

Research on the Construction and Development Model of Modern Industrial Colleges in Medical Universities

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Abstract: The construction of modern industrial colleges is an important way for medical universities to deepen the integration of industry and education and improve the quality of talent training. Taking the Cosmetics Industrial College as an example, this paper adheres to the orientation of cultivating compound and applied high-quality medical talents, constructs the "12445" modern industrial college construction plan of one core concept, dual drivers of school and enterprise collaboration, a "four councils" operation mechanism, "four integrations" for synergistic development, and "five innovations" for talent cultivation, optimizes the collaborative operation mechanism, enhances the pertinence and practicality of talent training, and provides experience and reference for effectively promoting the integrated development of education, talents and industry, as well as innovating the construction of modern industrial colleges in universities and talent training models.

Keywords: Modern Industrial College; Construction Plan; Talent Cultivation; Collaborative Innovation

1. Introduction

The report emphasizes "promoting the building of a healthy China" and "placing the protection of people's health in a strategic position of priority development", while proposing to "develop and expand the medical and health workforce". The "Healthy China 2030" Planning Outline further clarifies the specific paths for the development of health human resources, including strengthening the collaboration between medical education and practice, establishing and improving a mechanism for balancing the supply and demand of medical and pharmaceutical talent training, building a mechanism for training compound and

high-level talents, and strengthening the development of grassroots talent teams [1]. As important bases for cultivating high-quality medical and health talents, medical and pharmaceutical colleges and universities shoulder the important task of providing solid talent support for advancing Chinese modernization. It is worth noting that the report, for the first time, discusses the strategy of strengthening the country through talent in parallel with the strategies of rejuvenating the country through science and education and driving development through innovation. This discussion points out a new direction, sets a new benchmark, and paints a new development vision for the talent training work of medical and pharmaceutical colleges and universities.

The construction of modern industrial colleges is not only an important measure to fully implement the "trinity" decision-making arrangement of education, science and technology, and talents, and to promote the priority development of education, industrial innovation and high-quality economic development, but also an important carrier and path for application-oriented universities to solve the structural contradictions on the education supply side and realize the integration of industry and education for collaborative talent cultivation. In 2020, the General Office of the Ministry of Education and the General Office of the Ministry of Industry and Information Technology issued the Guidelines for the Construction of Modern Industrial Colleges, and announced the list of the first batch of modern industrial colleges in 2021. Since then, research and construction practices on modern industrial colleges have gradually increased, accumulating certain research results and practical experience. However, on the whole, the construction of modern industrial colleges still faces practical difficulties such as weak theoretical foundation and insufficient practical exploration, which are mainly

manifested in the following four aspects: (1) unclear rights and responsibilities of multi-subject school-running; (2) lack of sufficient guarantee for the operation mechanism; (3) disconnection between talent training and industrial needs; (4) failure to form an effective evaluation mechanism [2]. Therefore, the development of modern industrial colleges with strong connotation and high quality still needs to carry out targeted research, and summarize and improve in exploration and practice.

The Cosmetics Industrial College always adheres to the fundamental task of fostering virtue through education, centers on students' growth, and is committed to cultivating high-quality applied talents urgently needed for the development of the cosmetics industry. In the process of construction and development, the Cosmetics Industrial College has continuously absorbed and learned from the management experience and school-running achievements of peer institutions [3]. Aiming at the main problems existing in the current operation and development of industrial colleges, it has persisted in the original aspiration of cultivating compound, applied and high-quality medical talents in the exploration of reform and practice. Combined with the school's orientation, it has given full play to disciplinary advantages and professional characteristics, and actively constructed the "12445" implementation plan featuring "one core, dual drives, four councils, four integrations and five innovations".

2. Clarify the Construction Concept of "One Core"

The Cosmetics Industrial College closely centering on the "Healthy China 2030" strategy and innovating talent training models, it has established the core concept of "adhering to the integration of Chinese and Western approaches, pursuing healthy coexistence, and empowering the cultivation of compound, applied and innovative talents". By cultivating a large number of high-quality compound, applied and innovative talents who can adapt to the needs of industrial iteration, promote the development of "the homology of cosmetics and pharmaceuticals", and serve the people's needs for health and beauty, it provides talent support and intellectual backing for enhancing industrial competitiveness and gathering new momentum for development.

3. Stable Development Driven by "Dual Engines" of Schools and Enterprises

In the process of its development, the Cosmetics Industrial College adheres to the "dual-wheel drive" development concept. Firstly, it adheres to the "demand-driven" approach: Enterprises release annual technical pain points (such as substitution of bio-based raw materials, digitization of efficacy evaluation, stability of natural raw materials, formula design and optimization, and process optimization issues), and the Industrial College conducts targeted research to tackle these problems. In the talent training process, students are guided to focus on real-world problems of enterprises and use their professional knowledge to solve practical issues, providing enterprises with low-cost and highly flexible solutions, which effectively reduces the enterprises' trial-and-error costs [4]. Through in-depth cooperation with the Industrial College, enterprises can accurately identify students with a solid professional foundation and strong practical abilities, shorten the onboarding training cycle, and reduce recruitment costs. This has significantly increased enterprises' attention to and enthusiasm for the construction and development of the Industrial College, promoting resource feedback and long-term school-enterprise cooperation. Secondly, it adheres to the "innovation-driven" approach: Schools and enterprises focus on the cutting-edge of industry development and the driving forces of industrial transformation, strive to cultivate new productive forces, and help both parties achieve high-quality and connotative development. For example, schools and enterprises have jointly established the "Cosmetics Green Technology Research Institute", which focuses on fields such as green formulas, natural/organic raw materials, environmentally friendly packaging, and sustainable production. It gives full play to the application potential of artificial intelligence and digital technology in cosmetics research and development, continuously expands students' opportunities for innovative practice, enriches their exposure to and understanding of cutting-edge technologies, broadens their employment options, helps them achieve capability upgrading, and enhances their professional competitiveness.

4. Improve the "Four Councils" Operation

Mechanism

The Cosmetics Industrial College has established a collaborative operation mechanism of "four councils" to fully mobilize the forces of the government, colleges and universities, enterprises, and industries, and optimize the management and operation mechanism. Specifically, it includes the Joint Council of the Cosmetics Industrial College, the Academic Steering Committee of the Cosmetics Industrial College, the Executive Committee of the Cosmetics Industrial College, and the Supervision and Management Committee of the Cosmetics Industrial College.

The Joint Council of the Cosmetics Industrial College is composed of multiple representatives from school-enterprise co-construction units [5]. It formulates the council's articles of association, clarifying the council's organizational structure, scope of responsibilities, rules of procedure, as well as the rights and obligations of council members. As the highest decision-making body, the council is responsible for deliberating and deciding on major development issues of the Industrial College and guiding the formulation of its strategic development plan. The council has 1 chairman, 2 vice-chairmen, and several council members. The chairman is recommended by the school; the two vice-chairmen are respectively represented by a representative from an off-campus cooperative co-construction unit and a representative from the school; the council members include several persons in charge of relevant departments from the four parties: the school, enterprises, government, and industry.

The Academic Steering Committee of the Cosmetics Industrial College is responsible for managing the teaching and scientific research work of the Industrial College. It has two professional groups under it: the Academic Guidance Group and the Technical Guidance Group, which are respectively responsible for guiding and designing the theoretical teaching and practical teaching links in the talent training process of the Industrial College. The committee has 2 presidents, who are served by university discipline leaders and enterprise R&D directors, respectively leading the work of the Academic Guidance Group and the Technical Guidance Group; 2 vice-presidents, who are served by university professors and enterprise production managers. The committee members include industry-renowned experts, representatives from

China's Cosmetics Industry-University-Research Collaborative Innovation Platform and other professionals, providing professional guidance for the theoretical and practical teaching of the Industrial College. According to the actual situation of the construction and development of the Industrial College, the committee may also hire experts in related fields as consultants.

The Executive Committee of the Cosmetics Industrial College is responsible for coordinating the implementation of the strategic decisions of the Joint Council and the plans of the Academic Steering Committee, and timely feeding back the implementation status. The Executive Committee has 1 president, who is served by the dean of the Industrial College; 2 vice-presidents, who are respectively served by persons in charge of relevant departments of enterprises and the government; and members including persons in charge of various departments of the Industrial College, assisting the president in coordinating and implementing various specific tasks of the Industrial College.

The Supervision and Management Committee of the Cosmetics Industrial College is a supervisory body that ensures the standardized operation of the Industrial College [6]. It has two groups under it: the Teaching Supervision Group and the Compliance Evaluation Group, which respectively supervise and evaluate the quality of teaching practice guidance of the Academic Steering Committee and the work operation of the Executive Committee, and are also responsible for supervising the integrity and self-discipline of all committees of the Industrial College. The Supervision and Management Committee has 1 president, who is served by the director of the Market Supervision Bureau or the director of the Traditional Chinese Medicine Bureau; 2 vice-presidents, who are respectively served by school management personnel and enterprise executives; and members including several representatives of the management of the Industrial College, working together to ensure that the strategic planning of the Joint Council, the teaching practice guidance of the Academic Steering Committee, and the daily operation of the Executive Committee are standardized, orderly, honest and efficient.

5. "Four Integrations" for Synergistic Quality and Efficiency Improvement

The Cosmetics Industrial College has built a collaborative and innovative talent training

system through in-depth integration in four dimensions: "disciplinary integration, integration of industry and education, integration of Chinese and Western approaches, and integration of research and application".

In terms of disciplinary integration, it breaks down traditional disciplinary barriers, integrates disciplinary resources such as pharmacy, chemistry, and biology, and forms an interdisciplinary "Cosmetics Science and Technology" professional cluster. It focuses on promoting the integrated development of the new medical sciences with new agricultural sciences, new engineering, and new liberal arts, aiming to cultivate compound and applied talents [7].

In terms of integration of industry and education, schools and enterprises conduct in-depth cooperation in textbook compilation and curriculum design, accelerating the updating of teaching content. Industrial needs are embedded into the entire process of talent training, achieving seamless connection between the education chain and the industrial chain.

In terms of integration of Chinese and Western approaches, in the design of relevant cosmetic formulas, traditional Chinese medicine theories are organically integrated with advanced technologies from other countries (such as the United States, Europe, South Korea, and Japan), creating an innovative product design concept of "Eastern wisdom + Western technology".

In terms of integration of research and application, research directions are driven by market demands to ensure that technological achievements are quickly transformed into practical applications.

The "four integrations" advance in a coordinated manner, effectively promoting the high-quality development of the Cosmetics Industrial College. By breaking boundaries through interdisciplinary integration, linking resources through industry-education collaboration, innovating paths through the combination of Chinese and Western strengths, and accelerating transformation through the integration of research and application, it further promotes the symbiosis and win-win situation of the "education-industry-society" ecosystem.

6. Multi-Measure "Five Innovations" for Talent Cultivation

The Cosmetics Industrial College has built a "Five Innovations" education platform that

aligns with the entire industrial chain of "research, testing, production, marketing, and innovation". This platform comprehensively enhances students' knowledge reserves, industrial vision, scientific research capabilities, and innovative spirit, while helping the cosmetics industry upgrade towards the direction of "safety, efficacy, greenness, and intelligence" [8]. The "Five Innovations" platform includes the Green Formula Research Center, Efficacy Evaluation and Compliance Center, Digital Marketing Training Center, Intelligent Manufacturing Center, and Innovation and Entrepreneurship Incubation Base.

Green Formula Research Center: Focuses on the development of natural and sustainable cosmetic raw materials (such as plant extracts and bio-fermented ingredients) to replace traditional chemically synthesized components. It is committed to tackling issues related to formula stability, safety, and efficacy (e.g., antioxidant and anti-allergy effects). It also meets enterprise needs by developing characteristic product lines such as "traditional Chinese medicine skincare" and "cosmeceuticals with homologous medicine and cosmetics".

Efficacy Evaluation and Compliance Center: Establishes ISO-standard laboratories to conduct cosmetic efficacy verification (e.g., moisturizing, whitening, and anti-aging) and safety testing. It provides regulatory compliance services (such as interpretation of the Regulations on the Supervision and Administration of Cosmetics and support for filing and declaration) and collaborates with third-party institutions (e.g., SGS) to formulate industry evaluation standards.

Digital Marketing Training Center: Simulates digital marketing scenarios such as live e-commerce, social media operation, and big data user portrait analysis. It cultivates interdisciplinary talents with "technology + marketing" capabilities to enhance the market competitiveness of domestic brands. It also attempts to collaborate with relevant institutions to incubate beauty influencers, creating an integrated chain of "industry, academia, research, and marketing" [9].

Intelligent Manufacturing Center: Introduces AI formula design systems, automated filling equipment, 3D printing customization technology, etc., to develop flexible production lines. It supports small-batch and personalized

product trials (e.g., custom-made serums), optimizes production processes, reduces energy consumption and pollution, and promotes the achievement of the "carbon neutrality" goal.

Innovation and Entrepreneurship Incubation Base: Supports student teams in developing national trend brands, provides entrepreneurship guidance and resource connection, introduces angel investment and enterprise cooperation funds, and accelerates the transformation of scientific research achievements (e.g., commercialization of patented technologies). It also holds events such as the "Beauty Maker Competition" to explore innovative projects with market potential in depth.

7. Quality Evaluation System for Cosmetics Industrial College

The quality evaluation system for the construction of the Cosmetics Industrial College is set up from six dimensions: industrial alignment, integration of industry and education, social benefits, sustainable development and social responsibility, special indicators for students' innovative capabilities, and other aspects [10], with a total score of 100 points. This system adopts a combination of process assessment, result assessment, and developmental evaluation. Among them, industrial alignment is a process assessment, accounting for 25 points; integration of industry and education, social benefits, and special indicators for students' innovative capabilities are result assessments, accounting for 20, 20, and 10 points respectively; sustainable development and social responsibility, and other aspects are developmental evaluations, accounting for 15 and 10 points respectively.

Industrial alignment mainly examines the actual contributions of the Cosmetics Industrial College in supporting professional development and serving industrial progress, including whether the curriculum setting matches job requirements, whether talent training meets industrial needs, whether it jointly conducts organized scientific research, teaching, and practice with various parties, and whether it promotes the optimal layout of the industrial chain and resource sharing.

Integration of industrial and education mainly evaluates the specific value of the Cosmetics Industrial College in industrial development and talent training, including the construction of courses through school-enterprise cooperation,

the compilation of practical teaching materials, the joint application for projects or research topics, the co-construction of laboratories, platforms or enters, and the co-construction of industry-university-research-application training, internship, or teaching bases.

Social benefits mainly examine the effectiveness of the construction of the Cosmetics Industrial College in serving social progress and development, including the employment situation of graduates, the proportion of graduates employed in relevant enterprises in the industry, career development paths and promotion opportunities, the adoption of suggestions provided by teachers and students to the government and cosmetics industry-related policies and plans, and the input-output efficiency of the Industrial College's funds, such as project income and social influence.

Sustainable development and social responsibility mainly examine the Cosmetics Industrial College's relevant measures in the field of green production and environmental protection practices, such as promoting green chemical technology in cosmetics research and development and teaching, and the application of degradable packaging materials, the coverage and social influence of public welfare projects, such as rural beauty skills training and cosmetics safety popularization activities, and the participation of teachers and students in the formulation of ethical standards for the cosmetics industry and initiatives to protect consumers' rights and interests.

The special indicators for students' innovative capabilities focus on examining the effectiveness of the Cosmetics Industrial College in cultivating students' innovative and entrepreneurial capabilities and literacy in the talent training process, including the level and number of awards of students participating in cosmetics industrial innovation competitions, the implementation of achievement transformation, the establishment of special funds to support students' entrepreneurial projects, and the revenue of established enterprises.

Other aspects mainly examine the soundness of the Cosmetics Industrial College's system, the improvement of mechanisms, the smoothness of operation, the satisfaction of co-construction units with cooperation, and the influence of the construction achievements reported and promoted by the media, such as the number of

reports and the scope of the audience.

The evaluation system is independently carried out by the government, schools, enterprises, industry associations, and third-party evaluation agencies to ensure the objectivity and comprehensiveness of the evaluation. The decision-making body of the Cosmetics Industrial College will continuously optimize and improve the system and operation mode of the Industrial College based on the evaluation results and improvement suggestions, in order to promote the Industrial College to play a more important role in industry development and talent training.

8. Conclusion

As a key link connecting education and industry, modern industrial colleges are in a historical stage of active exploration and innovative development. The "12445" implementation plan of the Cosmetics Industrial College is a beneficial exploration in the construction of modern industrial colleges at present. This plan can effectively promote the integrated development of education, talents, industry and innovation, and provide experience and reference for the construction of modern industrial colleges in universities and the innovation of talent training models.

Acknowledgments

This paper is supported by the Higher Education Research Project of Guangdong Pharmaceutical University (No. GKP202405) and the College Students' Innovation Training Program Project of Guangdong Pharmaceutical University (No. G 202410573031).

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