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Exploring Industry-Education Integration in Health and Senior Care in the Era of Technological Disruption: Opportunities, Challenges, and Pathways

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Abstract: With the rapid development of new-generation information technologies such as artificial intelligence, big data, and the Internet of Things, the health and elderly care service sector is undergoing a profound digital and intelligent transformation. While this technological wave injects new impetus into industrial upgrading, it also reveals a significant gap between traditional talent cultivation models and the demands of emerging industries. This article, from the perspective of industry-education integration, deeply analyzes the new opportunities and challenges brought about by technological development to the health and elderly care service sector. The core of the article lies in exploring effective paths to address these challenges through deep industry-education integration, and proposes specific strategies such as building a "government-industry-enterprise-school" collaborative talent cultivation community, a co-construction and sharing type of practical training base, and an innovative project-based teaching model, with the aim of providing theoretical references and practical guidance for cultivating high-quality, compound talents that meet the future demands of the health and elderly care service sector.

Keywords: Technology enablement; Health and senior care; Industry-education integration; Talent cultivation; Smart senior care

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1. Introduction

Currently, China is accelerating into an aging society, leading to an explosive growth in demand for social care services and higher requirements for specialization, personalization, and convenience. New formats and models, such as smart senior care, telemedicine, and health management, have emerged, providing new solutions to the challenges of population aging. However, the rapid iteration of technology and cross-industry integration have fundamentally changed the market's demand for talent. The traditional, single-discipline talent training system can no longer meet the industry's need for composite technical skilled professionals who "understand both technology and service, and are proficient in management as well as humanities." Industry-education integration, as a key

initiative to organically link the education chain and talent chain with the industry chain and innovation chain, is the core engine for resolving the talent bottleneck in the health and senior care sector, seizing the opportunities of technological development, and confronting future challenges. This study, from a technology-enabled perspective, systematically examines the current state and future of industry-education integration in health and senior care, holding significant theoretical value and practical implications.

2. Opportunities: Technology as a catalyst for industry-education integration

Technology is not only a driver of industrial change but also provides abundant tools and scenarios for innovating talent cultivation models and deepening integration.

2.1. Emergence of new smart senior care formats and talent demands

Technologies like the Internet of Things and artificial intelligence have given rise to a series of new formats, including community smart care platforms, in-home bed monitoring systems, and intelligent rehabilitation robots [1]. These new formats require practitioners not only to master traditional nursing knowledge but also to possess skills in equipment operation, data interpretation, and platform maintenance.

2.2. Big data and precision health management driving innovation in teaching

Big data technology enables the collection and analysis of whole-lifecycle health data for the elderly population, facilitating early disease warning and personalized health management. In industry-education integration practice, enterprises can provide anonymized real health datasets as case studies for teaching and research in universities. Guided by instructors and assisted by enterprise engineers, students can learn to use data analysis tools for projects such as predicting population health trends and screening individual risks.

2.3. Virtual simulation and remote technologies expanding practical teaching scenes

VR/AR technologies provide solutions to break through the bottleneck in practical training within industry-education integration. Using VR technology, highly simulated high-risk scenarios, such as elderly care and emergency response, can be constructed, allowing students to repeatedly practice core skills in a risk-free environment. Enterprises and universities can jointly invest in building "Virtual Simulation Training Centers," enabling the cross-spatial and temporal sharing of high-quality practical teaching resources and effectively solving the internship difficulties where students "cannot get in, cannot see, and cannot operate."

3. Challenges in technology-driven industry-education integration

Opportunities are intertwined with challenges, and technology-enabled integration faces several practical difficulties.

3.1. The structural contradiction in talent supply and demand

The pace of industrial technological upgrading far exceeds the speed of adjustment in the education system, leading to a severe structural imbalance between talent supply and demand. The existing university programs (e.g., Nursing, Senior Care Service Management) are often clearly demarcated and have rigid curriculum systems, making it difficult to respond quickly to the smart senior care industry's demand for composite knowledge

structures like “Nursing + IT” or “Management + Data.” This has resulted in the awkward situation where “enterprises cannot find suitable people, and students cannot find satisfactory jobs,” which has become the primary problem for industry-education integration to solve [2].

3.2. The “Fireplace Phenomenon” in university-enterprise collaboration

Many university-enterprise collaborations remain at a superficial level of “cooperation agreements,” lacking deeply integrated “community of interest” mechanisms, i.e., the “Fireplace Phenomenon”—appearing warm but difficult to sustain. On one hand, enterprises, due to concerns about technical confidentiality, commercial competition, and operational efficiency, are reluctant to open core data and technical scenarios to universities. On the other hand, the faculty evaluation system in universities emphasizes academic papers and government-funded projects, providing insufficient incentive for participation in cooperation, curriculum development, and other industry-education integration work [3]. The difference in the objective functions of the two parties leads to the widespread phenomenon of “hot universities, cold enterprises,” resulting in insufficient depth of resource sharing.

3.3. Ethical and standardization gaps in technology application

The application of technology in health and senior care has triggered new ethical and standards issues. For example, where are the boundaries for health data privacy? How is liability defined for AI diagnostic results? Will the replacement of human companionship by smart devices exacerbate emotional loneliness among the elderly? Social consensus and industry standards on these ethical dilemmas are yet to be formed. In the teaching process of industry-education integration, both university teachers and enterprise mentors find it difficult to provide standard answers, posing new challenges for value shaping and professional ethics education in talent cultivation.

4. Pathways for deepening industry-education integration

To seize opportunities and address challenges, a systematic approach to building a deeply integrated ecosystem is essential.

4.1. Constructing a “government-industry-enterprise-institution” collaborative ecosystem

The government should play a guiding role by introducing policies such as tax incentives and special subsidies to encourage enterprises to participate deeply in industry-education integration. Industry associations should take the lead in developing technical competency standards and certification systems for the smart senior care field [4], providing clear goals for talent cultivation. Universities and enterprises should jointly establish “Industry Colleges” or “Program Development Committees” to institutionally ensure that enterprise experts participate in the entire process of talent training program formulation, curriculum development, and teaching implementation, forming a tight-knit collaborative entity characterized by “joint talent cultivation, shared process management, co-created outcomes, and shared responsibilities.”

4.2. Co-establishing integrated “teaching-R&D-service” platforms

Promote the evolution of university-enterprise cooperation from single “internship bases” to innovation platforms integrating teaching, research and development, and social service functions. For example, jointly building a “Collaborative Innovation Center for Smart Senior Care Application Technology.” This center would serve simultaneously as a student training base, a testing ground for new enterprise products, a technical R&D platform

for university faculty, and a provider of real technical services to the community.

4.3. Implementing "project-led, dual-supervision" teaching model reform

Comprehensively promote project-based teaching, focusing on solving real industrial problems. Course content should be organized around specific projects such as "User Experience Optimization of Smart Senior Care Platforms" and "Design of Fall Prevention Systems for Community-Dwelling Elderly." The teaching team should consist of both university teachers and enterprise mentors, forming a "dual-supervisor" system [5]. Through this approach, students' learning process becomes synonymous with the problem-solving process, and their outcomes can directly serve industrial development, thereby unifying educational value with industrial value.

5. Conclusion

Technological development is bringing disruptive change to the health and senior care sector, simultaneously presenting a historic opportunity to deepen industry-education integration and innovate talent cultivation models. Faced with challenges like the interdisciplinary talent shortage, ineffective collaboration mechanisms, and ethical standard gaps, superficial cooperation is no longer sufficient. A systemic approach is imperative. By constructing a multi-stakeholder collaborative ecosystem, co-building integrated innovation platforms, and promoting teaching reforms oriented toward real-world scenarios, we can effectively break down the barriers between industry and education. This will cultivate a new generation of health and senior care professionals who are not only proficient in leveraging future technologies but are also imbued with a strong sense of humanistic care, thereby providing solid talent and intellectual support for proactively addressing population aging and building healthier societies.

Disclosure statement

The author declares no conflict of interest.

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