Research on Innovative Paths of Pharmacology Teaching Based on the "Three Commonalities + Three Highlights" Model

Yan Zhang[1], Shuqiao Yang[2], Haili Zhang[1*]

1.Qingdao Binhai University, Qingdao , Shandong, 266555,China

2.Qingdao Hospital of Traditional Chinese Medicine (Qingdao Haici Hospital), Affiliated Haici Hospital of Qingdao University, Qingdao , Shandong, 266033, China

Abstract: "Pharmacology" is a core bridging course for medical majors, undertaking the tasks of consolidating professional foundations and shaping professional qualities. Under the background of new medical science, the team, guided by the social medical demands, aiming at the cultivation of innovative talents, focusing on the improvement of comprehensive capabilities, and taking the deepening of teaching reform as the driving force, has built a teaching innovation model of "three commonalities + three highlights" relying on information technology. "Consensus" consolidates the foundation of pharmacological knowledge and establishes clinical thinking. "Joint thinking" shapes the character of diligent thinking and good understanding, enhances medical ethics, and "joint evaluation" reconstructs a multi-dimensional evaluation system, stimulating the intrinsic motivation of teachers and students. By enriching "multi-platform +X" learning resources, break through the single learning path; Implement the "differentiated teaching +X" teaching strategy to break through the single teaching method; Integrate the interdisciplinary integration of "Pharmacology +X" and break through in a single disciplinary direction. By adopting the "Three Commonalities + Three Highlights" teaching innovation model, a learning community for teachers and students is created, effectively promoting the realization of the goal of mutual growth between teaching and learning.

Keywords: new medical; "Co-thinking"; Multi-platform +X; Differentiated teaching +X; Pharmacology +X

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1.Introduction

"Ancient physicians treated with the heart; when the heart is upright, medicine becomes genuine. Modern physicians treat with their hands; when hands are careless, medicine loses its power." Pharmacology is a bridge discipline grounded in physiology, biochemistry, pathology, and other sciences, focusing on the interactions between drugs and the body and their underlying principles, providing theoretical foundations for guiding rational clinical drug use. Studying this course requires not only mastering the mechanisms of drug action and maximizing clinical efficacy while minimizing adverse effects, but also cultivating a deep commitment to medicine — dedicated to healing diseases and nurturing compassion. With rapid updates, expansions, and interdisciplinary integration of medical knowledge, ongoing reforms in teaching methods have raised higher demands for medical education. Through our experience in pharmacology instruction, we have identified several key challenges: insufficient motivation for continuous learning, lack of advanced clinical reasoning, and limited mutual learning without depth among teachers and students; inadequate internalization of ideological and political education, absence of subtle value formation, and superficial reflection without insight; and insufficient evaluation dimensions, lacking multidimensional feedback, resulting in mutual assessment without meaningful nourishment. Addressing these issues, we embrace the student-centered educational philosophy and, based on practical exploration and reform efforts, have developed an innovative "Three Commonalities + Three Highlights" teaching model for pharmacology [1].

*Corresponding author: Zhang Haili, female, Master, Lecturer. Main research direction: pharmacology teaching reform.

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2.The Significance of "Three Commonalities + Three Highlights" in Pharmacology Teaching Innovation

2.1 Helps Overcome the Limitations of Traditional Teaching Content

A rich case database, ideological and political education resources, online materials, practical teaching, and student competitions help address the limitations of traditional curricula. These elements enhance teachers' ability to deeply integrate modern information technology with education and instruction, enabling them to actively explore new models of smart education that combine online and offline learning. In the era of "Internet+", innovations in assessment formats and formative evaluation have been promoted, achieving multi-dimensional evaluations involving both teachers and students, as well as a closed-loop assessment system covering pre-class, in-class, and post-class stages. The application of modern information technology not only allows us to assess teaching and learning outcomes promptly and accurately but also effectively expands students' learning time and space, deepening and broadening their professional knowledge.

2.2 Enhances Students' Ability for Self-Exploration of Knowledge

By incorporating more hands-on activities, case studies, teamwork, and research-based learning projects, students' interest and curiosity are stimulated, encouraging active participation in learning and fostering independent thinking and problem-solving skills. Such innovations contribute to developing students' overall competencies and lay a solid foundation for their future career development.

2.3 Strengthens Core Competencies of Both Teachers and Students

Encouraging students to engage more actively in learning cultivates their practical abilities and problem-solving skills, promoting professional growth and holistic development. Teachers must continuously update their knowledge and skills to meet new educational demands. In pharmacology teaching reform, instructors need to master diverse teaching methods and strategies, promote classroom interaction, and better guide student learning. These innovative approaches require teachers to possess higher levels of professional competence and pedagogical expertise. Moreover, teaching innovation strengthens interaction and communication between teachers and students. Throughout the reform process, educators must pay greater attention to students' needs and feedback, building closer relationships with learners. This fosters mutual understanding and trust, enhances teaching effectiveness, and simultaneously develops students' communication and teamwork skills.

3."Three Commonalities + Three Highlights" - Innovative Pathway Selection for Pharmacology Teaching

3.1 Establishing Co-consensus, Co-thinking and Co-evaluation Teaching Model to Build Teacher-student Community

3.1.1 From Simple Knowledge Acquisition to the Establishment of Advanced Clinical Thinking - Consensus

Before class: The teacher analyzes the students' learning situation, makes preparations, issues tasks, poses questions, posts reference materials on the Superstar platform, provides relevant links on Zhihuishu for students to refer to, and students study online. The teacher uses information technology for pre-class assessment, adjusts the learning content. During class: Present the completion status of the pre-class tasks, have group reports and discussions, the teacher raises advanced questions to guide students to express their viewpoints, students have conversations, questions, debates, and solve problems together with the teacher, and introduce industry mentors and integrate with the latest in the discipline. After class: Make full use of QQ or WeChat discussion groups, encourage students to summarize and conclude the content through PPT presentations and mind maps. Through posing questions - solving problems - summarizing - elevating, form a knowledge framework and the overall concept of pharmacology.

3.1.2 From Integrating Thought Politics Alone to Internalizing Shared Value Understanding - Co-thinking

Before class: Ideological and Political Inspiration. Students, based on their own learning and life experiences, use the course content as a foundation, pay attention to current affairs, news events, and typical stories, to trigger emotional enlightenment and resonance. During class: Ideological and Political Sharing. During the class, students and teachers jointly share ideological and political knowledge, enabling students to feel and empathize with it as if they were there, integrating ideological and political education into a three-dimensional format, emphasizing the synchronous resonance of values in the process of knowledge transmission. Collect ideological and political cases, increase presentation forms [2, 3], update regularly and in real time, and form an ideological and political database. After class: Ideological and Political Extension. Students write their reflections on the ideological and political content they have experienced before and during the class, and apply it in life to serve society. Encourage students to go to the community to promote knowledge about drugs and enhance health awareness.

3.1.3 Relying on information technology, establish a multi-dimensional evaluation system - Comprehensive Evaluation

Implement a diversified curriculum evaluation mechanism including diversified evaluation standards, diversified evaluation subjects, and diversified evaluation methods [4,5]. The diversified student learning evaluation standards are "self-evaluation + group evaluation + teacher evaluation", encouraging students to "question", and the teacher's role is reversed to fully "question" the class, making timely adjustments, breaking habits, providing comments and scores, listening to feedback, summarizing, and reflecting and correcting. The diversified evaluation subjects include students, teaching supervisors, peers, teaching management personnel, and individual teachers. The evaluation system runs through the entire process of course teaching, which is conducive to the timely adjustment of the course. The curriculum evaluation adopts a combination of formative evaluation and summative evaluation. Formative evaluation includes experiments, classroom performance, unit tests, and after-class assignments, etc. Summative evaluation uses "double test" assessment, where Test 1 is mainly objective questions; Test 2 is mainly subjective questions, fully reflecting the degree of students' process participation, classroom questioning situations, and innovation situations, etc., forming a dynamic, hierarchical, and diversified comprehensive evaluation system of grades.

3.2 Achieve Three Breakthroughs to Reach Teaching Objectives

3.2.1 Enrich Multi-platform+X Learning Resources to Break Single Learning Path

To break through the single and rigid learning path, we actively constructed a "Multi-platform + X" learning resource system, promoting teaching to transform from the traditional "classroom - textbook - teacher" tripartite model to a diversified and three-dimensional one [6]. The content covered by X includes: virtual simulation platforms, dynamically updated digital resources (such as new developments in the medical field, new clinical experiences and industry demands), and diversified teaching staff (integrating multi-disciplinary teachers within the school, clinical frontline physicians, and bilingual teaching forces) [7]. This system not only expands the channels for knowledge acquisition vertically, but also helps improve students' English proficiency, literature search and analysis abilities, and further broadens their knowledge horizons and international perspectives.

3.2.2 Implement Differentiated Teaching+X Strategy to Break Single Teaching Method

Based on the students' learning situations and the characteristics of the content, differentiated teaching methods are adopted in different chapters [8]. According to the mastery of the prerequisite courses and in accordance with the recent teaching reforms in pharmacology, corresponding integration is carried out. The students' potential is explored, they are encouraged to think actively, and their learning interest is stimulated. PBL method [9]: Introduce the drugs for treating heart failure, record cross-disciplinary knowledge in advance, and upload research progress to the Superstar platform. Students independently study the electrophysiological knowledge of the heart muscle, the pathophysiological knowledge of arrhythmias, and the cardiac glycoside drugs. During the process, they raise

questions, report tasks in class, ask questions and interact, have thought collisions, and conduct in-depth learning. The teacher guides and connects the knowledge in class, provides real-time comments, and leads the students. Connect with the teachers from the hospital pharmacy department to explain the classification of drugs for treating heart failure in practice. Case method [10]: Introduce the anticholinergic drugs, introduce the "organophosphorus poisoning" case, the teacher poses questions, sets tasks, students discuss and report in groups, and the teacher summarizes. Comparison method: Introduce the adrenergic receptor agonists [11], compare the similarities and differences between epinephrine, norepinephrine, and isoproterenol; in the individual sections, use representative drugs as the center and adopt the comparison method to summarize the non-key drugs. Inspirational method: The teacher sets reasonable and ingenious questions, gives students thinking time, leaves "white space" in class, highlights key and difficult points, and triggers hierarchical thinking of knowledge. Practical innovation: Introduce design and comprehensive experiments to enhance research-based learning, increase students' opportunities for hands-on operation, break fixed thinking, and the experimental reports can "seek common ground while reserving differences".

3.2.3 Integrate Pharmacology+X Interdisciplines to Break Single Disciplinary Boundary

The integration of multiple disciplines fully stimulates students' interest in learning, reduces the emphasis on a single discipline, and enhances the overall perspective. The original teaching mode of pharmacology lacks horizontal connections between disciplines. The course team mainly carried out interdisciplinary integration in the following three aspects [12]. They sought the help of teachers from physiology, pathology, anatomy, etc., conducted pre-class questionnaires, sorted out the overlapping parts of pharmacology and the knowledge of corresponding disciplines, as well as the parts that students in previous disciplines had poor mastery of, and asked teachers from other disciplines to record teaching videos in advance and publish them on the Superstar platform to strengthen students' basic knowledge; they introduced clinical teachers to strengthen the clinical application of drugs, expand clinical concepts and thinking, improve the targeted and rationality of drug use, and enhance students' practical ability; they appropriately and timely integrated discipline knowledge that is closely related to pharmacology, such as pharmacoeconomics, bioinformatics, computer science, etc., to expand students' multidisciplinary perspective and strengthen their scientific research thinking ability.

4."Three Commonalities + Three Highlights" - An Analysis of the Innovative Experience in Pharmacology Teaching

4.1 Gradual Improvement of Students' Comprehensive Competence

Innovative pharmacology teaching notably boosts students’ knowledge mastery, application capacity and knowledge retention. Students break conventional thinking limits and generate original ideas. By taking part in practical projects and contests, they integrate theories with real problems and gain prominent progress in innovation and entrepreneurship, winning many provincial and higher awards. Their overall competence is enhanced to adapt to future social demands.

4.2 Remarkable Improvement of Teachers' Teaching Effectiveness

Through systematic training and practice, the teaching team has greatly improved its teaching concepts, innovative methods and comprehensive abilities. Proficient in modern educational technologies, teachers effectively resolve traditional teaching difficulties, enliven classroom teaching and stimulate students’ learning enthusiasm. Meanwhile, their academic research, professional development and teaching competition performance have been enhanced, forming a virtuous teaching-learning cycle.

4.3 Analysis of Reform Experiences

To further deepen teaching reforms, peer cooperation should be strengthened to optimize the “Three Commonalities + Three Highlights” model and promote new medical science construction. A multi-dimensional,

process-based evaluation system shall be established for curriculum ideological education. Meanwhile, teachers are encouraged to produce high-level teaching achievements, adopt collaborative lesson preparation, and dynamically update core teaching resources.

5.Conclusion

This study advances pharmacology curriculum teaching innovation via information technology integration. It optimizes teaching design, strengthens classroom interaction and research-based learning, and builds a replicable new teaching model adapting to modern education.

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