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Research on Building and Practicing a New Mentorship System for Applied Undergraduates Based on the "Three Cultivations and Three Achievements"

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Abstract: This paper first examines the evolution and challenges of mentorship systems both in China and internationally. Using the disciplines of Surveying and Mapping Engineering, as well as Remote Sensing Science and Technology at Heilongjiang University of Technology as case studies, the research explores the construction and practice of a novel mentorship framework for applied undergraduates based on the "Three Cultivations and three achievements". By focusing on the enhancement of connotations, the establishment of innovative teacher-student relationships, the development of new systems, and the implementation of the "Fourfold Synergy", this approach aims to significantly improve the educational outcomes of students in surveying disciplines at applied undergraduate institutions. The paper also outlines the specific implementation pathways adopted by our university in developing the new mentorship system and highlights achievements in employment, internships, innovation and entrepreneurship, as well as academic competitions.

Keywords: Three Cultivations and Three Achievements; Mentorship; Innovation and Entrepreneurship; Surveying and Mapping; Employment

1. Formation and Development of the Mentorship System

1.1 Current Development of the Global Mentorship System

The undergraduate mentorship system was established at the end of the 19th century at the University of Oxford. It has gradually become a cornerstone of the university's distinguished teaching quality. As former Oxford Vice-Chancellor Curzon remarked, if there is one aspect that Oxford can particularly take pride in—leaving a lasting mark on students' lives and character while inspiring admiration from other nations—it is the personalized tutorial system that emerged almost unnoticed. The *Oxford Statutes* provide detailed regulations on this undergraduate mentorship system. In the early 20th century, Harvard University implemented a mentorship system to enhance the academic guidance of undergraduates. Over time, Harvard developed a model tailored to its unique characteristics by establishing freshman offices and "tutor groups" to offer comprehensive student guidance. The Harvard model views the mentorship system as an integral part of university education, emphasizing its connection to credit systems, course selection, freshman seminars, and undergraduate research programs [1-4].

1.2 Current Development of the Mentorship System in China

In 2004, the national guidance document on undergraduate teaching clearly advocated for the active implementation of the mentorship system in qualified universities to provide high-quality and personalized services for students' holistic development. Universities have since been exploring ways to enhance undergraduate mentorship systems. In 2005, the Ministry of Education's directive, *Opinions on Further Strengthening Undergraduate Teaching in Higher Education*, emphasized that qualified institutions should actively adopt the mentorship system to provide quality and personalized services for comprehensive student growth [5]. The 2012 document, *Several Opinions on Improving the Quality of*

Higher Education, further called for reforms in talent cultivation by implementing mentorship. [6] At the National Undergraduate Education Conference for the New Era held on June 21, 2018, Minister of Education Chen Baosheng emphasized the need to "prioritize undergraduate education, advance the four returns, and build high-quality undergraduate programs." He called for placing undergraduate education at the core of talent cultivation, the foundation of education and teaching, and the forefront of educational development in the new era. [7-13]

2. The Significance and Essence of Establishing a New Mentorship System for Applied Undergraduate Programs

Despite its long history and some achievements in China, the mentorship system currently faces several challenges. Its critical role has not been fully realized, leading to inadequate educational outcomes. The widespread adoption of academic mentors in universities has been generally unsatisfactory, marked by a lack of specialization, personalization [5], and attention to detail. Guidance often lacks standardization and compassionate care. Moreover, the development of the mentorship system is incomplete, lacking effective practical implementation. This educational framework suffers from unclear positioning and overlaps with the responsibilities of class advisors and counselors. Addressing these issues requires significant efforts to enhance the effectiveness of academic mentorship in Chinese universities.

2.1 The Significance of a New Mentorship System

In response to the aforementioned challenges, the development of a new mentorship system seeks to establish a "Four New" framework, offering a reference model and valuable experience for related institutions. This system aims to enrich content development, institutional construction, and the nurturing of innovative teacher-student relationships, aligning with the current educational and talent cultivation models to achieve "fourfold synergy". It focuses on building a qualified team of mentors and fostering progressive teacher-student dynamics, ensuring mutual growth through teaching and learning. The core principles of "Three Cultivations and Three Achievements" are integrated into mentoring activities, supporting student development from various perspectives of the "Two Aspects and Four Lines". By piloting the academic mentorship system, exemplary guidance cases and mentoring outcomes are collected to build a repository of mentoring resources and a mentorship database. This is coupled with an analysis and feedback mechanism based on data concerning students' academic performance, employment, entrepreneurship, further studies, public service exams, and employer feedback. This is the new mentorship system, show as Figure1.

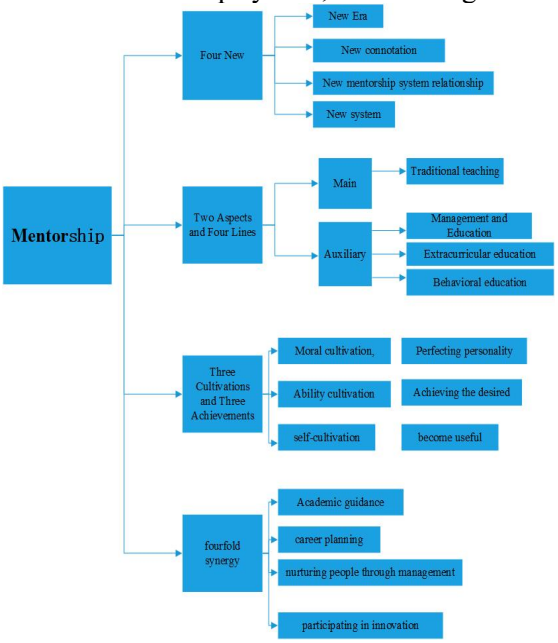

Figure 1. New Mentorship System

2.2 Defining Key Concepts of the New Mentorship System

The New Mentorship System and the Four News: The term "new" signifies a mentorship system distinct from traditional models, specifically designed for undergraduates in higher education institutions. This new approach is founded on the "Four News": 1. New Era—Referring to the irreversible historical progression starting from 2020, marking the next 30 years of China's journey towards the great rejuvenation of the Chinese nation. 2. New Connotation—Encompassing the new mission entrusted to the mentorship system in this era, with a precise focus on the system's role and the primary objectives to be implemented. 3. New Teacher-Student Relationship—Characterized by the

generational traits of the post-2000s students, including their lifestyle, learning, and working habits. It involves thoroughly researching these features to reconstruct a modern mentorship dynamic that aids in transforming teaching and learning styles to achieve educational goals. 4. New System—Involves designing and practicing institutional frameworks and mechanisms that align with the new mentorship system.

"Two Aspects and Four Lines" refers to two key areas in the educational system: the primary channel, which is traditional teaching, and the secondary channels, which include three lines—management education, extracurricular education, and behavioral education. "Three Cultivations and Three Achievements" involves the cultivation of morality, character, and ability, leading to personal development, achievements, and talents. This is based on the motto of Heilongjiang University of Technology to further clarify educational goals and levels, allowing teachers and students to strive together towards differentiated education. The "Fourfold Synergy" refers to the coordination between the new mentorship system and four areas: academic guidance (including internships, social practices, graduation projects, etc., under the four-year continual system), career planning (including employment, pursuing further studies, self-improvement to reshape a charming personality, planning a fulfilling life in response to the times), educational management, participation in innovation (engagement in entrepreneurship, mentorship programs, competitions).

3. Implementation of the Application - Oriented Undergraduate Mentorship System Based on "Three Cultivations and Three Achievements"

In the execution of this mentorship system, the "Fourfold Synergy" acts as the practical pathway. Within Heilongjiang University of Technology's surveying and mapping programs—specifically Surveying Engineering and Remote Sensing Science and Technology—the mentorship model establishes a student-centered collaborative approach. This integrates existing educational methods in academics, postgraduate preparation, entrepreneurship and innovation, and research projects, subtly embedding the "Three Cultivations and Three Achievements" educational philosophy into guidance activities. The goal is to achieve an imperceptible yet effective impact, progressing in harmony with established pathways.

The talent cultivation plan for these disciplines follows the "2.5+1+0.5" structure: 2.5 terms of on-campus professional knowledge learning, 1 term of internship, and 0.5 term dedicated to graduation design, show as Figure 2.

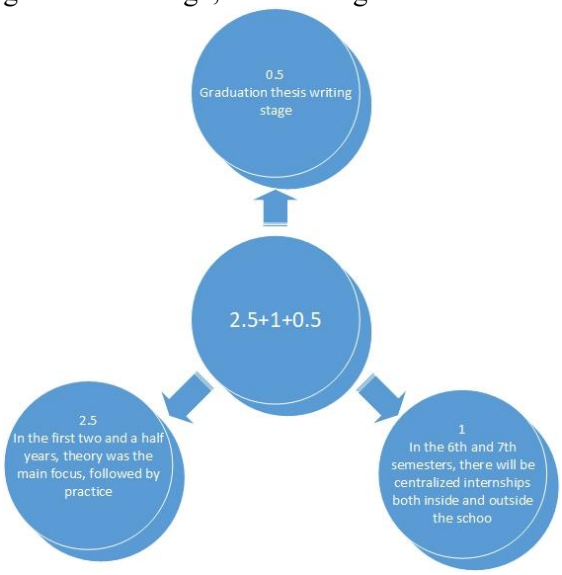

Figure 2. The "2.5+1+0.5" Talent Cultivation Model

Throughout the mentorship implementation: First Year: A mutual selection process between students and mentors occurs to establish the mentor-student relationship. The primary focus is on providing guidance in foundational courses and developing a comprehensive university study plan. Second Year: Emphasis is on training and education in subject competitions and innovation and entrepreneurship. Third Year: Students split into two pathways; some engage in a semester-long corporate internship with both academic and corporate mentors providing guidance. Others continue with on-campus professional course study, participating in competitions such as provincial and national surveying skills contests and relevant innovation and entrepreneurship challenges. Fourth Year: This phase involves integrating innovation, entrepreneurship, and subject competitions into scientific research projects, which can then be developed into research papers or patents. Students can also use insights gained during their third-year

internships to complete their graduation thesis. To gain insights into students' appraisals and recommendations during the implementation of the tutorial system, a regular questionnaire survey is conducted among students of each cohort. The survey results indicate that students exhibit a relatively high degree of satisfaction with their engagement in tutorial activities. Additionally, they have proffered several suggestions concerning the tutorial system, notably regarding the rapport between tutors and students.

Faculty members also engage in discussions to share experiences on the challenges and efficacious approaches encountered during the implementation. Concurrently, exchanges are facilitated with universities in the province that offer similar majors, enabling a mutual learning process in terms of tutorial system construction. By assimilating suggestions from students, teachers, and peer institutions, the tutorial system is continuously refined and enhanced to ensure its efficacy and relevance.

4. Effectiveness of the Application-Oriented Undergraduate Mentorship System Based on "Three Cultivations and Three Achievements"

Since its gradual implementation in 2016, the new mentorship system has developed into a robust framework. The number of participants has expanded from an initial handful to 60–80 students per grade, totaling 330 students currently involved. The system has yielded significant results in areas such as employment rates, high-quality internships, innovation and entrepreneurship, and success in academic competitions.

4.1 Employment Rate of Surveying and Mapping Students

The Surveying Engineering program has produced graduates from the classes of 2015 through 2020, with employment rates of 100%, 91%, 90%, 92%, 93%, and 91% respectively, averaging 93%, show as Figure 3.

Graduates primarily secure positions with Fortune Global 500 companies such as China Railway Eighteenth Bureau Group, Twenty-third Bureau, Twentieth Bureau, First Bureau, and the Third Railway Design Institute. Beyond these enterprises, high-quality employment is notable. For example, among 2020 graduates in Surveying and Mapping Engineering, 11 pursued further studies, 1 became a selected public servant, 1 ventured into entrepreneurship, 2 secured government positions, and 1 studied abroad.

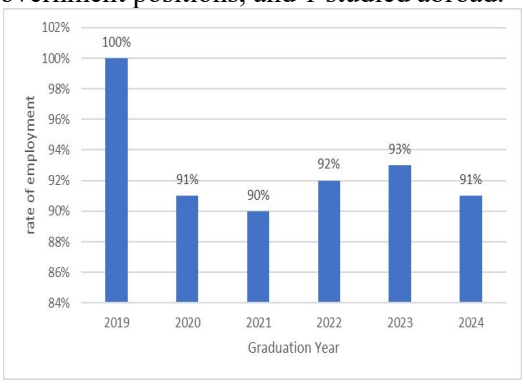

Figure 3. Employment Rate of Surveying and Mapping Engineering Major in the Past 6 Years

4.2 High-Quality Internships for Surveying and Mapping Students

Under the guidance of the "Three Cultivations and Three Achievements" mentorship system and the reformed "2.5+1+0.5" academic structure, students benefit from the "4+1" engineering training program. Over five semesters, they receive professional training in five key areas under their mentors: basic surveying instruments and low-altitude remote sensing; UAV mapping; aerial photogrammetry; remote sensing image processing; and a comprehensive low-altitude remote sensing project. This solid practical foundation equips students with advanced skills for internships at firms such as China Railway Design Group Co., Ltd. (China Railway Third Institute), Heilongjiang Second Surveying Institute, Southern Surveying & Mapping Co., Ltd. Harbin Branch, Heilongjiang Dixing Surveying and Technology Co., Ltd., and Liaoning Zhongcheng Surveying Co., Ltd. Internships are collaboratively managed by both the school and the enterprises, enhancing connections and communication with employers. As a result, students' professional abilities receive high recognition from these companies, while students also develop a strong sense of belonging within the enterprises.

4.3 Success in Skill Competitions and Innovation and Entrepreneurship Contests

There has been a significant increase in both

the quantity and quality of awards. Students have achieved over 80 accolades in provincial and national competitions, including 28 awards in the National Surveying and Mapping Competition, show as Figure 4.

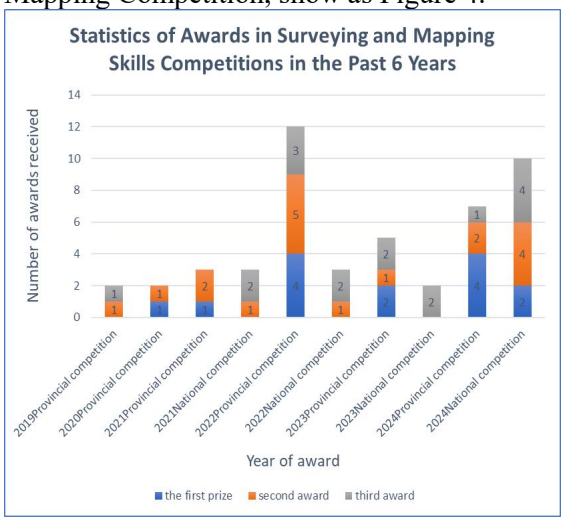

Figure 4. Statistics of Awards in Surveying and Mapping Skills Competitions in the Past 6 Years

They have also actively participated in innovation and entrepreneurship contests, securing 15 awards in these arenas.

5. Conclusions

The faculty of the Surveying and Mapping Department at Heilongjiang University of Technology, focusing on Surveying Engineering and Remote Sensing Science and Technology, has pioneered an application-oriented undergraduate mentorship system based on "Three Cultivations and Three Achievements". Through this system, the university has effectively enhanced the educational outcomes of surveying students in application-oriented undergraduate programs by fostering substantive content development, establishing new teacher-student relationships, creating innovative institutional frameworks, and implementing the "Fourfold Synergy". However, to continue improving this mentorship model, ongoing efforts are needed to strengthen the development of the mentoring team and further refine the management system. This approach serves as a valuable reference for similar programs in other application-oriented universities.

Acknowledgments

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