Research and Practice of Blended Teaching of Identification of Chinese Materia Medica under TfU Model: A Case Study of the Lesson "Authentic Medicinal Materials and Quality of Traditional Chinese Medicine"

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Abstract In order to improve the traditional teaching model of traditional Chinese medicine identification course for graduate students of pharmacy, this paper described the research on constructing and practicing the blended teaching model of "online + offline" based on the teaching concept of TfU by taking the course of "Authentic Medicinal Materials and Quality of Traditional Chinese Medicine" as an example. In the preparatory phase, through resource integration and course content decomposition, it identifies "generative topics" to engage students in pre-class online discussions. During the instructional phase, "comprehension-oriented objectives" are established based on learning analytics, followed by the implementation of "understanding-focused activities" for guided inquiry in offline classrooms. The post-class phase employs online extended materials to conduct "sustained assessment" through evaluations and summaries, thereby continuously optimizing subsequent teaching practices. This pedagogical framework not only effectively cultivates investigative research thinking among graduate students but also enhances standardized management and scientific development of the teaching team. The practical research outcomes and experiences derived from this model can provide valuable references for analogous course reforms.

Key words TfU teaching model; Identification of Chinese materia medica; Blended teaching

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In the current landscape of education and teaching, the continuous renewal of pedagogical concepts and sustained advancement of instructional technologies have made the exploration of innovative and effective teaching models a critical pathway to enhance educational quality. The Teaching for Understanding (TfU) model, known as understanding-oriented pedagogy, originated from Project Zero at the Harvard Graduate School of Education. Its core philosophy emphasizes the paramount importance of cultivating deep comprehension, aiming to guide students in integrating acquired knowledge and applying it flexibly to real-world contexts, thereby nurturing their holistic competencies and problem-solving abilities[1]. Subsequently, Tina Blythe elaborated on the four-component framework of the TfU model in her seminal work: "generative topics", "comprehension-oriented objectives", "understanding-focused activities", and "sustained assessment"[2]. This framework directs educators to prioritize the promotion of student understanding, a form of comprehension that transcends rote memorization of knowledge and principles. Instead, it demands students to extrapolate insights and adeptly transfer learned content to novel contexts for analysis and resolution. As a specialized course for pharmacy graduate students, Identification of Chinese Materia Medica emphasizes strong practical and applied competencies. However, the traditional teaching model has increasingly revealed limitations in this course, failing to meet the requirements of modern education or the career development needs of students. Identification of Chinese Materia Medica demands that students utilize modern scientific knowledge and methods to study the quality of medicinal materials and decoction pieces, thereby cultivating problem-solving abilities in both research and practical work[3]. Nevertheless, many graduate students currently exhibit a fragmented understanding of the discipline, limiting their knowledge to basic morphological identification and microscopic qualitative analysis. They often fail to integrate multifaceted content, such as physicochemical identification, molecular biological authentication, safety evaluation, the formation and development of Authentic Medicinal Materials, and commercial grading standards, into a cohesive framework for quality control, resulting in insufficient depth of comprehension. Additionally, the theoretical instruction for this course at our institution remains confined to traditional lecture-based methods, leading to low student engagement, passive learning attitudes, and inadequate mastery of knowledge and skills, all of which significantly hinder teaching effectiveness and talent development outcomes. To address these challenges, our teaching team has integrated the TfU framework into the blended teaching model of "online + offline", aligning with the disciplinary characteristics and educational objectives of Identification of Chinese Materia Medica. This reform aims to optimize teaching resources, enhance student interest and initiative, and lay a robust foundation for their future professional and scientific research endeavors[4].

Construction of a Blended "Online + Offline" Teaching Model Integrating the TfU Framework

To achieve the optimization and innovation of teaching in the Identification of Chinese Materia Medica, our teaching team meticulously developed a blended teaching model of "online +

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offline" based on the TfU framework[5]. Prior to classroom instruction, the teaching team leverages collective expertise through collaborative division of teaching tasks across chapters. Specifically, faculty members whose research aligns closely with the course content are assigned to design chapter-specific implementation plans, while other team members contribute to consolidating learning resources, updating lesson plans, producing microlectures, and developing courseware compatible with the Rain Classroom platform. This collaborative effort ensures the richness, scientific rigor, and practicality of teaching resources, thereby providing robust support for the effective execution of pedagogical activities.

Firstly, instructors establish "generative topics" before class to introduce teaching content, serving as entry points for the lesson. These topics are designed to stimulate student interest, activate prior knowledge, and contextualize chapter content through simplification and real-life relevance. For example, instructors may guide students to reflect on common applications of Chinese Materia Medica in daily life or explore its value and role in modern society, fostering curiosity about new knowledge within familiar contexts. Secondly, instructors define explicit and specific "comprehension-oriented objectives" based on the syllabus and students actual learning needs. These objectives encompass core theories, key concepts, and the expected competency levels students should achieve during the learning process. Next, instructors organize diversified "understanding-focused activities" to deepen comprehension. Through structured tasks, students actively apply theories and concepts, demonstrating mastery through personalized outputs. Finally, "sustained assessment" is implemented during and after class to provide timely feedback on student strengths and weaknesses. Instructors holistically evaluate learning outcomes using multi-dimensional data, including classroom participation, discussion contributions, and assignment performance. Assessment results inform immediate adjustments to teaching strategies, ensuring progress for all students[6].

Implementation of the Blended "Online + Offline" Teaching model Activities

This study takes the lesson "Authentic Medicinal Materials and Quality of Traditional Chinese Medicine" in Identification of Chinese Materia Medica as an example to elaborate on the implementation process of blended teaching research and practice under the TfU framework.

Pre-class discussion activities

(1) One week before the classroom session, instructors utilize the Rain Classroom platform (a widely used online teaching tool in China) to distribute microlectures related to the chapter and design "generative topics", such as "What Authentic Medicinal Materials exist in your hometown? Discuss their recent development." These topics aim to fully engage students' prior knowledge and life experiences, stimulating their interest and critical thinking toward the chapter content. By simplifying and contextualizing the teaching materials into relatable, life-oriented formats, students are encouraged to proactively learn and explore during fragmented time outside class. They then submit discussion outcomes via the Rain Classroom platform, achieving autonomous pre-class learning and preliminary reflection.

(2) Two days before the class session, instructors systematically collect and organize students discussion outcomes on "generative topics". By analyzing self-directed learning feedback, instructors gain precise insights into student learning profiles, thereby defining "comprehension-oriented objectives" for the lesson and adjusting instructional plans based on students' actual needs. This process not only helps instructors understand students' learning requirements and knowledge foundations but also enhances the relevance and effectiveness of teaching, laying a solid groundwork for successful classroom implementation.

In-class teaching activities

(1) At the beginning of the class, instructors and students collaboratively share the discussion outcomes of pre-class "generative topics". By presenting students' contributions, instructors facilitate peer exchange and inspiration, further igniting learning enthusiasm. Subsequently, instructors display the chapter's PPT courseware, clearly communicating the lesson's "comprehension-oriented objectives": to prioritize mastery of "the formation and development of Authentic Medicinal Materials", understand the "current research status of Authentic Medicinal Materials", and deeply grasp the challenging "research approaches and methodologies for Authentic Medicinal Materials". This ensures students develop a clear understanding of the lesson's learning direction and key priorities.

(2) Following this, the first phase of "understanding-focused activities" is initiated. Instructors provide an in-depth explanation of "the connotation of Authentic Medicinal Materials", elaborating on its seven attributes through rich case studies. During the instruction, instructors actively incorporate cutting-edge research and disciplinary literature to broaden students' academic perspectives. Students are encouraged to critically reflect on and actively engage in discussions about "formation mechanisms of Authentic Medicinal Materials" and "quality evaluation of Authentic Medicinal Materials". This process guides students to apply theoretical knowledge to analyze and address practical issues, thereby cultivating critical thinking and problem-solving skills.

(3) After students acquire a foundational understanding of Authentic Medicinal Materials, the second phase of "understanding-focused activities" commences. Students are required to design a research technical flowchart that aligns their research focus with Authentic Medicinal Materials, followed by presenting their research rationale in class. Through this activity, students integrate theoretical knowledge with practical research, honing their research design and innovative capabilities. Meanwhile, peer exchanges and discussions on the rationality and feasibility of the flowcharts further expand their scientific thinking. Instructors provide real-time feedback and guidance during student presentations, helping them identify and address shortcomings, thereby advancing the achievement of "comprehension-oriented objectives". This phase also marks the initiation of the first stage of "sustained assessment", enabling instructors to preliminarily

evaluate students' learning progress and comprehension levels based on their performance.

Post-class assessment activities

(1) In the second phase of "sustained assessment", instructors distribute key chapter content through the Rain Classroom platform and test students' mastery via open-ended questions. Examples include: "Please explain the impact of natural environments on the formation of Authentic Medicinal Materials." "How do you interpret the specialized genotypes of Authentic Medicinal Materials?" "Discuss modern methodologies for quality evaluation of Authentic Medicinal Materials." These questions aim to evaluate students' comprehension and application of core concepts. After students submit their responses, instructors analyze learning outcomes in detail, provide targeted feedback to address gaps, and reinforce knowledge consolidation.

(2) The third phase of "sustained assessment" is conducted through face-to-face student interviews, focusing on course content, instructional methods, activity design, class satisfaction, and teaching effectiveness. Through direct dialogue, instructors gain in-depth insights into students' perspectives, suggestions, and feedback regarding the teaching process. Based on evaluation results and student input, instructors promptly adjust subsequent teaching strategies, refine pedagogical approaches, and enhance teaching quality, ultimately achieving continuous improvement and optimization of instruction.

Research Results and Practical Effectiveness

Constructing a new teaching model for the course to cultivate graduate students' research and practical thinking skills

This project innovatively introduced a blended "online + offline" teaching model integrating the TfU framework, grounded in a thorough analysis of the disciplinary characteristics of Chinese Materia Medica Identification and talent development objectives. This comprehensive reform of traditional theoretical teaching methods effectively addressed the limitations of conventional pedagogy. Practical feedback demonstrates significant improvements in student engagement under the new model, with students actively participating in diverse teaching activities, fully embodying their central role in the learning process. Enhanced pedagogical outcomes are reflected in students' comprehensive, in-depth, and multidimensional understanding of quality evaluation and research methodologies for medicinal materials. The model successfully resolves the historical disconnect between theoretical instruction and practical application, enabling students to integrate theoretical knowledge with hands-on practice, thereby strengthening their operational competence and problem-solving skills.

This technology-enhanced pedagogical reform aligns with contemporary educational demands, organically merging textbook knowledge with internet resources to establish a student-centered, instructor-guided blended teaching mode. The model not only optimizes teaching resources-making course content more vivid and accessible-but also significantly enhances students' subjective initiative. Through the diversity and interactivity of online resources, students engage in self-directed learning tailored to their individual progress and needs, further igniting their academic interest and enthusiasm.

Furthermore, the new teaching model focuses on cultivating students' scientific research and practical thinking skills. Throughout the instructional process, students are encouraged to engage in research projects, case analyses, and experimental operations. These activities equip students with scientific research methodologies and technical competencies, enhancing their innovative capabilities and critical thinking. Through team collaboration and discussions, students also develop communication and cooperation skills, strengthening their teamwork awareness and interactive abilities, thereby laying a robust foundation for their future development in pharmaceutical research and practice[7].

Promoting standardized management and scientific development of the course teaching team

Establishing a rationally structured and scientifically grounded teaching team is a critical measure to enhance teaching quality, address pedagogical challenges, and ensure the sustainable development of the curriculum. In this project, the course coordinators are selected from faculty members with extensive educational backgrounds in Chinese Materia Medica, holding positions at the associate professor level or higher. These instructors not only possess profound academic expertise in the field of Chinese materia medica but also have accumulated rich teaching experience, enabling them to strategically guide the curriculum's overarching direction and teaching objectives. Other team members are equally qualified with specialized disciplinary backgrounds, covering diverse research areas relevant to Chinese Materia Medica Identification, such as plant taxonomy, chemical analysis, and molecular biology. This team structure capitalizes on the faculty's professional strengths, fostering interdisciplinary collaboration and ensuring comprehensive coverage of the subject's multifaceted dimensions.

Team members engage in in-depth discussions and scientific planning tailored to the disciplinary characteristics of Chinese Materia Medica Identification, collectively advancing curriculum development and instruction. During the teaching process, faculty members based on their professional expertise: some specialize in delivering content on morphological identification of medicinal materials, while others focus on microscopic identification or physicochemical identification, ensuring each module receives expert guidance from specialized instructors. Additionally, the teaching team's responsibilities extend beyond offline classroom instruction to include management and updating of online course resources. Through collaborative efforts, team members conduct regular maintenance and updates of digital materials, guaranteeing the timeliness and accuracy of content. This ensures students have access to rich, high-quality learning resources, effectively supporting their academic growth.

Through team collaboration, faculty members engage in mutual learning and complementary collaboration, actively conducting pedagogical workshops to share teaching experiences and insights, and collectively addressing challenges encountered in instruction to formulate effective solutions[8]. This collaborative culture has

significantly enhanced the teaching quality of the course and fostered continuous growth and advancement within the teaching team. Beyond jointly delivering theoretical instruction, laboratory experiments, and practical internships for Chinese Materia Medica Identification, the team regularly conducts in-depth discussions on the course's limitations and the evolution of talent development models in the discipline. By collecting data through questionnaires, student feedback, and teaching evaluations, they identify pedagogical gaps and collaboratively develop actionable strategies and recommendations for optimization. These measures not only promote standardized management and sustainable development of the teaching team but also provide robust support for the long-term advancement of the curriculum[9]. Consequently, Identification of Chinese Materia Medica has achieved notable progress in both teaching quality and team capacity building.

Conclusions

In conclusion, this study on the blended "online + offline" teaching reform of Chinese Materia Medica Identification based on the TfU framework effectively addressed the limitations of traditional teaching methods, such as overemphasis on theoretical knowledge while neglecting practical application and low student engagement. Constructing a four-phase closed-loop teaching model-generative topics, comprehension-oriented objectives, understanding-focused activities, and sustained assessment-established a reusable paradigm for reforming pharmaceutical education curricula. The reform not only significantly enhanced students' learning outcomes and cultivated their scientific research and practical thinking skills, but also promoted the standardized management and scientific development of the teaching team. These achievements have accumulated valuable experience for the advancement of Chinese Materia Medica Identification and provided practical references for similar courses seeking to integrate innovative pedagogical models with blended learning strategies.

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tap the rich humanistic connotation behind plants. The role changes of plants in the long river of human history should be described, from the important source of food, medicinal materials and building materials in ancient farming civilization to the embodiment of aesthetic value in modern garden landscape design and eco-tourism development. The symbolic meaning and folk customs carried by plants in different regional cultures can be explored. The promoting effect of plant industry development on social economy and employment structure should be analyzed. Ultimately, these efforts will cultivate students' ability to solve practical problems through multidisciplinary knowledge integration, students' holistic ecological values and social responsibility, and establish a widely influential brand course in ecological education.

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