

Construction and Practice of a Four-in-One Graduate Training Model Integrating Supervisor-Research Team-Informatization-Disciplinary Platform in Local Medical Colleges in Ethnic Regions

Hongyu Wei, Ying Luo, Rentong Hu, Fangyi Shu, Zhenfeng Xie*

School of Basic Medical Sciences, Youjiang Medical University for Nationalities, Baise, China

Email: 269866906@qq.com, *349030287@qq.com

How to cite this paper: Wei, H. Y., Luo, Y., Hu, R. T., Shu, F. Y., & Xie, Z. F. (2026). Construction and Practice of a Four-in-One Graduate Training Model Integrating Supervisor-Research Team-Informatization-Disciplinary Platform in Local Medical Colleges in Ethnic Regions. *Creative Education*, 17, 1151-1164.
<https://doi.org/10.4236/ce.2026.176069>

Received: April 22, 2026

Accepted: June 26, 2026

Published: June 29, 2026

Copyright © 2026 by author(s) and Scientific Research Publishing Inc. This work is licensed under the Creative Commons Attribution-NonCommercial International License (CC BY-NC 4.0).
<http://creativecommons.org/licenses/by-nc/4.0/>



Open Access

Abstract

Local medical colleges in ethnic regions have long faced deep-seated challenges in graduate education, including insufficient supervisory guidance, inadequate interdisciplinary collaboration, delayed resource integration, and low levels of informatization. Taking graduate students majoring in medical pathogenic biology as the target group, this study constructs and implements a four-in-one training model integrating “supervisor-research team-informatization-disciplinary platform”. In this model, a multidisciplinary supervisory team provides overall guidance, research teams serve as the core collaborative mechanism, an informatization-based sharing platform offers technical support, and multiple disciplinary experimental platforms function as practice bases, so that these four dimensions are organically integrated and operate in synergy. Practical experience shows that the model effectively enhances graduate students’ research innovation capacity and interdisciplinary thinking, and strengthens the academic atmosphere and collaborative momentum within teams. It thus offers a practical and replicable pathway for graduate education reform in similar institutions in ethnic regions.

Keywords

Supervisor-Research Team, Informatization, Disciplinary Platform, Graduate Training Model, Medical Colleges in Ethnic Regions

*Corresponding author.

1. Introduction

Graduate education is a core component of national high-level talent cultivation, and the design and implementation quality of training models directly influence the level of talent output (Chen et al., 2021). In September 2020, the Ministry of Education, the National Development and Reform Commission, and the Ministry of Finance jointly issued the Opinions on Accelerating the Reform and Development of Graduate Education in the New Era, which emphasized that graduate education should be advanced from the height of serving national strategies and explicitly identified the cultivation of innovation capacity as a central task (Ministry of Education, National Development and Reform Commission, & Ministry of Finance, 2020). Against this background, how local medical colleges in ethnic regions can improve the quality of graduate training under relatively limited resources has become an urgent practical issue in the current round of education reform.

Compared with key universities, local medical colleges in ethnic regions have several structural shortcomings in graduate training. Supervisors' research capacities are uneven, and some supervisors devote insufficient time and energy to supervision (Pang et al., 2024; Luo et al., 2025). Graduate students generally have weak research foundations and lack innovative thinking. At the level of disciplines or research groups, there is a lack of corresponding regulations to guide training, so that students cannot obtain timely support when encountering problems. Teaching approaches are traditional and single, there is little integration and communication between basic and clinical medicine, and a complete innovation-oriented training system is lacking (Zhou et al., 2024). These problems are particularly prominent in basic medical disciplines such as pathogenic biology, constraining the overall improvement of graduate education quality at such institutions.

In recent years, universities in China have accumulated a number of valuable experiences in reforming graduate training models. Explorations of multi-supervisor systems and inter-institutional joint training have effectively expanded supervisory resources (Jin et al., 2024). The promotion of research team-based participation models has strengthened students' practical abilities (Lu, 2024; Zhu & Li, 2023). The introduction of online platforms and informatization management tools has improved training efficiency to a certain extent (Li & Zhao, 2023; Zhao, 2023). Interdisciplinary graduate training has also received increasing attention from universities and research institutions (Chen & Zhang, 2024). However, these explorations mostly remain at the level of single-dimension reforms, lack systematic integration, and thus find it difficult to produce synergistic effects. The "supervisor-research team-disciplinary platform" tripartite model proposed by Wu Zhitao and colleagues represents an important step toward integration (Wu, 2024), yet informatization is not included in the overall design. Experience at Stanford University shows that improving graduate students' innovation capacity depends on the coordinated functioning of training objectives, curriculum sys-

tems, research training, and institutional support (Xiong et al., 2022), but such experience is often not directly applicable to institutions in ethnic regions with relatively limited resources.

Based on the above background and practical challenges, this study targets first-year graduate students in basic medical pathogenic biology at a local ethnic medical university. It proposes and implements a four-in-one training model integrating “supervisor–research team–informatization–disciplinary platform,” and explores a new, context-appropriate pathway for graduate training in local medical colleges in ethnic regions by constructing a systematic and collaborative mechanism.

2. Problem Orientation and Theoretical Basis of Model Construction

2.1. Systematic Diagnosis of Practical Problems

Before the implementation of this model, the research group conducted a systematic review of the current status of graduate training in pathogenic biology within basic medical sciences at the university. Through questionnaire surveys and interviews, four types of core problems constraining training quality were identified.

First, the insufficient provision of personalized supervision is a fundamental factor limiting the improvement of graduate training quality in this major. A single supervisor is often required to guide multiple graduate students at the same time, and scattered time and energy make it difficult to provide in-depth supervision. Furthermore, limitations in supervisors’ own disciplinary backgrounds objectively restrict students’ access to cross-disciplinary academic resources and support, which makes individualized training plans difficult to implement effectively in practice.

Second, the lack of interdisciplinary collaboration mechanisms is an important bottleneck restricting the development of graduate students’ innovative capacity. Research in pathogenic biology naturally calls for intersections with disciplines such as bioinformatics, immunology, and pharmacy. However, due to strong disciplinary barriers, students have almost no opportunity to engage with the research methods and modes of thinking of other disciplines, making it difficult to form diverse perspectives in the research process.

Third, the fragmented management of disciplinary platforms and research resources greatly reduces the efficiency of actual resource utilization. The university has established several platforms, including a Key Laboratory for the Prevention and Control of Drug-Resistant Microbial Infections, a Cell Biology Technology Platform, Genomics and Proteomics Technology Platforms, and an Immunology Technology Platform. Yet these platforms operate relatively independently and lack a unified resource scheduling mechanism, so that it is difficult for students to systematically access diverse research equipment and technical systems.

Fourth, the lack of informatization support runs through every stage of the training process. Research management methods are relatively outdated, and an

integrated online resource platform is absent. Students have very limited tool support for literature management, data analysis, and learning experimental techniques; information channels are fragmented and inefficient, which directly affects research progress and the overall learning experience.

2.2. Theoretical Basis

The construction of the four-in-one model is theoretically supported by three major perspectives. Constructivist learning theory holds that knowledge is constructed by learners through active interaction with their environment. Diversified supervisory guidance, interdisciplinary platform rotation, and integrated use of informatization tools are concrete practices that create rich cognitive interaction contexts for graduate students.

Collaborative learning theory reveals the central role of peer interaction and team collaboration in deep learning. The building of research teams and the implementation of staged reporting systems translate this principle into daily training processes, promoting sustained academic communication and collaborative problem-solving.

Situated cognition theory emphasizes that learning should be embedded in authentic problem-solving situations. The real research environments and projects provided by disciplinary platforms enable graduate students to develop and refine their abilities while engaging with actual research topics. The convergence of these three theoretical perspectives provides a solid conceptual foundation for the four-in-one model.

3. Construction and Implementation of the Four-in-One Model

The study enrolled a total of 18 postgraduate students from the 2023 cohort, all majoring in pathogenic biology, who were allocated to the multidisciplinary collaborative training group ($n = 12$) and the control group ($n = 6$). The inclusion criteria were as follows: 1) full-time master's students who had completed basic coursework and entered the research training phase; 2) research topics related to pathogenic microorganisms or closely allied interdisciplinary areas, with the necessary conditions to carry out projects on platforms such as antimicrobial infection prevention and control, immunology, pharmacy or clinical medicine; and 3) willingness to participate in this training model with approval from the supervisory team. The training model was implemented from the time students entered the laboratory and continued for one and a half years, during which multidisciplinary team supervision, research team-based collaborative activities, use of an information-based platform, and rotational learning across disciplinary platforms were carried out on an ongoing basis, and corresponding evaluations were conducted at the end of the process.

To strengthen the “junior students-senior postgraduates-multidisciplinary supervisors” tiered structure, the multidisciplinary collaborative training cohort

(**Table 1**) additionally incorporated senior postgraduates from different grades and disciplinary backgrounds, who played key roles in day-to-day mentoring, experience transmission and academic community building, thereby forming a stable tiered training structure in conjunction with the multidisciplinary supervisory team.

Table 1. Cohort composition of the multidisciplinary collaborative training model and the conventional training model.

Cohort type	Number of postgraduates receiving training	Number of senior postgraduates providing guidance	Number of faculty supervisors
Multidisciplinary collaborative training cohort	12	8 (cross-disciplinary peer mentoring)	6 (cross-disciplinary supervisors)
Conventional training control cohort	6	3 (mentoring within pathogenic biology)	1 (primary supervisor assigned to the postgraduate)

3.1. Formation and Operation of a Multidisciplinary Supervisory Team

The supervisory dimension is the core engine of the entire model. Drawing on existing research collaborations in pathogenic biology, the research group systematically integrated supervisors' academic backgrounds, ongoing projects, research strengths, and experimental equipment. According to each graduate student's research direction, thesis topic, and knowledge structure, the group matched a supervisory team composed of two to three supervisors from different disciplinary backgrounds. Graduate students in pathogenic biology thus established stable collaborative supervisory relationships with supervisors in pharmacy, immunology, clinical medicine, and other related disciplines, forming a complementary knowledge support network.

At the operational level, an individualized training mechanism was established. The supervisory team comprehensively evaluates each student's academic foundation and development goals, then develops a personalized training plan with detailed arrangements for research topic selection, coursework, skills training, and milestones for academic output. Regular joint supervision meetings are held at least twice each semester to discuss students' progress, encountered difficulties, and subsequent supervisory priorities, thereby ensuring that supervision is continuous, coherent, and targeted.

3.2. Establishment of a Research Team Collaboration Mechanism

Efficient information flow within research teams is a key foundation for the generation of innovative ideas. Within this model, a tiered academic community of "newly enrolled students–senior graduate students–multidisciplinary supervisors" is constructed, integrating supervisory teams and senior students into a single collaborative system and establishing a standardized interaction mechanism for daily academic discussion, real-time problem-solving, and experience transfer.

The standardized operation of the teams is supported primarily by two components: staged literature presentations and interdisciplinary research seminars. Liter-

ature presentations are held every two weeks, with graduate students taking turns to report on the latest papers related to their research directions and to respond to questions and comments from supervisors and team members. This not only develops students' academic presentation and defense skills but also encourages them to follow disciplinary frontiers on an ongoing basis. Interdisciplinary seminars are held once a month, focusing on thematic discussions of scientific frontiers or emerging areas. When appropriate, internal and external peers are invited to share their latest results, thereby broadening the depth and breadth of discussion.

In terms of interdisciplinary collaboration, relatively stable cooperative relationships have been established with disciplines such as pharmacy, immunology, stomatology, and clinical medicine. On this basis, regular joint group meetings have been introduced, allowing graduate students to participate in discussions within different disciplinary teams, learn how other fields formulate questions, design experiments, and interpret data, and become familiar with commonly used methods in those fields. For junior students, this structure also provides opportunities to observe closely how senior students advance projects and solve bottlenecks, enabling the timely transfer of many detailed yet critical experiences and significantly improving the overall efficiency of training.

3.3. Construction and Application of an Informatization-Based Sharing Platform

Informatization serves as the technical support for the efficient and normalized operation of the model. Based on the needs of graduate students in pathogenic biology, the research group sorted commonly used research resources and built an online shared repository organized by function, covering standard experimental operating procedures, biosafety regulations, instrument manuals, bioinformatics analysis workflows, and scientific visualization tools.

On this basis, a scientific research support platform for graduate students was developed, integrating literature management, data analysis, academic communication, and instructional videos through a single portal. Resources are centrally stored and retrieved as needed. Upload permissions are also open to students, encouraging them to incorporate self-organized literature notes, experimental protocols, and analysis pipelines into the repository so that materials can be continuously refined and reused in practice. Promotion of the platform is combined with a series of training activities, including regular workshops on experimental techniques and bioinformatics analysis. These activities explain how to select common tools and run workflows, and method guides tailored to the university's research directions have been compiled, covering modules such as sequence alignment, phylogenetic analysis, and protein structure prediction, thereby addressing the previous problem of scattered training materials.

3.4. Integration of Disciplinary Platforms and Rotational Learning

Disciplinary platforms provide a broader training arena for graduate students. Re-

lying on the Key Laboratory for the Prevention and Control of Drug-Resistant Microbial Infections and the technical platforms of cell biology, genomics and proteomics, and immunology, the research group designed a structured rotational learning program across platforms.

Rotational plans are developed according to the needs of each student's thesis research, ensuring that rotations do not interrupt the progress of the primary research direction. Typically, each student spends one to two months rotating through relevant auxiliary platforms. During the rotation, students participate directly in ongoing research projects on the platform, learn key techniques under the guidance of platform supervisors, and complete staged reports that link newly acquired methods with their thesis designs.

In terms of resource sharing, for example, graduate students focusing on "drug resistance mechanisms and drug screening" take part in cytokine detection experiments on the immunology platform and compound library screening tasks on pharmacy-related platforms. Such arrangements help students fill methodological gaps along a single problem chain and prevent them from advancing their research solely from a single disciplinary perspective. The research group has also organized cross-disciplinary joint projects around themes such as "anti-infective mechanisms of active components in ethnic medicine," grouping graduate students from pathogenic biology, pharmacy, and ethnic medicine into the same project teams. Through joint experiments, data discussions, and task division, more stable patterns of collaboration are formed.

4. Evaluation and Practical Outcomes

4.1. Design of the Evaluation System

To objectively evaluate the implementation effects of the four-in-one model, the research group established a multidimensional evaluation index system covering four major dimensions: research capacity, academic output, informatization tool use, and interdisciplinary collaboration ability. Research capacity is assessed through experimental operation tests, the quality of research scheme design, and tests of literature comprehension. Academic output is evaluated mainly in terms of the quality of academic presentations, the quality of thesis proposals, and the number of projects in which the student participates. Informatization tool use is evaluated based on platform login frequency, number of learning resources viewed, and the quality of uploaded shared materials. Interdisciplinary collaboration ability is comprehensively assessed through performance during platform rotations, participation in joint projects, and feedback from supervisors.

Evaluation runs throughout the implementation of the model. Three systematic evaluations are conducted at the beginning, middle, and end of the academic year and are combined with dynamic records from daily training activities. A two-way feedback mechanism between supervisors and students has been established. Students' opinions and suggestions on the training model are collected monthly, and the supervisory team adjusts training plans dynamically based on this feedback.

4.2. Questionnaire- and Interview-Based Evaluation

To further identify key issues arising during implementation and to continuously monitor the performance of the “four-in-one” training model, a combined evaluation approach integrating questionnaire surveys and semi-structured interviews was adopted throughout the implementation period. The questionnaires and interviews were used in parallel for initial problem diagnosis and subsequent outcome evaluation, providing quantitative information on overall trends as well as qualitative insight into underlying reasons.

The questionnaire was administered primarily to 12 postgraduates enrolled in the multidisciplinary collaborative training model and to supervisors involved in its implementation; where analysis of the tiered mentoring mechanism was required, senior postgraduates responsible for day-to-day mentoring were additionally included. The questionnaire focused on four core dimensions—research competence, academic achievement, use of information technology in research, and interdisciplinary collaboration—and also covered items on training satisfaction, supervision experience, resource accessibility, and perceptions of team collaboration. Most items were designed as Likert-type questions, supplemented by a small number of open-ended questions to collect detailed comments and suggestions.

On the basis of the questionnaire survey, semi-structured interviews were conducted with representative postgraduates and supervisors from different training stages and roles. The interviews focused on major difficulties encountered in research training, actual experiences of interdisciplinary collaboration, barriers to the use of the information platform, perceived effectiveness of collaborative supervision within the supervisory team, and suggestions for refining the training model. Follow-up questions were asked as appropriate in light of interviewees’ responses to obtain more complete and interpretable information. The quantitative questionnaire data were simply summarized descriptively to characterize overall patterns.

For feedback and follow-up, responses from students and supervisors in the questionnaires and interviews were compiled on a regular basis. The training plan, group meeting formats, platform training content, and rotation arrangements were then adjusted accordingly, forming a closed-loop cycle of “diagnosis–feedback–adjustment–re-evaluation”.

4.3. Scoring Rules for Each Evaluation Dimension

4.3.1. Mastery of Experimental Skills

Mastery of experimental skills was evaluated mainly in terms of completion quality of core experimental tasks, adherence to standard operating procedures, degree of independence, and stability of results (total score: 100 points). A typical scoring scheme was: procedural correctness (30 points), understanding of underlying principles (20 points), ability to perform independently (25 points), and quality and reproducibility of results (25 points). A total score of at least 80 points was defined as meeting the standard and was used to calculate the pass rate.

4.3.2. Quality of Literature Presentations

The quality of literature presentations was assessed across four aspects: content quality, logical organization, presentation and delivery, and on-site interaction, with a total score of 100 points. Specifically, topic relevance and content quality (30 points), logical structure (25 points), presentation and delivery (25 points), and performance in answering questions and participating in discussion (20 points) were scored, and the proportion of presentations rated as good or excellent was calculated accordingly.

4.3.3. Activity on the Research Information Platform

Activity on the research information platform was measured by the average number of days per week on which students were active on the platform, and changes between two implementation stages were used to evaluate variation in platform use.

4.3.4. Quality of the Thesis Proposal

A unified thesis proposal evaluation rubric was used to score topic value, research significance, research objectives and content, research methods and technical route, innovativeness, and quality of written expression (total score: 100 points). Proposals with a total score of at least 80 points, or with a review conclusion of “pass” or “basically pass,” were considered successful and were used to calculate both the pass rate and the proportion rated as good or excellent.

4.3.5. Questionnaire-Based Evaluation of Interdisciplinary Collaboration

Interdisciplinary collaboration was evaluated primarily through a questionnaire, focusing on participation in interdisciplinary activities, experiences of communication and collaboration, learning and transfer of methods, and feedback from supervisors and peers. Items related to “broadening of horizons” and “application of methods” were used to capture students’ subjective perceptions of rotations and the collaborative training model, and were triangulated with interview findings to characterize overall trends in interdisciplinary experience and willingness to collaborate.

4.4. Main Practical Outcomes

4.4.1. Comparison of Research Competence and Use of Digital Tools

There were marked differences between the multidisciplinary collaborative training group and the control group in mastery of core experimental skills and use of digital research tools. All 12 postgraduates in the collaborative training group met the assessment requirements for core experimental tasks such as cell culture, PCR, and Western blotting, yielding a pass rate of 100%. In contrast, 5 of the 6 postgraduates in the control group met the requirements, corresponding to a pass rate of 83.3% (Table 2). The collaborative training group showed faster acquisition and a broader coverage of experimental skills than the control group.

Usage records from the research information platform showed that, in the col-

laborative training group, the average number of active days per week increased from approximately 1.5 days in the initial implementation stage to about 2.1 days in the stable stage, an increase of roughly 40%. Over the same period, the control group showed little change, with an average of about 1.3 active days per week in both stages (**Table 2**). These findings suggest that the multidisciplinary collaborative training model facilitates the integration of digital tools into routine research training and enhances students' proactive use of platform resources.

4.4.2. Comparison of Academic Communication and Thesis Proposal Quality

In terms of academic communication and interim outputs, the multidisciplinary collaborative training group performed better overall than the control group. All students in the collaborative training group completed at least five structured literature presentations during the academic year, and the proportion rated as good or excellent by supervisors exceeded 85% (**Table 2**). Although the control group also fulfilled the required presentations, its proportion of good or excellent reports was clearly lower.

Thesis proposal evaluations indicated a 100% pass rate in both groups. However, on the standardized proposal rating scale—which covered topic innovativeness, feasibility of the research plan, quality of the literature review, and clarity of the research rationale—the multidisciplinary collaborative training group achieved higher overall scores than the control group (**Table 2**) and represented the strongest cohort among the same major over the past three years. These results indicate that the multidisciplinary collaborative training model helps students develop more mature research ideas and higher-quality thesis project designs.

4.4.3. Impact of Multidisciplinary Rotations on Interdisciplinary Thinking and Willingness to Collaborate

The overall effect of platform-based multidisciplinary rotations on the cultivation of interdisciplinary thinking was satisfactory. Questionnaire and interview data showed that, for the item “Have platform rotations broadened your research horizons?”, 11 of the 12 students in the collaborative training group reported obvious or relatively obvious broadening, accounting for nearly 92% (**Table 2**). For the item “Have you already applied methods learned during rotations to your current thesis or project design?”, 9 students responded positively (75%).

Compared with baseline interviews conducted before implementation, students generally reported positive changes in both their willingness and concrete practices of interdisciplinary collaboration, such as more proactively communicating with teams from other disciplines and incorporating techniques from other platforms into their project designs.

4.4.4. Effectiveness of Collaborative Supervision within the Supervisory Team

In the multidisciplinary collaborative training group, the joint supervision mechanism involving multiple supervisors effectively broke the previous pattern of isolated, single-supervisor guidance. Supervisors participating in this model gener-

ally believed that multidisciplinary collaborative training helped identify weaknesses in postgraduate training at an early stage, facilitated the development of consistent and operable supervision plans within the team, and stimulated new ideas for cross-disciplinary collaboration through multiple rounds of discussion. In contrast, supervisors in the control group mainly continued with a traditional one-to-one supervision model, with relatively limited opportunities for interdisciplinary interaction.

Table 2. Comparison of key training outcome indicators between the multidisciplinary collaborative training group and the control group.

Outcome indicator	Multidisciplinary collaborative training group (n = 12)	Control group (n = 6)
Pass rate for core experimental skills assessment (%)	100.0	83.3
Mean number of active days per week on the research information platform (stable stage)	2.1	1.3
Number of standardized literature presentations completed during the academic year	14	8
Proportion of literature presentations rated good or excellent (%)	85.0	80.0
Thesis proposal pass rate (%) / mean score	100/85	100/80
Proportion reporting that rotations significantly broadened their research horizons (%)	92.0	Not assessed
Proportion applying methods learned during rotations to thesis design (%)	75.0	Not assessed

5. Discussion

The practical operation of the four-in-one model suggests that systemic reform can move beyond conceptual proposals and be effectively implemented to produce tangible results. In contrast to previous fragmented and localized reform approaches, the key strength of this model lies not in reinforcing a single element, but in generating synergistic and cumulative effects through the interconnection of four components. Supervisory leadership is responsible for setting directions and standards; the research team mechanism embeds individual training within collective collaboration and allows learning to occur within everyday workflows; the informatization platform addresses how resources are found and used so that students at different stages can connect their learning experiences; and rotational training on disciplinary platforms embeds these arrangements in real research contexts, using concrete tasks to test the effectiveness of training. Together, these four elements form a cycle of “demand identification–resource matching–process feedback”, making the model an integrated structural design with internal coherence.

In ethnic-region institutions, this model shows strong contextual adaptability. By incorporating disciplinary resources with distinctive regional characteristics—such as ethnic medicine—into the platform system and placing pathogenic biology and research on active components of ethnic medicine on the same training chain, the model not only broadens the horizon of research questions but also

ensures that the cases and materials students encounter are closely linked to local realities. As a result, the training program is endowed with clear regional features and cultural depth.

At the same time, the current evidence base is still at an early stage. Data mainly come from the first cohort of participants, the number of graduate students is relatively small, and the observations cover only the first academic year, which limits the strength of the conclusions. The long-term effects of the model need to be clarified through continuous follow-up. Some qualitative evaluation indicators still have relatively strong subjectivity and lack unified quantitative standards and objective benchmarks. Future work should move toward “quantifiable and verifiable” evaluation by further subdividing evaluation dimensions, defining clear scoring rules, and supplementing horizontal comparative data, so that conclusions can rest on a more solid empirical foundation. The informatization platform also faces the issue of sustainable operation; if subsequent maintenance and updates do not keep pace, activity levels may decline over time and actual effectiveness may diminish.

6. Conclusion

This study constructs a four-in-one graduate training model integrating “supervisor–research team–informatization–disciplinary platform” and provides targeted responses to several common weaknesses in graduate education at local medical colleges in ethnic regions, including insufficient individualized supervision, unsystematic interdisciplinary collaboration, fragmented resource management, and weak informatization support. The key feature of this model is not the intensification of any single component, but the synergistic and cumulative effect generated through the linkage of its four parts. Its design draws on constructivist learning, collaborative learning, and situated cognition, whereby multidisciplinary supervision, team-based collaboration, platform support, and training in authentic research contexts enable students to actively construct knowledge and enhance their competencies while engaging in shared tasks and concrete situations. Current practice indicates that the model helps students develop more solid research training and interdisciplinary problem awareness, while also making collaboration among supervisors smoother. Disciplinary platforms’ instruments, projects, and data resources are used in a more centralized and efficient way, forming a clear, operable, and directly replicable pathway for reform.

The model has strong adaptability and operability in ethnic-region institutions. However, its existing support remains at a preliminary stage. Future optimization should include expanding the number of participants, extending the tracking period, improving quantitative evaluation tools and comparative data, and establishing a long-term investment mechanism for the platform, in order to further consolidate and enhance the model’s effectiveness.

Funding

This work was supported by the Guangxi Degree and Graduate Education Reform

Projects (Grant Nos. JGY2024322 and JGY2024333) and the Education and Teaching Reform Research Project of Youjiang Medical University for Nationalities (Grant Nos. J2025-03).

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- Chen, L. H., & Zhang, Y. (2024). Construction of Interdisciplinary Disciplines and Graduate Training Promoted by a Chemistry-Life-Medicine Cross-Platform: Exploration and Practice of the Institute of Chemistry and Biomedical Innovation, Nanjing University. *University Chemistry*, 39, 12-16. (In Chinese)
<https://doi.org/10.3866/PKU.DXHX202311089>
- Chen, Y. P., He, Y. T., Feng, L., Wu, S. L., & Luo, S. (2021). Methods for Improving the Quality of Graduate Training Based on Supervisor Team Management. *Science & Technology Vision*, 27, 196-198. (In Chinese)
<https://doi.org/10.19392/j.cnki.1671-7341.202127066>
- Jin, X., Yan, W. R., Du, Q. L., Shao, L. H., & Zhang, F. M. (2024). Application and Exploration of the Dual-Supervisor System in Professional Degree Graduate Education. *Journal of Suihua University*, 44, 121-124. (In Chinese)
- Li, K. N., & Zhao, N. N. (2023). Model Iteration of Interdisciplinary Graduate Supervisor Systems under an Informatization Orientation: Review of Research on Interdisciplinary Graduate Training. *China Science and Technology Papers*, 18, 1296. (In Chinese)
- Lu, B. P. (2024). Construction and Practice of an Innovation Ability Training System for Graduate Students Based on a “1+1+X” Supervisor Team Guidance Model. *Journal of Higher Education*, 10, 76-79. (In Chinese)
<https://doi.org/10.19980/j.CN23-1593/G4.2024.15.018>
- Luo, H. Y., Luo, J. Z., & Liang, L. L. (2025). Pathways to Enhance Research Innovation Ability of Graduate Students in Local Ethnic Medical Colleges under the Background of Building an Educational Power. *Educational Research*, 8, 63-65. (In Chinese)
<https://doi.org/10.12238/er.v8i11.6549>
- Ministry of Education, National Development and Reform Commission, & Ministry of Finance. (2020). *Opinions on Accelerating the Reform and Development of Graduate Education in the New Era*.
https://www.gov.cn/zhengce/zhengceku/2020-09/22/content_5545939.htm
- Pang, Y. Q., He, T., Ma, M. X., Long, H. S., & Qi, G. Z. (2024). An Investigation and Analysis of Graduate Supervisors' Guidance on Scientific Research in Local Ethnic Medical Colleges: A Case Study of Youjiang Medical University for Nationalities. *China Higher Medical Education*, 4, 140-142. (In Chinese)
<https://doi.org/10.3969/j.issn.1002-1701.2024.04.057>
- Wu, Z. T. (2024). Research and Practice on a Tripartite Graduate Training Model Based on “Supervisor-Research Team-Disciplinary Platform.” *Xueyuan*, 17, 68-70. (In Chinese)
- Xiong, H. J., She, Q., & You, X. Q. (2022). Stanford University's Interdisciplinary Graduate Training Model and Its Implications. *Academic Degrees & Graduate Education*, 1, 85-93. (In Chinese) <https://doi.org/10.13558/j.cnki.issn1672-3686.2022.008.001>
- Zhao, J. J. (2023). Informatization-Driven Practical Teaching under the Background of Industry-University-Research Cooperation: A Case Study of Graduate Innovation and Entrepreneurship Education. *Education Informatization Forum*, 1, 6-8. (In Chinese)

<http://jyxxhlt.qikanidc.com/?/jyxxhlt/2023/202301/230104.pdf>

Zhou, Y. X., Shi, M. J., & Guo, B. (2024). Construction and Practice of a “Study–Research–Innovation” Graduate Training Model in Western Medical Universities. *Basic Medical Education*, 26, 421-424. (In Chinese)

<https://doi.org/10.13754/j.issn2095-1450.2024.05.15>

Zhu, H. D., & Li, H. C. (2023). Research and Practice on the Cultivation Model of Graduate Students’ Innovation Ability Relying on Supervisors’ Scientific Research Innovation Teams. *China Educational Technology Equipment*, 6, 26-30. (In Chinese)

<https://doi.org/10.3969/j.issn.1671-489X.2023.06.026>