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Construction of a Modular Teaching System and Diversified Assessment Reform for the Fundamentals of Medicine and Pharmacy Course

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Abstract: *Fundamentals of Medicine and Pharmacy is a multidisciplinary foundational course for students majoring in pharmaceutical engineering and biopharmacy majors that integrates human anatomy, physiology, pathology, and pharmacology. After the integration, the course faced challenges such as a bulky knowledge system, compressed class hours, weak self-directed learning, and an assessment dominated by a single final examination. Guided by curriculum-based ideological and political education, this study rebuilt the teaching content into four modules organized around the thread of "organ system-disease-drug", combined several teaching methods under a BOPPPS classroom structure, and converted faculty research on how active ingredients of traditional Chinese medicine regulate intestinal mucosal immunity via gut microbiota into a demonstration case for the classroom. A diversified assessment system combining formative and summative evaluation was established, with value-oriented performance included as an assessment dimension. Recent practice has shown that students develop clearer knowledge frameworks, demonstrate stronger classroom engagement, and that a virtuous cycle between teaching and research has emerged. The reform offers a practical path toward integrating knowledge transmission, competence cultivation, and value shaping in pharmaceutical engineering education.*

Keywords: *fundamentals of medicine and pharmacy, modular teaching, ideological and political education, boppps, diversified assessment*

1. Introduction

Fundamentals of Medicine and Pharmacy is a foundational course for majors such as pharmaceutical engineering and biopharmacy. It integrates human anatomy, physiology, pharmacology, pathology, pathogenic microbiology and immunology, and an introduction to clinical medicine, which were previously taught as separate subjects. This integration is intended to alleviate timetable congestion and the heavy student workload caused by running these subjects separately. Reorganizing basic medical sciences around body systems rather than isolated disciplines has become a visible direction of curriculum reform. Organ-system integration has been implemented in Chinese eight-year medical programs with encouraging feedback from both students and teachers[1], and a recent scoping review concludes that such curricula foster a connected understanding of the structure-function-disease triad, although incomplete integration is still often reported[2].

Integration itself, however, creates new problems. First, the course covers a wide range of knowledge with limited class hours, and students often find the content abstract and hard to stay interested in it. Second, the merged disciplines are loosely linked in logic, so knowledge stays fragmented. Third, assessment still leans on a final written examination, which can hardly capture learning processes or comprehensive competence[3]. Finally, the Ministry of Education requires that ideological and political education run through the whole talent cultivation system, with all courses moving in step with ideological and political theory courses[4]. Pharmacy programs have started to meet this requirement; a pharmaceutical ideological and political education system oriented to public health security, for example, was reported to raise both teaching quality and cultivation outcomes[5]. How to blend value guidance into knowledge transmission as naturally as salt dissolving in water has become a question that this curriculum reform must answer.

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In response, this study takes ideological and political education as the leading principle and constructs a reform pathway for the course from four dimensions: modular reconstruction of teaching content, optimized combination of teaching modes, research cases feeding back into teaching, and diversified assessment design. The overall framework is shown in Figure 1.

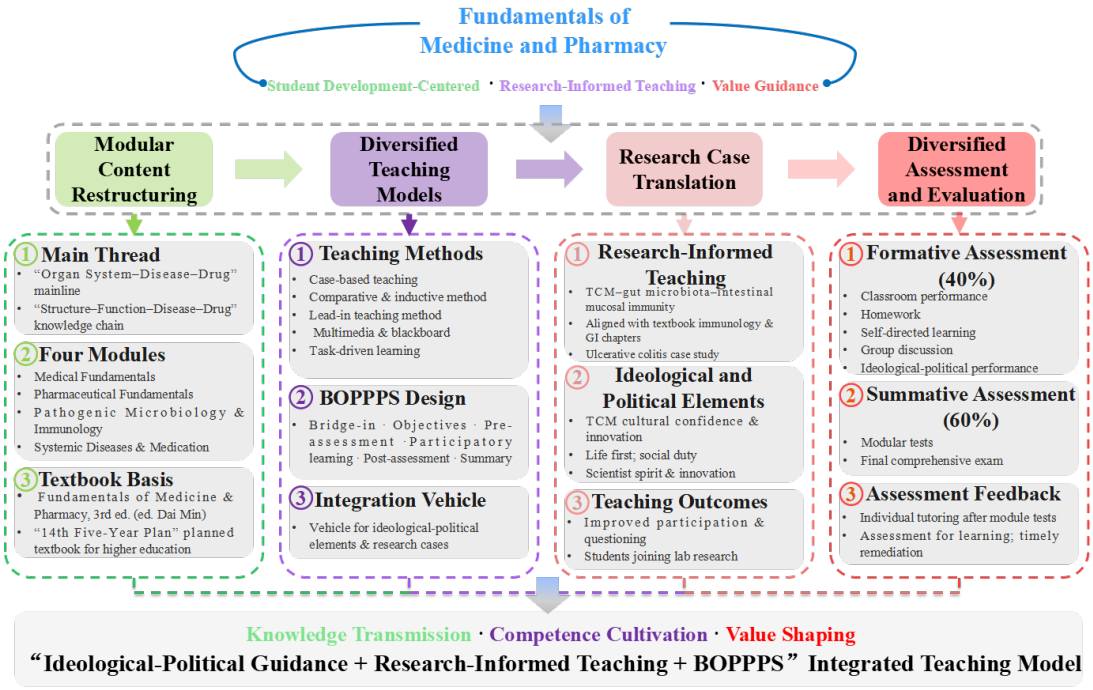


Figure 1. Overall framework of the teaching reform of the Fundamentals of Medicine and Pharmacy course

2. Modular reconstruction of the teaching content system

2.1 Module design

Following the principle of keeping content essential, sufficient and practical, and taking organ system, disease and drug as the main line, the course breaks down traditional disciplinary boundaries and is reorganized into four modules that form a complete knowledge chain of structure, function, disease and drug, based on the third edition of the textbook[6]. The basic medicine module covers the structure and function of cells, basic human tissues, and the principal pathological changes and processes; the locomotor system is included here, with emphasis on the bones of the trunk and important bony landmarks, so that students first establish basic medical concepts regarding normal human structure and function. The pharmacy fundamentals module covers the sources and classification of drugs, pharmacodynamics, pharmacokinetics, drug interactions and the process of new drug development, so that students grasp how drugs act and develop awareness of drug quality and safety. The pathogenic microorganisms and immunity module introduces bacteria, viruses and other pathogens together with basic immunological concepts and principles; content less relevant to pharmaceutical engineering is compressed, while aspects closely related to drug development and production are highlighted. The systemic diseases and medication module follows the main body systems, covering anatomical and physiological features, etiology and pathology of common diseases, clinical manifestations and medication selection, organized according to the principle of 'anatomy and physiology first, pharmacology second,' with pharmacology as the ultimate goal.

2.2 Implementation pathway

In teaching, students are trained to summarize knowledge along the logic of anatomy and physiology, pathology, and pharmacology. When the urinary system is taught, for instance, the structure of the kidney and the formation of urine are introduced first, and diuretics are then explained around each step of urine formation, including the site of action, mechanism and adverse reactions, so that anatomical, physiological and pharmacological knowledge interpenetrate and logical thinking is

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developed. In addition, ideological and political elements are woven into every module: the basic medicine module carries reverence for life and rigorous scholarship; the pharmacy fundamentals module strengthens drug quality and safety awareness together with professional ethics; the pathogenic microorganisms and immunity module draws on the epidemic prevention practice of China to cultivate patriotism and scientific responsibility; and the systemic diseases and medication module uses research cases such as traditional Chinese medicine and gut immunity to show the advantages of integrating Chinese and Western medicine, which enhances cultural confidence and innovation awareness and unifies knowledge transmission with value guidance.

3. Optimized combination of diversified teaching modes

To address monotonous lecturing and low student participation, the course team combined several methods into a student-centered mixed strategy. Case teaching creates suspense with selected cases; when adverse drug reactions are covered, the thalidomide incident is introduced and students are asked to judge whether the drug use was rational, which trains them to find, analyze and solve problems. Comparative induction asks students to compare and summarize; before teaching analgesics and antipyretic-anti-inflammatory drugs, the question of how their analgesic actions differ is raised so that students listen, compare and conclude with a purpose. Lead-in teaching designs the opening of a class carefully; a display of the harm of drug abuse together with the statement that a drug used properly is medicine, whereas a drug misused becomes poison leads naturally into narcotics represented by morphine. Multimedia shows dynamic processes and microstructures while blackboard writing presents the knowledge framework and logical main line, and the two complement each other. Task-driven learning sets self-study projects in which groups of four search literature, make slides and give a presentation and defend it, developing teamwork, expression and autonomous learning skills.

On this basis the classroom is organized around the BOPPPS structure of bridge-in, objectives, pre-assessment, participatory learning, post-assessment and summary, which provides a workable framework for systematically integrating ideological and political elements and research cases. A meta-analysis of 44 studies showed that blended BOPPPS teaching outperformed lecture-based learning in overall competence, mastery of theory and practical skills[7]. Its combination with case-based learning has also proven effective in nursing residency training[8] and in laboratory courses[9], and hybrid designs supported by platforms such as Rain Classroom extend this approach beyond the classroom[10].

4. Systematic integration of ideological and political education

4.1 Objectives and overall design

The pharmaceutical field directly affects people's lives and health, and the particular nature of drugs requires practitioners with high professional ethics.Guided by the fundamental task of fostering virtue through education and by the characteristics of the course, a progressive set of objectives is established around empathy, consensus, and resonance: medical stories and doctor–patient scenarios arouse emotional resonance; drug safety and industry regulations build professional consensus; and the achievements of the pharmaceutical industry, together with the spirit of scientists, inspire a sense of mission in students. An educational system centered on shaping the spirit of medicine thereby integrates knowledge acquisition, competence development, and value formation.

4.2 Identification and Integration Pathways of ideological and political elements

Based on the key concepts of each chapter, a resource bank has been established that maps knowledge points, ideological and political elements, and integration approaches (Table 1). Appropriate entry points and methods are designed for each chapter so that value guidance is integrated into teaching subtly but effectively.

Table 1. Main ideological and political integration points designed for the Fundamentals of Medicine and Pharmacy course

Knowledge point	ideological and political element	Integration approach
Innovative drug research and development	National confidence; professional pride	Reviewing the achievements of China in innovative drug development; guiding

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		students in career planning
Anti-infective drugs	Life first; patriotism	Combining the epidemic prevention and control practice of China; organizing classroom discussion
Artemisinin as antimalarial	Scientist spirit; cultural confidence	Introducing the research journey of the team of Tu Youyou; promoting the original thinking of traditional Chinese medicine
Narcotic analgesics	Rule-of-law awareness; anti-drug education	Teaching with the Drug Administration Law and addiction cases; carrying out warning-based instruction
Adverse drug reactions	Integrity in drug making; responsibility	Analyzing the thalidomide case; reflecting on the bottom line of drug safety
Vaccine development and application	People's health; institutional confidence	Presenting the vaccine achievements of China; holding comparative discussion of institutions
Rational use of antibiotics	Social responsibility; scientific spirit	Discussing the antimicrobial resistance crisis and rational drug use for public health

4.3 Evaluation of ideological and political outcomes

Ideological and political education is embedded in the setting of learning objectives, classroom discussion, and after-class assignments.In group discussions, students make slides and mind maps and present them in class, and the teacher comments on professional content as well as on humanistic concern, moral norms, and scientific spirit.A rubric for the ideological and political effects of the course formatively records students' value orientation, making ideological and political education observable, evaluable, and open to improvement. Case-driven reform in natural medicinal chemistry[11] and curriculum-level exploration in clinical pharmacology[12] provide useful reference for this practice.

5. Research feeding back into teaching: a BOPPPS classroom design based on the case of traditional Chinese medicine and gut immunity

5.1 Rationale for case selection

The immune system defends the body against pathogens, while the digestive system, in addition to digesting and absorbing nutrients, hosts the largest mucosal immune tissue in the human body. The gut microbiota plays a key role in regulating intestinal mucosal immunity, and the incidence of inflammatory bowel diseases such as ulcerative colitis continues to rise.Research-integrated teaching has been shown to deepen students' understanding of a topic and to develop their communication skills, and it has been argued that research should be systematically integrated across all levels of biomedical programs[13]. Consistent with this, the present case integrates the course team's research on how active ingredients of traditional Chinese medicine prevent and treat ulcerative colitis by regulating intestinal mucosal immunity through the gut microbiota into teaching content for the chapter on microbiological and immunological fundamentals and medication, and the chapter on the digestive system. Recent reviews confirm that compounds, single herbs, and active ingredients of traditional Chinese medicine exert therapeutic effects on ulcerative colitis by regulating the gut microbiota, the intestinal barrier, and immune function [14], as well as through microbiota-related signaling pathways and cytokines[15].

The value of this case can be seen at three levels. At the knowledge level, it connects microbiology, immunology, and pharmacology and introduces a research frontier involving interdisciplinary integration. At the competence level, it cultivates scientific thinking from observed phenomena to underlying mechanisms and develops data analysis and logical reasoning skills. At the value level, it embodies integrity-based innovation and cultural confidence in traditional Chinese medicine, helping students appreciate its modern scientific significance. In this way, research feedback into teaching and subtle value guidance are achieved simultaneously.

5.2 BOPPPS instructional design

The class session is structured around the six BOPPPS components—bridge-in, objectives, pre-assessment, participatory learning, post-assessment, and summary-as shown in Table 2.

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Table 2. BOPPPS instructional design of the research case on traditional Chinese medicine and gut immunity

Session	Instructional activities
Bridge-in	Play a short video on gut microbiota and ask why intestinal inflammation is clearly relieved in some patients after herbal intervention, so as to trigger cognitive conflict and activate prior knowledge.
Learning objectives	Knowledge: master the basic composition of mucosal immunity, the pathological features of ulcerative colitis and commonly used drugs. Competence: analyze drug targets along the line of microbiota, immunity and inflammation. Values: appreciate integrity-based innovation and cultural confidence of traditional Chinese medicine.
Pre-assessment	Publish online polls and questions such as whether the gut is only responsible for digestion and absorption and which herbs regulating the gut students know, so as to check the preview effect with random answering.
Participatory learning	Present the model mouse data of the course team, including disease activity index, colon length, inflammatory cytokines and microbiota composition; organize group discussion on through which pathways the active ingredients might influence intestinal mucosal immunity; the teacher comments and concludes the chain of gut microbiota, mucosal barrier and immune regulation.
Post-assessment	Publish a case analysis task, in which students predict the possible influence of a given herbal active ingredient on intestinal mucosal immunity and design a verification approach, plus an online quiz to examine knowledge mastery and transfer.
Summary	Students draw a mind map of traditional Chinese medicine, gut microbiota and intestinal mucosal immunity; the teacher comments and assigns an extension task of reviewing the immune regulation research of one food-medicine homology herb and writing a mini report.

5.3 Teaching outcomes and extension

Placing abstract immunological concepts in a real research context markedly increased classroom participation and improved the quality of students' questions, and students' understanding of immune regulation deepened. Some students joined the research team and entered the laboratory after this class, forming a virtuous cycle among teaching, research, and talent cultivation and providing a meaningful context for cultivating a spirit of innovation and exploration.

6. Establishment of a diversified assessment system

The assessment reform aims to move away from the traditional model in which which a single final examination determines the course grade and to allow assessment to guide and promote learning. The course grade consists of continuous assessment (40%) and examination performance (60%). Continuous assessment covers classroom participation, homework, autonomous learning and group discussion, and includes a value-oriented dimension, such as teamwork in discussion and the expression of professional ethics in case analysis. After each module test, students with unsatisfactory results receive interviews and targeted tutoring, so that problems can be identified and addressed promptly and the guiding role of assessment can be fully realized. This approach aligns with the direction of competency-based medical education, in which a balance between formative and summative evaluation enhances learning outcomes[3].

7. Achievements and reflections

Recent practice has yielded promising results. The modular system helps students develop a coherent knowledge framework and enhances learning efficiency. The optimized combination of methods stimulates interest and strengthens classroom interaction. Process-oriented assessment encourages students to accumulate knowledge steadily and fosters learner autonomy. The integration of ideological and political education and research cases helps students master professional knowledge while developing sound values and a strong sense of professional ethics.

Nevertheless, several challenges remain. Modular teaching demands strong interdisciplinary

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knowledge and skills from teachers, so collaborative lesson planning and teacher training should be strengthened. Process evaluation increases the workload, which can be alleviated by information tools such as Rain Classroom[10]. Quantitative evaluation of the effects of ideological and political education still requires better rubrics and longitudinal tracking. With the rapid development of medical and pharmaceutical sciences, teaching content and the repository of research cases also require continuous updating.

8. Conclusion

Fundamentals of Medicine and Pharmacy is a newly established, broad-coverage course built on the convergence of multiple disciplines, and its teaching quality directly affects the foundation of talent cultivation in pharmaceutical engineering. Through modular content reconstruction, combined teaching modes, systematic integration of ideological and political education and teaching informed by research, the course has developed a trinity of knowledge transmission, competence cultivation and value shaping. In the future, course resources will be further developed on online platforms, the material bank and the research case bank will be enriched, the diversified assessment system will be refined, and cross-institutional sharing of teaching resources will be explored, so as to cultivate applied pharmaceutical engineering professionals with both professional competence and integrity.

Acknowledgments

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References

[1] Wang Z, Zheng X, Li D, Meng L, Wang Y, He X, Liu J. Integration of a “cardiovascular system” curriculum into an eight-year medical education program: exploration and the experience in China. Global Medical Education. 2025; 2(1):163-169.

[2] Xia L, Jiang B, Zhang J, Yang K, Zhang Q, Zhu P. Organ-system-based curriculum in medical education: a scoping review. Advances in Medical Education and Practice. 2025; 16:1675-1681.

[3] Gupta S, Srivastava T. Assessment in undergraduate competency-based medical education: a systematic review. Cureus. 2024; 16(4):e58073.

[4] Ministry of Education of the People's Republic of China. Guidelines for curriculum-based ideological and political education in institutions of higher education. Available from: http://www.moe.gov.cn/srcsite/A08/s7056/202006/t20200603_462437.html [Accessed September 20, 2026].

[5] Fu Q, Guo X. Construction of curriculum ideological and political education system in pharmaceutical major for national public health security. Pharmaceutical Education. 2024; 40(3):45-49.

[6] Dai M. Fundamentals of Medicine and Pharmacy. 3rd ed. Beijing: Chemical Industry Press; 2024.

[7] Li S, Wei W, Li X, Ma L, Li Q, Sun X, Chen X. Impacts of blended learning with BOPPPS model on Chinese medical undergraduate students: a comprehensive systematic review and meta-analysis of 44 studies. BMC Medical Education. 2024; 24:914.

[8] Wang Y, Chen Y, Wang L, Wang W, Kong X, Li X. Assessment of the effectiveness of the BOPPPS model combined with case-based learning on nursing residency education for newly recruited nurses in China: a mixed methods study. BMC Medical Education. 2024; 24:215.

[9] Feng X, Wu W, Bi Q. Reform of teaching and practice of the integrated teaching method BOPPPS-PBL in the course “clinical haematological test technique”. BMC Medical Education. 2024; 24:773.

[10] Qu M, Hou Q, Yu C, Li X, Xia J, Dong Z. Application and evaluation of the hybrid problem-based learning model based on Rain Classroom in experimental courses of medical molecular biology. Frontiers in Medicine. 2024; 11:1334919.

[11] Wang Y, Xu J, Xiao J, Luo A, Luo Y. Curriculum ideological and political education reform of natural medicinal chemistry based on ideological and political cases. Pharmaceutical Education. 2024; 40(3):50-55.

ISSN 2522-6398 Vol. 9, Issue 10: 16-22, DOI: 10.25236/FER.2026.091003

[12] Zhao X, Cui H, Lin Y, Wang M, Zhang Q, Yuan J, Mu H, Song J. Exploration and practice of clinical pharmacology curriculum ideological and political education. Pharmaceutical Education. 2024; 40(4):24-27.

[13] Nakouti I, Johnson D. Research-integrated teaching. In: Pedagogies of Biomedical Science. Abingdon: Routledge; 2024. p.43-54.

[14] Wang M, Fu R, Xu D, Chen Y, Yue S, Zhang S, Tang Y. Traditional Chinese medicine: a promising strategy to regulate the imbalance of bacterial flora, impaired intestinal barrier and immune function attributed to ulcerative colitis through intestinal microecology. Journal of Ethnopharmacology. 2024; 318(Pt A):116879.

[15] Wang T, Liu X, Zhang W, Wang J, Wang T, Yue W, Ming L, Cheng J, Sun J. Traditional Chinese medicine treats ulcerative colitis by regulating gut microbiota, signaling pathway and cytokine: future novel method option for pharmacotherapy. Heliyon. 2024; 10(6):e27530.