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Exploration of a Digital-Intelligent Education-Empowered "Dual-Direction and Dual-Integration" Ideological and Political Education System in Clinical Laboratory Medicine

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Abstract: *Under the context of construction of the new medical education system, digital intelligence education is profoundly empowering the systemic restructuring of talent cultivation frameworks and educational ecosystems in clinical laboratory medicine. Centering on the imperative need to enhance the quality of talent cultivation in clinical laboratory medicine for the new era, particularly in professional innovation capabilities and comprehensive competencies, this initiative implements systematic construction and practice of ideological-political education through multidimensional approaches. These encompass disciplinary connotation refinement, pedagogical innovation, and resource development, while pioneering a novel educational paradigm integrating "disciplinary ideology-curriculum ideology-ideological classroom" tripartite synergies. This paper proposes the establishment of a novel ideological-political education system based on a dual-PBL (Problem-Project Based Learning) pedagogy, with strategic focus on innovating digitally-infused ideological textbooks, PBL cases embedding ethical dimensions, smart courseware systems, and MOOC-based ideological resources. Through these curriculum innovations, it propels the cultural advancement of clinical laboratory medicine characterized by "verification through testing, validation through practice, and cultivation of quintessential competencies", thereby nurturing professionals equipped with both technical mastery and ethical consciousness.*

Keywords: *Digital intelligence education, Laboratory medicine, Problem-based learning, Project-based learning, Curriculum ideology and politics*

1. Introduction

As the core paradigm of digital transformation in education, digital intelligence education essentially relies on new-generation information technologies such as big data, artificial intelligence, and cloud computing. It reconstructs the educational ecosystem through technologies like data-driven approaches, intelligent analysis, and the integration of virtual and physical environments. This process aims to achieve the reengineering of educational processes and the innovation of educational models. In the context of the construction of the new medical discipline, digital intelligence education is deeply empowering the reconstruction of the laboratory medicine talent cultivation system and educational ecosystem [1,2]. Promoting the deep integration of artificial intelligence with laboratory medicine education and teaching, and cultivating compound talents in laboratory medicine who possess data thinking and the ability to apply intelligent technologies, is an inevitable demand of the times for advancing the development of laboratory medicine and contributing to the construction of a Healthy China.

The Medical College of Jiangsu University, in response to the new international medical development pattern, is committed to the innovative research and practice of laboratory medicine talent cultivation systems under the leadership of the "New Medical Science" framework [3,4]. Since 2019, the college has relied on national-level first-class undergraduate program construction sites such as "Medical Laboratory Technology" and 18 national and provincial-level courses and teaching teams, including "Clinical Basic Laboratory Techniques" and "Clinical Molecular Biology Testing". The college has actively promoted integrated reforms in curriculum ideological and political education, teaching modes, and resources. Through the Ministry of Education's Industry-University Cooperation Collaborative Education Project,

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titled “Innovation Research and Practice of the AI Course System and Teaching Model for Clinical Molecular Biology Testing”, the college has initiated the construction of intelligent course groups for laboratory medicine. This approach integrates laboratory medicine knowledge, skills, and professional quality into an effective educational pathway. It has explored a new educational model based on autonomous learning, the “bidirectional and dual-integration” ideological and political education model for laboratory medicine-combining professional ideological education, curriculum ideological education, and ideological classrooms. This model truly achieves “student-centered” education, cultivating high-quality laboratory medicine talents with both medical ethics and professional skills, thus contributing to the construction of a Healthy China in the new era.

2. The Goal of Ideological and Political Education in Laboratory Medicine

Laboratory medicine is an organic combination of clinical medicine with disciplines such as cellular pathology, chemical pathology, and molecular pathology. It involves the use of various testing technologies, including microbiology, immunology, hematology, biochemistry, and molecular biology, to analyze samples such as blood, urine, and feces, for disease prevention, diagnosis, treatment monitoring, and prognosis observation [5,6]. Medical laboratory professionals are also referred to as the “scouts” of diseases and the “guardians” of health.

Under the guidance of new medical education concepts such as the integration of medical education in the new era, new medical disciplines, precision medicine, and smart medicine, Jiangsu University has actively explored, refined, and established a new model for the cultivation of laboratory medicine professionals. This model focuses on the transformation of the demands for improving clinical basic skills among laboratory medicine students, emphasizing “cultural leadership, multi-dimensional interaction, and diversified thinking.” It has greatly enhanced students' clinical thinking, innovative practice, and job competence. Among these efforts, the university strengthens medical ethics and the education of socialist core values, integrates cutting-edge disciplines such as prenatal diagnosis, precision treatment and consolidates the key elements of professional ideological education. The main line of ideological education is emphasized through the practice of “professional ideological education-curriculum ideological education-ideological classrooms”, aiming to enhance students’ professional interests and career literacy. Through ideological and political education, this approach promotes the development of laboratory medicine culture and talent cultivation with the principles of “verification through inspection-practical results through testing-the development of five skills.”

3. “Bidirectional and Dual-Integration” Measures for Ideological and Political Education in Curriculum

Adhering to the higher education philosophy that centers on student-driven learning, and based on Problem-Based Learning (PBL) and Project-Based Learning (PBL), the laboratory medicine curriculum integrates ideological and political education through a model that combines “online and offline” ideological education and “theory and practice” ideological education (Figure 1). This approach guides and strengthens self-education in both academic knowledge and ideological education, continuously stimulating students’ intrinsic potential and enhancing their overall competencies.

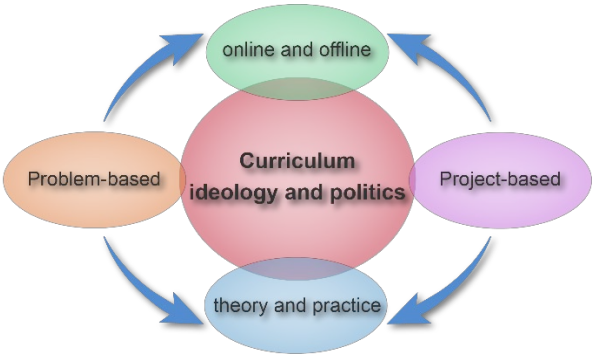

Figure 1: The New Model of "Bidirectional and Dual-Integration" Ideological and Political Education in Laboratory Medicine Curriculum.

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3.1 Focusing on the Frontier of the Discipline in the New Era, Constructing a New Model of Integrated Ideological and Political Education

3.1.1 Ideological and Political Education in Curriculum Based on "Blended Problem-Based Learning"

A curriculum ideological and political education PBL case library is created, based on integrative medical original cases with everyday relevance, to reconstruct teaching content and resources. This approach combines smart courses, Massive Open Online Courses (MOOCs) and practical teaching platforms to implement an “online/offline” and “theory/practice” integrated ideological and political education [7]. For example, students are guided to create infectious disease testing cases. These cases enrich related smart courses and MOOC resources, such as “Clinical Microbiology Testing” and “Clinical Molecular Biology Testing”. A blended PBL approach is implemented, with ongoing improvements in teaching evaluation. At the same time, students are organized to visit several medical staff who fought in the anti-epidemic efforts in Hubei Province and participate in practical activities like online music festivals to pay tribute to the heroes of the epidemic. Through these heuristic, integrated case studies and related theme practices, students not only gain a comprehensive understanding of the pathogenic features, pathogenic mechanisms, immune responses, and differential diagnosis of infectious diseases but also experience the vital role of laboratory medicine in the development of human society, the understanding of life, and the protection of health. This process enhances their sense of professional mission and fosters a patriotic spirit of “medicine serving the nation”.

3.1.2 Ideological and Political Education in Curriculum Based on “Blended Project-Based Learning”

Relying on smart courses, MOOCs, and other platforms, the first unit of the online course sets up project-based learning tasks, such as “Analyzing the Laboratory Medicine Report Around You” and “Course Self-Directed Learning Report”, which cover the entire content and process of the course. Students, using course learning resources recommended by teachers and peers, engage in self-directed learning on laboratory medicine topics they are interested in. Taking the “Clinical Molecular Biology Testing” course as an example, the process of “Self-Directed Learning Report” is as follows: (1) Introduction Release: "Introduction and Re-collection of Online Learning Resources for Clinical Molecular Biology Testing" and "Self-Directed Learning Report Assignment"; (2) Students conduct self-directed learning and submit assignments two weeks before the course ends; (3) Teachers evaluate based on the relevance, innovation, and completeness of the topic; (4) Excellent cases are added to the database, and students present their reports in class; (5) The best cases are selected to record student teaching videos, which are then uploaded to the MOOC "Self-Directed Learning Special Topic" section for discussion and learning by future learners. In the project-based online and offline flipped teaching approach, through "self-directed, collaborative, and inquiry-based" learning, students focus on practical issues around them and integrate disciplinary practice. They convey the latest hot topics in the field from their perspective to teachers and peers. While stimulating their intrinsic potential and enhancing their ability for self-directed lifelong learning, students also learn the importance of "caring for family and cherishing life" through "compassionate" medical course teaching [8].

Based on the "Problem" and "Project" dual PBL approach that runs through the entire teaching process, the practice of "Three-Dimensional Education" is implemented, where "all members," including teachers, students, and peer students, participate in the course teaching at every stage and with "comprehensive" enhancement.

3.2 Consolidating Key Elements of Professional Education and Practicing a New Multi-Dimensional Ideological and Political Education System

Under the strategic background of "integrated development of new medical disciplines," multidisciplinary theories and technologies are continuously applied in the field of laboratory medicine, promoting the cultivation of high-level innovative laboratory medicine professionals with a "Medicine + X" multidisciplinary background [3,9]. The role of ideological and political education in enhancing the professional culture of the brand and the professional literacy of both teachers and students is emphasized, leading to deeper reforms in the curriculum system, teaching content, and teaching methods [2,10]. This innovation in the "discipline-culture-teaching" multi-dimensional collaborative education system has become a key factor in the cultivation of talent in the new medical education system for laboratory medicine.

In the practice of ideological and political education within the curriculum, based on PBL, the

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integration of "teacher-student teams-course resources-theoretical and practical classrooms-online/offline methods" is realized. This approach aims to achieve the collaboration of "teacher-student teams," the optimization of "course", the connection between "theory and practice," and the vitality of "online and offline" methods. The focus is on building three-dimensional ideological and political teaching resources such as "digital textbooks ideological education, PBL case ideological education, smart courses, and MOOC ideological education.

3.2.1 Publishing Digital Series Textbooks and Integrating Ideological and Political Education into Textbooks

The chief editor of the series of textbooks on medical laboratory technology integrates curriculum ideological and political education and smart teaching methods. In line with the cutting-edge developments in the discipline, the textbooks focus on the main ideological education themes. For example, in "Clinical Molecular Biology Testing", the introduction connects related Nobel Prize research achievements and narrates the development history of the discipline, allowing students to deeply appreciate the charm of molecular biology and medicine and recognize the crucial role this field plays in human life understanding. Subsequent chapters introduce classic medical cases, combined with expanded readings and micro-courses on key knowledge points and challenges, fully stimulating students' enthusiasm for self-directed learning. This approach helps students understand the tangible impact of laboratory medicine on human societal development and personal health, while guiding them to embrace the idea of "learning and application complementing each other, and knowledge and practice being unified."

Table 1: Ideological and Political Education Based on PBL Cases.

Case Name	Teaching Topic	Teaching Content	Ideological and Political Education Goals
The Bold Boy Xiao W	HIV Diagnosis	Pathogenic characteristics of HIV, HIV quantification, subtyping, resistance testing, etc.	(1) Enhance scientific understanding and protection against AIDS, cherish life; (2) Appreciate the important value of molecular diagnostics in infectious disease diagnosis; (3) Improve medical ethics and moral character (using the "Gene-edited AIDS-resistant babies" case as a warning).
Hearing Protection for Love	Prenatal Diagnosis of Hereditary Deafness	Pathogenic genes for hereditary deafness, deafness gene testing, etc.	(1) Care for patients with hearing loss, respect new life; (2) Appreciate the important value of molecular diagnostics in prenatal diagnosis of genetic diseases; (3) Focus on the "Yan Huang Plan" to aid in the construction of a Healthy China, enhance confidence in the national system and culture.
L Grandpa with Lung Cancer	Precision Diagnosis and Treatment of Non-Small Cell Lung Cancer	Targeted treatment for non-small cell lung cancer, gene testing related to targeted drugs, etc.	(1) Care for the elderly, promote respect for the elderly; (2) Appreciate the important value of molecular diagnostics in tumor precision medicine; (3) Enhance the professional mission and patriotism of "medicine serving the country".

3.2.2 Creating a Curriculum Ideological and Political Education PBL Case Library and Improving PBL Ideological and Political Education Teaching

Combining hot topics in disciplines such as early diagnosis of viral diseases, prenatal diagnosis of genetic diseases, and precision oncology, and integrating ideological and political education elements, original cases are optimized and enriched. Guided by PBL ideological and political education cases, these elements are integrated throughout the entire teaching process. This approach ensures that students, while gaining an in-depth understanding of the diagnostic mechanisms, strategies, and methods for infectious, genetic, and oncological diseases, also appreciate the significant value of laboratory medicine in implementing the Healthy China strategy, especially in early disease diagnosis, prenatal diagnosis, and precision medicine (Table 1).

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3.2.3 Building MOOC Ideological and Political Education and Promoting Blended Ideological and Political Education Teaching Online and Offline

MOOC teaching focuses on the integration, applicability, and cutting-edge nature of laboratory medicine, aiming to better enhance students' professional interests and competencies. (1) Initial MOOC Ideological and Political Education: Teachers and students jointly recommend "Weekly Course Series on Great Shows and Books", such as the "Fire Recording-A New Perspective on the Nobel Prize" series of short films from the Learning Power platform. These films familiarize students with relevant Nobel Prize knowledge, deeply appreciating the words of the Nobel Prize in Physiology or Medicine: "New discoveries make life better". (2) Full MOOC Ideological and Political Education： Based on the aforementioned PBL ideological and political cases, the online teaching resources are restructured to implement the "Three-Dimensional Education" approach throughout the entire course. (3) Real-time MOOC Ideological and Political Education: Forums are created to introduce a large number of practical, contemporary ideological and political teaching resources and discussions. Ideological and political elements are subtly and continuously integrated into all aspects of teaching, promoting and practicing the medical spirit of respecting life, saving lives, being willing to serve, and having boundless love.

4. Promoting the Cultural Construction and Talent Cultivation of Laboratory Medicine Specialty with the Teaching of Ideological and Political Education

In his 2021 report "Consolidating the 'New Infrastructure' of Teaching to Foster High-Quality Talent", Director Wu Yan emphasized the integrated development of new medical disciplines. Under the new positioning of "national strategy", "public welfare", "major disciplines" and "major specialties", he stressed the importance of strengthening the comprehensive quality cultivation of medical students by focusing on the five skills: "Daoism", "benevolence", "academics", "technology" and "art". The research and practice of Jiangsu University's "Bidirectional and Dual-Integration" Ideological and Political Education System in Laboratory Medicine focuses on the core issue of the urgent need to comprehensively improve the quality of laboratory medicine talent cultivation, including its professional innovation capabilities and overall literacy, under the new global medical development landscape, China's new medical discipline construction, and the background of digital intelligence education. The system aims to build and practice laboratory medicine curriculum ideological and political education through multidimensional, systematic construction, focusing on professional content, curriculum, teaching models, and resources. In the ideological and political education of the curriculum, the goal is to promote the construction of Jiangsu University's laboratory medicine professional culture with the principles of "Verification through Inspection-Practical Results through Testing-The Development of Five Skills", using culture to ignite students' professional interests and enhance their sense of medical mission.

5. Conclusions

We have established a novel ideological-political education system based on a dual-PBL (Problem-Project Based Learning) pedagogy. By leveraging smart courses, MOOCs, and other platforms, the university practices inter-school curriculum co-construction, promoting the sharing and dissemination of high-quality teaching models and resources. This approach aims to cultivate a broader range of high-caliber laboratory medicine professionals with a self-directed and lifelong learning attitude, who are innovative, application-oriented and compassionate, contributing to the high-quality development.

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References

[1] Zhiting Zhu, Ling Dai. Convergence Innovation: Empowering New Quality Development in Higher Education through Digital Intelligence[J]. Open Education Research, 2024, 30(03).

ISSN 2663-8169 Vol. 7, Issue 6: 50-55, DOI: 10.25236/IJNDE.2025.070607

[2] Ling Tang, Hang Gui, Chen, Wang. Reimaging Medical Education in the Age of Healthy China[J]. Journal of National Academy of Education Administration. 2024 (01).
[3] Lin Zhang. Accelerating the construction of new medical science and promoting the innovative practice of medical education[J]. China Academic Journal Electronic Publishing House, 2021, (4):7-12.
[4] Xu Zhang, Hui Shi, Hui Qian. Training high-quality laboratory medicine professionals at Jiangsu University School of Medicine[N]. China Education News, 2023-10-01(04).
[5] Xiao Jiang, Jianan Sun, Qi an Yue, et al. Exploration and practice of integrating innovation and entrepreneurship education with professional education in medical laboratory technology[J]. China Academic Journal Electronic Publishing House, 2023, 20(09): 1334-1336.
[6] Linjing Li, Bei Xie, Li Huang. Exploration on the New Teaching Mode of Laboratory Medicine From the Perspective of Ideological and Political Education[J]. China Academic Journal Electronic Publishing House, 2023, (22): 132-135.
[7] Zixuan Sun, Xiao Xu, Yuanyuan Zhao, et al. Research on the mixed teaching mode of medical laboratory technology based on HIM-PBL education reform[J]. CHINA MEDICAL EDUCATION TECHNOLOGY, 2019, 33(1): 121-125.
[8] Yi Wu. A MOOC journey in a foreign land[N]. China Education News, 2020-11-16(07).
[9] Gang Yu, Yanhua Gao. Construction and practice of ideological and political case librar. of medical education under the background of New Medical Science[J]. CHINA MEDICAL EDUCATION TECHNOLOG Y, 2021, 35(05): 579-582.
[10] Honglu Luo. Research on the path of ideological and political education in aesthetic education course of medical colleges and universities[J]. China Academic Journal Electronic Publishing House, 2022, (9): 133-134.