Teaching Reform of Chinese Medicine Processing Technology Course under the Integration of Technical and Higher Vocational Education

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Abstract Against the backdrop of integrated development between technical education and higher vocational education, the teaching of Chinese Medicine Processing Technology courses faces new opportunities and challenges. This paper analyzes the existing problems in the current teaching of Chinese Medicine Processing Technology courses, discusses the necessity of reforming the teaching model under the context of integration, and proposes the construction of a "Dual-Capability Progression, Six-Dimensional Empowerment" teaching model. The aim is to enhance the teaching quality of Chinese Medicine Processing Technology courses and cultivate high-quality skilled talents in Chinese medicine processing who can meet industry demands.

Key words Technical education, Higher vocational education, Integrated development, Chinese Medicine Processing Technology Course, Teaching reform

1 Introduction

In September 2024, the National Vocational Education Conference, themed "Developing Modern Vocational Education and Cultivating Master Craftsmen for a Great Nation", was held in Beijing. The conference reaffirmed the central importance of promoting the high-quality development of modern vocational education and clearly stated that vocational talent cultivation must adhere to the goals of serving students' holistic development and socio-economic development. It emphasized enhancing the core capabilities of vocational schools, deepening industry-education integration, and promoting the convergence of vocational and general education to accelerate the high-quality development of skilled talents. This necessitates greater efforts from vocational education practitioners. In recent years, several provinces have successively introduced corresponding policies and measures to support the integrated development of technical and vocational education. For instance, the *Several Policy Measures for Promoting the High-Quality Development of Technical Education in Guangdong Province*, issued by the General Office of the Guangdong Provincial People's Government in December 2021, highlighted the need to promote the integrated development of technical and vocational education. Similarly, the *Yunnan Province Implementation Plan for Enhancing the Quality and Efficiency of Vocational Education*, issued by the General Office of the Yunnan Provincial People's Government in March 2024, emphasized promoting the deep integration of "Vocational and Technical" education, adhering to principles of "collaborative enrollment, collaborative teaching, and collaborative competition", to advance the integrated development of vocational and technical education. As an institution concurrently offering both technical education and higher vocational education, Yunnan Technician College (Yunnan Industry and Trade Vocational College) finds research on "collaborative teaching" particularly urgent and significant. Such research will also provide robust support for this institution and similar ones to accelerate the high-quality cultivation of skilled talents. Chinese Medicine Processing Technology is a core course within Chinese *Materia Medica* programs, and its teaching quality directly impacts students' professional skills and future career development. With the integrated development of technical and higher vocational education, how to integrate the strengths of both types of education—where technical education emphasizes practical skill cultivation, and higher vocational education focuses on integrating theory and practice while enhancing students' comprehensive competencies—to innovate the teaching model for the Chinese Medicine Processing Technology course has become a critical issue in the educational reform of Chinese medicine-related majors in vocational institutions offering both backgrounds. Furthermore, the deep integration of these two educational streams can inject new ideas and methods into the teaching of this course, further elevating the quality of talent cultivation and their job readiness.

2 Problems in the current teaching of Chinese Medicine Processing Technology course

2.1 Disconnection between teaching content and industry needs The teaching content of Chinese Medicine Processing Technology courses in some institutions is not updated promptly and fails to closely align with the latest developments and practical demands of the industry. The knowledge and skills presented in textbooks lag behind their application in actual production. The disconnect between the learned theoretical knowledge, skills, and competencies and the requirements of job positions is evident. This results in a gap between what students learn and the actual needs of enterprises, making it difficult for graduates to adapt quickly to their work roles.

2.1.1 Diverse medicinal materials and processing methods posing significant learning challenges. The processing methods docu-

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mented in Chinese medicine processing technology textbooks primarily derive from the processing standards for decoction pieces included in the Chinese Pharmacopoeia. These methods are diverse and numerous, commonly including stir-frying without additives (such as stir-frying until yellow, stir-frying until charred, stir-frying until carbonized), stir-frying with solid adjuvants (*e. g.*, bran stir-frying, rice stir-frying, earth stir-frying, sand stir-frying), roasting with liquids (*e. g.*, wine-roasting, vinegar-roasting, salt-water roasting, honey-roasting), as well as various water-fire combined methods and other specialized processing techniques. Adding to the complexity, the same medicinal material often requires processing using multiple methods depending on different needs. These needs include adapting for the treatment of specific diseases, facilitating dispensing and preparation, aiding storage management, *etc*. This characteristic of "multiple methods for one drug" significantly increases the learning complexity of Chinese medicine processing techniques. Secondly, Chinese medicine processing is a profound and intricate art. The methods also encompass uniquely transmitted processing techniques with distinct heritage significance. For example, among China's four major processing schools: Jiangxi Zhangbang's "Fengyan Slices of Bitter Orange Peel", Beijing Jingbang's "Nine Cycles Processed *Arisaema* with Bile", Sichuan Chuanbang's "Nine Times Processed Rhubarb", and Jiangxi Jianchangbang's "Jianchang Processed Aconite Lateral Root Slices". These techniques are characterized by complex processes, reliance on practical experience, long production cycles, or the need for specialized equipment, making them difficult for students to fully master in a classroom environment. Furthermore, due to factors such as regional culture, medicinal traditions, characteristics of medicinal materials, and differences in clinical practice, local drug regulatory authorities establish local processing standards based on actual local conditions to strengthen the management of Chinese medicine processing within their jurisdictions and ensure quality and medication safety. This also contributes to the diversity of Chinese medicine processing methods.

2.1.2 Obscurity of some processing principles hindering student comprehension. The obscure aspects of Chinese medicine processing principles primarily lie in the disconnect between traditional empirical theory and modern scientific explanations, complex chemical transformations, and difficulties in quantifying processes. In traditional processing, critical operations such as "gentle heat" (wen huo), "strong heat" (wu huo), "stir-frying until yellow", and "stir-frying until carbonized" often rely heavily on the operator's sensory judgment without clear quantitative indicators. For instance, processing Sophora Flower-bud (Huaimi) into carbonized form requires "retaining therapeutic nature". Students, finding it difficult to precisely control the degree of carbonization, frequently produce substandard decoction pieces due to improper heat control. The processing of Scutellaria Root involves an enzymatic reaction where "turning green signifies loss of efficacy". Students need to understand the relationship between enzyme activity and temperature; mistakenly using cold water for soaking and softening can lead to the loss of medicinal efficacy. Simultaneously, discrepancies between some traditional processing theories and conclusions from modern research also increase the difficulty of comprehension. Traditionally, the "core" of Dwarf Lilyturf Tuber was considered non-medicinal and believed to cause restlessness upon ingestion. However, modern analysis shows no significant difference in composition between the core and the flesh of the tuber. Moreover, the "core removal" process is complex and inconvenient. Consequently, it is suggested in practical application that core removal may be omitted[1]. Similar situations exist with other herbs like Ginseng and Platycodon Root. Students often feel confused during instruction about why certain materials still require processes like core removal or "removing the reed head" during cleaning and preparation.

2.1.3 Ambiguous quality characteristics of decoction pieces hindering quality control in practical operations. In the practical teaching of Chinese Medicine Processing Technology courses, operations often follow traditional processing methods. However, the determination of the processing degree and endpoint primarily relies on human senses, specifically through visual inspection of color, tactile assessment of texture, olfactory detection of odor, and gustatory evaluation of taste. For example, stir-frying Hawthorn Fruit until charred requires reaching a stage described as "surface charred-brown, interior yellowish-brown, with a scorched aroma released". Descriptions of these sensory indicators (color, texture, odor, taste) are often vague and subjective. Compounded by individual differences among instructors in judging the "degree" of processing, this frequently leads to contradictory assessments of finished product quality in actual teaching scenarios. Consequently, it becomes difficult to objectively and uniformly determine whether decoction pieces are qualified during practical operations, posing significant challenges for quality control of the final products.

2.2 Weaknesses in practical teaching components Although Chinese Medicine Processing Technology is a highly practice-heavy course, numerous problems often exist in its practical teaching components during actual instruction. For instance, practical training venues and equipment are often limited, failing to meet students' hands-on learning needs; practical operational procedures are fragmented, meaning the complete processing workflow (cleaning/sorting → softening → cutting → processing with heat/liquid) is broken down, allowing students to experience only isolated segments and preventing them from independently executing the entire process; furthermore, the practical experience and professional expertise of instructors guiding practical sessions vary significantly, adversely impacting the quality of practical teaching.

2.3 Limitations of traditional teaching methods and suboptimal practical teaching outcomes Traditional teaching in Chinese Medicine Processing Technology courses is predominantly teacher-centered lecturing. Students are placed in a passive knowledge-receiving mode, lacking opportunities for active participation and independent critical thinking. This singular teaching approach struggles to stimulate student interest and motivation, and it is also detrimental to cultivating students' innovation and practical abilities. Even though many institutions, recognizing these issues, have adopted a theory-practice integrated teaching model, the core challenge in Chinese medicine processing—a traditional craft reliant on long-term practical accumulation and experiential sedimentation—remains the precise control of the processing degree. It is inherently difficult to enable students to master solid operational skills within the constrained hours allocated for practical teaching. Moreover, traditional practical teaching typically focuses on requiring students to master operational procedures, precautions, and the characteristics of the finished product, but it often fails to deeply analyze the key factors influencing those finished product characteristics. This results in students knowing the 'how' but not the 'why' during operations[2], making it difficult for them to flexibly respond to various problems encountered in practical work. Consequently, the effectiveness of practical teaching ultimately proves unsatisfactory.

2.4 Inadequate assessment system Currently, the assessment system for the Chinese Medicine Processing Technology course primarily relies on written examinations and lab reports. Evaluation of students' practical operational skills and comprehensive competencies is neither sufficiently comprehensive nor objective. This assessment framework fails to accurately reflect students' learning outcomes and actual capabilities. Furthermore, it does not effectively incentivize students to actively participate in practical learning or to enhance their overall competencies.

3 Necessities of teaching model reform under the background of technical and higher vocational education integration

3.1 Meeting industry talent demands With the rapid development of the Chinese medicine industry, enterprises are demanding increasingly higher qualifications from professionals specializing in Chinese medicine processing. Beyond solid theoretical knowledge and proficient practical skills, there is also a demand for talents possessing strong innovation capabilities, teamwork skills, and professional ethics. The integrated development of technical education and higher vocational education can harness the strengths of both systems to cultivate interdisciplinary talents who possess robust practical operational abilities alongside foundational theoretical knowledge and comprehensive competencies. This approach meets the diverse and high-caliber demands of enterprises for skilled personnel.

3.2 Enhancing the efficiency of teaching resource utilization For institutions concurrently offering both technical education and higher vocational education, each stream possesses distinct advantages in teaching resources: technical education boasts faculty with highly refined practical skills, while higher vocational education possesses a well-developed theoretical teaching system and stronger research capabilities. Promoting the integrated development of these two educational streams enables the sharing and optimal allocation of teaching resources, thereby enhancing resource utilization efficiency. This, in turn, creates more favorable conditions for the teaching of courses such as Chinese Medicine Processing Technology.

3.3 Promoting students' holistic development Technical education emphasizes the cultivation of practical skills, enabling students to rapidly master the actual operational skills of Chinese medicine processing; higher vocational education stresses the acquisition of theoretical knowledge and the enhancement of comprehensive competencies, contributing to the development of students' innovative thinking and problem-solving abilities. The integrated development of both provides students with a more holistic education, promotes their all-around development, and enhances their employability and career development potential.

4 Construction of the teaching model for the Chinese Medicine Processing Technology course under the background of technical and higher vocational education integration

Addressing the issues identified in the teaching process of the Chinese Medicine Processing Technology course, such as the disconnection between teaching content and industry needs, weaknesses in practical teaching components, singular teaching methods, and an inadequate assessment system, it has become particularly urgent for Yunnan Technician College (Yunnan Industry and Trade Vocational College), an institution offering both technical and higher vocational education, to actively explore an effective teaching model to enhance students' professional skills.

The specific construction approach is as follows: Relying on the College's Professional Development Steering Committee, core faculty members and enterprise technical experts were organized to conduct in-depth research on the development status of Yunnan's Chinese medicine industry and the core competency requirements for positions related to Chinese medicine processing. Building on this foundation, the approach adheres to the core objectives of high-quality employment and meeting job demands, emphasizing the dual-leadership role of both the school and enterprises. This led to the construction of the "Dual-Capability Progression, Six-Dimensional Empowerment" teaching model centered on competency cultivation. The core pathway of this model is "Dual-Track Progression", achieved through the parallel implementation of the "Job Task Line" (Basic Knowledge → Job Skills → Comprehensive Application) and the "Project Task Line" (Basic Job Tasks → Core Job Tasks → Comprehensive Job Tasks). This facilitates the step-by-step enhancement of students' professional competencies. Throughout this process, the educational philosophy of school-enterprise dual development, work-study integration, and industry-education integration is fully integrated. Simultaneously, a student-centered "Six-Step Task-Based Learning Method" is constructed (Mind Mapping → Learning Objectives → Case Introduction → Learning Process → Assignment Sheet → Learning Evaluation), forming an integrated self-directed learning cycle of "learning by doing, refining by evaluating", thereby prompting a shift in the teacher's role towards that of a facilitator. In the implementation of teaching, ideological and political education, Chinese medicine thinking, and smart teaching tools are deeply integrated to create a "Four-Dimensional" classroom, ultimately achieving comprehensive cultivation of students' professional competencies. The teaching model is illustrated in Fig. 1.

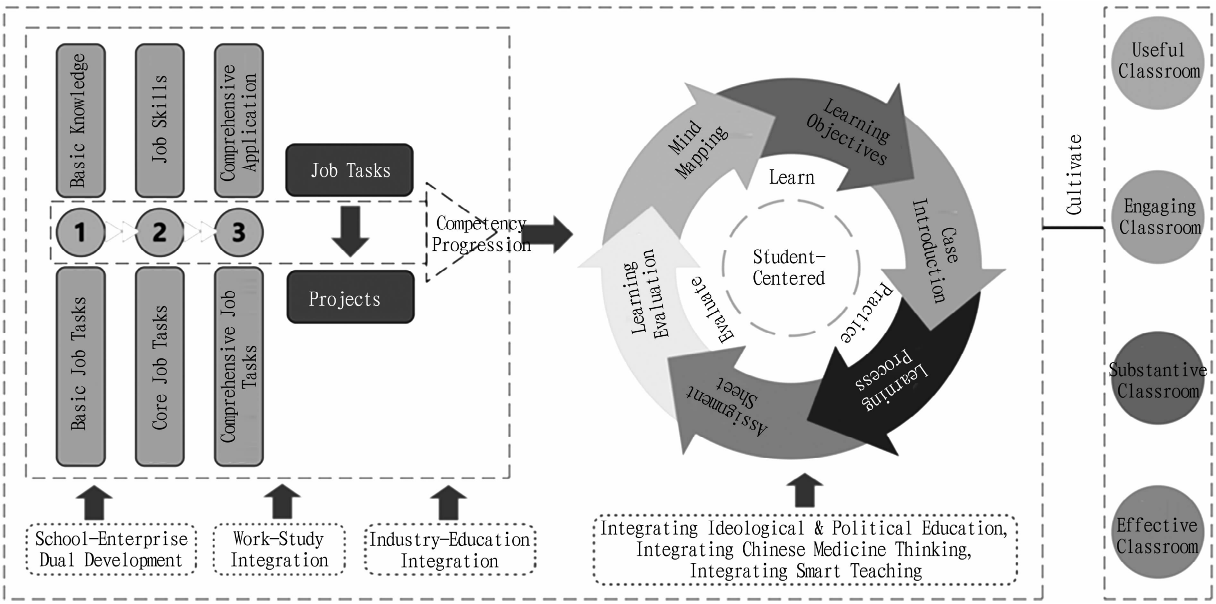

Fig. 1 The "Dual-Capability Progression, Six-Dimensional Empowerment" teaching model

4.1 Restructuring course content The content of the Chinese Medicine Processing Technology course is restructured with a specific approach centered on processing techniques and technological workflows. A three-tiered framework—"Professional Position (Chinese Decoction Piece Production Post) → Learning Projects (9 Major Production Stages) → Job Tasks"—is adopted to construct a work-process-based curriculum system.

4.1.1 Structural design. (i) Vertical layering. The entire decoction piece production workflow is divided into eight major projects (namely: Fundamentals of Chinese Medicine Processing, Chinese Medicine Cleaning/Trimming, Chinese Medicine Stir-Frying, Chinese Medicine Roasting, Chinese Medicine Calcining, Chinese Medicine Water-Fire Combined Processing, Special Processing of Chinese Medicine, Packaging of Chinese Decoction Pieces, Storage and Management of Chinese Decoction Pieces). Each project is decomposed into 2 – 9 learning-oriented job tasks, such as "Cleaning of Medicinal Materials" and "Softening of Medicinal Materials".

(ii) Horizontal closed loop. Each learning-oriented job task is designed according to a six-step logic (Mind Mapping → Learning Objectives → Case Introduction → Learning Process → Assignment Sheet → Learning Evaluation), forming an integrated "Learn-Practice-Evaluate" unit.

(iii) Evaluation system. At the level of each learning-oriented job task, an assignment sheet is used to achieve immediate assessment of skill points. At the learning project level, a "Project Learning Summary Evaluation" is added to comprehensively assess professional competencies (*e.g.*, comprehensive application ability of processes, process optimization ability).

4.1.2 Content organization. The content organization focuses on three distinctive educational philosophy features, detailed as follows:

(i) School-enterprise dual development of course content. Enterprise technical experts take the lead in formulating work sheets for learning-oriented job tasks and developing supporting digital teaching resources (*e.g.*, equipment images, standard operating procedures, job responsibilities, operational safety knowledge). College faculty take the lead in conceptualizing the learning content for learning-oriented job tasks (*e.g.*, mind maps, learning objectives, ideological and political education cases, learning materials, learning evaluations).

(ii) Deep implementation of work-study integration. "Project Task Line": The nine major projects fully correspond to the standardized processes of enterprise decoction piece production. For example, the "Chinese Medicine Cleaning/Trimming" project equals the "Raw Decoction Piece Production Procedure" of an enterprise's pre-processing department. Project design follows "Basic Job Tasks → Core Job Tasks → Comprehensive Job Tasks" (*e.g.*, Cleaning of Medicinal Materials → Softening of Medicinal Materials → Cutting of Decoction Pieces → Drying of Decoction Pieces → Production of Decoction Pieces), enabling the step-by-step enhancement of students' professional competencies.

(iii) "Job Task Line". Using authentic work tasks like "Softening of Medicinal Materials" as the vehicle, task design adheres to the current edition of the *Chinese Pharmacopoeia*, national decoction piece processing standards, or local decoction piece processing standards, with some tasks derived from enterprise cases (*e.g.*, production of "*Scutellaria amoena* C. H. Wright Slices"). The difficulty gradient follows "Basic Knowledge → Job Skills →

Comprehensive Application" (*e. g.*, for the learning process of softening medicinal materials: Fundamentals of Softening Medicinal Materials → Completing Work Sheets, Recognizing Tools/Equipment, Understanding the Post → Specific Operations of Softening Medicinal Materials). Content design progresses from simple to complex, easy to difficult, and embeds "education-oriented" ideological and political elements.

(iv) Deep implementation of industry-education integration. By transforming core elements from decoction piece production processes, such as technical specifications and process parameters, into course knowledge modules, skill training items, and assessment scales through content restructuring and evaluation mechanism design, students internalize the actual requirements of enterprise positions concurrently during learning. This achieves deep industry-education interpenetration where "what is learned is the work standard, and assessment results are job performance". Specific measures include adopting authentic enterprise production standards for technical indicators in job learning tasks. For instance, in the preparation of Angelica Sinensis Slices, the "Low-Temperature Drying Temperature Control" requirement is (60 ± 2) ℃, with data sourced from the pharmaceutical enterprise's *Drying Procedure Operation Standard*. Learning evaluations incorporate core enterprise assessment dimensions such as "cleanliness" and "finished product pass rate". For example, "cleanliness" is a key metric in the assessment of the job learning task "Cleaning of Medicinal Materials".

4.1.3 Additional uses of course content. Beyond supporting teaching implementation, the course also concurrently supports skill certification (aligned with the *Chinese Medicine Processing Technician Vocational Skill Standards*) and enterprise training (assignment sheets can be converted into work sheets).

4.2 Innovative teaching process[2] The specific approach involves designing job tasks according to the six-step method ("Mind Mapping → Learning Objectives → Case Introduction → Learning Process → Assignment Sheet → Learning Evaluation"), supporting student self-directed inquiry. The "Six-Step Task Method" facilitates an integrated vocational education closed loop of "learning by doing, refining by evaluating", shifting the teacher's role to that of a facilitator. In teaching implementation, deep integration of ideological and political education, Chinese medicine thinking, and smart teaching tools is achieved to realize comprehensive cultivation of students' professional competencies.

Specifically, "Case Introduction" deeply integrates content related to ideological and political education and Chinese medicine thinking, fostering students' patriotism, scientific spirit, and humanistic literacy; teaching content in the "Learning Process" phase introduces new processes, methods, technologies, and standards, exercising students' innovative thinking, broadening their horizons for learning new knowledge and skills, and stimulating their enthusiasm for studying traditional processing theories. Teachers can utilize forms like flipped classrooms and second classrooms to encourage students to actively consult literature and summarize cases. This not only compensates for shortcomings in classroom teaching but also stimulates students' subjective initiative in proactively exploring Chinese Medicine processing techniques[3]. Assignment sheets are designed based on a "problem-guided" approach, strengthening students' ability to analyze and solve practical problems. Table 1 provides an example of an assignment sheet design.

Table 1 Work sheet for medicinal material cleaning operation

<table>
<tr><td colspan="3">Name</td><td></td><td>Student ID</td><td></td><td colspan="2">Class</td><td></td></tr>
<tr><td colspan="3">Group No.</td><td></td><td>Group Leader</td><td></td><td colspan="2">Date</td><td></td></tr>
<tr><td colspan="3">Name of Medicinal Material</td><td colspan="6"></td></tr>
<tr><td colspan="3">Purpose of Cleaning</td><td colspan="6"></td></tr>
<tr><td colspan="3">Names of Impurities and Non-medicinal Parts</td><td colspan="6"></td></tr>
<tr><td colspan="9">Process Flow</td></tr>
<tr><td colspan="9"></td></tr>
<tr><td rowspan="7">Key Steps</td><td rowspan="2">Preparations</td><td colspan="2">Cleaning Tools</td><td colspan="5"></td></tr>
<tr><td colspan="2">Cleaning Method</td><td colspan="5"></td></tr>
<tr><td colspan="3">Weighing</td><td colspan="5"></td></tr>
<tr><td colspan="3">Tools Used (Key Operation Points)</td><td colspan="5"></td></tr>
<tr><td rowspan="2">Cleanliness</td><td colspan="2">Weight before Operation (g)</td><td></td><td colspan="2">Calculated Cleanliness (%)</td><td colspan="2">Does the Cleanliness Meet Requirements?</td></tr>
<tr><td colspan="2">Weight after Operation (g)</td><td></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Site Clearing</td><td colspan="7"></td></tr>
<tr><td colspan="3">Operation Duration (min)</td><td colspan="6"></td></tr>
<tr><td colspan="9">Summary and Problem Analysis</td></tr>
<tr><td colspan="9"></td></tr>
</table>

4.3 Smart teaching tools assisting instruction Instruction is conducted with a practice-oriented approach. During the teaching process, the following teaching tools are applied to assist in implementation, aiming to enhance the precision, efficiency, initiative, and quality of both teaching and learning, cultivate the "Four-Dimensional" classroom, and ultimately achieve comprehensive cultivation of students' professional competencies.

4.3.1 Online teaching platforms. Online teaching platforms, such as Smart Vocational Education and XuetangX, are introduced to provide students with abundant learning resources. Students autonomously learn course videos, courseware, assignments, and other content through the online platforms, thereby improving their learning autonomy and initiative.

4.3.2 Virtual simulation teaching software. Utilizing Chinese Medicine processing virtual simulation teaching software, the actual operational processes of processing are simulated, allowing students to conduct practical operations in a virtual environment. This compensates for the limitations of practical teaching venues and equipment. Students improve their practical skills through repeated operational practice. Simultaneously, the virtual simulation software can record students' operation processes and data, providing objective evidence for teachers' instructional assessment.

4.3.3 Blended online-offline teaching. A blended online-offline teaching model is adopted, combining online learning with offline instruction. Teachers check and guide students' online learning progress in the classroom, answer their questions, and simultaneously organize activities such as practical operations and group discussions to enhance teaching effectiveness.

4.4 Innovating a multi-dimensional assessment system Teaching employs a comprehensive assessment system combining "Formative Assessment + Stage Assessment + Summative Assessment", aiming to evaluate students' learning outcomes and professional competency development in an all-round, multi-dimensional manner. Formative Assessment focuses on students' performance during their daily learning process, specifically examining their conduct in job task learning segments. This includes the quality and timeliness of assignment sheet completion, adherence to labor discipline, behaviors demonstrating professional ethics and competencies, application ability of theoretical knowledge in practice, mastery level and proficiency of practical skills, *etc*. A Formative Assessment Evaluation Form must be designed and used for systematic recording and quantitative evaluation. Stage Assessment focuses on key milestone outcomes after the completion of project task learning, emphasizing the completion status of project tasks and the achievement level of stage objectives. Outcomes can take various forms, such as design proposals, work sheets, processed products, *etc*. Attention is also paid to assessing students' problem-solving abilities and teamwork skills. Summative Assessment comprehensively examines the overall level of professional competency students attain by the end of the course. It emphasizes assessing students' comprehensive professional abilities in areas such as skill competitions, certification for the Chinese Medicine Processing Technician role, and comprehension of processing knowledge. Throughout the entire teaching process, "evaluation" permeates all dimensions across the whole journey, enabling "learning by doing, refining by evaluating" at any time. This ultimately forms an integrated "Learn-Practice-Evaluate" teaching and assessment system (Fig. 2).

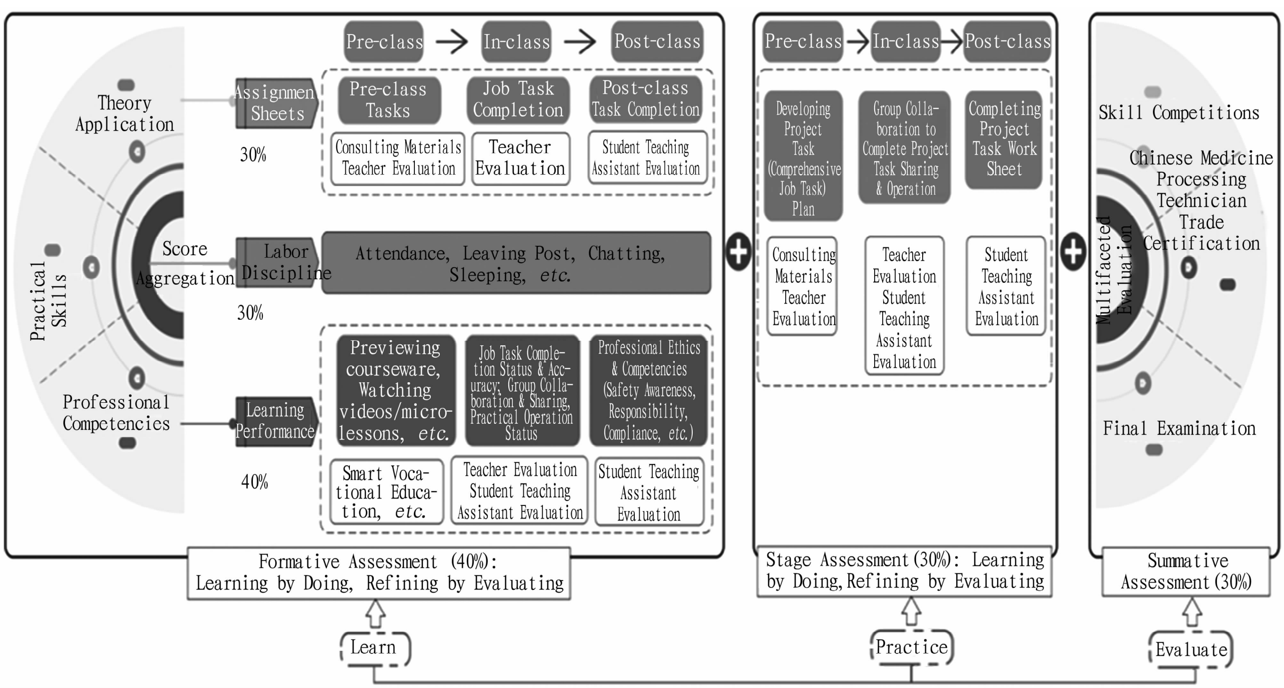

Fig. 2 Integrated "Learn-Practice-Evaluate" teaching and assessment system

5 Conclusions

Against the backdrop of the integrated development of technical education and higher vocational education, reforming the teaching model of the Chinese Medicine Processing Technology course holds significant practical importance: it aims to break down the boundaries of traditional education types, integrate advantageous resources, achieve deep integration of theory and practice, bridge tradition and modernity, and forge a close connection between industry and education. To this end, this paper has established the

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"Dual-Capability Progression, Six-Dimensional Empowerment" teaching model by restructuring course content, innovating the teaching process, applying smart teaching aids, and constructing a multi-dimensional assessment system. The goal is to enhance the teaching quality of the Chinese Medicine Processing Technology course and cultivate high-quality skilled talents who can meet industry demands. Besides, this model possesses the characteristic of dynamic optimization; it will undergo continuous refinement and updating in response to societal progress, industry development, and evolving job requirements, thereby promoting the sustainable development of Chinese medicine-related professional education.

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