Education Insights

Article

Challenges and Countermeasures of Industry-Education Integration in Local Application-Oriented Universities under the New Quality Productive Forces

Leian Liu [1,2], Ting Wu [3,*], Jieqiong Han [3] and Ling Yang [4]

1 Academic Affairs Office (Admissions Office), Zhongkai University of Agriculture and Engineering, Guangzhou, China
2 Office of the Assistant to the President, Changchun University, Changchun, China
3 College of Information Science and Technology, Zhongkai University of Agriculture and Engineering, Guangzhou, China
4 College of Automation, Zhongkai University of Agriculture and Engineering, Guangzhou, China
* Correspondence: Ting Wu, College of Information Science and Technology, Zhongkai University of Agriculture and Engineering, Guangzhou, China

Abstract: As an important pillar of the higher education system, local application-oriented universities play a crucial role in fostering the new quality productive forces and promoting high-quality regional economic development through the integration of industry and education. Currently, these universities face several challenges in their industry-education integration practices, such as fragmented industry-education collaboration mechanisms, misalignment between academic program offerings and evolving industrial demands, and urgent need for enhanced multi-stakeholder resource integration efficiency, etc. These issues severely restrict their ability to contribute to national modernization efforts. This paper, based on the demands for the development of the new quality productive forces, proposes a "Five-in-one" systematic reform framework: through the innovation of a long-term governance system for industry-education integration, the establishment of an agile response mechanism between the education chain and the industrial chain, the construction of a digital resource sharing platform, A model for collaborative faculty co-development in industry-education integration, and the reconstruction of an integrated quality evaluation system, it explores innovative pathways for the deep integration of higher education and regional economies, providing theoretical frameworks and practical paradigms for the deepening of industry-education integration in application-oriented universities in the new era.

Keywords: new quality productive forces; local application-oriented university; industry-education integration

Published: 31 May 2025

1. Introduction

Local application-oriented universities, constituting a numerical majority (over 50%) of China's regular undergraduate universities, serve as a strategic cornerstone in the national higher education ecosystem. Their institutional positioning intrinsically aligns with the dual imperatives of advancing national modernization goals and driving the construction of an education powerhouse through human capital structural upgrading. The development orientation of these universities is to serve the local economic and social development, with the goal of cultivating application-oriented talents who possess practical abilities and professional qualities. They emphasize industry-education integration and school-enterprise cooperation, focusing on the practical application of knowledge and technology. The most important aspect is to follow market guidance, meet market demands, and based on their own discipline and professional settings as well as the foundation of industry-university-research cooperation, actively connect with related industries, serve the value chain of industry enterprises, meet the human resource demands of enterprises, and cultivate talents that fit the needs of industry development and social demands, achieving a deep integration and coordinated improvement of education and industry [1]. Overall, compared with research-oriented universities and vocational colleges, China's application-oriented universities have three main characteristics: the orientation of talent cultivation towards application, the focus on the application of scientific knowledge and technological achievements, and the orientation of serving local economic and social development [2].

The evolutionary trajectory of China's application-oriented universities has traversed three distinct developmental phases: the exploratory phase of categorical development (2005-2013), marked by institutional innovation in differentiated positioning; the comprehensive transformation phase (2014-2018), characterized by nationwide implementation of institutional restructuring and educational paradigm shifts; and the quality consolidation phase (2019-present), focused on systemic optimization of talent cultivation ecosystems through standard certification and innovation-driven enhancement [3]. Early guidelines established research universities as core institutional carriers of the national innovation system through paradigm-shaping initiatives, thereby laying institutional groundwork for subsequent categorical management of higher education institutions. A national medium-and long-term education reform introduced a ground-breaking institutional design by proposing to establish a hierarchical classification system for higher education institutions and implement categorical management, strategically addressing homogenization tendencies through policy steering and optimized resource allocation. The document mandated universities to formulate differentiated development trajectories aligned with their institutional positioning, thereby laying conceptual foundations for subsequent categorical reform initiatives. Subsequent guiding opinions delineated strategic tasks for institutional transformation, encompassing critical domains such as industry-education integration mechanisms, restructuring of disciplinary architectures, and dual-qualification faculty development. This policy shift marked a transition from conceptualization to a roadmap for operationalization for application-oriented universities, strategically positioning service to regional socioeconomic development as their institutional mandate. Later national education development plans instituted a tripartite classification framework for higher education institutions — research-oriented, application-oriented, and vocational-skills-based categories — while institutionalizing dynamic classification adjustment mechanisms. This strategic categorization compelled application-oriented universities to prioritize the cultivation of techno-skilled talent through curricular reforms aligned with emerging technological trajectories, thereby reconfiguring China's higher education governance paradigm towards demand-responsive human capital development. Recent implementation plans introduced a classification-based evaluation system, bifurcating universities into academic-oriented and application-oriented categories. For application-oriented universities, the framework established a tripartite evaluation matrix emphasizing applied relevance, technological sophistication, and practice orientation, thereby dismantling the dominance of uniform academic evaluation standards through institutionalized value reconfiguration. The latest national policy directives strategically mandated categorical promotion of university reform. Complementing this, a construction plan for education development instituted a tripartite institutional taxonomy dividing universities into research-intensive, application-oriented, and skills-specialized categories, coupled with incentive-compatible resource allocation mechanisms. The policy particularly codified application-oriented universities' strategic mission to anchor industrial technology innovation chains, constructing closed-loop ecosystems integrating technological breakthroughs, achievement transformation, and talent cultivation value chains through deep industry-academia-research integration, thereby operationalizing the "Triple Helix" innovation model within China's national innovation strategy. Industry-education integration, serving as a pivotal mechanism for advancing higher education reform and supporting the national strategy of building an education powerhouse, has emerged as the central pathway for local application-oriented universities to achieve institutional transformation, overcome developmental bottlenecks, and realize qualitative leaps [4]. Its value extends far beyond the innovation of talent cultivation models, profoundly reshaping the practical efficacy of universities in serving regional economies and optimizing educational ecosystems, while fundamentally reconstructing the tripartite symbiosis among higher education institutions, industries, and regional economic systems. This mechanism injects threefold dynamic forces for high-quality development of local application-oriented universities by dismantling barriers between traditional education systems and industrial practices: achieving precise supply-demand alignment in talent cultivation, promoting innovation factor flow in knowledge production, and enhancing the capacity of regional economies to support social services, ultimately forming a closed-loop ecosystem integrating educational chains, talent chains, and industrial chains. Strengthening industry-education integration not only constitutes the fundamental pathway for the transformation of local universities, but also epitomizes the intrinsic value pursuit in the developmental transition of application-oriented undergraduate universities [5].

2. Challenges of Industry-Education Integration in Local Application-Oriented Universities

While China's local application-oriented universities are currently in a phase of steady quality improvement, pervasive challenges remain in their developmental trajectory, particularly regarding the cultivation of applied talents. These universities are actively addressing historically weak foundations and limited experience in applied education by enhancing faculty expertise, innovating curriculum design, and improving educational resources [6]. Amid changing societal contexts and new strategic demands, the fundamental challenge confronting supply-side structural reform in higher education and industry-education integration lies in the need to better align educational resources with the evolving demands of industrial transformation and upgrading [7]. Although current initiatives for industry-education integration in China primarily rely on guideline-based policy instruments, increasing attention is being directed toward establishing enforceable standards and practical frameworks. This ongoing refinement process reflects a growing institutional awareness of the importance of translating policies into effective action. As a result, efforts are intensifying to bridge the "policy-implementation gap" and to promote substantive synergy between higher education and industry. Faced with the emergence of new quality productive forces, local application-oriented universities are proactively responding to shifting talent demands brought about by technological advancements. By strengthening institutional responsiveness and deepening cooperation with industry partners, these universities are increasingly contributing to regional innovation and high-quality development [8].

2.1. Insufficient Depth in Industry-Education Integration

The new quality productive forces are characterized by intelligence, digitalization, and greenness. Their development calls for local application-oriented universities to build close, dynamic, and sustainable partnerships with industry, fostering deep integration between education and enterprise. Currently, the level of industry-education integration in these universities is still evolving, with challenges such as fragmentation and formalization yet to be fully addressed. First, university-enterprise cooperation mechanisms are often based on short-term agreements or project-specific models, lacking a unified long-term strategic vision. Many collaborations are centered on skills training or internships, rather than forming comprehensive platforms such as joint R&D centers or innovation labs that facilitate both technological advancement and industrial upgrading. This fragmented approach makes it harder to meet the demands of rapid technological change and interdisciplinary development driven by new productive forces. Second, the benefit-sharing mechanism is still being refined. Key aspects such as intellectual property rights and revenue distribution from technological outcomes require clearer definition to incentivize broader and deeper enterprise participation. In talent development, while universities have traditionally played the leading role, there is growing recognition of the need to empower enterprises with more autonomy and initiative in the collaboration process [9]. A strong foundation has been laid through top-level design and coordination for advancing industry-education integration. Moving forward, further enhancement of market-driven operational mechanisms will help stimulate enterprise engagement [10]. Enterprises, guided by market logic, are increasingly exploring how to leverage universities' strengths in innovation and talent cultivation to achieve mutual gains. Strengthening mechanisms for knowledge and benefit-sharing will support the formation of resilient, innovation-driven partnerships. This will ultimately enable closer alignment between education and emerging fields such as artificial intelligence and biomanufacturing, advancing both economic transformation and talent development in a mutually reinforcing way.

2.2. Lag in Industry-Education Integration Content

The core characteristic of the new quality productive forces lies in technological breakthroughs that drive industrial chain reconfiguration. This transformation places higher demands on local application-oriented universities to enhance agility in configuring disciplines and specialties, updating curricula, and strengthening practical teaching. While industry-education integration is progressing, there remains room for improvement in aligning educational content with rapidly evolving industrial technologies. For example, discipline development is still influenced by established academic and institutional practices, which can limit timely adaptation to practical applications and evolving market needs [11]. Strengthening alignment with regional economic development priorities and accelerating updates to curriculum systems will further support responsiveness. Although program adjustments may follow a 2-3-year cycle, fostering mechanisms to incorporate industry feedback more dynamically can help bridge the gap created by fast technology iteration. Furthermore, fostering interdisciplinary integration is essential to meet the demands of the new quality productive forces, which prioritize cross-domain innovation and integrated competencies. Continued expansion of interdisciplinary programs and collaborative platforms can enrich students' cross-functional capabilities. In terms of practical teaching, many institutions have established foundational training bases. Going forward, upgrading equipment and enhancing industrial simulation environments will help bring practice scenarios closer to real-world settings, enabling students to gain deeper experience in applying core technologies.

2.3. Insufficient Resource Integration in Industry-Education Integration

The cultivation of the new quality productive forces requires the deep integration of resources from multiple subjects such as universities, enterprises, industries, and the government. However, the current industry-education integration still faces multiple obstacles in resource integration. First, hardware resources are scattered and underutilized. There is a lack of intercommunication mechanisms between university laboratories, engineering technology research centers, and enterprise production lines, and the construction of equipment sharing platforms between universities and enterprises lags behind. Second, the development of data resources is insufficient. The new quality productive forces driven by technologies such as artificial intelligence and big data rely on massive industrial data. However, enterprises often refuse to open their core production data to universities for commercial confidentiality reasons, resulting in the construction of teaching case libraries remaining at the theoretical level. Furthermore, the financial support are insufficient. Although national policy strongly supports industry-education integration, local finances have limited special investments in key links such as university-enterprise joint laboratories and the cultivation of dual-qualified teachers. Enterprises, due to insufficient fiscal and tax incentives, have low enthusiasm for long-term cooperation. This resource mismatch makes it difficult for industry-education integration to support the high investment and high-risk technological research and development demands of the new quality productive forces.

2.4. Insufficient Industry Practical Capabilities of Faculty

The development of the new quality productive forces places elevated expectations on the practical capabilities and industry engagement of teaching staff, encouraging a dual emphasis on academic foresight and hands-on industrial experience. Local application-oriented universities are actively working to enhance this alignment. While a significant proportion of current faculty members have progressed through academic pathways (from undergraduate to postgraduate to teaching positions), efforts are being intensified to enrich their exposure to real-world industrial environments and to better integrate theoretical knowledge with practical application. To this end, universities are increasingly promoting the development of "dual-qualified" teaching teams. While existing mechanisms such as enterprise secondments provide valuable experience, there is growing recognition of the need to deepen and extend these exchanges. Enhancing the duration and strategic depth of these placements will help faculty engage more meaningfully with enterprise innovation processes, thereby enriching the classroom with current industrial insights. At the same time, there is rising momentum to build more flexible and inclusive institutional mechanisms that enable technical experts from industry to participate in university teaching. By broadening recognition criteria and creating structured channels for industry professionals to engage in curriculum development and instructional delivery, universities can accelerate the integration of cutting-edge industrial practices into teaching and talent development. Strengthening these collaborative teaching models will greatly enhance the capacity of institutions to cultivate high-level, application-oriented professionals capable of addressing complex engineering challenges in emerging fields of productivity.

2.5. Misalignment of Evaluation System

The current evaluation system of universities still mainly focuses on academic indicators such as research papers and scientific research projects, which presents a structural mismatch with the core mission of local application-oriented universities to serve the new quality productive forces. First, faculty evaluation systems tend to prioritize academic achievements over applied research outcomes. Most universities consider research publications and government-funded projects as primary criteria for faculty promotion, while giving less weight to outcomes of industry-education integration, such as collaborative industry-academia projects and technology patent commercialization. This emphasis may lead faculty to focus more on theoretical research rather than industrial technology innovation. Second, student evaluation systems lack multidimensional criteria. Predominantly based on examination performance, current assessment practices tend to emphasize rote memorization of isolated knowledge points, while relatively underemphasizing the development of practical problem-solving skills. This institutional setup results in a certain degree of misalignment with the evolving competency requirements of industry. For example, a 2023 national skills survey found that 68% of employers reported graduates' limited ability to handle real-world workplace challenges. At present, measures promoted by the education department for industry-education integration (such as establishing industry-university colleges) could benefit from closer coordination with the technological breakthrough plans of the science and technology department and the industrial upgrading policies of the industry and information technology department. Such coordination would help reduce fragmented resource allocation and better support the development of the new quality productive forces through a more coordinated support system.

3. Countermeasures for Industry-Education Integration in Local Application-Oriented Universities

In order to solve the challenges of industry-education integration in local application-oriented universities mentioned in section Ⅱ, a "Five-in-one" systematic reform framework is proposed, as shown in Figure 1.

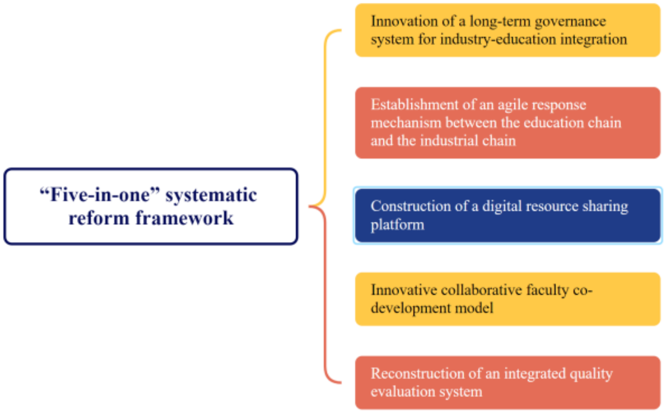

Figure 1. Countermeasures for Industry-Education Integration in Local Application-Oriented Universities.

3.1. Building a Long-Term Mechanism for University-Enterprise Cooperation

A long-term cooperation mechanism featuring "Strategic Coordination + Dynamic Adjustment" should be jointly constructed between universities and enterprises between universities and enterprises, promoting the transition from "Project-based Cooperation" to "Strategic Symbiotic Relationship" to resolve fragmentation and formalization issues in industry-education integration. First, establish a joint governance platform centered on the industrial technology chain. Under the leadership of the local government, universities, industry associations, and leading enterprises should jointly establish an "Industry-Education Integration Council" to formulate regional industrial and educational collaborative development plans. Second, implement a dynamic agreement mechanism. Universities and enterprises sign framework agreements, clearly defining medium and long-term goals such as technological breakthroughs and talent co-cultivation, and adjusting cooperation details annually based on technological trends. Additionally, introduce a third-party assessment agency to conduct annual performance evaluations to ensure both parties to fulfill their responsibilities. Improve the market-driven system of benefit sharing and risk sharing, and establish a distribution system of "Quantification of Contribution + Rights Protection" to solve the problems of intellectual property rights and benefit distribution. First, implement a pre-negotiation system for intellectual property rights. In the early stage of cooperation, universities and enterprises jointly formulate a plan for the ownership of achievements, adopting models such as "Ownership Based on Investment Ratio" or "Segmented Ownership". Second, establish a risk compensation fund pool. The local government allocates special funds from industrial support funds to subsidize enterprises for production capacity losses caused by participating in industry-education integration in universities or to share the risks of failed technology transformation. Additionally, explore technology equity investment and equity incentive mechanisms. Universities can value their patents and participate in equity in joint ventures with enterprises, and faculty teams can receive equity dividends based on their contributions, enhancing the motivation for continuous cooperation. Ravi and Janodia verified that by establishing research platforms and technology transfer centers, universities and enterprises can collaborate in conducting technological research and innovation, which not only enhances students' research capabilities but also facilitates the commercialization of technological achievements [12].

3.2. Construction of Agile Response System for Industry-Education Integrated Education Chain

Establish a response system of "Industry Demand Early Warning + Dynamic Course Iteration" to solve the problem of industry-education integration content lagging behind industrial technological development. First, establish a regional industrial technology radar system. Leveraging data from local industry and information technology authorities as well as industry associations, this system will capture technology upgrade trends in key industrial chains in real time and push relevant information to universities. Break through traditional disciplinary boundaries and build a modular talent development system that aligns technological development paths with corresponding curriculum structures, addressing the challenge of insufficient interdisciplinary integration. Universities and enterprises collaborate to implement the "Technology Cluster" course development model, forming cross-disciplinary course groups around key technologies driving emerging industrial productivity. Simultaneously, implement a micro-credential certification system, allowing students to earn industry-recognized skill certificates by completing specific technology modules. Additionally, establish agile iteration teams for industry-education integration and implement a dual-review mechanism for curriculum content, where enterprise technical experts and university faculty jointly review teaching syllabi. This ensures alignment of each knowledge point with real-world job competency requirements, while conducting regular technical retrospectives and curriculum optimizations.

3.3. Construction of New Infrastructure for Industry-Education Integration

Build a new infrastructure for industry-education integration that combines the virtual and the real, create a deeply integrated carrier of "Digital Twin + Resource Sharing", and enhance the efficiency of resource integration. On the one hand, establish a regional digital platform for industry-education integration. Integrate data from university laboratories and enterprise production lines to build a virtual simulation system. Elfakki et al. explored the role of virtual simulation experiments in industry-education integration and verified their effectiveness [13]. On the other hand, implement a system of equipment sharing vouchers and a reverse equipment leasing mechanism. Local governments issue quota-based "Sharing Vouchers" to universities. Enterprises can open up the usage rights of their high-end equipment to universities based on these vouchers, and universities can use the vouchers to offset the training costs of enterprise employees. Enterprises can also lease their outdated advanced equipment to universities at low prices, which not only solves the problem of outdated equipment in universities but also reduces the disposal costs of enterprise assets. In addition, establish a mechanism for the desensitization and sharing of industrial data, and implement "Blockchain-based rights confirmation" for teaching resources to address concerns about data leakage during sharing. Under the premise of ensuring the security of enterprise data, convert production data into teaching case libraries to solve the problem of data isolation between industry and education.

3.4. Construction of New Model for Industry-Education Integrated Faculty Collaboration

Innovate the "Dual-Track Mutual Appointment + Capability Certification" faculty co-development model, restructure the teacher development system, and address the lack of industry experience among faculty. Scientifically integrate the training requirements and content of "Industry-Education Integration" to enhance teachers' awareness and capabilities in this area [14]. Implement a "Dual-Appointment and Dual-Assessment" system, lowering academic and professional title requirements for enterprise technical experts. Qualified experts can be appointed as part-time university faculty, while university teachers must obtain enterprise technical position certification. On the other hand, establish an "On-Site Enterprise Teaching-Research Office" system. Universities set up permanent workstations in leading enterprises, select key faculty to participate in actual engineering research and development projects, and collaborate with enterprise engineers to develop practical case studies. Additionally, jointly build a "Faculty Capability Iteration Center" between universities and enterprises to co-develop digital training packages for teachers, annually update cutting-edge technology courses, and ensure synchronization between faculty knowledge systems and industrial technological advancements.

3.5. Construction of Industry-Education Integration-Driven Dual-Track Evaluation Mechanism

Establish a categorized and tiered faculty evaluation system by refining teacher positions into a dual-track structure of "Academic Research-oriented" and "Industry Service-oriented". Reform the professional title evaluation system to incorporate university faculty participation in enterprise technology projects and standard development into the assessment criteria with increased weighting. Concurrently, create special "Industry Professor" positions allowing faculty to retain institutional affiliation while serving as technical directors in enterprises, with enterprise technological research and development projects recognized as equivalent to government-funded research initiatives. Develop a three-dimensional student evaluation system comprising knowledge mastery, practical competence, and innovation literacy, emphasizing comprehensive competency assessment. Implement an "Achievement Substitution for Examinations" mechanism for innovation evaluation, permitting students to replace graduation project credits with approved invention patents (under substantive review) or enterprise-adopted technical solutions. Establish a provincial-level "Iron Triangle" coordination platform integrating education, science & technology, and industry sectors. Formulate cross-departmental collaboration procedures, create an industry-education integration center, and implement performance accountability mechanisms to forge systemic synergy.

4. Conclusion

The fundamental challenge faced by local application-oriented universities in industry-education integration stems from the structural mismatch between educational supply and regional industrial demand. By implementing strategic symbiotic governance to strengthen university-enterprise partnerships, leveraging digital technologies to optimize resource allocation, and reforming competency certification and evaluation systems to incentivize stakeholders, a closed-loop ecosystem among the education chain, industrial chain, and innovation chain can ultimately be formed. As a result, this will significantly enhance the responsiveness of universities to emerging technologies and provide talent and intellectual support for high-quality regional economic development.

Funding: This work was funded by the Second Batch of Ministry of Education Industry-University Collaborative Education Projects in 2022 (Grant No. 220900179193633); the R&D Projects in Key Areas of Guangdong Province (Grant No. 2021B0202030001); the Key R&D Projects in Zhongshan (Grant No. 2023AJ003); the Key R&D Projects in Guangzhou (Grant No. 2023B03J1308); and the Education Reform Project at Zhongkai University of Agriculture and Engineering (Grant No. 20236753).

References

1. Y. Zhang and X. Chen, “Empirical analysis of university–industry collaboration in postgraduate education: A case study of Chinese universities of applied sciences,” *Sustainability*, vol. 15, no. 7, p. 6252, 2023, doi: 10.3390/su15076252.
2. F. Wei, X. Yang, X. Yu, and H. Zhou, “Exploration and practice of deepening industry-education integration mechanism in Guangxi applied undergraduate universities and colleges,” in *Proc. 2020 6th Int. Conf. Social Science and Higher Education (ICSSHE 2020)*, Atlantis Press, Dec. 2020, pp. 396–400, doi: 10.2991/assehr.k.201214.077.
3. Y. Zhang and X. Chen, "Application-oriented higher education in China," in *Application-Oriented Higher Education: A Comparative Study between Germany and China*, Singapore: Springer Nature Singapore, 2022, pp. 73–81. ISBN: 9789811926471.
4. L. Mordhorst and T. Jenert, “Curricular integration of academic and vocational education: a theory-based empirical typology of dual study programmes in Germany,” *Higher Educ.*, vol. 85, no. 6, pp. 1257–1279, 2023, doi: 10.1007/s10734-022-00889-7.

5. H. Y. Wang, "Research on the construction of integrated education mechanism of industry and education in applied undergraduate colleges," in *Int. Conf. on Educational Technology and Administration*, Cham: Springer Int. Publishing, Dec. 2022, pp. 233–243, *doi:* 10.1007/978-3-031-29016-9_22.
6. F. Wei, T. Yu, X. Yang, and H. Zhou, "Develop a new talent cultivation model of full-process industry-education integration—The path of transformation and development of Liuzhou Institute of Technology," in *Proc. 2020 Int. Conf. Soc. Sci., Econ. and Educ. Res. (SSEER 2020)*, Aug. 2020, pp. 1–7, doi: 10.2991/assehr.k.200801.001.
7. X. Z. Zhuang, "The Internal Contradictions and Solving Strategies of Integration of Industrial System and Education System," *Chin. High. Educ. Res.*, no. 09, pp. 81–86, 2018, doi: 10.12677/AE.2024.142282.
8. D. Liu, "A study on the present situation and countermeasures of the integration of industry and education in applied colleges and universities under the background of 'Internet'," in *Proc. 2019 Int. Conf. Educ. Sci. Econ. Dev. (ICESED 2019)*, Jan. 2020, pp. 81–83, doi: 10.2991/icesed-19.2020.90.
9. M. Diao, F. Wang, X. Sun, G. Wang, and Y. Zou, "Study on the mechanism of school-local cooperative education of local application-oriented universities in Heilongjiang Province," in *Proc. 1st Int. Conf. on Educ.: Curr. Issues & Digit. Technol. (ICECIDT 2021)*, Jun. 2021, pp. 238–243, doi: 10.2991/assehr.k.210527.044.
10. J. Li and S. D. Li, "International Comparative Analysis of Industry-Education Integration in Vocational Education," *Res. High. Educ. Eng.*, no. 04, pp. 159–164, 2019, doi:10.54844/vte.2024.0692.
11. Y. Wang, "Construction elements and path of practical education model in universities," *Eurasia J. Math. Sci. Technol. Educ.*, vol. 13, no. 10, pp. 6875–6882, 2017, doi: 10.12973/ejmste/78525.
12. R. Ravi and M. D. Janodia, "Factors affecting technology transfer and commercialization of university research in India: a cross-sectional study," *J. Knowl. Econ.*, vol. 13, no. 1, pp. 787–803, 2022, doi: 10.1007/s13132-021-00747-4.
13. A. O. Elfakki, S. Sghaier, and A. A. Alotaibi, "An efficient system based on experimental laboratory in 3D virtual environment for students with learning disabilities," *Electronics*, vol. 12, no. 4, Art. no. 989, 2023, doi : 10.3390/electronics12040989.
14. J. Zhang and Y. Zhou, "Research on innovation and entrepreneurship talent training model for application-oriented university under perspective of collaborative innovation," *Int. J. Inf. Educ. Technol.*, vol. 9, no. 8, pp. 575–579, 2019, doi: 10.18178/ijiet.2019.9.8.1269.