

Construction and Exploration of an Intelligent Course in Chinese Medicinal Materials Commodity Science Based on the "One Core, Three Integrations, Five Transformations" Blended Teaching Path

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Abstract As a compulsory course for the Chinese Medicinal Resources and Development major, Chinese Medicinal Materials Commodity Science has long faced challenges in teaching practice concerning student motivation, content innovation, and pedagogical value orientation. In response, the course team first broke away from the traditional course framework and initiated blended teaching reform and practical research, adhering to the principle of "Preserving the Essence while Innovating", upholding the concepts of student-centeredness, problem-orientation, and continuous improvement, and fully leveraging the appeal, value-driven force, and attractiveness of curriculum-based ideological and political education. The team explored and established an innovative teaching path characterized by "One Core, Three Integrations, and Five Transformations". This path centers on "Fostering Virtue and Cultivating Talent", achieves integration across "Knowledge, Competency, and Values", and drives the transformation of five key aspects: reshaping the course objectives towards being "high-level, innovative and challenging", restructuring the teaching content to be "layered and progressive", reforming the teaching strategy to be "task-driven", renewing teaching resources to be "co-constructed and shared", and reconstructing the evaluation system to be "multidimensional and comprehensive". Practical results demonstrate that this path has effectively addressed the identified teaching problems, enhanced student learning outcomes, and successfully achieved the established educational objectives of the course with high quality.

Key words Chinese Medicinal Materials Commodity Science, Teaching path, Teaching exploration

0 Introduction

Pharmaceuticals are special commodities, and Chinese medicinal materials (CMMs), as a category within pharmaceuticals, are intrinsically linked to human life and health. Chinese Medicinal Materials Commodity Science is an applied course formed at the intersection of natural sciences and social sciences. It is a specialized course offered to undergraduate students majoring in Chinese Medicinal Resources and Development. Based on the requirements of the "Healthy China" initiative and the cultivation demands for innovative, interdisciplinary, and application-oriented talents in Chinese medicine under the "New Medical Education" context, this course aims to enable students to understand clinically used CMMs from a commodity science perspective. It seeks to explore the patterns of commodity specifications and quality changes within the circulation domain, along with relevant management theories and identification techniques. The course further aims to cultivate students' mindset for CMM product research and development, instill the concept of integrity in CMM business operations, enhance students' sense of identity with their major and pride in China's traditional Chinese medicine (TCM) culture, and clarify their responsibilities, mission, and commitment. With increasing demand for TCM, the trade in CMM com-

modities continues to grow. This places higher demands on the quality, production, management, usage, supervision of CMM commodities, as well as on personnel engaged in related trade activities. The advancement of the TCM industry urgently requires the theoretical and practical knowledge provided by Chinese Medicinal Materials Commodity Science. Currently, in the actual teaching process under the New Medical Education background, the interdisciplinary nature of Chinese Medicinal Materials Commodity Science presents challenges in knowledge comprehension, leading to problems that affect student learning outcomes. Consequently, the need for innovation and reform of this course is urgent. This paper reflects on and explores reforms for this course, hoping to provide a reference for similar institutions in cultivating talents for the Chinese medicinal commodities sector.

1 Problems identified in the teaching process of Chinese Medicinal Materials Commodity Science

During the course teaching process, through investigation and self-reflection, the following problems were identified in teaching practice. At the student level: Students possess foundational knowledge in Chinese medicinal resources and development but lack marketing knowledge. There is a disconnection between theory and practice. Basic innovative ability is insufficient. Logical thinking and practical problem-solving skills are lacking. Furthermore, learning autonomy is poor, and intrinsic motivation is difficult to stimulate. At the course level: The teaching content is extensive but class hours are limited. The content lacks contemporary relevance and is disconnected from societal production and daily life. The interdisciplinary nature of knowledge points makes key

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and difficult concepts hard to grasp. The extension of curriculum-based ideological and political education from within class to extra-curricular activities urgently needs strengthening. At the teaching level; The faculty composition is homogeneous; the teaching team lacks instructors specializing in marketing science. Teaching methods are monotonous, emphasizing knowledge transmission over practical application. Teaching evaluation is simplistic, focusing solely on summative assessment. Teachers' interdisciplinary knowledge is insufficient, and their ability to apply modern information technology also needs enhancement.

2 The "One Core, Three Integrations, Five Transformations" blended teaching philosophy for Chinese Medicinal Materials Commodity Science

The course adheres to the principle of "Preserving the Essence while Innovating". "Preserving the Essence" entails upholding TCM theoretical guidance and cultivating law-abiding professionals in the Chinese medicinal materials industry. "Innovating" involves integrating modern information technology to reform

all aspects of teaching in order to enhance teaching quality. Guided by the concepts of fostering virtue and cultivating talent, student-centeredness, problem-orientation, and continuous improvement, the course fully leverages the appeal, value-driven force, and attractiveness of curriculum-based ideological and political education. Taking authentic problems from teaching practice as the logical starting point, with root cause analysis as a crucial foundation, fostering virtue and cultivating talent as the value orientation, systematic innovation as the fundamental principle, blended design as the basic approach, achieving "high-level, innovative and challenging" standards as the core criterion, and teaching quality standards as the basis, innovative reforms were undertaken in aspects such as course objectives, content, methods, environment, and evaluation. Utilizing modern educational information technology and platforms ensured the coordinated unity of all teaching elements. This exploration led to the formation of an innovative teaching methodology characterized by "One Core, Three Integrations, Five Transformations", as illustrated in Fig. 1.

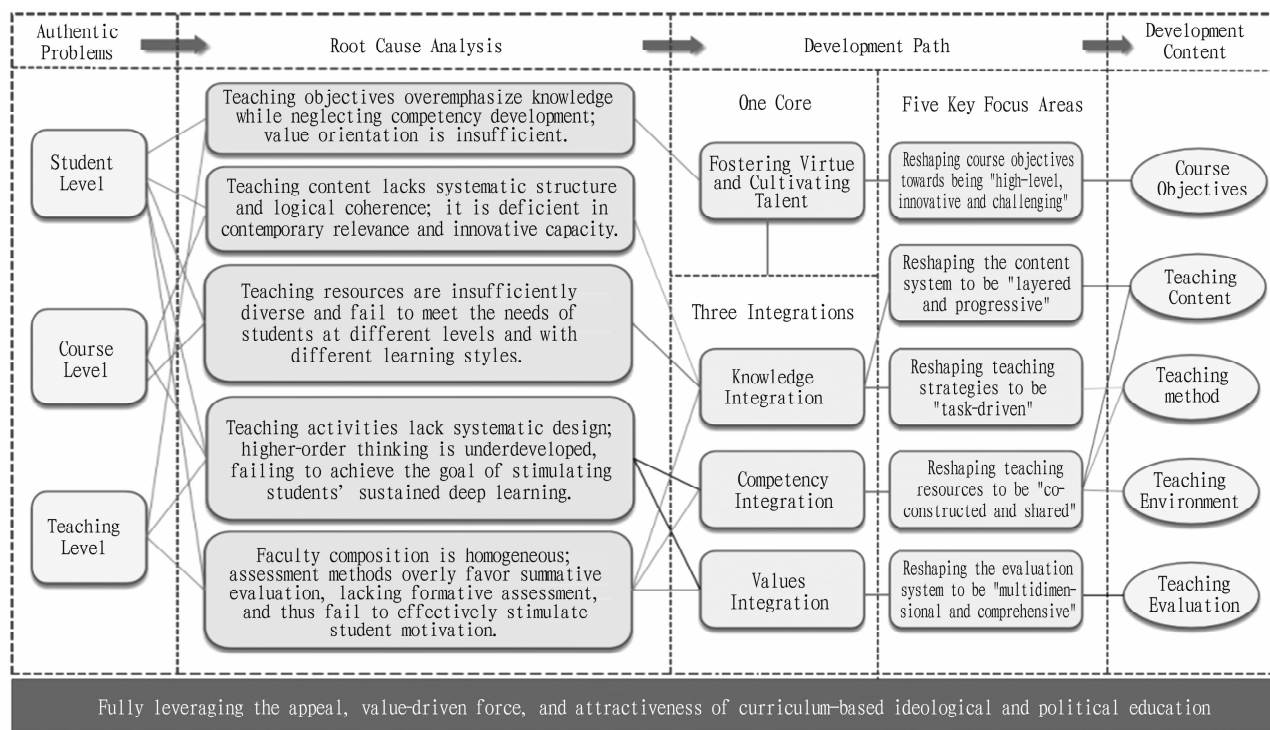


Fig. 1 Conceptual diagram of innovative teaching reform for the intelligent course in Chinese Medicinal Materials Commodity Science

3 Implementation path of the "One Core, Three Integrations, Five Transformations" course innovation

Through practical implementation, the course team focused on overcoming challenges related to self-learning incentive mechanisms, curriculum-based ideological and political education, assessment and evaluation models, and resource development. This led to the establishment of an innovative course path characterized by "One Core, Three Integrations, Five Transformations". The "One Core" centers on "Fostering Virtue and Cultivating Talent",

which fundamentally means being student-centered. The "Three Integrations" involve the fusion of capabilities developed in the three areas of knowledge, competency, and values. The "Five Transformations" entail reshaping the course objectives, content, methods, environment, and evaluation, detailed as follows:

3.1 Defining teaching objectives The ideological and political education is integrated with knowledge transmission, competency cultivation, thinking training, and quality enhancement to reshape course objectives towards being "high-level, innovative

and challenging". Unwaveringly adhering to the core goal of cultivating professional values, essential qualities for Chinese medicine professionals are defined as possessing excellent moral character, a strong sense of social responsibility, good teamwork spirit, respect for life, and an awareness of integrity in business operations. To this end, building upon the existing foundation, the course team further established a model with New Medical Education characteristics, reshaping the course objectives towards "high-level, innovative and challenging". This achieves an organic integration of knowledge transmission, competency cultivation, and the development of emotional attitudes and values. It highlights high-level thinking, innovation, and an appropriate degree of challenge. It fully leverages the appeal, value-driven force, and attractiveness of curriculum-based ideological and political education. This addresses the problems of overemphasizing knowledge while neglecting competency development and insufficient value orientation.

3.2 Restructuring course content The textbook material is integrated with cutting-edge disciplinary knowledge and practical cases to reshape a "layered and progressive" content system. Aligning with the talent cultivation objectives and graduation requirements of the Chinese Medicinal Resources and Development

major, deeply exploring the logical relationships between knowledge points while incorporating market attributes, content closely related to market production and sales is prioritized. For example, the focus is placed on commonly used Chinese medicinal materials and precious/rare herbs that are frequently subject to counterfeiting and adulteration. This core content is then organically infused with ideological and political elements, disciplinary frontiers, practical cases, market trends, *etc.* Combining innovation with practicality, the approach moves from theory to application. This reshapes a "layered and progressive" content system, as shown in Fig. 2.

Three knowledge modules are formed: I. General Principles & Patterns; II. Chinese Medicinal Materials; III. Chinese Patent Medicines. Emphasis is placed on both the depth and breadth of content to broaden students' horizons, cultivate disciplinary thinking, establish the intrinsic connection and logic between Chinese medicine and commodities, and construct a mindset for Chinese medicinal commodity research and development. This addresses the problems of high course difficulty, limited class hours, weak systematic structure and logical coherence in teaching content, and insufficient contemporary relevance and innovation.

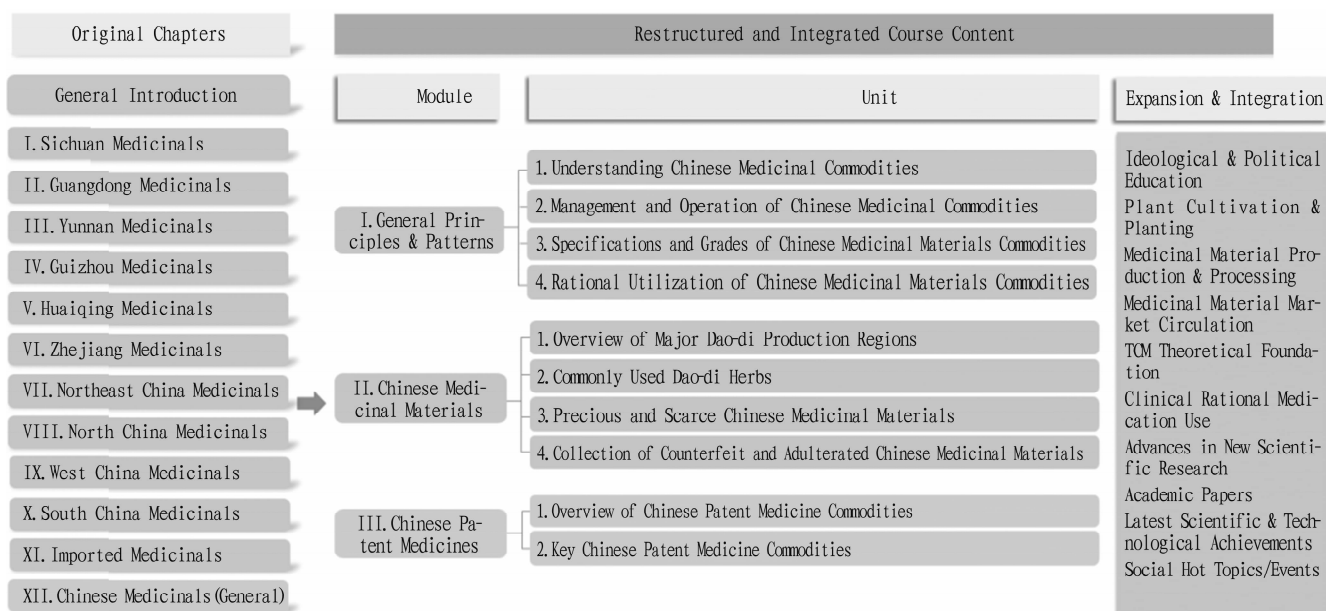


Fig. 2 Diagram of restructured and expanded course content system for Chinese Medicinal Materials Commodity Science

3.3 Innovating teaching methods Diverse activities such as self-directed learning and collaborative discussions are integrated to reshape "task-driven" teaching strategies. To comprehensively enhance students' higher-order thinking skills, the course established a three-step blended teaching model comprising: clarifying logic, establishing connections, and constructing perspectives. This involves: pre-class self-directed learning of foundational knowledge, in-class flipped classroom activities for internalization and enhancement, and post-class consolidation and sublimation. Tasks are used to actively engage students in teacher-student interaction, student-content interaction, and peer-to-peer interaction.

This addresses the problems of low learning engagement and investment, and the lack of higher-order thinking and deep learning. Simultaneously, the increased difficulty for teachers in lesson preparation and for students in learning requires significant effort to succeed, embodying the "high-level, innovative and challenging" standards of a "Golden Course".

3.4 Creating the teaching environment The online and offline resources are integrated to reshape a "co-constructed and shared" teaching environment. Online resources were built on platforms like Yunbanke (Cloud Class) and Zhihuishu (Wisdom Tree). Offline, a rich collection of specimen libraries, ideological

and political element repositories, video materials, *etc.*, was developed. On-campus and off-campus internship bases ensure students can conduct inquiry-based research. Reshaping this "co-constructed and shared" teaching environment allows student learning to extend from inside the classroom to extracurricular activities. A new teaching team was formed with backgrounds in Chinese Materia Medica and Marketing Science, addressing the problems of homogeneous faculty, insufficient motivation for continuous learning and tackling difficult points, and resource shortages.

3.5 Reforming teaching evaluation methods Learning evaluation is integrated with teaching activities to reshape a "multidimensional and comprehensive" evaluation system. By organically fusing learning evaluation with teaching activities, a "multidimensional and comprehensive" evaluation system was established.

This achieves an organic integration of continuous assessment throughout the learning process (accounting for 60%, including attendance, assignments, interactions, PBL tasks, stage exams, *etc.*) and final assessment (accounting for 40%). A higher-order assessment rubric was designed, as shown in Fig. 3, along with a specially designed higher-order additional evaluation form and group collaboration evaluation, facilitating students' achievement of higher-order goals. The purpose is to promote learning through evaluation and improve teaching through evaluation, thereby stimulating intrinsic learning motivation and comprehensively and effectively enhancing learning outcomes. This addresses issues such as simplistic course evaluation, difficulty in stimulating intrinsic learning motivation, and the disconnect between theory and practice.

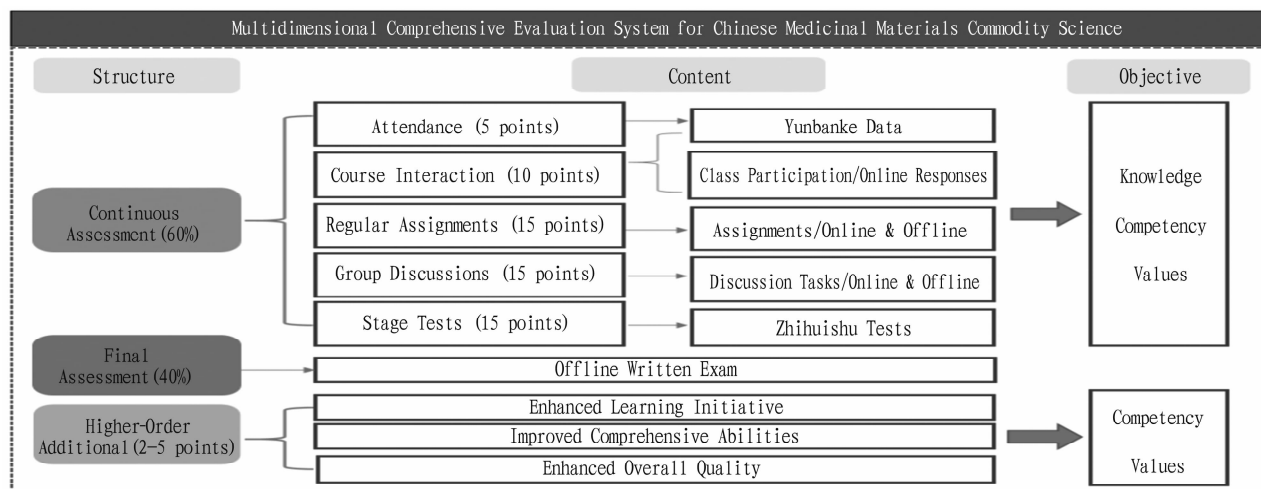


Fig. 3 Higher-order assessment scale

4 Application of blended teaching in the Chinese Medicinal Materials Commodity Science course

The online course for Chinese Medicinal Materials Commodity Science underwent a three-year pilot run on the Yunbanke APP. Through continuous improvement and updates, it now possesses all the necessary functions for online course teaching, with positive feedback from both teachers and students. Taking the undergraduate class of 2021 majoring in Chinese Medicinal Resources and Development at Guizhou Minzu University as an example, this section introduces the application of the blended online-offline teaching model for the Chinese Medicinal Materials Commodity Science course.

4.1 Teaching content Content on commonly used Guizhou geo-authentic herbs from the "Chinese Medicinal Materials" section of the course was selected for implementation. This involved scheduling: 4 credit hours of offline theoretical lectures, 2 credit hours of online self-study content, and 4 credit hours of post-class practical laboratory work on Guizhou medicinal commodity identification and specification/grade classification. Students from the 2021 Chinese Medicinal Resources and Development cohort were evenly divided into two groups of 24 students each. The experimental group received blended online-offline teaching for the Guizhou herbs section of Chinese Medicinal Materials Com-

modity Science. Key Guizhou commodities such as *Gastrodia elata* (Tianma), *Eucommia ulmoides* (Duzhong), and *Polygonatum spp.* (Huangjing) were taught using research-based methods focusing on identification characteristics and commodity specifications/grades. Online learning covered extended knowledge of key herbs and involved completing interactive discussions. Post-class laboratory sessions simulated a medicinal materials market for hands-on classification learning; non-key herbs were assigned for student self-directed learning. The control group only participated in the online classroom teaching content. Evaluation was conducted after the sessions, comprising student evaluation (via quizzes and exams) and student evaluation of the course (via questionnaires).

4.2 Survey questionnaire on blended teaching for Chinese Medicinal Materials Commodity Science To understand the application effectiveness of the blended Chinese Medicinal Materials Commodity Science course and satisfaction with the content of various sections of the online course, a questionnaire survey on the practical application of the online course was administered to the 2021 undergraduate students majoring in Chinese Medicinal Resources and Development.

(i) Questionnaire content: Satisfaction with the use of vari-

ous sections of the Chinese Medicinal Materials Commodity Science online course, offline face-to-face classes, course practical content, and evaluation of teaching effectiveness.

(ii) Questionnaire completion rate: A total of 48 questionnaires were distributed, 48 were returned, achieving a 100% return rate.

(iii) Result statistics: Overall satisfaction rate with the online course. Evaluation of the advantages of online course teaching: Through online course teaching, 78 students (87.6%) believed it could compensate for knowledge missed in class; 80 students (89.9%) felt the online course offered greater freedom and more abundant, vivid, and engaging resources; 24 students (27.0%) suggested adding an English version so that international friends interested in TCM could learn related knowledge of Chinese Medicinal Materials Commodity Science through the website; 81 students (91.0%) recommended developing a dedicated Chinese Medicinal Materials Commodity Science online course APP suitable for mobile phones or tablets, making it more convenient for students to learn during fragmented time periods.

4.3 Evaluation of AI-assisted teaching effectiveness for Chinese Medicinal Materials Commodity Science Introducing generative AI to assist in student evaluation (via quizzes and exams) yielded results showing that students in the experimental group exhibited greater learning enthusiasm, achieved better learning outcomes, and had higher answer accuracy rates compared to the control group. They also demonstrated greater familiarity with identifying Chinese medicinal materials and recognized more herbs. This demonstrates that with the support of the online course, students can review and consolidate after classroom learning, and promptly preview the content of the next session. Abundant exercises, vivid images, and engaging teaching videos are essential guarantees for students to master Chinese Medicinal Materials Commodity Science. Furthermore, Chinese Medicinal Materials Commodity Science itself is a highly practical course requiring students to master medicinal identification; classroom learning alone is insufficient and necessitates extensive images and videos for supplementary learning. Only then can students theoretically grasp the course. The online course's simulated field herb-gathering environment allows students to experience the natural habitat where medicinal herbs grow; the simulated TCM pharmacy enables students to perceive how prepared herbal pieces appear in the circulation environment, deepening their understanding of Chinese medicine; authentic vs. counterfeit identification helps students quickly recognize genuine products, laying a solid foundation for future careers in TCM-related fields; strong local characteristics are featured, such as the Zhuang medicine cabinet introducing Guangxi Zhuang medicine and related theoretical knowledge, enabling students to learn about local characteristic medical knowledge; the inclusion of ethnopharmacological knowledge enriches the extended knowledge base of Chinese Medicinal Materials Commodity Science.

5 Conclusions

The teaching innovation and reform of the Chinese Medicinal Materials Commodity Science course are grounded in authentic

classroom teaching problems, embodying the "student development-centered" philosophy, and propose solutions to address these issues. It consistently integrates the requirements of "New Medical Education" construction throughout teaching. The comprehensive and thorough analysis of all aspects of the teaching process—objectives, content, methods, activities, evaluation—effectively highlights the innovative aspects of teaching. The exploration led to the formation of an innovative teaching path characterized by "One Core, Three Integrations, Five Transformations": centering on "Fostering Virtue and Cultivating Talent", integrating "Knowledge, Competency, Values", and transforming five key areas—reshaping course objectives towards "high-level, innovative and challenging", restructuring content to be "layered and progressive", reforming strategies to be "task-driven", renewing resources to be "co-constructed and shared", and reconstructing evaluation to be "multidimensional and comprehensive". It fully reflects the characteristics of curriculum-based ideological and political education and adeptly addresses the learning preferences of students in the new era—their preference for learning via mobile phones, computers, or tablets—by fully utilizing mobile platforms. Advanced modern information technology (generative AI) is employed to conduct teaching activities; reasonable statistical scales are used for learning evaluation; and formative assessment throughout the entire process demonstrates high-level thinking and innovation. The purpose of this reflection and exploration on course teaching is to systematically design and practice Chinese Medicinal Materials Commodity Science teaching under the New Medical Education concept, while also providing ideas for teachers of Chinese Medicinal Resources and Development specialized courses undertaking teaching reform. Moreover, it effectively demonstrates that teaching via the "One Core, Three Integrations, Five Transformations" blended path enhances students' self-directed learning ability and interest in learning, thereby improving teaching effectiveness. In future teaching endeavors, Chinese Medicinal Materials Commodity Science requires continued exploration by colleagues to strengthen the integration of curriculum-based ideological and political education, deeply excavate teaching elements, continuously innovate teaching methods and means, enhance teaching efficacy, and cultivate new-era talents in Chinese medicinal commodities with profound TCM knowledge, noble character, and practical abilities.

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