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Exploration of the Combination of Micro-video and Case-based Teaching Methodology Applied to the Teaching of Physiology

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Abstract

Micro-video is an emerging, short and convenient learning resource on the Internet, which can effectively meet students' needs for personalized learning of physiology; case-based teaching is student-centered, which guides students to be immersive and analyze the problems based on relative cases.

Keywords

physiology; micro-video; case-based teaching; teaching model

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1. Introduction

Physiology is the discipline that studies the laws of normal human life activities[1]. It is one of the important basic theoretical courses for medical majors and a foundational course for students growing into medical professionals[2-3]. Physiology involves complex concepts and mechanisms, and the difficulty students face in learning and understanding physiology cannot be ignored, as it is highly logical, abstract, and hard to comprehend[4-6]. The content of physiology is closely related to subsequent medical courses and serves as an important bridge connecting basic medical courses with clinical practice[7]. Physiology teaching requires students not only to master basic theoretical knowledge but also to possess high medical humanistic qualities, a professional spirit of reverence for life, and healing the wounded and rescuing the dying[8]. Currently, traditional physiology teaching methods cannot meet the needs of students for comprehensive, multi-perspective learning or the requirements of scientific development in the discipline[9-10]. Micro-video, as the carrier of micro-lectures, is one of the important forms of emerging education and teaching[11]. It can objectively, authentically, and effectively convey information to students and enhance their interest in learning[12]. Case-based teaching is student-centered, meets the needs of personalized learning, and integrates theoretical knowledge with practical scenarios[13-15]. Based on traditional teaching, this research breaks through conventional teaching methods by effectively combining micro-video and case-based teaching methodology. It conducts a study to explore a teaching model more suitable for physiology teaching and

more easily accepted by students, aiming to improve the quality of physiology education.

2. Current Status and Existing Problems in Physiology Teaching in Universities of Traditional Chinese Medicine

2.1. Analysis of Students' Cognitive Characteristics and Knowledge Starting Point

The teaching targets are first or second-year university students in medical or non-medical majors. The vast majority are students from science backgrounds with strong visual thinking abilities and good memory for knowledge points. They can master previously learned knowledge points relatively well, but their abstract thinking ability is insufficient. Their systematic thinking, coherence, and accuracy in physiology are less than ideal, leading to slight deficiencies in constructing connections between knowledge points, and the knowledge system network needs further improvement. Both medical and non-medical major students have already studied courses such as Human Anatomy and Basic Theory of Traditional Chinese Medicine, possessing the basic theoretical knowledge required for this course.

2.2. Analysis of Learning Habits and Abilities

Regarding learning habits, pre-class communication with the surveyed students showed strong curiosity and desire for knowledge. However, according to preliminary research on learning conditions, 77.45 % of students occasionally watch academic knowledge or professional course videos on the Internet, 7.66 % never watch them, only 13.62 % often independently use the Internet to learn and enrich professional knowledge, and 1.28 % always engage in independent learning and watching. This indicates that most students do not have a strong habit of actively using existing Internet resources for learning. Their interest in independent learning needs to be stimulated, and the use of Internet resources for learning needs improvement. See **Figure 1**.

In terms of learning ability, based on students' classroom performance and proactiveness during usual teaching, the author found that the students' ability to think actively and raise questions needs strengthening. They tend to prefer spoon-feeding learning, and lack critical thinking. A small portion of students in this major come from arts backgrounds in high school, with weak foundations in biology, chemistry, physics, and other sciences, relatively weaker logical thinking abilities, and find it more difficult to understand physiological knowledge. This series of classroom performances and after-class learning reminders urge teachers to further explore students' learning abilities, increase classroom participation, and improve the utilization rate of the

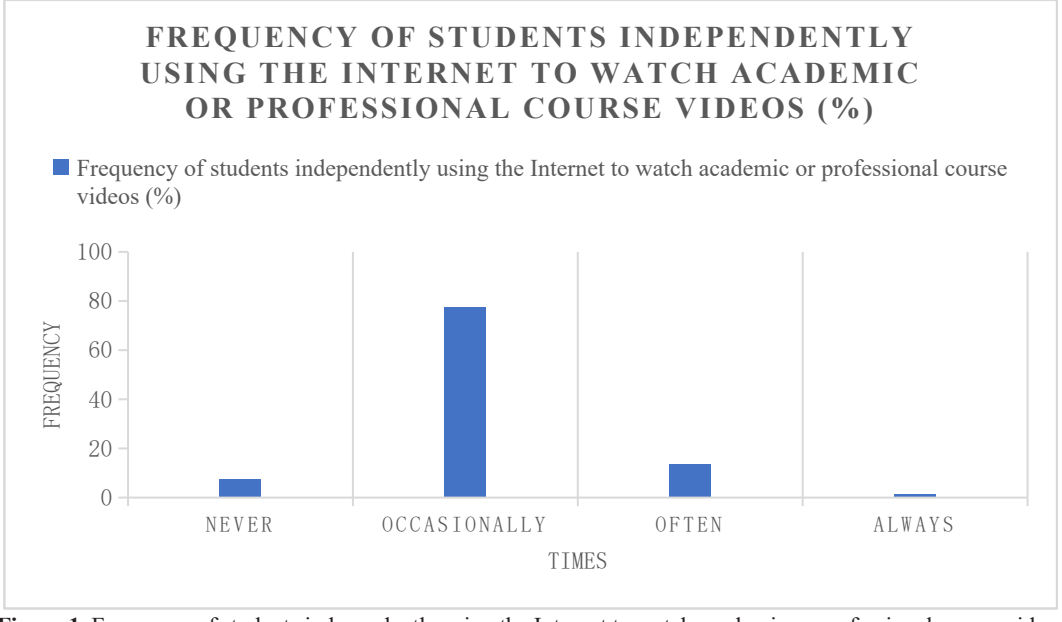

Figure 1. Frequency of students independently using the Internet to watch academic or professional course videos

Internet.

2.3. Challenges in Imparting Knowledge in the Classroom

Teaching centered on knowledge transmission focuses on the understanding and mastery of knowledge, emphasizing the learning hierarchy of knowledge. However, it inevitably leads to the phenomenon of "much knowledge feeding, little flexible application and innovative awareness oriented by problems," keeping physiology learning at the low level of memory and rote learning, making it difficult to form high-order abilities such as evaluation and application, and innovative outcomes. The development of clinical practice and the future "New Medicine" requires reverse thinking from effect to cause and innovative thinking. They need to solve complex clinical problems and utilize comprehensive knowledge to innovatively become new medical talents in the future, all of which require innovative awareness and thinking. This poses new challenges to the traditional teaching model centered on knowledge transmission.

2.4. Challenges in Talent Training Assessment

Traditional teaching mostly uses a single summative assessment for evaluation, aiming to assess students' mastery, understanding, and application of knowledge, and guide them towards a diligent learning attitude. It relatively lacks process assessment and competency assessment. The drawback brought by the single assessment method is that students often do not pay attention to usual learning, tend to focus only on scores, judge solely by final exam results, fail to develop good thinking and learning habits, do not value the improvement of practical skills and emotional values, making it difficult to achieve the comprehensive ability training objectives outlined in the syllabus, such as cultivating self-learning ability, scientific logical thinking ability, ability to analyze, judge and solve problems, independent thinking ability, and good communication and exchange skills. The particularity of the medical profession requires them to use their professional skills to rekindle life and use their souls to inspire souls in the future. Excellent comprehensive quality and personal charm are particularly important for clinical medical talents. A single written exam cannot achieve the guiding role for the all-around training objectives of students.

2.5. Challenges of Theory and Clinical Practice

Physiology courses are closely related to clinical practice. The experience of clinical medical knowledge includes but is not limited to clinical scenarios, field visits, etc. The students facing this course not only have to deal with the knowledge difficulty of the physiology course but also face difficulties in understanding clinical experience and overall experience. This lack of clinical cognition and experience not only affects students' learning interest and effectiveness but also reduces their learning initiative in the long term, and may even affect the learning of subsequent courses, thereby affecting the achievement of the goal of cultivating high-level TCM clinical talents during the undergraduate stage. How to bridge the gap between theoretical knowledge and clinical practice is also worth considering when teaching physiology.

3. Teaching Model Combining Micro-video and Case-based Teaching Methodology Applied in Physiology Teaching

3.1. Micro-video

There is currently no unified definition for the concept of micro-video in academia. The "micro" in micro-video means the video length is short and the content is precise, generally ranging from 30 seconds to 20 minutes. It combines sound and images, making it more visual and intuitive for medical teaching. It helps transform obscure, abstract, and complex medical textual knowledge into dynamic visuals, characterized by being easy to understand, authentic, highlighted, diverse, and interactive. It aids in organizing learning knowledge and has clear learning objectives[16].

3.2. Case-based Teaching Methodology

Case-based Teaching (CBT) originated in the early twentieth century, first advocated by Harvard Business School, and later widely used in the education field, especially popular in the medical field[17]. After 1990, China began to explore and gradually apply the case-based teaching methodology. Case-based teaching is a teaching method based on cases, integrating theory with

practice. Its core idea is student-centered and teacher-led. The teacher plays the role of an encourager or designer, guiding students to analyze and handle problems faced in real cases (scenarios, plots), imparting knowledge through teacher-student interaction. This teaching method can largely mobilize students' learning enthusiasm and improve their logical thinking ability, language expression ability, etc. [18]. Different from traditional teaching methods, teachers introduce case scenarios into the teaching process, using multimedia, Internet and other technologies to integrate video, audio, pictures and other learning content with teaching objectives and content. While guiding students to think independently and learn actively, students satisfy their thirst for knowledge and learning through watching, group discussions, etc., making abstract, complex, and obscure teaching content intuitive, concrete, and easy to understand[19].

4. Analysis of the Teaching Model Combining Micro-video and Case-based Teaching Methodology Applied in Physiology Teaching

4.1. General Information

This study selected undergraduates from Beijing University of Chinese Medicine, including medical majors (medical class *n*=405) and non-medical majors (non-medical class *n*=132), totaling 537 students as the research objects. Using the class as the sampling unit, an anonymous questionnaire was distributed via Wenjuanxing for data collection, and screening was conducted to ensure the authenticity and completeness of the data. See **Table 1**. Among the surveyed subjects, there were 126 males and 411 females. These students came from 12 classes, and the combined teaching mode of case-based teaching and micro-video was often used in the teaching process. The distribution of majors is representative.

4.2. Survey Results

4.2.1. Students' Overall Evaluation of the Teaching Model Combining Micro-video and Case-based Teaching Methodology Applied in Physiology Teaching

The questionnaire results showed that 69.09 % of students were satisfied with the overall evaluation of the teaching model combining micro-video and case-based teaching methodology applied in physiology teaching. Over 60 % of students had a general level of understanding of this combined method before the course, indicating that students were not very familiar with this teaching model before class. However, after students gained a preliminary understanding of this teaching model, a post-course survey found that over 80 % of students considered this teaching model "very good" or "good". The recognition rate of the teaching model combining micro-video and case-based teaching exceeded 60 % across different majors, indicating that this teaching method is beneficial for both medical and non-medical major students. See **Table 2** and **Table 3**.

A questionnaire survey was conducted on students of different majors and classes regarding the teaching model combining micro-videos with the case-based teaching method. Students' evaluations on the level of understanding, subjective recognition and satisfaction with the teaching method reflect the cognitive change of students from being unfamiliar to recognizing and from being unknown to being satisfied. Through the explanation of teachers, students can accept and are

Table 1. Distribution of the number of students in the surveyed classes (*n* = 537)

Major	Class	Number of Students
Medical Majors	Acupuncture, Massage and Rehabilitation Class	27
	Acupuncture and Massage Class	31
	Excellent 8 - year Acupuncture and Massage (Acupuncture) Class	74
	Nursing (International) Class 2	45
	Nursing (International) Class 1	49
	Undergraduate Nursing Class	69
	5 - year Acupuncture and Massage Class	35
	5 - year TCM Class	26
Non - medical Majors	Chinese Materia Medica Class	49
	Management Class	61
	Law Class	37
	English Class	34

Table 2. Students' Overall Evaluation of the Teaching Model Combining Micro-video and Case-based Teaching (*n*=537)

Survey Questions	Very Good	Good	General/Uncertain	Poor	Very Poor
a	21	71	353	81	11
b	124	325	85	1	2
c	96	275	152	6	8

a. Level of understanding of the combination of micro-videos and case-based teaching method; b. Importance of the combination of micro-videos and case-based teaching method; c. Satisfaction with the combination of micro-videos and case-based teaching method

Table 3. Students' Overall Evaluation of the Teaching Model Combining Micro-Videos with Case-Based Teaching Method by Major (*n* = 537)

Survey Questions	Major	Very Good	Good	General/Uncertain	Poor	Very Poor
b	Medical	99	241	64	1	0
	Non - medical	25	84	21	0	2
c	Medical	79	208	109	3	6
	Non - medical	17	67	43	3	2

b. Importance of the combination of micro-videos and case-based teaching method; c. Satisfaction with the combination of micro-videos and case-based teaching method

willing to adopt this teaching method, and they are eager to acquire knowledge and learn independently.

4.2.2. Students' Evaluation of the Teaching Effectiveness and Quality of the Teaching Model Combining Micro-video and Case-based Teaching Methodology Applied in Physiology Teaching

The survey results show that non - medical students have a higher recognition rate ("very good" and "good") than medical students in terms of stimulating learning interest (92.42 % > 92.35 %), improving the ability to correctly analyze problems (90.15 % > 90.12 %), dealing with and solving problems, enhancing the ability to analyze and solve practical problems in the future (94.70 % > 89.38 %) and the proportion of teaching methods (69.70 % > 59.01 %). The possible reasons for this are as follows: medical students pay more attention to the cultivation of clinical thinking and the impact of knowledge itself and in - class teaching on their clinical development; while non - medical students attach more importance to stimulating learning interest and teaching methods, so that they can better engage in in - class and after - class learning. Moreover, non - medical students focus on in - depth learning of their own majors and tend to tilt towards professional knowledge in the study of various courses offered by the university, thus paying more attention to the improvement of practical learning and work abilities. Compared with non - medical students, medical students have a higher recognition rate ("very good" and "good") in terms of clinical application ability (68.94 % < 78.27 %), operability (70.45 < 75.31 %), class participation (55.30 % < 59.01 %) and knowledge mastery (22.72 % < 28.15 %). There may be three reasons for this: first, medical students have a heavy course load and relatively limited spare time, so the efficiency in class is particularly important; second, they will encounter practical problems in clinical practice such as internships and following doctors for consultations, which require a solid foundation of basic knowledge. To be proficient in clinical practice, they must pay attention to the learning and application of basic knowledge; third, students of different majors may focus on career development, and medical students are more inclined to have a solid grasp of medical knowledge to cope with the challenges of future work.

However, both groups have problems in mastering knowledge in class, which indicates that the teaching method combining micro-videos with the case-based

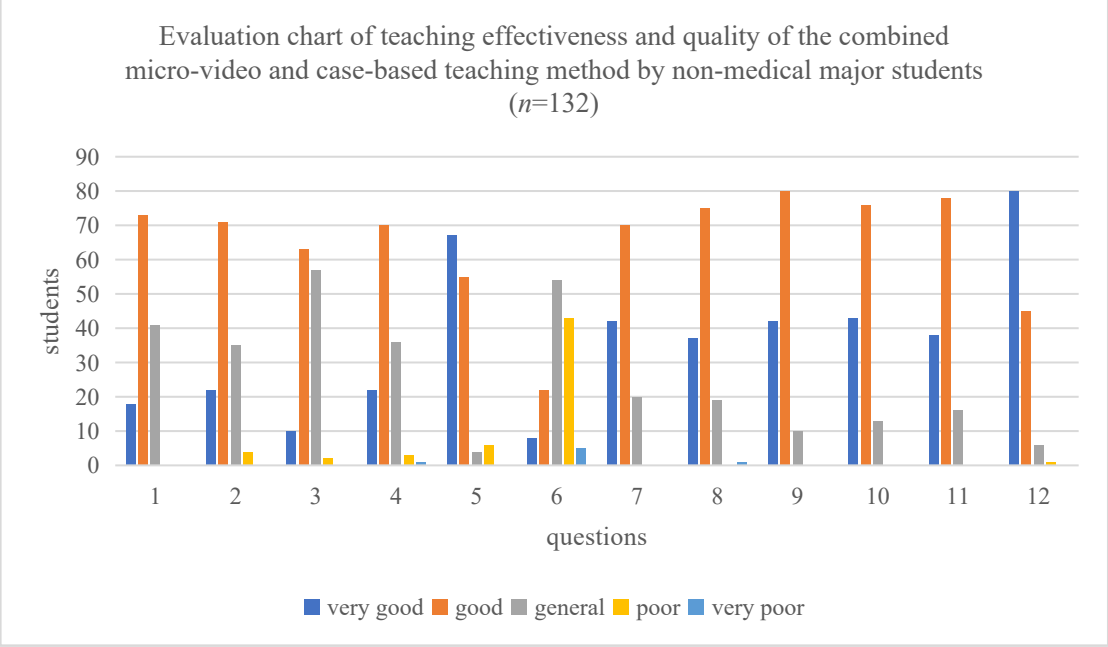

Figure 2. Evaluation chart of teaching effectiveness and quality of the combined micro-video and case-based teaching method by non-medical major students (n=132)

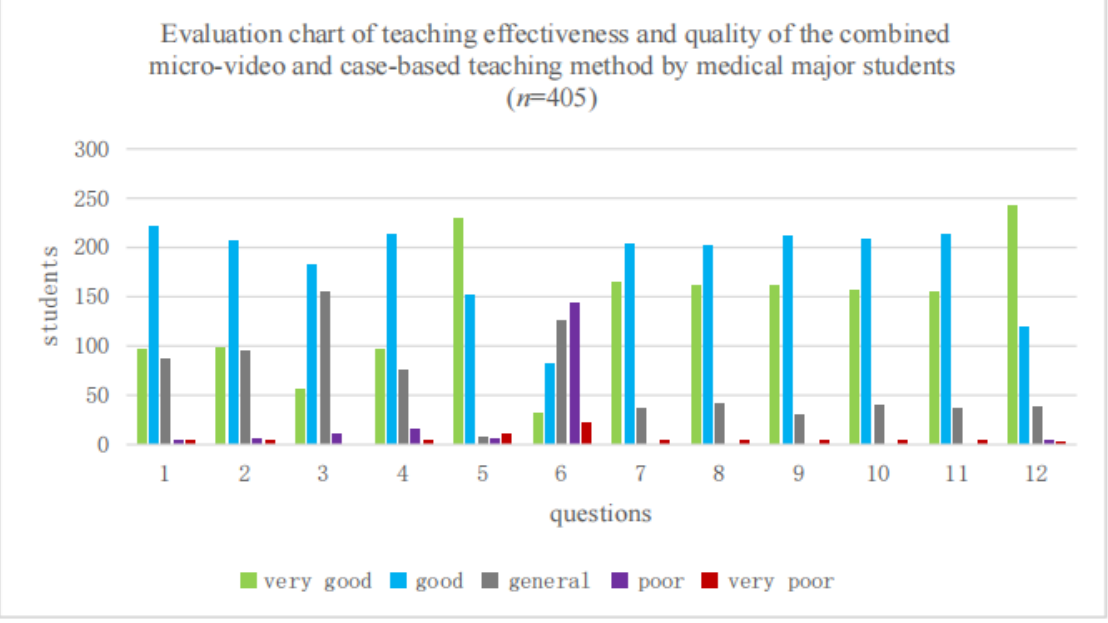

Figure 3. Evaluation chart of teaching effectiveness and quality of the combined micro-video and case-based teaching method by medical major students (n=405)

(1. Closeness of theory and practice; 2. Degree of student operability; 3. Degree of student participation; 4. Appropriateness of teaching time proportion (time occupied by this teaching method in the total course time); 5. Degree of integration of post-class review knowledge points with cases; 6. Degree of knowledge mastery; 7. Degree of enriching relevant professional knowledge; 8. Degree of improving logical thinking; 9. Degree of stimulating learning interest; 10. Improving the ability to correctly analyze, approach, handle, and solve problems; 11. Improving thinking ability, judgment, decision-making ability, and comprehensive quality; 12. Improving the ability to analyze and solve practical problems in the future)

teaching method should be based on traditional teaching, and attention should be paid to pre - class preview, in - class learning and after - class review to strengthen the mastery of physiology knowledge. This study shows that more than 80 % of the students, whether medical or non - medical majors, believe that the combination of micro-videos with the case-based teaching method can better integrate theory with practice, and effectively combine the learned theoretical knowledge with clinical practice such as following doctors for consultations, giving students an immersive experience. This lays a solid foundation for students to learn subsequent clinical courses and engage in clinical practice, instead of merely relying on reading textbooks and listening to teachers' explanations, which lacks the integration of practical scenarios. The teaching model combining micro-videos with the case-based teaching method can fully arouse students' enthusiasm and participation in class. Students can not only communicate actively with teachers, but also accept and internalize knowledge faster and better, make effective use of class time, and facilitate their after - class review. At the same time, this teaching method is also conducive to teachers to better complete teaching tasks. Especially when there is sufficient teaching practice time, teachers can broaden students' horizons, draw inferences from one another, and better achieve teaching effects. When students discuss in groups, they fully activate their brains to think within the effective time, improving their thinking ability, judgment and decision - making ability. At the same time, group cooperation is beneficial to improving students' collaboration ability and team awareness, and enhancing their ability to analyze and solve problems. It is not difficult to find from the survey results that the teaching model based on the combination of micro-videos and the case-based teaching method is relatively more reasonable. Instead of the traditional single teaching method of lectures, it introduces cases combined with micro-videos into the classroom. The new teaching method complements the traditional teaching method. Through the layers of questions raised by teachers, the key and difficult points of physiology teaching are integrated into the teaching process, making physiology learning vivid and lively, helping students master knowledge faster and better, and improving their comprehensive quality (see **Figures 2 and 3**).

5. Reflections on the Teaching Model Combining Micro-video and Case-based Teaching Methodology Applied in Physiology Teaching

Applying the combination of micro-video and case-based teaching methodology to physiology teaching is an innovative model that integrates theory with practice at the current stage.

5.1. A Bridge Between Theory and Practice

Traditional physiology classroom education models mostly use "spoon-feeding, cramming" teaching methods. Teachers follow teaching objectives and content, and students learn based solely on textbooks and teacher instruction. This easily leads to the practical problem that students cannot fully understand knowledge points, let alone apply them to future clinical practice[20], and more easily affects the development of students' clinical thinking. Micro-video-based and problem-oriented case-based teaching can provide students with real-scenario cases, helping them connect abstract theoretical knowledge with practical application. Micro-video can provide vivid visual elements for cases by displaying actual scenes, patient conditions, or experimental processes, making learning more vivid and interesting. What is accomplished this way is not only superficially making the classroom content, form, and scenario lively, but more importantly, teachers utilize the work experience of clinical doctors, combine physiological knowledge, present typical and relevant cases to students, help students perceive intuitively, and lead students to achieve the leap from theory to practice, thereby better applying physiological knowledge in clinical shadowing, internships, work, and other practices.

5.2. The Integration of Learning and Thinking

The implementation of the teaching method combining micro-videos with the case-based teaching method requires teachers to make full preparations for classes, design typical in - class questions in advance, stimulate students' curiosity, and guide students to think step by step. Neither standard answers nor judgments on right or

wrong are provided; instead, students are encouraged to learn fully and express their opinions freely. If students have some knowledge gaps or learning problems during the teaching process, teachers should guide them appropriately and subtly to ensure that students learn correct knowledge and master it as much as possible in class[17]. Compared with the traditional teaching method, the combination of micro-videos with the case-based teaching method applied in physiology teaching can better stimulate students' interest in learning. In the teaching process, the interaction between teachers and students increases, which gives full play to students' ability of independent thinking and autonomous learning, and realizes the vitality of knowledge, experience, ability and spirit of both teachers and students. This makes the teaching process a pleasant emotional experience for students, integrates learning with thinking, and turns learning into a process of "autonomy and exploration", which gives students more motivation to explore and solve problems and promotes the absorption of knowledge.

5.3. The Improvement of Abilities and Quality

With the continuous development of physiology and the constant update of cutting - edge knowledge, students should not only be satisfied with the basic theories in textbooks, but also focus on building a solid foundation and keeping pace with the times. The traditional teaching method often lacks the cultivation of students' comprehensive quality and may ignore students' self - learning ability, questioning ability and cooperative discussion ability. The new teaching method closely follows the trend of the "Internet +" era, consolidates students' basic knowledge, improves the efficiency of in - class learning, and meets the needs of the development of the discipline. In the process of case discussion, teachers can give enlightenment to inspire students to think by drawing inferences from one another and improve their ability to analyze and solve problems. The mutual discussion and debate among students can exercise their logical judgment ability, language expression ability and thinking response ability. Furthermore, students can not only master theoretical knowledge, but also improve their humanistic literacy, breaking through the teaching level that only focuses on knowledge. On the basis of guiding students to master medical knowledge about the laws of human life activities, attention is paid to the cultivation of abilities, the growth of life and the cultivation of human nature, so as to achieve the teaching goal of pursuing comprehensive abilities and excellent personality qualities. According to the teaching content, teachers can appropriately cite cases to implement the educational concepts of "all - round education", "establishing morality and cultivating people", and realize the moral education guidance for students to become socialist successors who are "important to the country and useful talents".

5.4. Mutual Assistance between Individuals and the Group

Teachers should fully arouse students' subjective initiative and encourage more students to participate actively. The classroom has transformed from the original "teacher – centered" model to a physiology classroom that is "student – centered" with students as the main body and teachers as guides. Students' role has changed from "passive acceptance" to "active acquisition". Students cooperate with each other, conduct active communication and discussion, analyze teaching cases in depth, create practical training scenarios, and inspire creative thinking and imagination. This teaching method organically integrates auditory and visual elements, which is conducive to students' better absorption of medical knowledge, the cultivation of excellent medical clinical thinking mode, and the improvement of team cooperation ability. In addition, it can also enhance the communication and interaction between students and teachers, which is beneficial for students to ask questions actively and think in depth. Students have different views and express themselves freely, and work together to explore ways to solve problems, creating a good cooperative atmosphere.

5.5. The Connection between In - class and After - class Learning

The class time for physiology is short, and the knowledge is extensive and complex. Relying solely on in - class learning cannot fully digest and absorb the knowledge, and it is difficult to complete the teaching tasks. Therefore, after-class review is particularly important[18,21]. Teachers can carefully design some relevant questions or cases for students to discuss and learn, so as to

consolidate knowledge and broaden their horizons. By integrating the teaching model of combining micro-videos with the case-based teaching method into traditional medical teaching, students can not only master important and complex knowledge in class, but also be encouraged to take the initiative to engage in in - depth independent learning and explore knowledge beyond the course, thereby broadening their medical horizons[21]. Students can explore knowledge from cases, read relevant books and literature, and give full play to their learning initiative. The case - based teaching method and micro-videos are convenient for students to watch and learn without being restricted by time or place, thus providing students with a more convenient learning method. This enables students to make more full use of time and alleviate the pressure of medical students in time arrangement.

The application of the combination of micro-videos with the case-based teaching method in physiology teaching is not only a beneficial supplement to the traditional teaching classroom, which further improves the teaching effect, but also enhances students' mastery of knowledge, stimulates their interest in learning, improves their comprehensive quality, and lays a solid foundation for subsequent clinical practice. This teaching method also helps students to more keenly discover clinical symptoms in their future clinical work, carefully identify the key points of diseases, analyze the causes carefully, effectively solve the pain of patients, and contribute to effective health education and communication, so as to better achieve the goal of cultivating TCM clinical talents.

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Disclosure statement

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