Existing literature addresses these concepts separately, but there is limited guidance on creating cohesive frameworks that leverage the synergies between authentic industry engagement and intelligent technological tools. This gap is particularly pronounced in experimental teaching, where hands-on learning experiences must prepare students for both current industry practices and emerging technological developments.

Grounded in constructivist learning theory and systems thinking approaches, this study addresses this gap through a comprehensive analysis of educational innovation possibilities. The research employs a qualitative methodology that synthesizes three years of teaching practice data, systematic student feedback collection, and extensive industry collaboration experiences. This empirical foundation supports the construction and proposal of a systematic teaching innovation model that integrates theoretical rigor with practical applicability.

The study aims to contribute to the emerging field of gerontology education by providing a theoretically grounded, empirically informed framework for experimental teaching that prepares students for the realities of contemporary and future elderly care practice. By addressing the dual challenges of industry alignment and technological integration, this research offers practical guidance for educators while contributing to broader discussions about professional education in an aging society characterized by rapid technological advancement.

2. Challenges in Traditional Gerontology Pedagogy

Traditional experimental teaching in gerontology suffers from systemic flaws that create a significant gap between academic training and professional practice. The content often lags years behind industry practice, focusing on skills that have been automated. Analysis of student feedback over three academic years reveals significant disengagement, with negative expressions such as "repetitive," "boring," and "disconnected from reality" appearing in the course evaluations. This aligns with self-determination theory, which posits that motivation is intrinsically linked to autonomy, competence, and relevance—qualities often absent in traditional labs [10].

The specific structural problems and their consequences are summarized below (Table 1).

Table 1: Structural Problems in Traditional Gerontology Experimental Teaching

Problem Category	Specific Manifestations	Impact on Learning
Content Lag	Outdated, paper-based assessment; manual data entry	Low engagement; development of obsolete skills
Methodological Rigidity	Verification-based experiments; standardized procedures	Passive learning; stifled creativity and critical thinking
Resource Isolation	Learning confined to labs; textbook dependency	Disconnection from real-world complexity and context
Integration Deficiency	Fragmented disciplinary knowledge	Incomplete competency development; inability to synthesize

This disconnect becomes more apparent when comparing industry needs with typical graduate capabilities. The result produces graduates who may understand theoretical concepts but lack abilities to transfer knowledge to novel, complex situations—a well-documented educational psychology challenge [11].

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3. The Dual-Driven Innovation Model

To address these challenges, this study proposes a “three-tier progressive, four-dimensional integration” model. The core logic is a dual-driven mechanism: industry-education integration provides the institutional framework and authentic problems, while AI technology offers the advanced pedagogical tools and personalized pathways. The model's design follows four key principles: systematicity, adaptability, progressivity, and openness.

3.1 The Three-Tier Progressive Capability Framework

The model structures learning across three progressive tiers, aligning with Bloom’s Taxonomy to ensure a logical scaffolding of skills from foundational knowledge to creative innovation [12].

Table 2: Three-Tier Progressive Capability Development Structure

Tier	Cognitive Level (Bloom's)	Learning Objectives	Key Activities & Technologies
Foundation	Memory & Understanding	Master basic AI tools; comprehend core theories	AI system training; interactive concept visualization
Integration	Application & Analysis	Synthesize multi-disciplinary data; solve complex problems	Case analysis with AI data; virtual reality simulations
Innovation	Evaluation & Creation	Conduct independent research; design novel solutions	Capstone R&D projects; AI-assisted solution modeling

As shown in Table 2, the three-tier framework establishes a progressive learning pathway that systematically develops students' capabilities from basic competencies to advanced innovation. At the foundational level, students begin by acquiring essential knowledge and technical skills, including the operation of smart health monitoring devices and the use of AI software for basic data analysis. This initial phase establishes the necessary technological literacy and theoretical understanding required for more complex applications.

Building upon these foundational competencies, the integration phase shifts focus toward application and analytical thinking. During this stage, students employ AI tools to examine complex, multi-dimensional case studies within simulated environments, which facilitates the synthesis of knowledge drawn from different disciplinary perspectives. This approach enables students to develop their ability to connect theoretical concepts with practical problem-solving scenarios while working with interdisciplinary information.

The innovation phase represents the culmination of this progressive development, where students engage in evaluation and creation activities that require the highest levels of cognitive engagement. Through independent research and development projects, students design novel smart service protocols or develop AI-based assistive tools, thereby demonstrating their capacity for original thinking and creative problem-solving. This final tier ensures that graduates possess not only technical proficiency and analytical skills but also the innovative capabilities necessary to contribute meaningfully to the evolving field of elderly care technology.

3.2 The Four-Dimensional Integration Strategy

The model's implementation depends upon the deep integration of four interconnected dimensions that work synergistically to create a comprehensive educational framework. The first dimension involves the fusion of theory and practice, where learning becomes anchored in authentic problems that students encounter in real-world contexts. This approach follows established principles of experiential learning through a spiral advancement process that allows students to revisit and deepen their understanding of concepts through successive encounters with increasingly complex situations.

Complementing this theoretical-practical integration, the model employs a hybridized approach that combines online and offline learning experiences to create a blended educational ecology [13]. Through this arrangement, online platforms serve as vehicles for delivering personalized content tailored to individual learning needs, while face-to-face sessions become dedicated spaces for collaborative problem-solving activities and hands-on practical work that requires direct interaction and immediate feedback.

The third dimension establishes campus-enterprise synergy that transcends conventional internship programs by fostering deep collaborative partnerships grounded in situated learning theory. Rather than

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treating industry engagement as an add-on component, this approach integrates industry expertise directly into the educational process, with industry professionals participating as co-developers of curriculum content and active participants in student assessment procedures.

Finally, the model maintains a deliberate balance between technological advancement and humanistic values, placing critical emphasis on the ethical application of technology within elderly care contexts. This dimension addresses fundamental concerns such as data privacy protection and the preservation of human-centered care approaches, drawing upon principles of communicative action to ensure that technological tools enhance rather than diminish the human elements that remain central to effective gerontological practice.

4. Implementation: Support Systems and Quality Assurance

Effective implementation necessitates robust support systems, including governance, technology infrastructure, faculty development, and a dynamic quality assurance framework.

4.1 Governance and Technology Infrastructure

Implementation requires establishing collaborative governance structures between the university, industry partners, and government bodies to ensure alignment and resource sharing. At the core of the technical support is an integrated platform designed to facilitate the new teaching model (see Table 3).

Table 3: Technology Platform Components and Functions

Component	Core Functions	Technical Features	Educational Benefits
AI Learning Management	Personalized pathways, progress tracking	Machine learning integration	Adaptive instruction
Virtual Simulation Lab	Scenario modeling, risk-free practice	VR/AR technologies	Experiential learning
Assessment Analytics	Data integration, automated analysis	Big data processing	Objective evaluation
Collaborative Platform	Cross-platform interaction, project management	Cloud computing	Enhanced cooperation

4.2 Faculty Development

This model requires the cultivation of “dual-qualified” faculty—academics who are also proficient in industry practice and technology [14]. This is achieved through systematic training, enterprise rotation programs, and the inclusion of industry experts as adjunct instructors. Faculty evaluation criteria must also be reformed to recognize and reward contributions to teaching innovation and industry collaboration, not just traditional research metrics.

4.3 Quality Assurance and Continuous Improvement

Quality assurance is not a static measure but a continuous, data-driven cycle. It employs a multi-stakeholder evaluation framework that provides a holistic view of the program's effectiveness, consistent with modern evaluation theory [15]. Feedback from students, peer faculty, and industry partners is systematically collected and used to refine the curriculum, teaching methods, and technological tools in an ongoing loop of improvement.

5. Conclusion

The “industry-education integration and AI technology dual-driven”model offers a systematic and theoretically grounded solution to the pressing challenges of gerontology education. By synergizing institutional collaboration with technological innovation, it provides a clear pathway for cultivating professionals equipped with the complex, hybrid skills required by the smart elderly care industry.

While the model presents a robust framework, its implementation faces challenges, primarily the need for significant institutional investment in technology and faculty development, and the ongoing task of maintaining an ethical balance in a technology-rich learning environment.

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Future research should focus on the empirical validation of this model through longitudinal studies tracking student competency development and career outcomes. Further exploration into the application of more advanced AI and the development of scalable faculty training programs will also be critical for the model's widespread adoption and long-term success [16].

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