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Exploration of Diversified Talent Training and Collaborative Innovation Models from the Perspective of Scientific Research Team Construction and Collaborative Management Mechanism in Applied Undergraduate Universities

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Abstract: This study is dedicated to exploring the role of scientific research team construction and collaborative management mechanisms in applied undergraduate universities in promoting diversified talent training and collaborative innovation models. By forming an interdisciplinary scientific research team and recording in detail the team's performance, problems encountered, and solutions during the collaborative innovation process, the study found that interdisciplinary team construction significantly improved scientific research timeliness, which was 29.33% higher than that of traditional single-disciplinary teams. Therefore, the construction of interdisciplinary scientific research teams and collaborative management mechanisms are effective ways for applied undergraduate universities to promote diversified talent training and collaborative innovation.

Keywords: Applied undergraduate; Scientific research team construction; Collaborative management mechanism; Diversified talent training; Educational model exploration

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1. Introduction

In today's rapid globalization and informatization, applied undergraduate colleges and universities are important bases for cultivating high-quality, applied talents. The research on scientific research team construction and collaborative management mechanisms is particularly important. As society's demand for diversified and multi-faceted talents continues to grow, how to build effective scientific research teams and promote cross-disciplinary and cross-field collaborative innovation has become a key issue that needs to be urgently addressed in the field of higher education [1]. However, the traditional scientific research team management model often focuses on research cooperation within a single discipline, ignoring the importance of interdisciplinary collaboration, which has limited scientific research innovation and made it difficult to improve the quality of talent training. Therefore, exploring a scientific research team construction and collaborative management mechanism that adapts to the needs of the new era is of great significance for promoting diversified talent training and collaborative innovation in applied undergraduate universities [2].

In response to the above challenges, this study aims to explore the effective model of scientific research team construction and collaborative management mechanism in applied undergraduate universities through empirical research methods. First, the study selects representative applied undergraduate universities as the research objects and forms an interdisciplinary scientific research team. Secondly, the data on the team's performance, problems encountered, and solutions in the collaborative innovation process are comprehensively collected. Finally, qualitative research methods are used to conduct an in-depth analysis of the data, evaluate the effectiveness of the collaborative management mechanism, and put forward targeted improvement suggestions. The core goal of this study is to construct a scientific research team and collaborative management mechanism suitable for applied undergraduate colleges and universities to promote diversified talent training and collaborative innovation.

2. Literature review

In the field of diversified education, many researchers have revealed many key factors that affect the promotion and effectiveness of diversified education practices from different perspectives. Ahmad and Al Thani reviewed 67 interdisciplinary studies from 2011 to 2021 and found that the curriculum-based undergraduate research experience model is particularly effective in STEM (Science, Technology, Engineering, Mathematics) fields, especially in biology-related fields, which can significantly enhance students' research skills and academic achievements [3]. Adebisi emphasized the comprehensive benefits of undergraduate experience to academic institutions, faculty, and students, especially in developing countries. In fields such as medicine and health sciences, undergraduate participation in research is crucial to promoting knowledge innovation, and called for strengthening undergraduate research participation and capacity building [4]. Leonetti *et al.* focused on the impact of CURE (Clustering Using Representative) on community college and workforce students and proposed that although CURE implementation was limited, it had the potential to expand STEM career pathways and promote student success, and called for more research to guide the effective implementation and evaluation of CURE [5]. Plass *et al.* demonstrated how they were able to overcome barriers to nanoscience research and motivate and retain students in STEM fields by designing a low-threshold, modular nanomaterials research program at a major undergraduate institution, combining peer and near-peer mentoring with innovative strategies such as routine use of transmission electron microscopy [6]. Ruth *et al.* conducted a retrospective evaluation of the impact of CURE in the social sciences and found that it has a positive effect on improving students' research skills, memory, and graduate school enrollment rates. They particularly pointed out that social science CURE is crucial to promoting the academic success and diversity of minority and female students [7].

Most of the above studies are limited to specific subject areas, and there is a lack of comprehensive discussion on the effectiveness of implementing undergraduate research experiences in other disciplines such as social sciences. Therefore, this paper explores diversified talent training and collaborative innovation models, focusing on the construction of scientific research teams and collaborative management mechanisms in applied undergraduate universities. This paper also aims to explore diversified talent training and collaborative innovation models from this perspective and to provide a broader vision and practical path for the development and implementation of undergraduate research experiences.

3. Methods

3.1. Integration of applied scientific research and professional theoretical teaching

Starting from the construction of scientific research teams and collaborative management mechanisms in applied undergraduate universities, exploring diversified talent training and collaborative innovation models requires strengthening the deep integration of applied scientific research and professional theoretical teaching [8]. Compared with academic undergraduate universities that focus on imparting professional theoretical knowledge, and vocational colleges that focus on practical teaching, applied undergraduate colleges must not only ensure a solid foundation of professional theoretical knowledge in classroom teaching, but also keep up with the academic frontier and incorporate the latest applied scientific research results. To this end, professional teachers in applied undergraduate colleges should have both profound theoretical knowledge and continuous applied scientific research capabilities, constantly update teaching content, implement project application case teaching and applied technology teaching, and effectively improve the practicality and foresight of classroom teaching.

3.2. Integration of applied scientific research and professional practical teaching

The core purpose of professional practical teaching in applied universities is to cultivate students' ability to understand, master, and develop new technologies, and to enhance their ability to apply and innovate new scientific and technological achievements in society, industry, and enterprises [9]. To achieve this goal, applied universities need to introduce enterprise industry standards into the practical training of various majors, and transform the school's professional practical training laboratories and training bases into learning platforms that are close to the real enterprise processing and production environment. This initiative aims to provide students with opportunities to apply their knowledge and skills in real-world work environments, thereby enhancing their ability to solve real-world engineering problems. In professional practical teaching, applied universities actively invite key technical personnel from enterprises and industries to serve as instructors, and integrate the technology of the enterprise's production line into the practical teaching of courses.

3.3. Professional talent cultivation goals

Applied undergraduate education is unique in talent cultivation, and its core lies in the organic combination of knowledge, skills, and quality [10]. Aiming at computer majors, combined with the urgent need for information technology talents in urban economic development planning, industrial structure adjustment, and transformation of the communications industry, this paper carefully designs the main framework of the talent training system for this major. This system takes professional knowledge as the main line, while focusing on the development of skills and quality, forming a pattern of two wings flying together. Specifically, the theoretical teaching system covers three platforms: public basic theory, professional basic education, and personalized education, aiming to comprehensively promote students' knowledge accumulation, skill improvement, and quality development. The system architecture is shown in **Figure 1**.

Figure 1. Framework of the professional talent training target system

4. Results and discussion

4.1. Professional education evaluation

Students' professional theoretical knowledge is crucial to becoming high-level technical application talents, which requires comprehensive and practical knowledge. In order to evaluate students' mastery of the subject, the study took the School of Computer Science of a certain university as an example, reviewed the examination papers of the three core courses, Signal and System, Software Engineering, and Automation and Control, and explored the effects and causes of the implementation of the talent training model. The results are shown in **Table 1**.

Table 1. Analysis of the implementation effect and causes of the talent training model (unit: %)

Content	Grade	Signal and System	Software Engineering	Automation and Control
Basic mastery	Excellent	57.24	57.24	60.7
	Pass	23.35	16.54	29.18
	Fail	19.41	26.22	10.12
Analysis and design	Excellent	47.24	47.24	31.67
	Pass	41.24	43.35	59.18
	Fail	11.52	9.41	9.15
Comprehensive application	Excellent	35.56	46.54	32.37
	Pass	27.51	29.46	29.18
	Fail	36.93	24.00	38.45

According to **Table 1**, in the three core courses of computer science, students perform well in mastering basic theoretical knowledge, with up to 60.7% of students achieving excellent results. In the analysis and design phase, students' performance declines, and the excellent rate generally decreases, with only 47.24% of students achieving excellent results. In terms of comprehensive application, students' performance is poor, with a maximum of 38.45% of students failing the subject assessment.

Subsequently, this study compared the comprehensive scores of the 2020 Computer Science and Technology Class 1 and the 2020 Computer Science and Technology Class 2 of the School of Computer Science. The students of the 2020 Computer Science and Technology Class 1 implemented the talent training model in this paper during the teaching process, while the teaching model of the 2020 Computer Science and Technology Class 2 remained the traditional teaching method. The results are shown in **Figure 2**.

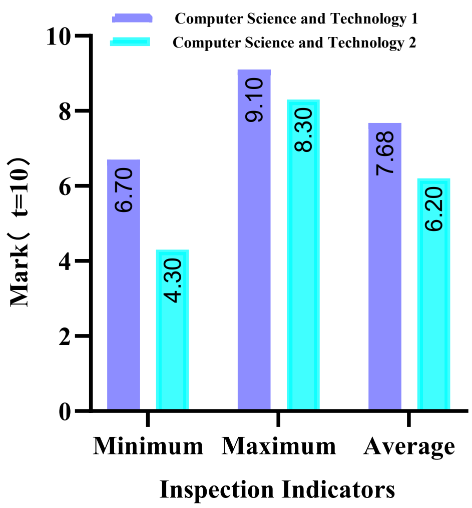

Figure 2. Comprehensive performance comparison

According to the data in **Figure 2**, the lowest score in Class 1 is 6.7 points, which is about 2.4 points higher than the lowest score of Class 2 (4.3 points); the highest score in Class 1 is 9.1 points, which is 0.8 points higher than the highest score of Class 2 (8.3 points). In terms of average score, Class 1 has 7.68 points, which is 1.48 points higher than Class 2 (6.2 points). These data show that the adoption of new talent training models has a positive impact on improving students' overall academic performance.

4.2. Effect evaluation

This experiment aims to evaluate the effectiveness of the collaborative management mechanism by forming a small-scale interdisciplinary research team of 5–8 people (including teachers and students from different disciplines such as computer science, electronic engineering, and management, with one teacher with interdisciplinary research experience serving as the team leader). The team then discussed and determined an interdisciplinary research topic, and the team's performance, problems encountered, and solutions adopted during the collaborative innovation process were observed and recorded. **Table 2** shows the comprehensive evaluation results of the team's collaborative management in different steps.

Table 2. Comprehensive evaluation of collaborative management in different steps

Evaluation steps	Assessment content	Score (total = 10)
Team construction	Diversity of disciplinary backgrounds among members	6
	Team leader experience	9
Research topic	Topic relevance	8
	Theme innovation	6

Table 2 (Continued)

Evaluation steps	Assessment content	Score (total = 10)
Research plan	Clarity of research steps	8
	Rationality of time nodes	9
	Clear division of labor	10
Collaborative innovation process	Communication efficiency	6
	Collaboration ability	9
	Innovative thinking	8
	Problem identification ability	10
	Solution effectiveness	9
Summary	Team performance summary	7
	Improvement suggestions	8

The study then compared the time efficiency of the entire research process of the same research topic between research group A, which had not adopted the model of this paper, and system management group B, and obtained the data in **Figure 3**.

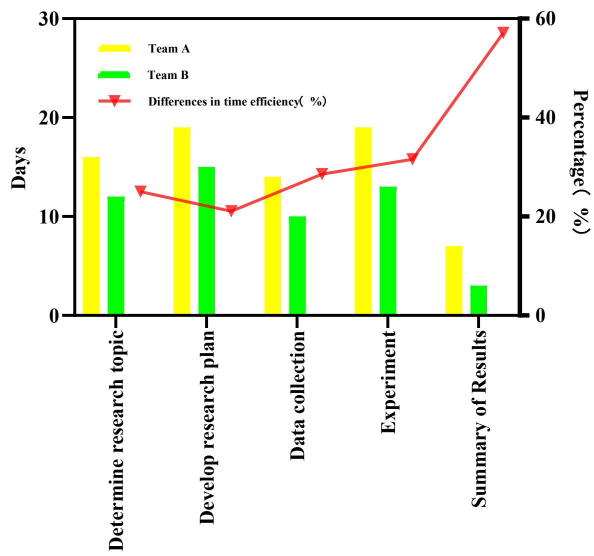

Figure 3. Time efficiency during the study among different groups

According to **Figure 3**, the results show that system management group B has shown higher time efficiency in all research stages. Overall, the total time efficiency of Group B in completing the entire research project is 29.33% higher than that of Group A.

5. Conclusion

This paper found that by forming an interdisciplinary scientific research team and implementing an effective collaborative management mechanism, the team's innovation ability and the quality of research results were significantly improved, and the overall development of students' comprehensive quality was promoted. This finding not only explains why interdisciplinary cooperation and collaborative management are crucial to improving the scientific research level of universities, but also reveals its positive role in cultivating diversified talents. Compared with the team that did not implement this mechanism, the research team in this paper showed obvious advantages in scientific research output, student employment competitiveness, and team collaboration efficiency. This study provides empirical support and theoretical contributions to the construction and collaborative management mechanism of scientific research teams in applied undergraduate universities, which is of great significance for promoting the improvement of higher education quality and innovation in talent training.

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Disclosure statement

The authors declare no conflict of interest.

References

[1] Tang L, Ke Z, Zhang Y, 2024, Research on the Construction of the "7S" Student Management Model of Light Chemical Engineering Major from the Perspective of Collaborative Education. Paper Science and Technology, 43(08): 164–168.

[2] Chen M, 2024, Exploration of the Cross-Border Integration Path of University Experimental Management under the Background of "Double Innovation" Education. Fujian Light Industry, (10): 93–95.

[3] Ahmad Z, Al-Thani NJ, 2022, Undergraduate Research Experience Models: A Systematic Review of the Literature from 2011 to 2021. International Journal of Educational Research, 114(1): 101996–102001.

[4] Adebisi YA, 2022, Undergraduate Students' Involvement in Research: Values, Benefits, Barriers and Recommendations. Annals of Medicine and Surgery, 81(1): 104384–104391.

[5] Leonetti CT, Lindberg H, Schwake DO, et al., 2023, A Call to Assess the Impacts of Course-Based Undergraduate Research Experiences for Career and Technical Education, Allied Health, and Underrepresented Students at Community Colleges. CBE—Life Sciences Education, 22(1): 4–5.

[6] Plass KE, Krebs JK, Morford JL, et al., 2024, Nanomaterials Research at a Primarily Undergraduate Institution: Transforming Nanorods, Undergraduate Research Communities, and Infrastructure. ACS Nanoscience Au, 4(4): 223–234.

[7] Ruth A, Brewis A, Sturtz Sreetharan C, 2023, Effectiveness of Social Science Research Opportunities: A Study of Course-Based Undergraduate Research Experiences (CUREs). Teaching in Higher Education, 28(7): 1484–1502.

[8] Brazendale K, Rovito M, Garcia J, 2024, Changing Attitudes towards Research through a Course-Based Undergraduate Research Experience. Journal of the Scholarship of Teaching and Learning, 24(2): 66–78.
[9] Quan J, 2024, Current Situation and Practical Path of the School-Enterprise Cooperation Education Mechanism in Higher Vocational Colleges under the Background of Smart Education. Hebei Vocational Education, 8(03): 40–43.
[10] Wang N, 2024, Research on the Collaborative Management Mechanism of "Double-Zone Coordination and Three-Dimensional Education" in Higher Vocational Colleges. Economist, (09): 205–206.

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