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Exploration of the Model of Joint Graduate Training between Scientific Research Institutes and Skill-Oriented Vocational Undergraduate Colleges

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Abstract: The joint graduate training between scientific research institutes and skill-oriented vocational undergraduate colleges serves as a crucial channel to integrate scientific research resources with skill development, addressing the issue of disconnect between talent cultivation and practical needs while enhancing the quality and comprehensive capabilities of graduate students. Practically, it is essential to establish a robust collaborative linkage mechanism, create a stable and efficient cooperation model, optimize the structure of dual-instructor teams, enhance teaching and research guidance, develop a distinctive curriculum system, precisely align industry-education integration with research needs, build practical research platforms, provide graduate students with opportunities for hands-on training and innovative practice, improve the quality evaluation system, ensure the quality of joint training throughout the process, deepen industry-education integration, facilitate the transformation of research achievements, promote the effective implementation of joint training outcomes, and assist in cultivating compound talents with both research capabilities and practical skills.

Keywords: Scientific research institutes; Skill-oriented vocational undergraduate colleges; Joint graduate training

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1. Introduction

Scientific research institutes possess cutting-edge research platforms, practical project resources, and support for technology transfer and implementation, while skill-oriented vocational undergraduate colleges focus on cultivating vocational abilities, transferring technological achievements, and establishing a system for developing technical and skilled personnel. There are significant complementarities between the two in terms of teaching objectives, resources, and educational approaches. Promoting joint graduate training between scientific research institutes and skill-oriented vocational undergraduate colleges is not only an inherent requirement for improving the cultivation chain of high-level technical and skilled talents but also an effective way to advance the deep integration of education chains, talent chains, innovation chains, and industrial chains. Establishing a joint training model that aligns with the development characteristics of both parties can integrate high-quality educational resources and enhance the comprehensive technical literacy and innovative practice capabilities of graduate students, thereby providing stable support for industrial transformation and regional high-quality development.

2. Establish a robust collaborative linkage mechanism to solidify the foundation for joint training cooperation

A collaborative linkage mechanism is the guarantee for the orderly operation of the joint training model, and its completeness directly affects the quality and efficiency of joint training. Clarifying the cooperative positioning and division of responsibilities between the two parties and establishing a regular communication and resource-sharing platform can effectively integrate and optimize the allocation of educational resources, thereby facilitating seamless integration and coordinated advancement across all aspects of joint training [1].

Establishing a robust collaborative linkage mechanism can be advanced systematically in multiple ways. First, create a cross-entity collaborative management body composed of relevant leaders, academic leaders, and key teachers from both parties. This body is responsible for formulating joint training plans, supervising the process, evaluating quality, and performing other tasks. Regular working meetings should be held to coordinate and resolve various issues arising during the joint training process, ensuring consistent direction and orderly progress. Second, establish a resource-sharing platform that integrates the scientific research equipment and project resources of scientific research institutes with the teaching resources and training facilities of skill-oriented vocational undergraduate colleges. This promotes the opening of scientific research instruments and equipment to colleges and the extension of teaching courses to scientific research institutes, enabling graduate students to access cutting-edge scientific research practices while systematically strengthening their vocational skills foundation. Third, clarify the respective responsibilities and divisions of labor between the two parties. The primary task of scientific research institutes is to cultivate the research capabilities of graduate students, designate corresponding research key research personnel as mentors, provide support for research projects and practical guidance, while the main task of skill-oriented vocational undergraduate colleges is to teach basic theories and cultivate professional qualities of graduate students, improve the teaching system and practical training links, and ensure the synchronous improvement of knowledge and skills among graduate students. Fourth, establish a collaborative evaluation mechanism that incorporates joint training achievements into the annual evaluation systems of both parties, determine evaluation indicators and criteria, and conduct comprehensive evaluations of mentor performance and the quality of graduate student cultivation to prompt both parties to take on their responsibilities and improve the standardization of joint training work. Fifth, build a regular communication bridge through a combination of online communication platforms and offline regular seminars to achieve effective communication among mentors, administrators, and graduate students from both parties, thereby promptly grasping the progress of cultivation and providing feedback on issues that arise, ensuring tight and efficient advancement across all aspects of joint training.

The collaborative linkage mechanism should clearly define the rights and responsibilities of both parties, strengthen resource integration, and improve evaluation and communication systems. Only through coordinated efforts and consistent rights and responsibilities across all aspects can a solid foundation for joint training cooperation be established to ensure the stable and efficient operation of the joint training model.

3. Optimize the construction of dual-instructor teams to strengthen the core support for education

Team construction should take collaborative education as the fundamental starting point, establish a collaborative mechanism with clear divisions of labor and complementary advantages, integrate the human resources of both parties through institutional design, solidify the ability foundation, improve the cultivation system, achieve efficient linkage of educational resources, precisely align educational objectives with practical needs, and enhance the quality and connotation of education [2].

The construction of dual-instructor teams can be carried out from three aspects: collaborative selection, ability enhancement, and incentive guarantees. In terms of collaborative selection, establish a joint selection mechanism between the two parties, determine selection criteria and processes, and prioritize the selection of individuals with both solid theoretical foundations and rich practical experience to form dual-instructor teams. Scientific research institutes should focus on selecting researchers with cutting-edge research capabilities and familiarity with industry technology development trends, while skill-oriented vocational undergraduate colleges should focus on selecting teachers with systematic teaching capabilities and mastery of practical skill cultivation methods to ensure a reasonable structure and matching capabilities of the dual-instructor teams. In terms of ability enhancement, establish a regular enhancement platform and regularly conduct teaching and research exchanges, technical discussions, teaching training, and other activities for dual instructors. Personnel from scientific research institutes can participate in teaching method training at colleges to improve their teaching expression and design capabilities, while college teachers can enter scientific research institutes to participate in the implementation of research projects, update their knowledge structure, and enhance their practical operation capabilities, achieving dual improvements in theoretical teaching and practical guidance capabilities. In terms of incentive guarantees, improve the incentive guarantee mechanism for dual instructors, clarify their job responsibilities and evaluation criteria, incorporate joint training achievements into the personnel evaluation systems of both parties, provide corresponding title promotions, performance rewards, and resource support to mobilize the enthusiasm and initiative of dual-instructor teams in participating in joint training work, ensure the stable development of dual-instructor teams, and achieve coordinated advancement of theoretical teaching and practical guidance during the joint training process to provide solid talent support for graduate student cultivation.

The construction of dual-instructor teams relies on collaborative linkage and matching capabilities, requiring scientific selection, precise cultivation, and a comprehensive incentive mechanism to achieve complementary resources and strengthen educational synergy between the two parties, ensuring the effective implementation of the joint training model.

4. Construct a distinctive curriculum system to align with industry-education-research needs

The construction of a curriculum system should take collaborative education as the core, balance the systematicness and practicality of knowledge, achieve deep alignment between research capabilities, professional skills, and industry needs, break down disciplinary and industry barriers through hierarchical and modular design, highlight the differentiated advantages of the joint training model, and build a learning framework with theoretical depth and practical value for graduate students [3].

Constructing a distinctive curriculum system that aligns with industry-education-research needs can be advanced from four perspectives: curriculum module design, content updating, teaching implementation, and evaluation mechanisms. First, optimize curriculum module settings. Combine the research resources of scientific research institutes with the skill cultivation advantages of skill-oriented vocational undergraduate colleges to set up basic theory modules, research method modules, practical skill modules, and industry adaptation modules. These modules support and integrate with each other organically. The basic theory module is primarily responsible for imparting core knowledge and providing graduate students with a solid theoretical foundation. The research method module focuses on cultivating research thinking and research capabilities. The practical skill module is responsible for training practical operation capabilities. The industry adaptation module mainly aligns with industry frontier needs to bridge the gap between theory and industry. Second, establish a dynamic content updating mechanism for the curriculum. Form a curriculum construction team composed of researchers from scientific research institutes, college teachers, and technical experts from industry enterprises to regularly conduct research on industry development trends, research directions, and enterprise job requirements. Incorporate the latest research achievements, industry technical standards, and job operation requirements into the curriculum content, remove outdated knowledge, and ensure that the curriculum content keeps pace with industry-education-research needs. Third, innovate teaching implementation methods. Adopt a teaching model that integrates online and offline learning, theoretical instruction, and research practice, and on-campus teaching with institute training. Colleges undertake on-campus teaching of basic theories and core skills, while scientific research institutes provide platforms for research practice and arrange researchers as practical mentors to lead graduate students in participating in actual research projects, prompting graduate students to deepen their understanding of theoretical knowledge and enhance their research capabilities and practical operation levels during research activities. Fourth, improve the curriculum evaluation mechanism. Establish a diversified evaluation system that breaks away from a single examination evaluation model and includes graduate students' course performance, research practice performance, skill mastery, and industry adaptation capabilities in the evaluation scope. Combine the evaluation opinions of college teachers, research mentors, and industry experts to comprehensively evaluate graduate students' learning achievements and comprehensive capabilities, ensuring the effectiveness and pertinence of the curriculum system. During specific implementation, clarify the responsibilities of each entity, with colleges undertaking overall planning and on-campus teaching organization work, and scientific research institutes conducting research practice guidance and providing research resources. Maintain regular communication between the two parties to promptly address various issues arising during curriculum construction and teaching implementation, ensuring the orderly advancement and practical effectiveness of the curriculum system.

The core of the effective operation of the curriculum system lies in the clear division of rights and responsibilities and resource integration among collaborative entities. It is necessary to strengthen the adaptability of modules and the timeliness of content, link teaching and practical links, and ensure that curriculum construction meets the requirements of collaborative education in industry-education-research.

5. Establishing a practical scientific research platform to enhance practical and innovative capabilities

The practical scientific research platform serves as a crucial link between theoretical teaching and practical application, with its quality directly influencing the cultivation of graduate students' practical and innovative abilities. To create a distinctive practical scientific research platform, it is essential to integrate the advantageous resources of both parties, focusing on actual industry needs and cutting-edge scientific research to establish a multi-tiered and diversified practical scientific research system, providing graduate students with an immersive space for practice and innovation [4].

The establishment of a practical scientific research platform can be implemented following systematic steps. First, establish joint laboratories and training bases, integrating the scientific research equipment, project resources from research institutes, with the training venues and teaching resources from skill-oriented vocational undergraduate universities. Clearly define platform construction standards and usage norms, appoint professional management personnel to ensure regular opening and efficient operation of the platform, enabling graduate students to participate fully in scientific research projects and skill training. Second, set up special practical research projects for graduate students based on key scientific research projects of research institutes, determining research directions and task requirements. Jointly guided by mentors from both sides, graduate students are led through the entire process of project research, program design, experimental operation, and achievement transformation, enhancing their practical scientific research abilities. Third, establish a technology transfer practice platform, aligning with actual industry and enterprise needs, encouraging graduate students to combine scientific research achievements with vocational skills, conducting technical breakthroughs and achievement transformation practices, and honing their innovative application abilities through simulated project implementation, technology promotion, and graduate student innovation competitions. Fourth, establish a platform-sharing mechanism, defining usage rights and responsibilities for graduate students and mentors from both sides, developing a reservation process for platform usage and equipment maintenance norms to ensure rational resource utilization, and regularly training platform users to familiarize graduate students with instrument operation and scientific research methods. Fifth, collaborate with industry enterprises to create a tripartite practical platform involving universities, research institutes, and enterprises, inviting enterprises to participate in platform creation, incorporating actual enterprise projects and technical standards into graduate students' scientific research, enabling graduate students to enhance their operational skills in real project scenarios, thereby achieving precise alignment between practical scientific research and industry needs.

The core of establishing a practical scientific research platform lies in integrating high-quality resources, defining scientific functional positioning and a sound operational mechanism, strengthening the integration of practice and scientific research, and improving graduate students' practical and innovative capabilities.

6. Improving the quality evaluation system to ensure the quality of joint training

The creation of a quality evaluation system should follow a whole-process management logic, defining a multi-dimensional and multi-tiered evaluation framework that integrates evaluation standards from various aspects to achieve dynamic monitoring and feedback throughout the cultivation process. Strengthen the closed-loop use of evaluation data, using process evaluation results to improve cultivation plans and adopting a results-oriented approach to feed back into teaching links, thereby forming a continuous improvement quality ecosystem and providing institutionalized guarantees for the quality of joint training [5].

Improving the quality evaluation system can be advanced from three aspects: evaluation dimension design, evaluation subject collaboration, and data management application. First, design whole-process evaluation dimensions, covering five main stages: admission selection, course learning, scientific research practice, thesis work, and job matching. Conduct comprehensive ability tests at the admission stage to assess students' professional foundations and vocational qualities; implement modular assessments during course learning, using online learning data and classroom performance for comprehensive scoring; focus on project completion as the assessment criterion during scientific research practice, evaluating task completion, teamwork, and problem-solving abilities; implement double-blind reviews during the thesis stage, with joint evaluation by university and research institute mentors, focusing on academic norms and application value; and collaborate with enterprises for probationary tracking evaluations during the job matching stage, collecting career development-related data to create evaluation archives throughout the period. Second, create a multi-subject collaborative evaluation system. Establish an evaluation committee comprising academic mentors from universities, practical mentors from research institutes, technical experts from enterprises, and representatives from industry associations, clarifying responsibilities for each party. University mentors emphasize academic norms and theoretical depth, research institute mentors focus on scientific research abilities and project experience, enterprise experts prioritize job skills and industry standards, and industry association representatives provide macro-industry orientation suggestions. Implement a mutual recognition system for evaluation results, unifying evaluation indicator weights to avoid duplicate evaluations and ensure the authority and consistency of evaluation results. Third, create a digital evaluation data management platform. Integrate multi-source data such as course grades, scientific research project records, practice logs, and enterprise feedback to create a dynamic evaluation database. Use data analysis techniques to identify weaknesses in cultivation links and automatically generate quality analysis reports. For example, compare employment data and project achievements of different batches of graduate students to identify discrepancies in curriculum alignment with industry needs, providing data support for curriculum updates. Establish an evaluation early warning system to issue warnings to graduate students with consecutive declines in academic performance or slow project progress, and collaboratively develop personalized coaching plans to address issues.

The implementation of a whole-process evaluation system relies on subject collaboration and data closed loops, using multi-dimensional evaluation dimensions to complement each other and dynamic data to feed back into each other, achieving continuous improvement and long-term guarantees for cultivation quality.

7. Deepening industry-education integration to empower and broaden pathways for achievement transformation

Empowering industry-education integration should rely on the core advantages of joint training, breaking down barriers between scientific research, teaching, and industry, and promoting the integration of knowledge, skills, and resources. Rely on collaborative linkages to strengthen the precise alignment between scientific research achievements and industry needs, improve achievement transformation mechanisms, facilitate the conversion of scientific research achievements into practical productivity, and achieve the dual enhancement of educational and industrial values.

Progress can be made from three aspects: collaborative platform construction, transformation mechanism improvement, and adaptability of talent cultivation. First, create an industry-education scientific research collaborative transformation platform, integrating scientific research resources from research institutes, talent resources from universities, and industrial resources from enterprises to jointly establish joint laboratories, technology research and development centers, and achievement incubation bases, defining operational mechanisms and responsibilities for the platform, providing graduate students with practical venues for participating in achievement transformation, and enabling graduate students to intervene throughout the entire process from scientific research project initiation, technology research and development to achievement implementation. Second, improve incentive and guarantee mechanisms for achievement transformation, establishing a scientific research achievement transformation revenue distribution system, determining revenue-sharing ratios among research institutes, universities, graduate students, and enterprises, mobilizing the enthusiasm of all parties to participate in achievement transformation, creating an achievement transformation fault-tolerance mechanism to encourage bold exploration and innovation, reducing risks in the achievement transformation process, jointly developing achievement transformation standards with enterprises to ensure scientific research achievements meet actual industry needs and improve transformation success rates, and creating an achievement transformation tracking and feedback mechanism to promptly address technical adaptation, market alignment, and other technical issues arising during achievement transformation. Third, promote deep matching between achievement transformation and talent cultivation, integrating achievement transformation-related content throughout the cultivation process, offering courses on achievement transformation, teaching knowledge on technology transfer, market research, and intellectual property protection; guiding graduate students to participate in tackling actual technical challenges faced by enterprises, conducting scientific research project research based on enterprise needs to combine scientific research achievements with enterprise production practices, inviting enterprise technical experts and intellectual property agents to give special lectures to enhance graduate students' awareness and abilities in achievement transformation, promoting the synchronous development of scientific research achievement transformation and graduate student cultivation, and enabling joint-trained graduate students to become important participants and drivers of achievement transformation.

The core of empowering industry-education integration and broadening pathways for achievement transformation lies in resource collaboration and mechanism guarantees, strengthening demand alignment and talent adaptability, promoting benign interactions between scientific research, teaching, and industry, and improving achievement transformation effects.

8. Conclusion

In summary, the establishment of a joint graduate student training model between research institutes and skill-oriented vocational undergraduate universities should rely on the complementary resources of both parties, based on collaborative linkages, supported by mentor team construction, carried by the curriculum system, dependent on practical platforms, guaranteed by quality evaluation, and grasped by industry-education integration, coordinating efforts from all aspects to address the core challenge of disconnect between talent cultivation and actual needs, integrating high-quality educational resources, improving graduate students' comprehensive qualities, and achieving dual promotion of education and industrial development.

Disclosure statement

The author declares no conflict of interest.

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