

EXPLORATION OF CHALLENGES AND COUNTERMEASURES IN INDUSTRY–EDUCATION INTEGRATION AT APPLICATION-ORIENTED UNDERGRADUATE INSTITUTIONS

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Abstract: This paper systematically examines the developmental trends, challenges, and corresponding solutions of the industry–education integration model in the field of application-oriented undergraduate education. Through a detailed analysis of issues encountered during the implementation of industry–education Integration—such as low enterprise enthusiasm, imperfect collaborative mechanisms, and a disconnect between talent cultivation and industry needs—this study proposes practical countermeasures. These include strengthening policy and regulatory frameworks, exploring new models of cooperation, and establishing diversified collaboration systems. The aim is to provide both theoretical foundations and practical guidelines for the further development of industry–education Integration in application-oriented undergraduate education, better aligning it with the practical needs of socio-economic development, and to cultivate more highly qualified talent.

Keywords: Industry–education integration; Application-oriented undergraduate education; Education; Challenges; Countermeasures

1 INTRODUCTION

Against the backdrop of rapid socio-economic development, application-oriented undergraduate education has become a key component of higher education, charged with cultivating high-quality, practice-ready graduates who meet real-world needs. The industry–education integration model tightly couples industry and academia, enabling students to understand sector demands, sharpen practical skills, and boost employability. Yet, its implementation is fraught with difficulties. On the one hand, how to immerse students deeply in industry and raise their hands-on competence remains an urgent puzzle; on the other, institutional and interest barriers between educational institutions and companies hinder the formation of stable, long-term collaboration mechanisms. If all upstream and downstream stakeholders coordinate their efforts and continuously refine integration pathways and models, application-oriented undergraduate programs can produce more job-ready talent for society.

2 CURRENT STATE OF INDUSTRY–EDUCATION INTEGRATION IN APPLICATION-ORIENTED UNDERGRADUATE EDUCATION

2.1 Continuously Growing Policy Support

In recent years, the central government has attached great importance to the role of industry–education integration in educational development, issuing a series of policy documents, including the Several Opinions on Deepening Industry–Education Integration. These documents define the development goals, main tasks, and safeguard measures of Integration, providing both a policy foundation and directional guidance for its advancement in application-oriented undergraduate programs. Local governments have responded actively, formulating detailed implementation rules and supporting policies tailored to regional realities. These initiatives facilitate on-the-ground Integration and create a favorable policy environment for collaboration between application-oriented universities and enterprises.

2.2 Cooperation Models Are Becoming Increasingly Diverse

Deepening industry–education integration, institutions and enterprises co-build and share resources: jointly investing in training bases to move classrooms onto the shop floor; running "order-made" programs that align curricula with job specifications so graduates fit posts immediately; teaming up on research that sends faculty to solve shop-floor problems and converts results on site; co-hosting skills competitions that replace drills with contests to spark innovation. These multi-pronged initiatives precisely link the talent, industry, and innovation chains, raising educational effectiveness and social benefits in tandem, see Table 1.

Table 1 Cooperation Models between Application-Oriented Universities and Enterprises in Industry–Education Integration: Features and Outcomes

Cooperation Model	Feature	Educational Effect	Social Benefit
Jointly Build Practice & Training Base	The university and enterprise co-invest to establish a base; the enterprise supplies a real workplace and live projects.	Students gain authentic practice, boosting practical skills and professional qualities.	Cultivates adaptable future employees for the firm and raises recruitment efficiency.
Order-Made Talent Training	The curriculum is customized to enterprise needs; graduates move straight into company posts.	Graduates fit posts immediately, cutting enterprise training costs.	Satisfies specific talent demands and strengthens corporate competitiveness.
Collaborative R&D Projects	Joint research projects accelerate technology transfer and upgrading.	University research is commercialized, raising academic standards; enterprises acquire tech support for upgrades.	Propels industrial technology progress and regional economic growth.
Co-Host Vocational Skills Contests	The university and an enterprise co-organize contests to spark student interest and innovation.	Students' practical ability, overall quality, and innovative thinking are enhanced.	Raises the public profile of both partners and aligns talent cultivation with market demand.

2.3 Some Institutions Have Achieved Remarkable Results

Several application-oriented universities have taken the lead by co-founding industrial colleges with enterprises, jointly designing curricula, and exchanging faculty to integrate educational and industrial resources more deeply. Graduate employment rates and satisfaction have soared, while firms gain both talent and technological momentum, creating a win-win model that offers replicable experience for peer institutions and propels industry–education integration to a higher level.

3 CHALLENGES FACING INDUSTRY–EDUCATION INTEGRATION IN APPLICATION-ORIENTED UNDERGRADUATE EDUCATION

3.1 Insufficient Corporate Motivation

3.1.1 Imbalance between cost input and return

Companies must invest heavy human, material, and financial resources—building training bases, assigning engineers to mentor interns, co-designing curricula—yet these outlays seldom generate immediate revenue; they may even raise operating costs[1]. Talent dividends and technological innovations arrive late, if at all, making the cost–benefit equation unfavorable and dampening enthusiasm.

3.1.2 Lack of incentives for long-term cooperation

Current incentives are limited to tax breaks and modest subsidies that involve complicated applications and fall far short of covering total expenditure. No policy rewards sustained, strategic collaboration, so firms prefer short, transactional projects, preventing deep and durable university partnerships.

3.2 Flawed Cooperation Mechanism

3.2.1 Unequal status of partners

Universities and enterprises pursue different goals: the former prioritize talent cultivation and academic quality, while the latter focus on profit maximization. This asymmetry leaves enterprises with little say in curriculum design or program planning, so their needs are underrepresented, eroding the quality and depth of Integration.

3.2.2 Weak operational coordination

Cooperation spans multiple departments and stages, yet no effective communication platform exists. Poor information flow among university units, between the university and the company, and within the firm itself results in mismatched schedules, unclear responsibilities, and stalled or failed projects[2].

3.3 Mismatch Between Talent Supply and Industry Demand

3.3.1 Outdated study programs

Drafted on scant, slow-moving industry intelligence, application-oriented curricula are revised too infrequently to keep pace with the sector's fast-changing needs; graduates therefore master obsolete knowledge and skills that undermine their employability.

3.3.2 Weak curricula and practice links

Courses still rely on stale theory and lack live cases or projects. Practical training earns few credits, while a shortage of work-placement sites, industry-experienced instructors, and robust management leaves students short of the hands-on ability and innovative mindset high-caliber applied posts require.

3.4 Shortfalls in Teaching-Staff Development

3.4.1 Shortage of “dual-qualified” teachers

"Dual-qualified" teachers—those who command both solid academic knowledge and extensive industry experience—are the backbone of industry–education integration, yet their numbers and structure remain inadequate. Recruitment criteria undervalue workplace practice, so most new hires lack enterprise exposure; in-service training and incentives to upgrade practical skills are weak, lowering the quality of integration.

3.4.2 Poor results from enterprise placements for teachers

Although some universities send staff to firms, lax supervision and assessment render the exercise ineffective. Enterprises seldom assign teachers to real projects, while universities set no clear performance standards or rewards, leaving faculty motivation low and hampering the depth of Integration[3].

4 PATHWAYS FOR INDUSTRY–EDUCATION INTEGRATION IN APPLICATION-ORIENTED UNDERGRADUATE EDUCATION

4.1 Improve Policies and Regulations to Create a Supportive Environment

4.1.1 Strengthen the policy–law framework

Governments should accelerate the passage of legislation on industry–education integration to provide institutional security for deep university–enterprise collaboration. First, promulgate a Regulation on Promoting Industry–Education Integration that defines the rights and obligations of both parties in talent training, resource sharing, and technology transfer. Second, issue supporting implementation rules that give step-by-step guidance for jointly building industrial colleges, training bases, and other cooperative formats. Third, set up a policy-outreach system—special workshops, model cases, etc.—to raise awareness. A supervision mechanism is also needed: integrate integration tasks into local government performance reviews and conduct regular evaluations of policy implementation to ensure that every support measure takes effect. An integrated chain of "legal guarantee + implementation rules + oversight & assessment" will create a favorable policy climate for industry–education integration.

4.1.2 Refine the incentive policy package

To give firms a real reason to participate, the incentive system must be improved.

Tax relief: streamline applications, raise deduction rates, and grant substantial reductions in VAT and corporate income tax for companies engaged in university partnerships.

Cash support: create a special fund that matches corporate spending on training bases, equipment and similar items.

Non-financial rewards: award the title "Demonstration Enterprise for Industry–Education Integration," grant priority in government procurement and bidding, and allow leading firms to help draft sector standards and provide fast-track channels for talent acquisition.

By combining economic compensation, policy preference and reputational recognition, the package turns participation into a profitable, long-term proposition and builds a durable engine for university–enterprise cooperation.

4.1.3 Establish an evaluation mechanism for industry–education integration

A comprehensive, scientific evaluation system should be developed to enhance the quality and efficiency of university–enterprise collaboration. The mechanism should include a diversified set of indicators: Talent development quality, such as graduate job relevance and employer satisfaction; Enterprise engagement, including resource input and teaching participation hours; Cooperation project outcomes, like the conversion rate of research results and utilization of jointly built training bases; Social benefits, such as contributions to regional economic development[4]. It is recommended that third-party organizations conduct regular evaluations and link the results to policy support, project approval, and funding allocation, forming a system of incentives and constraints. A dynamic feedback mechanism should also be established to adjust cooperation models based on evaluation outcomes, continuously improving the depth and effectiveness of industry–education integration, and ultimately achieving a virtuous cycle of collaborative talent cultivation[5].

4.2 Innovate Cooperation Models to Deepen University–Enterprise Collaboration

4.2.1 Build diversified cooperation models

Application-oriented universities should actively innovate school–enterprise cooperation models and work with industry to establish a multi-level, three-dimensional collaborative education system. Co-establish industrial colleges through a "dual-principal" governance structure that embeds real production standards, technical specifications, and job requirements into every stage of talent cultivation, achieving precise alignment between academic programs and industrial chains[5]. Partner with leading firms to create industry–university–research collaborative innovation centers or joint laboratories for technology development and achievement transformation, simultaneously upgrading the university's research service capacity and supplying enterprises with high-caliber technical talent. Develop high-level practice and training bases that replicate authentic production environments—"teaching factories"—and import live enterprise projects as instructional cases. Pilot characteristic programs such as "order-made classes" or "modern apprenticeships," in which companies co-design curricula, co-deliver instruction, and co-evaluate quality. By diversifying cooperation models, universities can leverage their educational resources while tapping enterprises'

industrial expertise, fostering an ecosystem of "integrated industry–education, collaborative talent cultivation" that produces more high-quality application-oriented graduates for regional economic development[6].

4.2.2 Deepen university–enterprise collaboration

To align talent development precisely with industrial demand, a long-term co-education mechanism is needed. Universities should proactively engage leading firms through visits, surveys, and roundtables to capture new technological avenues and competency requirements, and then dynamically adjust programs, curricula, and teaching content. Enterprises must step into the entire cultivation process—through industrial colleges or custom-made classes—by supplying real cases, technical standards, real projects, and internship posts, while dispatching senior engineers as part-time or "industrial" lecturers to co-develop courses, supervise training, and mentor capstone projects with the latest technologies and management know-how. Such tight cooperation forms a sustainable "joint cultivation, joint governance, shared outcomes" triangle that delivers high-caliber, application-oriented graduates and wins for the university, enterprise, and students alike[7].

4.2.3 Build a digital collaboration platform for efficient resource allocation

A smart, end-to-end platform can eliminate information asymmetry. An industry–education cloud system should include: a course-sharing module where firms post practical-course needs and universities match teaching staff; a demand–supply engine that updates corporate technical challenges and graduation-project topics in real time; and a quality-monitoring center that tracks intern KPIs and employer satisfaction[8]. Zhejiang's provincial cloud already connects 200+ firms and universities, raising project-match success by 65%. Virtual teaching studios using VR/AR create cross-regional classrooms: Guangdong Tech's "Cloud Industrial College" streams live data from 12 factory floors, letting students remotely control CNC machines. Joint online lesson-preparation groups co-write project-based textbooks via collaboration software. Courses run in virtual studios show 92% alignment with industry standards, compared with 58% for traditional ones[9].

4.3 Optimize Talent-Cultivation Programs and Raise Graduate Quality

4.3.1 Create a dynamic adjustment mechanism

To keep graduate competences aligned with industrial demand, universities should run a closed "monitor–adjust–feedback" loop: Set up an industry radar that routinely collects data on technological change and job profiles; Use school–enterprise bodies such as programme steering committees and industrial colleges to embed employers in every stage of cultivation; Conduct termly employer surveys (questionnaires, interviews) to capture emerging needs; Introduce a rapid-response rule that updates courses within 1–2 teaching cycles when new domains appear; Reserve 15–20% of curricular space for just-in-time modules; Operate a two-way feedback system that tracks graduates and solicits employer ratings.

This cycle of "demand pulls → rapid revision → quality rises" continuously refreshes study programs and boosts graduate competitiveness, supplying high-caliber talent for regional development.

4.3.2 Strengthen the practice component

To produce application-ready graduates, instructional design must foreground hands-on learning. Co-build training bases with leading firms; run sandwich placements and project-based courses that expose students to frontier technology while importing live company cases into classrooms[2]. Upgrade teaching capacity: appoint senior engineers as part-time instructors, send university staff to industry secondments, and run joint "dual-qualified" teacher-training programs. Guarantee that practice credits account for 30–40% of the curriculum and adopt "project-driven + process-assessment" quality management to cultivate students' technical, teamwork and problem-solving skills. This deep Integration of theory and practice turns out market-ready, high-level technical talent.

4.4 Strengthen Teaching-Staff Development and Boost Faculty Practical Competence

4.4.1 Expand the pool of "dual-qualified" teachers

Recruitment must weight real-world experience: candidates with substantial industry backgrounds are preferred. Once hired, all teachers are offered regular in-company placements to update their technical skills and workplace knowledge, narrowing the theory-practice gap. Only instructors who have lived the production cycle can embed authentic practice in their lessons and give students a solid professional foundation. Universities should also build career paths that recognize and reward time spent in industry; deeper company partnerships mean greater first-hand exposure, stronger practical pedagogy and smoother graduate employment.

4.4.2 Institutionalize teachers' enterprise placements

A systematic training scheme starts with clear goals and standards. Organize collective visits to benchmark firms, so staff observe current operations; Encourage individuals to apply for self-initiated placements that fuse theory with practice; Track every placement—participants submit reflective reports that feed into future planning; Evaluate outcomes rigorously and link results to promotion, tenure, and performance pay. Well-defined tasks, transparent assessment, and tangible rewards will keep faculty motivated to return to the shop floor year after year, continuously sharpening their practical skills[10].

5 CONCLUSION

The emergence and maturation of any novelty follows a winding upward trajectory; the industry–education integration model in application-oriented undergraduate education is no exception and will require a long gestation before it is fully perfected. By examining current conditions, bottlenecks, and solutions, this paper proposes strategies that include refining policies and regulations, innovating cooperation models, optimizing talent-cultivation programs, and strengthening teaching-staff development, thereby offering both theoretical support and practical guidance for the deeper integration of industry and higher education. As policies continue to improve and implementation experience accumulates, industry–education integration within application-oriented undergraduate programs will gain further depth, producing ever-larger numbers of high-caliber application-oriented graduates for social and economic development.

COMPETING INTERESTS

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REFERENCES

- [1] Yang Y F. Dilemmas and Development of Industry–Education Integration in Undergraduate Vocational Education. *Modern Vocational Education*, 2024(28): 173-176.
- [2] Chen C, Luo S, Ke D. Research on Industry–Education Integration Models in Modern Vocational Education. *Hubei Engineering Vocational College*, 2018: 107-109.
- [3] Ma S, Sun Y Q, Hu X Y. Research and Practice on Industry–Education Integration Models in Higher Vocational Education. *Journal of China Multimedia & Network Teaching*, 2024(07): 157-160.
- [4] Wang X Y. Research and Reflection on Industry–Education Integration in Higher Vocational Education Reform. *Science & Technology Information*, 2020, 18(25): 171-173.
- [5] Yang Y M. Enlightenment of Australia's TAFE Industry–Education Integration Model for China's Higher Vocational Education Reform. *The Science Education Article Collection*, 2014(30): 3-4.
- [6] Ding Z X, Sha W L. Strategies for Optimizing Industry–Education Integration Pathways in Teacher-Education Programs. *Henan Agriculture*, 2022(06): 15-16.
- [7] Wang J Y. A Meta-analysis of Industry–Education Integration Research in the Field of Higher Vocational Education. *Vocational & Technical Education Forum*, 2017(03): 26-33.
- [8] Huang X B, Chen Y H, Lin X F. Research on the Difficulties and Countermeasures for the Promotion of Industry-Education Integration in Application-Oriented Undergraduate Institutions. *Vocational & Technical Education Forum*, 2022(07): 66-71.
- [9] Chen Y, Zhang B, Li R, et al. AI-Empowered Industry-Education Integration: Overcoming Challenges and Reconstructing Collaborative Pathways in Applied Undergraduate Institutions. *Frontiers in Educational Research*, 2025, 8(12): 34-41.
- [10] Tong X, Ruan M. Practical Application of Python Technology in Intelligent Finance Courses for Vocational Undergraduate Education under Industry-Education Integration. *Exploration of Educational Management*, 2025, 3(11): 54-60.