Teaching Reform of Pharmacognosy Course

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Abstract Leveraging the rich TCM resources, the active ethnic medicine traditions of Southwest China, and the technological platforms of Chengdu University and Sichuan Industrial Institute of Antibiotics in TCM resource evaluation and natural medicine development, the course Pharmacognosy follows a reform approach of "student-centered, application-oriented, and feature-driven". Systematic innovations have been implemented in the course objectives, teaching modules, practical components, industry-academia collaboration, and ideological and political education. The course emphasizes the integrated application of authentic medicinal materials, regional herbal resources, and modern analytical techniques. By building an authentic medicinal materials case library, implementing modular teaching, and establishing intelligent teaching platforms and diversified assessment systems, the students' understanding and practical application of professional knowledge have been strengthened. Teaching practice shows that the reform significantly improves students' abilities in pharmacognostic identification, research innovation, and cultural confidence. The reformed classes demonstrate higher pass rates, excellence rates, and course satisfaction compared with the control groups, achieving favorable outcomes. This paper could provide an effective model for cultivating innovative TCM talents with regional focus and global vision.

Key words Pharmacognosy, Curriculum reform, Modular teaching, Industry-academia integration, Teaching evaluation, Ideological and political education

1 Introduction

With the modernization of traditional Chinese medicine (TCM), the development of the green pharmaceutical industry, and the comprehensive advancement of the national "Healthy China" strategy, TCM, as a key resource under China's independent intellectual property system, is undergoing increasingly standardized development and modern utilization[1-2]. Pharmacognosy is a discipline primarily focused on medicinal materials, studying their names, sources (origins), production (cultivation), harvesting and processing (collection, refinement, and preparation), identification (authenticity verification and quality evaluation), chemical constituents, resource development and utilization, and new drug development. It integrates knowledge from Chinese materia medica, pharmacology, botany, zoology, natural products chemistry, and pharmacology, enabling students to master the fundamental theories, knowledge, and basic skills of pharmacognosy, as well as the origins, identification, chemical composition, pharmacological effects, and efficacy of commonly used medicinal materials[3-4]. Pharmacognosy leverages the interdisciplinary strengths of pharmacy and TMC, cultivating high-level professionals professionals with a background in TCM, international perspective and interdisciplinary skills for careers in education, research, management, distribution, international exchange, and cultural dissemination in pharmacy and related fields[5-7]. Therefore, as a foundational and core course for pharmacy and pharmaceutical disciplines, Pharmacognosy plays a pivotal role in guiding students to understand the sources of medicinal materials, master the identification of medicinal plants, and become familiar with quality evaluation and modern technological applications of TMC. It serves as both an introductory gateway to the theoretical system of TCM and a critical pillar for fostering research and practical capabilities in pharmacy.

However, under the current higher education landscape, the teaching system of this course still faces numerous challenges. First, the teaching content tends to lag behind modern industrial demands, with traditional lectures primarily focusing on the identification of medicinal materials and the memorization of their medicinal parts, while failing to effectively integrate industry needs with cutting-edge practices such as modern TMC research and development, resource conservation, and quality control. Second, the teaching model is predominantly classroom-based, with relatively monotonous methods and weak interactivity, resulting in insufficient opportunities for students to engage in autonomous inquiry and project-driven learning experiences. Third, there are issues of "insufficient integration and superficial implementation" in ideological and political construction, which fail to systematically convey the value of TMC culture and promote confidence in Chinese pharmaceutical science, making it difficult to fulfill the educational mission of "fostering virtue through education" in the new era[8-13]. Currently, with the advancement of major national projects such as the Standard System for Authentic Medicinal Materials and the Chinese Medicinal Resources Census, universities, as important hubs for talent cultivation, must urgently update their curricula to transform Pharmacognosy from an "identification-focused" course into a competency-oriented course encompassing "application, evaluation, and research", thereby better serving the modernization needs of China's TMC industry[14-16]. Therefore, to meet the new requirements for cultivating high-quality TCM professionals and to capitalize on the advantages of authentic

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medicinal resources in Southwest China, the Pharmacognosy course team at Chengdu University, relying on the technological platform of the Sichuan Industrial Institute of Antibiotics and regional medicinal resource advantages, conducted a systematic teaching reform involving pharmacy students enrolled from 2023 to 2025. The reform focused on four dimensions: course goal restructuring, teaching content redesign, teaching method integration, and the strengthening of ideological and political education. This paper aims to systematically summarize the Pharmacognosy course reform from the perspectives of goal positioning, pathway design, teaching organization, effectiveness evaluation, and continuous optimization, thereby providing references for teaching reform in pharmacy-related courses, especially resource-oriented foundational professional courses.

2 Basic ideas for teaching reform

Pharmacognosy is a core course that combines theory, practice, and inheritance, widely serving undergraduate majors such as pharmacy, TMC, and biopharmaceuticals. It is an important teaching link for students to understand the sources of natural medicines, master the identification and quality control of medicinal materials, and establish an understanding of TMC. The course content involves multiple dimensions such as medicinal plant classification, medicinal herb origin, morphological and microscopic identification, chemical composition analysis, resource distribution, and harvesting processing, *etc.* It has the characteristics of strong interdisciplinarity, high professionalism, and intensive practical requirements. At the same time, as a bridge connecting the traditional pharmaceutical knowledge system with modern natural medicine research and development, the teaching quality of Pharmacognosy directly affects students' learning outcomes and research abilities in courses such as TMC pharmacology, natural medicine chemistry, and drug quality evaluation. As a key course for developing professional cognition and practical abilities, Pharmacognosy not only serves as a link between previous and subsequent courses in the curriculum system, but also as the first classroom to guide students to establish research interests, cultivate clinical and research literacy, and develop cultural confidence and professional identity. Its reform is directly related to the professional construction quality and optimization of talent cultivation pathways.

However, there are still shortcomings in the current curriculum teaching, such as single teaching methods, lack of exploratory experimental teaching, passive learning of students, single evaluation methods, and insufficient integration of ideological and political elements. In response to the above issues, the course team has established a "four-dimensional linkage" reform path based on the advantages of TMC resources in the Chengdu – Chongqing region and the TCM research platform of Sichuan Industrial Institute of Antibiotics, with "student-centeredness, systematic thinking, and industry-education integration" as the core. Firstly, in terms of teaching system, traditional identification techniques and modern scientific research methods are integrated through modular design to establish a systematic knowledge chain of "morphology-microscopy-physicochemistry-molecular biology". Secondly, in terms of teaching mode, project-based learning is adopted. Relying on the research platform of Sichuan Industrial Institute of Antibiotics and the authentic medicinal herb database, industrial issues are transformed into exploratory topics. Thirdly, in terms of evaluation mechanism, an intelligent multi-dimensional process evaluation system is established to achieve three-dimensional capability assessment of "theory-practice-innovation". Fourthly, in terms of education, ethnic medicine culture, research ethics, and professional teaching should be organically integrated to form a value-oriented framework across the entire chain of "drug identification-drug research-medication". Through the upgrading of teaching staff, the construction of digital resources, and the collaboration of industry, academia, and research, it aims to achieve a triple transformation from knowledge imparting to innovative ability cultivation, from single teaching to diversified education, and from classroom learning to industry service. This will guide students to form professional values of "respecting nature, respecting life, and serving the people", and achieve a teaching synergy of "knowledge education-ability cultivation-value guidance" (Fig. 1).

3 Basic points of teaching reform

3.1 Adhering to the student-centered development, and building a strong teaching staff to promote the integration of academic frontiers The practice of teaching reform has shown that in order to break through the limitations of traditional teaching models, it is necessary to deeply implement the educational philosophy of "student-centered development" and comprehensively reconstruct the teaching system. Through systematic curriculum reform, the course transforms students from passive recipients to active constructors, focusing on cultivating their self-learning ability, critical thinking, and innovative practical literacy. In specific implementation, classroom teaching has achieved a fundamental transformation from one-way indoctrination to multi-dimensional interaction: firstly, teachers have carefully designed diversified teaching activities such as case studies, experimental explorations, and group collaborations, significantly enhancing students' classroom participation and learning enthusiasm. Specifically, the teaching group has established a dynamic teaching feedback mechanism, which accurately grasps students' learning needs and difficulties through regular learning surveys, real-time classroom feedback, and personalized tutoring, and realizes timely optimization and adjustment of teaching strategies to effectively achieve individualized teaching.

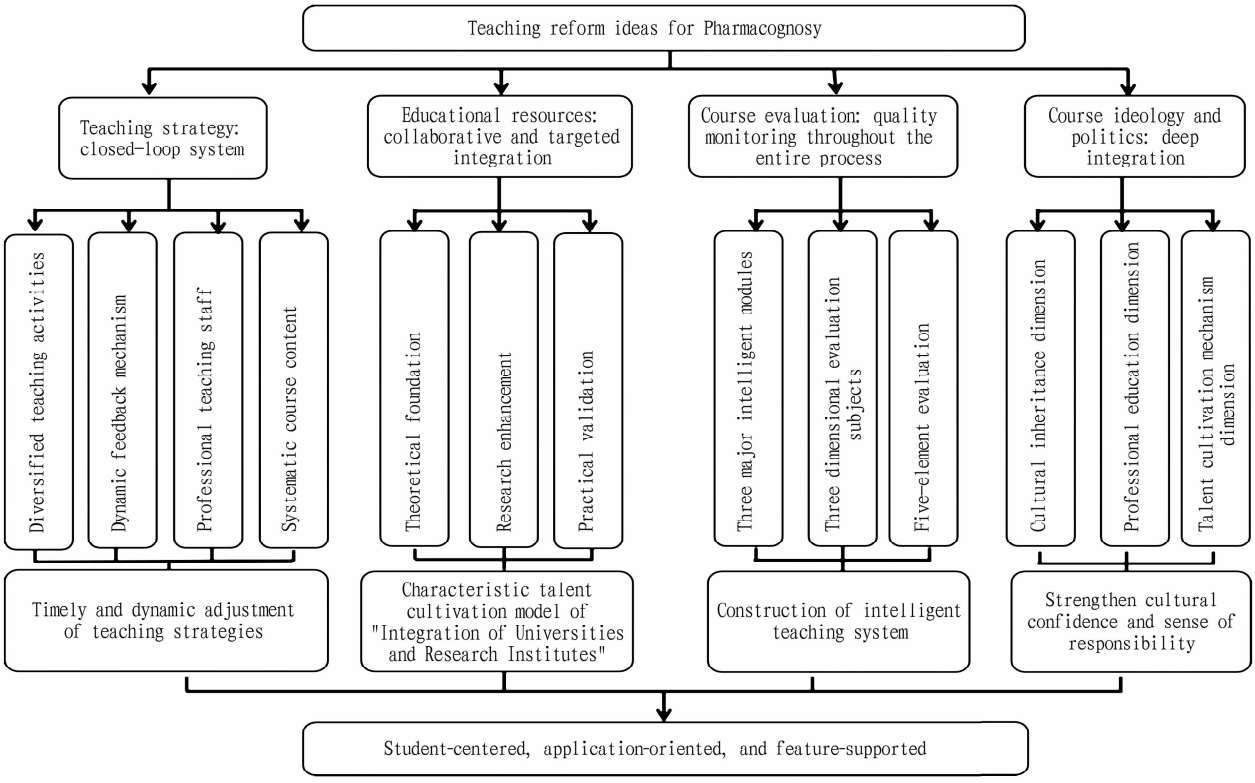


Fig. 1 Reform strategy of laboratory teaching of Pharmacognosy

In terms of faculty construction, relying on the scientific research advantages of Sichuan Industrial Institute of Antibiotics and the multidisciplinary resources of Chengdu University, it focuses on building a teaching team with excellent academic expertises, reasonable structure, and keeping pace with disciplinary frontiers. By introducing experts and scholars with outstanding research achievements in the field of TMC, it continues to strengthen the academic background and practical guidance ability of teaching staff. At the same time, a sound teacher development mechanism should be established: encourage subject teachers to participate in domestic and international academic exchanges, scientific research projects, and teaching ability training, ensuring that the latest developments in the subject are transformed into high-quality teaching resources. At the same time, the teaching and research group regularly conducts teaching seminars, demonstration observations, and information-based teaching training, forming a virtuous cycle of "mutual promotion between teaching and research". These measures have effectively ensured the high-quality development of the Pharmacognosy course and provided solid support for cultivating innovative pharmaceutical talents.

3.2 Systematic construction of the identification system for medicinal herbs and cultivation of systematic scientific thinking The identification of medicinal materials is the core content of pharmacognosy research, and the systematic construction of its system not only relates to the accuracy of quality control of medicinal materials, but also directly affects the scientific and practical abilities of pharmaceutical talent cultivation. Traditional teaching of medicinal herb identification often focuses on fragmented knowledge points, such as microscopic observation and physical and chemical property testing, but lacks a comprehensive understanding of the identification system, which makes it difficult for students to form systematic analytical thinking when facing complex medicinal herbs. To this end, based on the principles of "integrity, hierarchy, and logic", a complete medicinal identification system covering "origin identification-trait identification-microscopic identification- physicochemical identification-molecular identification-biological activity evaluation" has been constructed. In the stage of primitive identification, emphasis is placed on the correlation between plant taxonomy and medicinal origins, enabling students to master the progressive cognition from macroscopic morphology to microscopic structure. In the process of morphological and microscopic identification, combining digital microscopic imaging technology, the accuracy and repeatability of observation can be improved. At the level of physical, chemical, and molecular identification, modern analytical techniques such as HPLC and DNA barcoding are introduced to enhance students' comprehensive application ability of multidimensional identification methods. In the stage of biological activity evaluation, combined with pharmacological experiments, students should understand the inherent connection between identification results and clinical applications. Through the systematic training of this system, students can gradually establish a scientific thinking framework from macro to micro, from static observation to dynamic analysis, and ultimately achieve a comprehensive grasp and flexible application of herbal identification.

The cultivation of scientific thinking is one of the core objec-

tives of pharmaceutical identification teaching, and the formation of systematic thinking requires a logically rigorous training system and practice oriented teaching methods. Through the four-step progressive model of "theory-experiment-case-research", students are encouraged to transition from passive knowledge acquisition to active exploration. In the theoretical teaching stage, the "problem chain" guidance method is adopted, such as "how to identify easily confused medicinal materials?" and "how can different identification methods verify each other?", to stimulate students' logical reasoning ability. In the experimental stage, comprehensive experimental projects are designed, such as "developing a comprehensive identification plan for a certain medicinal herb", requiring students to integrate multi-level data such as microscopy, physics and chemistry, and molecules, and cultivate systematic analysis skills. In the case teaching section, the identification difficulties in the real medicinal herb market are introduced, such as the authenticity identification of Cordyceps and the origin tracing of Ginseng. Through group discussions and debates, students' critical thinking and problem-solving abilities are enhanced. During the scientific research training stage, students are encouraged to participate in teacher research projects or independently design innovative experiments, such as quality evaluation of medicinal materials based on metabolomics, microscopic feature recognition of Gastrodiae Rhizoma from different origins, *etc.*, to deepen their systematic thinking in real scientific research contexts. Through this training path, students can not only master the professional skills of crude drug identification, but also develop a scientific thinking mode of "observation-analysis-verification-innovation", laying a solid foundation for future drug research and development, quality control, or clinical pharmacy work.

3.3 Modular classroom design, ensuring systematic and diverse teaching processes In the traditional teaching mode, Pharmacognosy course often adopts a linear knowledge transmission method, with relatively independent content in each chapter, which makes it difficult for students to establish a systematic knowledge framework, and the learning process lacks flexibility. To solve this problem, a modular classroom design is adopted, dividing the course content into four core modules: "basic knowledge-technical methods-comprehensive application-innovative expansion". Each module is divided into several sub units, forming a clear and logically progressive teaching system. In the basic cognitive module, the focus is on teaching the core concepts, classification system, and resource distribution of pharmacognosy, and constructing a knowledge network through mind mapping. In the technical methods module, the microscopic identification, physical and chemical analysis, and molecular biology techniques are trained systemically, and specific experiments in pharmacognosy are combined to enhance operational standardization. In the comprehensive application module, practical cases such as authenticity identification of market circulating medicinal materials and evaluation of authentic medicinal materials are introduced to cultivate students' multidimensional analysis ability. In the innovation and expansion module, combined with cutting-edge disciplines, emerging technologies such as artificial intelligence-assisted identification and metabolomics quality control are explored to stimulate research interest. Each module is both relatively independent and interrelated, and teachers can flexibly adjust teaching priorities based on students' professional backgrounds to ensure the integrity and adaptability of the knowledge system. At the same time, a blended learning process of "online preview-classroom lectures-experimental reinforcement-post class expansion" is adopted to form a closed loop for each module of learning, truly achieving the integration of "learning-practice-application".

To ensure the effective implementation of modular teaching, a diversified classroom activity system has been constructed to stimulate students' learning initiative and creativity. In the theoretical classroom, an interactive mode of "case introduction-problem driven-group discussion-summary improvement" is adopted. For example, when explaining "identification of adulterated medicinal materials", real market cases are first presented, and then students are guided to design identification schemes from multiple perspectives such as morphology, microscopy, and physicochemical properties. Finally, group presentations and teacher comments are used to deepen understanding. In experimental teaching, the three-level training of "basic experiment-comprehensive experiment-innovative experiment" is promoted. Basic experiments ensure standardized skills, comprehensive experiments (such as "comprehensive quality evaluation of a certain medicinal herb") strengthen technical integration ability, and innovative experiments (such as "plant traceability and relationship identification based on DNA barcode") encourage independent exploration. In addition, with the help of digital teaching platforms, students are encouraged to make good use of resources such as micro course videos and 3D herbal models from different universities across the country to support personalized learning. In terms of assessment methods, a "process evaluation + modular assessment" mechanism is adopted to ensure that learning outcomes are quantifiable and effectively fed back. Through modular classroom design, not only has the systematicity and coherence of teaching content been optimized, but also the participation and practical ability of students have been enhanced through diversified teaching forms, providing an effective path for cultivating pharmaceutical talents with innovative thinking and application abilities.

3.4 Creating a collaborative education mechanism of "curriculum-research-industry", and integrating educational resources To meet the demand for pharmaceutical talent cultivation in the new era, the course team has broken through the barriers of traditional education models and innovatively constructed a three-dimensional collaborative education system of "curriculum-research-industry", achieving the optimal integration of educational resources. This mechanism takes course teaching as the foundation carrier, scientific research training as the engine for ability enhancement, and is guided by industry demand, forming a complete training chain of "theoretical foundation-scientific research

strengthening-practical testing". At the course level, it has restructured the teaching content and integrated practical industry cases (such as GAP cultivation of TMC and formulation of drug quality standards) into theoretical teaching. At the scientific research level, relying on the provincial and ministerial key laboratories of Chengdu University (such as the Sichuan Provincial Key Laboratory for the Development of Medicinal and Edible Plant Resources, the Sichuan Provincial Key Laboratory for Antibiotic Research and Re-evaluation, and the Sichuan Provincial Research Center for Anti-infective Drug Creation Engineering), it implements the "undergraduate mentorship system" and encourages students to participate in teacher's basic and applied research projects in the early stage, such as the research on the mechanism of authentic medicinal material quality formation. In terms of industrial collaboration, it has jointly established practical bases with more than 10 well-known pharmaceutical companies, and held characteristic activities such as "enterprise mentors in the classroom" and "on-site teaching of pharmaceutical production" to ensure seamless integration between talent cultivation and industry needs.

The implementation effectiveness of this collaborative mechanism is significantly reflected in three aspects: firstly, students' engineering practice ability has been significantly improved. In recent years, a pharmacy course ideological and political case library has been established, and students have won nearly a hundred awards in provincial and above subject competitions. Secondly, the efficiency of transforming scientific research achievements has been improved. By establishing open experimental projects, innovative training programs, *etc.*, students are encouraged to participate in teacher research projects early to enhance their scientific research literacy. Finally, the quality of employment continues to improve, and graduates' competence in key positions such as research and development, quality inspection, and registration has been highly praised by employers. The "integration of universities and research institutes" education model has been pioneered in China, with research institutes serving as innovation drivers. This model forms distinctive advantages in "industry-chain-oriented education", featuring laboratory research and technological innovation centered on research institutes and pilot-scale incubation and industrial application driven by research platforms.

3.5 Promoting the construction of an intelligent teaching system, and establishing a diversified curriculum evaluation mechanism to assist in the quality monitoring of the entire process In the context of digital transformation, with the core concept of "intelligent technology empowering educational innovation", an intelligent teaching system covering the entire process of "pre-class intelligent preview, in class intelligent teaching, and post-class precise improvement" is systematically constructed. This system relies on Chaoxing intelligent teaching platform of Chengdu University and integrates three intelligent teaching modules. In the pre class preview section, an intelligent preview guidance system has been developed. Based on learning analysis technology, the personalized preview content packages are pushed to each student, including micro lesson videos, 3D herbal models, preview tests, and other resources. In the in class smart teaching section, the smart classroom system monitors classroom participation in real-time through technologies such as facial recognition and behavior analysis, and automatically generates learning reports based on learning analysis. During the post class improvement stage, the learning assistant could intelligently push consolidation exercises and expanding resources based on classroom performance, forming a complete learning loop. In the process of teaching implementation, a "data-driven" teaching decision-making mechanism has been established: by collecting multidimensional data such as learning behavior, assessment scores, and classroom performance, a digital student profile has been established to provide support for personalized learning path planning.

To ensure continuous improvement of teaching quality, a "three-dimensional and five-element" course evaluation mechanism has been innovatively established. "Three dimensions" refer to the dimensions of evaluation subjects (student self-evaluation, teacher evaluation, and supervision suggestions). Through comprehensive evaluation of multiple subjects, it ensures the comprehensiveness and objectivity of teaching quality monitoring. Student self-evaluation adopts an intelligent questionnaire system to conduct reflective evaluations of learning outcomes on a weekly basis. Teacher evaluation relies on a smart teaching platform to record and analyze real-time data on each student's classroom performance, homework completion quality, and other aspects. The supervision suggestion is provided by the teaching supervision team through regular class observation, teaching document inspection, and other methods. The "five evaluation elements" include: (i) online learning behavior analysis, tracking student preview time, resource click through rate, online test scores, and other data through an intelligent teaching platform; (ii) classroom interaction quality assessment, using the smart classroom system to record indicators such as student questioning frequency, group discussion participation, and in class test performance; (iii) assessment of experimental operation skills, adopting a dual evaluation of virtual simulation experiment platform and physical experiment scoring system; (iv) intermediate evaluation effect, conducting periodic learning effectiveness assessment through unit testing, case analysis reports, and other forms; (v) after class learning behavior tracking, monitoring the review material retrieval status, participation in online Q&A, and other post class consolidation behaviors (Table 1). This mechanism realizes the collection of data throughout the entire process, forms a complete learning trajectory record from before to after class, automatically generates personalized learning diagnosis reports, and establishes a closed-loop feedback system. The evaluation results are pushed to both teachers and students in real time to guide teachers to adjust teaching strategies and help students improve their learning methods.

Table 1 Grades component of experiment course assessment %

Class	Composition of grades					
	Attendance	Homework status	Online learning	Classroom performance	Experimental practice	Exam results
Reform	10	10	10	10	10	50
Control	30	10	–	–	–	60

3.6 Deeply integrating ideological and political education into the curriculum, and strengthening cultural confidence and sense of responsibility in ethnic medicine In the construction of Pharmacognosy course, a series of innovative ideological and political measures have been implemented, deeply integrating the inheritance of ethnic medicine culture with professional education. By establishing the feature module of "authentic medicinal materials and cultural inheritance", the cultural connotations and modern values of more than 20 characteristic medicinal materials such as Fritillariae Cirrhosae Bulbus, Cordyceps, and Rhodiolae Crenulatae Radix Et Rhizoma are systematically integrated. In the teaching of Fritillariae Cirrhosae Bulbus, by comparing the endangered status of wild resources with breakthroughs in artificial cultivation techniques, students are guided to think about the dialectical relationship between resource conservation and sustainable utilization. In the special topic of Cordyceps, it aims to cultivate students' innovative consciousness by combining its development from traditional tonics to modern anti-tumor drugs. At the same time, a diversified collaborative education mechanism has been established, consisting of "professional teachers lecturing, ideological and political teachers guiding, and industry experts participating", and 20 typical cases of ideological and political education in courses have been jointly developed. Ideological and political elements are innovatively integrated into experimental teaching. For example, in the experiment of "establishment of fingerprint profile", the quality control of antibiotics developed by Sichuan Industrial Institute of Antibiotics is taken as the study case. It emphasizes a rigorous and practical scientific attitude, and adopts a mixed teaching approach of "situational experience and project-based learning". Using virtual simulation technology, it restores the preparation process of Tibetan medicine, which enhances students' cultural experience. The innovative practice of curriculum ideological and political construction has formed a systematic education system. These measures have broken through the preaching mode of traditional ideological and political education, achieved a natural integration of professional knowledge and value guidance, and formed a full-process and multi-dimensional ideological and political education system. This integrated teaching model not only enhances students' professional competence, but also cultivates their cultural confidence and sense of responsibility, providing talent support for the inheritance and development of ethnic medicine culture.

4 Effects of teaching reform

As a core course in pharmacy, the teaching quality of Pharmacognosy directly affects students' understanding and mastery of subsequent courses such as TMC and Drug Analysis, and is also a key link in cultivating practical abilities and innovative thinking of pharmacy talents. In response to the problems of fragmented knowledge systems, single teaching methods, and insufficient student participation in traditional teaching, comprehensive reforms have been carried out through systematic restructuring of teaching content, innovative teaching methods, and improvement of evaluation systems. Since the implementation of the reform, pharmaceutical students in Chengdu University have achieved significant improvements in their ability to identify medicinal herbs, scientific research literacy, cultural confidence, and other aspects (Table 2). The excellent rate, passing rate, and course satisfaction have all greatly improved, and students' sense of identification with ethnic medicine culture has significantly increased. Practice has shown that a teaching model centered on student development and emphasizing the deep integration of theory and practice is an effective way to improve the quality of curriculum teaching and cultivate high-quality pharmaceutical talents.

Table 2 Teaching reform effects of Pharmacognosy %

Class	Passing rate	Excellent rate	Course satisfaction
Pharmacy 23 – 1 (reform)	90.91	36.36	93.94
Pharmacy 23 – 2 (control)	78.79	24.24	75.76
Pharmacy 24 – 1 (reform)	91.43	37.14	91.43
Pharmacy 24 – 2 (control)	77.14	22.86	71.43
Pharmacy 25 – 1 (reform)	92.11	39.47	92.11
Pharmacy 25 – 2 (control)	76.32	23.68	73.68

References

[1] WU WY, ZHAN SF, JIAO X, *et al*. Current status and development trends of machine learning research in the field of traditional Chinese medicine[J/OL]. Chinese Archives of Traditional Chinese Medicine, 1 – 16[2025 – 09 – 02]. https://link.cnki.net/urlid/21.1546.R.20250730.1634.002. (in Chinese).

[2] FU LJ, WU JY, LIU W, *et al*. Three-dimensional quantitative study of traditional Chinese medicine policies from the perspective of Healthy China[J]. Soft Science of Health, 2025, 39(8): 1 – 7, 12. (in Chinese).

[3] WU M, LI HZ, MA XH, *et al*. Research on the aesthetic education path of ideological and political construction in pharmacognosy curriculum[J]. Journal of Traditional Chinese Medicine Management, 2025, 33(7): 9 – 11. (in Chinese).

[4] DENG J, PEI SQ, DU HZ, *et al*. Exploration on the content and form of pharmacognosy experiment teaching for pharmacy specialty[J]. Chinese Medicine Modern Distance Education of China, 2025, 23(6): 22 – 25. (in Chinese).

[5] XING YP, MEN WX, XU L, *et al*. Reform and exploration of experimental teaching of Molecular Pharmacognosy course for Chinese herbal medicine cultivation and identification major: Guided by disciplinary development[J]. Learning Weekly, 2025 (23): 1 – 3. (in Chinese).

[6] DU YT, TANG J, HU CG, *et al.* Study on the identification of medicinal herbs of Banfenghe[J]. Jiangxi Chemical Industry, 2025, 41(2): 70 – 75. (in Chinese).
[7] TIAN H, HUANG Y, HUANG D, *et al.* Diversified teaching reforms and practices in graduate-level molecular pharmacognosy [J]. Journal of Guangxi University of Chinese Medicine, 2025, 28(2): 82 – 84. (in Chinese).
[8] TANG WZ, JIA XH, LU ZY, *et al.* Practice of ideological and political construction in the course of Pharmacognosy with the integration of knowledge and action and dual education of morality and intelligence[J]. Journal of Pharmaceutical Research, 2025, 44(5): 517 – 520. (in Chinese).
[9] MI RENSHA Y, YIMING G, CONG YY, *et al.* Teaching Reform of Medicinal Botany and Pharmacognosy Courses: Taking the School of Pharmacy of Xinjiang Medical University as an example[J]. The Theory and Practice of Innovation and Entrepreneurship, 2025, 8(5): 51 – 54. (in Chinese).
[10] WU XH. Teaching practice of the pharmacognosy course under the "Tri-Integration" concept [J]. Education and Teaching Forum, 2025(6): 157 – 160. (in Chinese).
[11] WU Y, LIU DD, FU Q, *et al.* Teaching reform and practice of Pharmacognosy course in applied technology universities[J]. The Guide of Science & Education, 2025(4): 39 – 41. (in Chinese).
[12] LU Q. Refining and teaching of ideological and political education cases in pharmacognosy[J]. Chinese Medicine Modern Distance Education of China, 2025, 23(2): 24 – 26. (in Chinese).
[13] WU ZQ, SHEN Y, ZHANG LB, *et al.* The practice of local cases of curriculum-based ideological and political education in pharmacognosy teaching[J]. Pharmaceutical Education, 2024, 40(6): 53 – 57. (in Chinese).
[14] ZHANG MY, YIN C, YOU QY, *et al.* Exploration on integrating BOPPPS into the experimental teaching design of Medicinal Botany under the background of the fourth national survey of traditional Chinese medicine resources[J]. Pharmacy and Clinics of Chinese Materia Medica, 2025, 16(4): 64 – 67. (in Chinese).
[15] KE F, LI XH, XIE YY, *et al.* Biodiversity analysis of Chinese medicinal resources in Guangxi based on the Fourth National Survey of Chinese Materia Medica Resources [J/OL]. China Journal of Chinese Materia Medica, 1 – 11 [2025 – 09 – 02]. https://doi.org/10.19540/j.cnki.cjcmm.20250630.101. (in Chinese).
[16] CHEN FZ, WANG ZC, YANG YX, *et al.* Current situation and countermeasures of genuine traditional Chinese medicine industry standardization in Hubei province[A]. Proceedings of the 18th China Standardization Forum[C]. China Association for Standardization, 2021: 8. (in Chinese).

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It is noteworthy that renal dysfunction accounted for a high proportion of 33.17% in this group of patients, making it the most common organ complication, significantly higher than interstitial lung disease (17.75%) and osteoporosis (12.5%). This is closely related to long-term hyperuricemia, prolonged disease duration, and comorbidities such as hypertension and other metabolic diseases[8]. Therefore, routine monitoring of renal function and early intervention should be implemented in clinical practice. In addition, the rate of co-infection is 23.73%, primarily involving pulmonary infections (38.78%). Patients with gout have increased susceptibility to infections due to immune dysfunction[9], and attention should be paid to infection screening and differentiation during hospitalization. The detection rate of interstitial lung disease (17.75%) deserves attention, and high-resolution CT examination is recommended for patients with respiratory symptoms. Gout has been confirmed as an independent risk factor for osteoporosis, which may be related to chronic inflammation and long-term medication use[10]. Bone density testing should be performed in a timely manner.

In summary, gout often affects the kidneys, cardiovascular system, and metabolism, and forms complex pathological interconnections with underlying diseases such as hypertension, cerebral infarction, and diabetes. Clinical diagnosis and treatment urgently need to shift from "single acid-lowering" to "precision-optimized treatment based on organ involvement", adjusting medication according to the functional status of the specific damaged organs, strengthening the whole-cycle management of chronic diseases, and ultimately improving patient prognosis and reducing the risk of disability.

References

[1] CHINESE MEDICAL ASSOCIATION. Guideline for rational medication of gout[J]. Chinese Journal of General Practitioners, 2021, 20(6): 631 – 638. (in Chinese).
[2] YANG YZ, JIANG W. Traditional Chinese medicine syndrome characteristics of 356 patients with gouty arthritis[J]. Guangming Journal of Chinese Medicine, 2023, 38(15): 2920 – 2923. (in Chinese).
[3] LI DF, LIU W. Research progress on the relationship between traditional Chinese medicine syndrome types and related factors of gout[J]. Inner Mongolia Journal of Traditional Chinese Medicine, 2019, 38(8): 161 – 163. (in Chinese).
[4] TAUSCHE AK. Gout[J]. Zeitschrift für Rheumatologie, 2022, 81(5): 400 – 412.
[5] LIU D, YI DY, ZHOU DJ. DECT and complication characteristics of gout patients with different disease courses[J]. Journal of Xiangnan University (Medical Sciences), 2022, 24(2): 32 – 36. (in Chinese).
[6] ZHENG L, ZHU Y, MA Y, *et al.* Relationship between hyperuricemia and the risk of cardiovascular events and chronic kidney disease in both the general population and hypertensive patients: A systematic review and meta-analysis [J]. International Journal of Cardiology, 2024, 399: 131779.
[7] LI SW, ZHU Y, LU XL. Correlation analysis between hypertension, abnormal blood glucose and lipid metabolism and the site and frequency of gout attack[J]. Journal of New Medicine, 2024, 55(2): 127 – 131. (in Chinese).
[8] ROBINSON PC, KEMPE S, TEBBUTT I, *et al.* Epidemiology of inpatient gout in Australia and New Zealand: Temporal trends, comorbidities and gout flare site [J]. International Journal of Rheumatic Diseases, 2017, 20(6): 779 – 784.
[9] NIE PY, LI Q, GU BJ, *et al.* Risk factors for renal insufficiency in 264 patients with gout[J]. Labeled Immunoassays and Clinical Medicine, 2025, 32(1): 43 – 51. (in Chinese).
[10] KIM JH, KIM SR, KANG G, *et al.* Gout as a risk factor for osteoporosis: A Korean population-based study [J]. Medicine (Baltimore), 2022, 101(45): e31524.