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Project-Based Learning in the Context of Cultivation and Education: A Case Study on Astragalus Cultivation

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ABSTRACT

Farm-based education serves as an important carrier for cultural inheritance and the implementation of cultivating people's morality. Its core lies in the dialectical unity of "cultivation" and "reading", promoting the integration of theory and practice. Project-based learning (PBL) aligns with the concept of farm-based education. This article takes the cultivation of astragalus and its mechanized harvesting as the carrier, and constructs a four-stage project-based teaching model of "theoretical learning - practical exploration - innovative application - enhancement of literacy", integrating multiple disciplines of knowledge and transforming the production practice 环节 into teaching content. Through analyzing the design logic of the project, the implementation path, teaching effectiveness and reflection, this paper provides a practical model for farm-based education in agricultural-related majors of universities, helps cultivate new-era agricultural talents, and serves the rural revitalization strategy.

KEYWORDS

Farming and reading education; Project-based teaching; Astragalus cultivation; Talent development

1 Introduction

Farm-study education is a unique educational tradition of the Chinese nation, embodying the concepts of "educating through farming and cultivating people through culture". In the new era of rural revitalization and the construction of new agricultural disciplines, it has been given new missions and has become a key solution to the disconnection between agricultural talent cultivation and industrial demands, as well as to the shortcomings of exam-oriented education that emphasizes theory over practice. Its core value lies in breaking the barrier between theory and practice and achieving the integration of knowledge and action, helping students majoring in agriculture to establish the belief of "loving agriculture and working for agriculture" and cultivating a spirit of labor and social responsibility.

Project-based teaching is centered around students, promoting autonomous exploration and cooperative learning through real project tasks. Just like farm-study education, both are centered on practice and problem-oriented, emphasizing comprehensive qualities. The cultivation of ginseng planting is feasible: Ginseng is a traditional and valuable medicinal herb with significant value. Its cultivation is concentrated in the northwest region, with Longxi County in Gansu Province accounting for 46% of the national total. It provides abundant industrial resources and practical scenarios. The industry faces problems such as low mechanization levels and high costs, and urgently needs compound talents. The entire value chain covers multiple disciplines of planting and processing, and existing technical materials provide support for teaching, possessing the advantages of project-based teaching.

2 Project Design Concept

Taking "education centered on nurturing students" as the core guiding ideology of education, by guiding students to participate in the specific practical activities of growing astragalus, the aim is to deeply cultivate and shape the students' spirit of labor, allowing them to experience the value and significance of labor through personal experience; at the same time, by organizing students to participate in the research and development process of agricultural machinery, it effectively stimulates their innovative consciousness and exploratory spirit, encouraging them to be courageous in trying and breaking through in practice. Moreover, by leading students to deeply understand the important role of the astragalus industry in economic and social development, it further enhances their sense of identity and mission for future careers, thus achieving the comprehensive goal of comprehensive education.

The project strictly follows the cognitive law of "from practice to practice", breaking the boundaries between traditional disciplines. Driven by the actual needs of high-efficiency planting and mechanized harvesting of astragalus, it meticulously constructs a closed-loop learning path of "practice - theory - innovation - practice". This path not only helps students internalize the knowledge they have learned, but also promotes the transfer and application of knowledge, truly implementing the educational concept of integrating knowledge and action.

During the implementation of the project, knowledge contents from multiple disciplines such as agriculture and mechanical engineering were integrated. Students were required to not only master solid agricultural 基础知识，but also possess certain engineering technical capabilities. Through this interdisciplinary learning model， students' interdisciplinary thinking and comprehensive application abilities were cultivated，enabling them to better handle complex agricultural problems.

To ensure the targeted and effective nature of the project, a hierarchical task system was designed: the basic level mainly focuses on training the basic skills of ginseng cultivation, enabling students to master the necessary planting techniques; the intermediate level guides students to design and improve agricultural machinery components, enhancing their practical and innovative abilities; the expansion level further challenges students, requiring them to develop complete machines to comprehensively test and improve their comprehensive qualities. Through this hierarchical task design, every student can achieve growth and progress in the project.

3 Project Implementation Process

This project focuses on the "High-yield Cultivation and Mechanized Harvesting of Astragalus" as its core task, covering the entire growth period of Astragalus.

The first stage is theoretical learning and project preparation, lasting for 4 weeks. Through inviting agricultural policy experts and leaders in the Astragalus industry to conduct special lectures, the students are introduced to the connotation and value of farming education, the current situation of Astragalus industry development, and the prominent problems it faces. This aims to stimulate the students' enthusiasm for participation and sense of social responsibility. Modular theoretical courses covering multiple disciplines are offered, including agricultural science modules such as the biological characteristics of Astragalus, traditional cultivation techniques, and soil physical and chemical properties; mechanical engineering modules focusing on agricultural machinery design principles and core component structures; and data science modules involving simulation basics and experimental design methods. Students form 5-6 person project teams based on their interests and specialties, and after clarifying their roles, they work under the guidance of their mentors, combining literature research with field investigations to formulate detailed project implementation plans. At the same time, based on the resources of school-enterprise cooperation, a teaching practice base is established to provide relevant literature materials, professional design analysis software, and experimental instruments, providing support for the project implementation.

The second stage is the cultivation practice and problem discovery, lasting for 16 weeks. Each project team conducts the planting of astragalus at the practice base, strictly following the agronomic requirements to complete tasks such as land preparation, sowing, fertilization, and irrigation, and records the growth conditions of astragalus and key planting data. Through on-site observation, interviews with growers, and reviewing industry materials, the core pain points of the astragalus harvesting process are focused on: the labor intensity of manual harvesting is high, the efficiency is low, the cost is high, and it is prone to cause damage or missed digging of the medicinal materials; the existing agricultural machinery has problems such as poor adaptability, low efficiency of soil separation, and high damage rate of medicinal materials. Each team sorts out the research results, combines literature research to determine the core research target, and forms field management logs, problem investigation reports, and preliminary solutions.

The third stage is the development and innovation of agricultural machinery, lasting for 20 weeks. Each team based on the core research target, conducts the design and optimization of key components of agricultural machinery, including the structure and parameters optimization of core components such as the digging shovel, roller sieve, vibration mechanism, and soil separation device. Professional software is used for three-dimensional modeling and simulation to analyze the impact of different parameters on the operation effect, determine the optimal parameter combination, and then conduct field trials to measure key performance indicators such as the rate of clear stems, the rate of loosening, the damage rate, and the operation efficiency, and optimize the design scheme based on the test data, forming results such as three-dimensional models, design manuals, simulation reports, and test analysis reports.

The fourth stage is the summary of achievements and enhancement of qualities, lasting for 8 weeks. Each team systematically organizes the process-related materials and final results of the project, and forms a summary report that includes the project background, research methods, innovative points, test results and application prospects. A project outcome exhibition is held, presenting the research results through PPT presentations and physical displays, and inviting industry experts, farmers and university teachers for comments. Multi-dimensional reflection and evaluation are conducted. Students write personal learning reflection diaries, team members conduct mutual evaluations, and the supervisor conducts a comprehensive evaluation based on students' theoretical learning, practical operation, innovative achievements and team cooperation performance. At the same time, excellent project outcomes are sorted out and promoted to local agricultural machinery enterprises and planting cooperatives. Students are encouraged to apply for patents or publish academic papers, and promote the teaching outcomes to actual productivity.

4 Teaching Outcomes and Evaluation

4.1 Eaching Outcomes

At the level of knowledge acquisition, students successfully achieved a deep integration and effective internalization of interdisciplinary knowledge. Through participating in project-based teaching activities, their knowledge acquisition rate significantly increased from the original 75% to 92%. In terms of skill development, the practical operation ability and innovation ability of students have been significantly enhanced: over 90% of students can operate related software proficiently, 85% of students have the ability to independently complete experiments, and 70% of the project outcomes have reached the level that can be directly applied to practice. In terms of quality improvement, students' labor spirit and social responsibility have been further strengthened. 95% of students have a deeper sense of identification with the agricultural major, and 88% of students expressed their willingness to engage in work related to agriculture. This proportion has increased by 35% and 42% respectively compared to before. In terms of industrial service contribution, the project provided solid technical support for the relevant industries, resulting in a 4% increase in the employment rate, a 30% increase in work efficiency, and a cost reduction of over 20%. This injected new impetus into the sustainable development of the industry.

4.2 Teaching Evaluation

The project has meticulously established a three-dimensional evaluation system consisting of "process evaluation, outcome evaluation, and comprehensive evaluation", aiming to ensure the comprehensiveness and objectivity of the evaluation process, thereby more scientifically measuring students' overall performance. Among them, process evaluation accounts for 40% of the weight, mainly focusing on students' specific performance in each stage of the project. Through various evaluation methods, such as detailed teaching logs, detailed practice operation records, and mutual evaluation mechanisms among team members, quantitative scoring is conducted in meticulous detail on aspects like students' attendance in theoretical learning, participation in field practice activities, contribution in team collaboration, and demonstration of problem-solving abilities, striving to comprehensively reflect students' learning process.

The outcome-based evaluation accounts for 30% of the total weight, with the final project outcome serving as the core evaluation basis. This part of the evaluation is jointly conducted by experienced mentors and experts in the industry. They conduct in-depth reviews of key achievements such as project summary reports, simulation simulation reports, field test data, and agricultural machinery design plans. The focus is on evaluating the performance of these achievements in terms of scientificity, innovation, and practicality, ensuring the authority and professionalism of the evaluation results.

The comprehensive evaluation also accounts for 30% of the total weight. This part of the evaluation places greater emphasis on the assessment of students' comprehensive qualities. It conducts a comprehensive qualitative evaluation by combining students' personal reflection summaries, performance during the achievement presentation process, and improvement in professional qualities. The focus is on the development of core qualities such as the labor spirit, innovative thinking, and social responsibility demonstrated by students during the project process. This multi-dimensional evaluation system enables the project to not only comprehensively and objectively reflect students' learning outcomes but also effectively promote their all-round development.

5 Reflections and Prospects

5.1 Teaching Reflection

The core advantages of the project are mainly reflected in the following aspects: Firstly, the project uses real existing industrial problems as the driving force. This practical teaching method not only greatly stimulates students' interest in learning, but also effectively mobilizes their initiative and enthusiasm for learning, making the learning process more vivid and meaningful. Secondly, the project integrates knowledge from multiple disciplines for comprehensive application, breaking the barriers between different disciplines in traditional classroom teaching, promoting the integration of knowledge, and significantly enhancing students' comprehensive application ability and problem-solving skills in complex situations. Finally, the project builds a complete practical chain, from theory to practice, and then to reflection and improvement. Each link fully embodies the profound connotation of farming and reading education, not only imparting professional knowledge, but also implicitly guiding students' values, achieving the organic unity of knowledge transmission and value guidance.

However, during the implementation of the project, some shortcomings were also revealed: Firstly, the project's duration is restricted by the growth cycle of astragalus. The entire project lasts for an academic year, which makes the adjustment of the project progress lack flexibility and places high demands on students' time management skills. Some students may feel considerable time pressure. Secondly, the smooth progress of the project requires the provision of a professional software platform, advanced testing equipment, and a complete practical base. The investment in these resources is relatively large. For some universities with limited resources, they may face the problem of insufficient supporting conditions, which will affect the comprehensive implementation of the project. Finally, due to the individual differences in students' academic foundations and practical abilities, some students with relatively weak foundations may encounter significant challenges in high-difficulty sections such as agricultural machinery research and simulation, and may struggle to keep up with the project's progress. This requires teachers to provide more personalized guidance and assistance to ensure that each student can gain something from the project.

5.2 Teaching Outlook

In the future, the teaching model will be continuously optimized by implementing a multi-batch project parallel mechanism, fully leveraging the technological advantages of online platforms, and significantly enhancing teaching flexibility and efficiency. Specifically, modular course design and real-time interaction tools will be introduced, enabling students to participate in multiple projects according to their own progress. At the same time, through the cloud resource library, learning materials can be shared and updated, thus meeting diverse learning needs.

In terms of cooperation, strategic collaboration with agricultural enterprises, research institutions, etc. will be deepened to jointly build practice bases and research platforms. Through regular seminars and workshops, industry experts and scholars will be invited to participate in teaching and research activities, not only enhancing the professionalism and cutting-edge nature of the courses, but also providing students with opportunities for practical operation and research practice, promoting the integration of theory and practice.

In response to individual differences among students, a stratified guidance system will be improved, designing personalized learning tasks and project paths based on students' interests, abilities, and career plans. For example, basic skills training will be set for beginners, and innovative research projects will be arranged for advanced students, ensuring that each student can achieve growth at their respective levels and achieving overall progress.

Ultimately, these measures will strongly support the agricultural modernization and rural revitalization strategies, promoting agricultural industrial upgrading and rural sustainable development through educational innovation.

6 Conclusion

The project-based teaching under the cultivation and reading education approach is guided by real agricultural production issues and centered on the practical exploration of interdisciplinary integration. It provides an effective teaching model for the cultivation of professionals in agriculture-related fields. The project teaching centered on the cultivation and mechanized harvesting of astragalus not only enables students to systematically master knowledge related to agricultural science and mechanical engineering, enhance their practical abilities and innovation capabilities, but also cultivates students' spirit of labor and sense of social responsibility, achieving a comprehensive improvement in "knowledge, skills, and qualities". In the context of the rural revitalization strategy and the construction of new agricultural disciplines, agricultural universities should further deepen the reform of cultivation and reading education, promote the deep integration of project-based teaching and agricultural industries, continuously optimize teaching models, integrate teaching resources, and improve evaluation systems, and cultivate more comprehensive talents who are knowledgeable about agriculture, love agriculture, and are dedicated to promoting agriculture, providing solid support for the modernization of agriculture and rural revitalization in our country.

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References

[1] Du Jianpu, Sun Wei, Dong Limei, et al. Design and Testing of the Yellow Excavator [J]. Forestry Machinery and Woodworking Equipment, 2024, 52(10): 25-35.

[2] Yang Xiaoping, Shi Linrong, Sun Wei, et al. Optimization and Testing of Working Parameters of the Yellow 芪 Vibrating Excavator [J]. Journal of China Agricultural University, 2018, 23(10): 152-160.

[3] Wang Qifang. Design of the Excavation Device Components of the Yellow Harvester [J]. Agricultural Machinery, 2025, (9): 16-18.

[4] Zhou Shengmao, Wu Weigang, Guo Liang, et al. Changes in China's Yellow Production Areas and the Development Process of Cultivation Industry [J]. Chinese Modern Chinese Medicine, 2023, 25(11): 2428-2433.

[5] Sun Wei, Wang Huichen, Zhao Wuyun, et al. Design and Testing of the Residue Film Recovery Type Full Film Covering Ridge Sowing Potato Excavator [J]. Journal of Agricultural Machinery, 2018, 49(9): 105-114.

[6] Ministry of Education. Opinions on Accelerating the Construction of New Agricultural Disciplines and Promoting the Innovation Development of Higher Agricultural and Forestry Education [Z]. 2020.

[7] Ministry of Agriculture and Rural Affairs. National Rural Revitalization Talent Development Plan (2021-2025) [Z]. 2021.

[8] Chen Qiangqiang, Tang Zhengxing, Li Guoshun. Research on Agglomeration and Driving Factors of Chinese Medicinal Herbs Industry [J]. Agricultural Modernization Research, 2017, 38(1): 145-153.

[9] Yu Qingxu, Cao Guangqiao, Chen Bin, et al. Application and Research Status of Harvesting Mechanization for Root and Stem Medicinal Herbs [J]. Chinese Journal of Agricultural Machinery Chemistry, 2022, 43(8): 21-27.