

Cultivating Elderly-Care Management Engineers: Dilemmas, Breakthroughs, and Practical Explorations within an Industry-Education Community

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Abstract: To address the structural, content-related, and institutional mismatches in the cultivation of Elderly-Care Management Engineers, this study proposes and implements a practical framework for an industry-education integration community involving multiple stakeholders, including higher education institutions, elderly care enterprises, industry associations, and the government. Employing a mixed-methods approach, the research conducted a systematic reform of the curriculum system, faculty development, and practical training platforms. The effectiveness was empirically evaluated using data on learning outcomes, competency development, and industry feedback. Results demonstrate that the community model significantly enhanced the quality of talent cultivation: the core competency attainment rate of graduates increased by 27 percentage points, the job alignment rate rose to 88%, and employer satisfaction reached 91%. This study confirms that the industry-education integration community, through its institutionalized collaboration and governance mechanisms, effectively achieves a precise alignment between talent supply and industry demand, offering a replicable experience for educational reform in related fields.

Keywords: Industry-education integration; Elderly care services; Talent cultivation; Community; Educational reform

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1. Introduction

The 21st century is an era dominated by knowledge economy, and also an era of educational quality global demographic aging presents not only socio-economic challenges but has also catalyzed the emergence of the “silver economy,” driving the transformation of the elderly care service industry from a traditional model focused on basic living assistance towards a comprehensive model characterized by specialization, intellectualization, and humanization ^[1]. Within this transformative process, human resources constitute the core element supporting

industry development. Composite technical management talents—termed “Elderly-Care Management Engineers”—who possess competencies in modern institutional operation and management, health and wellness technology application, and humanistic literacy, have become a critical bottleneck constraining industrial upgrading ^[2,3]. International experience demonstrates that the professionalism of elderly care services directly depends on a specialized workforce capable of mastering theoretical foundations while solving complex practical problems ^[4].

In stark contrast to the industry’s urgent demands, a significant structural imbalance exists in talent cultivation within China’s higher education system in this field. Multiple studies indicate a substantial gap between the theoretical knowledge acquired by university graduates and the actual operational needs of elderly care institutions, with graduates particularly lacking practical capabilities in project management, quality control, technology integration, and crisis handling ^[5,6]. This phenomenon of “disconnect between learning and application” exposes a systematic lag in the current talent cultivation model regarding objective positioning, curriculum design, and practical training components.

The academic consensus generally identifies the root cause as a lack of substantive breakthrough in the industry-education integration mechanism within the elderly care sector. Although “school-enterprise cooperation” has been advocated and practiced for years, most collaborations remain superficial, limited to establishing internship bases or occasional lectures by industry experts, failing to penetrate core aspects such as jointly formulating training standards, developing curricula, building faculty teams, and evaluating training quality ^[7]. This loose cooperative model struggles to promptly and effectively translate rapidly evolving industry needs into educational supply, resulting in a disconnection between the supply side of talent cultivation and the demand side of the industry.

In recent years, the “Industry-Education Integration Community” has emerged as an institutionalized innovative organizational model perceived as a key pathway to resolve these deep-seated contradictions. This model transcends the unidirectional, temporary resource-exchange relationships characteristic of traditional school-enterprise cooperation, aiming to construct an educational ecosystem involving multiple stakeholders—guided by government, and participated in by industry enterprises, higher education institutions, and research institutes—characterized by resource sharing and responsibility sharing ^[8,9]. Theoretically, such a community can achieve seamless alignment between industrial demands and educational objectives, organic integration of technological resources and teaching content, and bidirectional flow of human resources through establishing normalized consultation and governance mechanisms ^[10]. However, existing research predominantly focuses on macro-policy discussion or theoretical model construction. There is a notable scarcity of empirical studies that provide a systematic, data-driven examination of how such a community model is implemented in the elderly care sector and quantitatively assess its impact on cultivating specific core competencies.

Based on this context, this study employs a mixed-methods approach to both propose a practical community framework and rigorously evaluate its effectiveness. The research aims to systematically identify and analyze the multidimensional dilemmas faced in cultivating Elderly-Care Management Engineers. Grounded in the theoretical framework of the industry-education integration community, it seeks to deeply explore the internal logic and practical pathways for resolving these dilemmas. This is achieved by constructing a concrete community model and empirically evaluating its impact through a combination of quantitative data and qualitative feedback from both industry and students. Through this integrated theoretical and empirical analysis, this research expects to provide robust academic evidence and feasible solution references for constructing a high-quality talent cultivation

system for elderly care services suited to the Chinese context.

2. Analysis of the challenges in cultivating elderly-care management engineers

The fundamental challenge in training high-quality elderly-care management engineers lies in the systemic mismatch between industry demands and the supply of qualified graduates from educational institutions. To systematically examine this issue, this section develops a competency-supply analytical framework, dissecting the existing problems across three dimensions: structural, content-related, and institutional.

2.1. The competency-supply analytical framework

Drawing on human capital theory and competency models from service management, the quality of elderly-care management engineer training hinges on the alignment between educational provision and industry needs across four core competency dimensions: operational management, technology application, humanistic care literacy, and innovation and sustainable development capability. These four dimensions constitute an integrated competency system. However, the current training system exhibits significant systematic deviations in constructing this system. The mismatch between educational supply and industry demand manifests not only in the absence of individual competency elements but also in the multi-layered misalignment of competency structures, content systems, and supporting mechanisms.

2.2. Systematic gaps in core competencies

Existing training programs display notable deficiencies in competency structure. On one hand, the curriculum tends to overemphasize management subjects while underemphasizing technology, with technology application courses typically accounting for less than 20% of the total curriculum, failing to meet the demands of smart elderly-care development ^[11]. On the other hand, the cultivation of humanistic care literacy is often reduced to isolated general education courses, lacking organic integration with operational management practices. This structural imbalance creates a fundamental gap between the competency profile of graduates and actual job requirements. Particularly regarding innovation and sustainable development capabilities, most existing curricula lack dedicated training modules, leaving students ill-prepared for the rapidly evolving industry landscape.

2.3. Disconnect between knowledge systems and industry practice

The disconnection between training content and industry practice represents another prominent challenge. Theoretical knowledge taught in universities often lags behind industry developments by at least three to five years, while the elderly-care sector is undergoing rapid technological iteration and service innovations. This disparity in the pace of knowledge renewal necessitates a lengthy relearning process for graduates before they can become competent in their roles. Concurrently, practical training components are seriously flawed, rarely offering students opportunities to participate in complete management processes or the implementation of technical solutions ^[12]. Such superficial engagement in practice prevents students from developing the capacity to solve complex problems.

2.4. Systemic failures in faculty and evaluation systems

Deep-seated institutional issues further exacerbate the training challenges. The prevailing faculty evaluation system overemphasizes academic research publications, failing to adequately value industry experience and

applied teaching capabilities. This institutional orientation directly results in the chronically low proportion of dual-qualified teachers^[13]. Simultaneously, the authority for evaluating training quality resides primarily within educational institutions, with insufficient participation from industry enterprises, preventing the formation of an effective quality feedback loop. More critically, industry-education integration lacks stable institutional guarantees and resource investment mechanisms, with most collaborations remaining project-based and failing to establish a continuously improving training ecosystem.

These three levels of mismatch reinforce each other, collectively forming a systemic bottleneck constraining talent development quality. Structural defects lead to a weak competency foundation, content misalignment causes a theory-practice divide, and institutional failures prevent the effective resolution of the first two issues. This in-depth analysis indicates that any isolated, piecemeal reform is unlikely to break the current impasse, necessitating the construction of a new training paradigm at the systemic level. This also establishes the theoretical necessity and practical urgency for introducing the industry-education integration community model.

3. Research design and data collection methods

To systematically evaluate the effectiveness of the Industry-Education Integration Community model in cultivating Elderly-Care Management Engineers, this study adopted a mixed-methods approach, integrating quantitative and qualitative data and incorporating perspectives from multiple stakeholders to ensure comprehensive and credible analysis.

3.1. Sampling method and data sources

A multi-source sampling strategy was implemented. For the student cohort, a combination of cluster and convenience sampling was used, selecting all participants in the community-based training program. Quantitative data were collected from the 2022 (pre-reform) and 2025 (post-reform) cohorts, totaling 165 students, while qualitative data were obtained through in-depth interviews and open-ended questionnaires with a representative subset of 100 students. To capture academic perspectives, eight discipline-specific teachers and three academic administrators involved in the curriculum reform participated in focus group discussions and individual interviews. Industry perspectives were secured by engaging fifteen partner elderly care institutions of varying scales, with 25 individuals including human resource managers, operations directors, and frontline mentors providing survey and interview data.

3.2. Data collection instruments and procedures

The study utilized multiple data collection instruments. Quantitative data included student academic performance metrics such as course examination scores and semester project grades, competency self-assessments measured via a five-point Likert scale questionnaire covering eight core dimensions, and graduate employment statistics including job alignment rates and starting salaries. Qualitative data were gathered through semi-structured interviews, open-ended survey responses, student reflective journals, and structured feedback forms from enterprise mentors, focusing on practical performance, curriculum relevance, and collaborative experiences.

3.3. Data analysis and integration process

Data analysis followed a triangulation framework. Qualitative materials including interview transcripts and reflective journals were transcribed and coded using thematic analysis, while quantitative data were analyzed

with statistical software for descriptive and comparative analysis. Quantitative results such as competency scores and employment metrics were systematically compared with qualitative findings from enterprise evaluations and student reflections to identify consistencies and discrepancies. Throughout this process, particular attention was paid to examining issues like curriculum practicality from both educational and industry perspectives, revealing how industry-education integration addresses talent supply-demand alignment through specific mechanisms.

The integrated approach provided both quantitative evidence of the training model's effectiveness and in-depth insights from multiple stakeholders, offering comprehensive empirical support for deep industry-education integration.

4. Construction pathways for industry-education integration communities

To address the aforementioned structural, content-related, and institutional mismatches, this study proposes a practical framework for an industry-education integration community involving multiple stakeholders, including higher education institutions, elderly care enterprises, industry associations, and the government. Guided by the principles of “resource sharing, process co-management, and outcome mutual benefit,” this framework aims to achieve a precise alignment between talent cultivation and industry demands through an institutionalized collaboration mechanism.

4.1. Organizational vehicle and collaborative governance structure of the community

The effective operation of the community relies on a clearly defined entity with distinct rights and responsibilities. This study tentatively establishes the “Elderly Care Service Management Talent Development Alliance,” with its Council serving as the supreme decision-making body. The Council comprises deans of secondary colleges from universities, human resources directors and operations directors from partner enterprises, experts from industry associations, and representatives of local civil affairs departments. This multi-stakeholder organizational framework facilitates collective deliberation and decision-making, enabling comprehensive coverage of issues arising in industry-education integration practices. Under the Council, two committees are established: the “Teaching Guidance Committee,” responsible for reviewing talent training programs and curriculum standards, and the “Practical Base Management Committee,” tasked with coordinating and managing student internships and practical training. This governance structure ensures that industry needs are fully reflected in the top-level design of talent cultivation, thereby resolving institutional mismatches at the organizational level.

4.2. Restructuring and implementation of the curriculum system

The industry-education integration community has undertaken a systematic restructuring of the original curriculum system. Through a survey of 25 elderly care institutions in Shanghai, eight core competency domains—including smart elderly care management and application of aging-adaptive technologies—were identified. Based on these findings, a modular curriculum system characterized by “shared foundational courses, specialized branch courses, and integrated practical experiences” was developed. Among these, core specialized courses were jointly designed by academic institutions and enterprises, with authentic case studies provided by enterprises accounting for 45% of the content—a 30-percentage-point increase compared to the period before the alliance was established.

In terms of practical teaching, the alliance established a four-stage progressive practical system encompassing “cognitive learning, job shadowing, post practice, and research innovation.” Over the course of their three-year

study program, students’ cumulative practical training hours increased from the original 240 to 480, all of which were completed in real work environments provided by alliance member organizations. This reform has reduced the average job adaptation period for graduates from six months to two months.

4.3. Innovative practices in faculty development

To address the shortage of “dual-qualified” instructors, the industry-education integration organization implemented a faculty development model characterized by “two-way appointments and joint evaluation.” On one hand, 15 technical backbone personnel from enterprises were appointed as industry professors, undertaking 32% of specialized course teaching tasks. On the other hand, 8 young faculty members were selected for full-time practical training at enterprises for six months, with their assessment results incorporated into the professional title evaluation system.

Through these practices, the proportion of “dual-qualified” faculty in alliance universities increased from 28% to 65%, establishing a teaching team proficient in both theoretical knowledge and practical skills. Furthermore, academic and industrial partners jointly developed 12 course standards, promoting student learning in authentic environments and enhancing the efficiency of translating knowledge into practice.

4.4. Practical outcomes and data analysis

Data from the two-year operation of the organization demonstrate a significant improvement in talent cultivation quality. The results are shown in **Figure 1**. It shows that the core competency attainment rate of the 2025 graduating cohort reached 92%, representing a 27-percentage-point increase compared to the 2022 cohort prior to the alliance’s establishment. The job alignment rate rose from 65% to 88%, while the average starting salary of graduates increased by 35%. Employer satisfaction surveys indicated that comprehensive competency satisfaction with graduates improved from 72% to 91%.

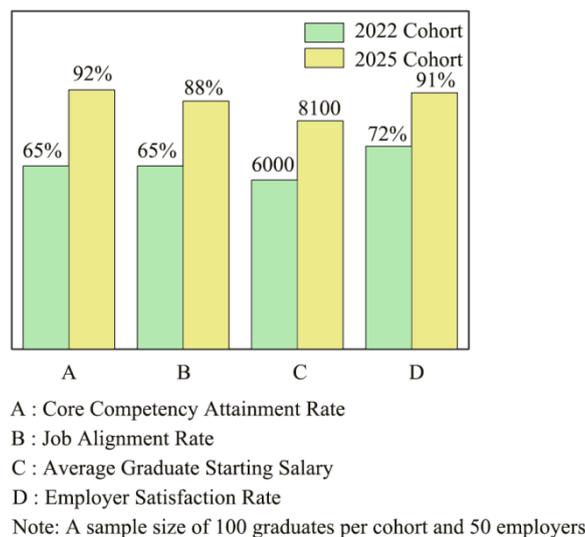


Figure 1. Comparison of key metrics between 2022 and 2025 cohorts

These quantitative improvements are not isolated outcomes but are underpinned by the community’s core operational mechanisms. The 27-percentage-point surge in core competency attainment can be primarily attributed to the project-based learning driven by authentic industry challenges, which compelled students to

integrate and apply fragmented knowledge. The rise in job alignment rate to 88% directly reflects the success of the governance structure—particularly the Teaching Guidance Committee—in translating dynamic industry needs into updated curriculum standards in a timely manner. For practice, this suggests that the key to enhancing graduate employability lies not merely in adding more internships, but in granting industry a substantive role in the co-creation and governance of the entire curriculum. Consequently, this model offers a replicable blueprint for other regions or sectors aiming to move beyond superficial school-enterprise cooperation towards a sustainable, demand-driven talent ecosystem.

5. Empirical effectiveness evaluation and analysis

To systematically examine the effectiveness of the curriculum reform based on the industry-education integration community, this study adopted a mixed-methods approach. Data were collected from three dimensions—learning outcomes, competency development, and industry feedback—for a comprehensive evaluation.

5.1. Quantitative analysis of student learning outcomes

Student academic performance exhibited marked improvements following the curriculum reform. A comparative analysis of student grades from the Fall 2022 and Fall 2025 semesters was conducted. The results reveal that the average course score increased from 78.5 to 85.2 points, while the excellence rate (scores ≥ 90 points) rose from 12% to 35%. More significantly, the average score in the “Semester Project” module—which assesses comprehensive practical abilities—demonstrated a substantial increase, rising from 70.5 to 88.7 points. These findings indicate that the project-based tasks co-designed by academic and industrial partners more effectively stimulate students’ learning potential and enhance the translation of theoretical knowledge into practical competence.

5.2. Self-assessment of students’ core competency development

To comprehensively evaluate students’ competency progression, a core competency self-assessment questionnaire was administered to 52 students enrolled in the Fall 2025 semester upon course completion. The designed questionnaire is shown in **Table 1**. Utilizing a five-point Likert scale, the survey required students to rate their perceived improvement in various competencies before and after the course. The results indicate the most significant enhancements in three dimensions: “Operational Capability in Smart Elderly Care Platforms,” “Data Analysis and Decision-Making Skills,” and “Complex Problem-Solving Ability,” all with average scores above 4.5. In contrast, “Systematic Understanding of Theoretical Knowledge” showed a relatively smaller improvement, with an average score of 3.8. The self-assessment pattern, where practical capabilities like smart platform operation and problem-solving scored highest, while systematic theoretical understanding showed relatively less perceived improvement, offers crucial insight for curriculum designers. It indicates that the community model excels at fostering procedural knowledge (know-how) through immersion in authentic contexts, which is precisely what the industry demands for immediate job performance. This does not undermine theoretical foundations but highlights a shift in pedagogical focus towards application and integration. For educational administrators, this implies that assessment systems should evolve to value such applied competency development equally with traditional academic knowledge acquisition.

Table 1. Student self-assessment questionnaire on core competency development

Number	Core competency dimension	Detailed description	Self-assessment rating (1–5)
1	Operational Capability in Smart Elderly Care Platforms	Platforms Proficiency in using smart elderly care systems, devices, and management platforms to perform routine operational tasks.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
2	Data Analysis and Decision-Making Skills	Ability to collect and process operational data from elderly care institutions and formulate management decisions based on the analysis.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
3	Complex Problem-Solving Ability	Capacity to develop systematic solutions for complex operational issues (e.g., risk response, resource coordination).	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
4	Interdisciplinary Knowledge Integration	Ability to synthesize and apply knowledge from management, information technology, gerontology, etc., in practical contexts.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
5	Communication and Team Collaboration	Effectiveness in communicating and collaborating within teams and with diverse stakeholders (e.g., elderly residents, family members).	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
6	Systematic Understanding of Theoretical Knowledge	Comprehensive grasp of the theoretical frameworks and knowledge systems underlying elderly care institution management.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
7	Innovative Design and Planning Capability	Ability to design innovative service models or optimize existing operational processes for elderly care.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5
8	Ethical Awareness and Professionalism	Understanding and adherence to ethical principles and social responsibility in elderly care practice.	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5

*Note: Rate your perceived level of improvement for each competency compared to your ability before the course. Use the scale below, where 1 = Almost No Improvement, 2 = Slight Improvement, 3 = Moderate Improvement, 4 = Significant Improvement, 5 = Very Significant Improvement.

5.3. Qualitative feedback from industry and students

In addition to quantitative data, this study collected qualitative feedback through open-ended questionnaires and in-depth interviews. Several mentors from partner enterprises noted, “The feasibility and innovation of the proposals submitted by this cohort of students far exceed those of previous years; they have genuinely grasped the real-world logic of elderly care institution operations.” Student reflective journals from the course provided corroboration from an internal perspective. One student wrote: “To complete the project on reducing fall rates, our team not only analyzed platform data but also conducted multiple on-site observations at the institution. This process of learning and validating knowledge through addressing authentic problems enabled me to achieve an unprecedented depth of understanding.” These accounts vividly illustrate how the industry-education integration model enhances the relevance and effectiveness of talent cultivation by reshaping the learning process.

Collectively, this qualitative feedback transcends mere satisfaction ratings; it reveals a fundamental shift in the nature of learning. Students are no longer learning about management in the abstract but are learning to manage through engaging with real institutional complexities. From the industry perspective, graduates are valued not for having memorized standards, but for having developed the adaptive problem-solving mindset needed to navigate an evolving sector. The primary practical implication is clear: the educational value of an industry-education community lies in its capacity to create a shared context for action, which transforms both the learner’s identity and the employer’s expectations.

6. Conclusion and prospects

This study systematically demonstrates that the industry-education integration community serves as an effective pathway to resolve the dilemmas in cultivating Elderly-Care Management Engineers. By establishing an entity alliance guided by the principles of “resource sharing, process co-management, and outcome mutual benefit,” and implementing reforms in curriculum restructuring, collaborative faculty development, and practical teaching, empirical data confirm the model’s significant effectiveness in improving students’ academic performance, core competency attainment, employment quality, and employer satisfaction. These findings reveal that deep industry-education integration can systematically address structural imbalances, content obsolescence, and institutional inefficiencies by reshaping the learning process and governance structure.

To translate these findings into actionable strategies, integrated recommendations are offered. For policymakers, efforts should focus on institutionalizing and providing tangible support for such communities, including clear legal frameworks, dedicated funding, and data platforms to facilitate sustainable operation and regional talent development. Incorporating metrics of deep industry collaboration into educational quality assessments and professional certification systems would further align training with market needs. For education administrators, internal governance reforms are essential, including granting greater autonomy to professional teams in curriculum updates and cross-institutional appointments, as well as formally recognizing faculty engagement in enterprise collaboration within promotion and evaluation systems.

This study has certain limitations. Its findings are primarily based on a case from a developed region, and the model’s adaptability to areas with different resource levels requires further validation. Furthermore, the research tracks medium-term training outcomes, leaving the long-term career impact of graduates and the sustained viability of the community model open for future inquiry. Subsequent research could conduct comparative studies across diverse regions, perform longitudinal tracking of graduate careers, and explore the model’s application in other public-service fields such as health management or community rehabilitation. Such endeavors would not only test the generalizability of the framework but also contribute to building a more responsive and integrated vocational education system.

Disclosure statement

The author declares no conflict of interest.

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