

# Empirical Research on Improving of Medical Students' Innovation Literacy by Promoting Innovation — Taking the Higher Vocational Clinical Medicine "Preventive Medicine" Course as an Example

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DOI: 10.32629/jher.v5i6.3399

**Abstract:** In view of the difficulties of narrow employment surface, great employment difficulty and poor employment quality, in 2019, 13 departments such as the Ministry of Education, the Central Political and Legal Commission and Technology jointly launched and comprehensively promoted the construction of new engineering, new medical science, new agricultural science and new liberal arts, which created good opportunities and conditions for the employment and innovative development of medical students. The integration of classroom teaching and practical experience aims to promote the innovation literacy of medical students through exploration and practice. This is primarily achieved by reforming teaching methods to cultivate their innovative spirit and practical abilities. The goal is to encourage open-mindedness, broaden their perspectives, develop innovative thinking, and form habits of innovation. This approach enhances the innovation quality of vocational medical students and contributes to their success in innovation and entrepreneurship.

**Keywords:** curriculum innovation and integration; promoting innovation; competition; innovation accomplishment

## 1. Introduction

In view of the particularity of vocational clinical medicine, narrow employment, low education, low experience, difficult qualification, and poor quality, compared with other majors, students of vocational clinical medicine should learn and develop more social attention and the guidance of schools and teachers.

## 2. Background and purpose

The Preventive Medicine course primarily utilizes project-based learning, case teaching, and classroom teaching reforms. The entire course is structured around different project units, each designed to explore innovative and entrepreneurial elements. This approach aims to foster innovation awareness among medical students, stimulate creative ideas, and encourage the development of innovative entrepreneurial projects. Students are encouraged to participate in competitions at various levels, broadening their horizons and enhancing their practical innovation skills. The goal is to integrate professional course content with innovative entrepreneurship education, thereby cultivating students' innovative spirit and practical abilities. The specific practices are outlined as follows.

## 3. Research objects and methods

(1) Study subjects were randomly divided into two groups from 4 classes of clinical medicine in grade 2022 in our hospital. Class 3 and 4 were experimental group with 84 students, and class 1 and 2 were control group. The difference between the two groups of students in the course performance, gender, age, and the proportion of matching and ordinary higher vocational colleges is not significant ( $P>0.05$ ), which has good comparability.

(2) The control group adopts traditional teaching method, while the experimental group reforms the teaching method, focusing on project-driven method, case method and flipped classroom method. Other aspects such as talent training program, curriculum standard, teaching plan and teaching hours are exactly the same. At the end of the semester, the evaluation will be conducted from the results of the final examination, innovation quality and comprehensive evaluation.

## 4. Results

The project-driven method is divided into six steps of circular improvement. 1) scenario introduction and task definition; 2) data collection and plan formulation; 3) independent cooperation and specific implementation; 4) point guidance and process inspection; 5) display of results, correction and improvement; 6) evaluation and testing, expansion and sublimation. Therefore, this method has a good advantage in implementing the teaching principle of "student-oriented and teacher-

oriented". It can guide students step by step to dig into the problems deeply- -detailed analysis of the root of the problem- -innovative problem solving. This curriculum reform retained the core element of the project-driven teaching method while placing greater emphasis on developing students' ability to learn autonomously, identify problems, and focus on how to solve them. As a result, students in the reform group demonstrated superior professional performance, dual abilities, and overall quality compared to the control group ( $P < 0.05$ ).

#### **4.1 Health Management and Clinical Prevention Services Project**

While studying the project unit, Zhang, a student from the clinical class, discovered that a patient named Li had been poisoned due to taking expired medication, driven by a false sense of security. The students further realized that it was a common social issue for residents to keep expired drugs. They collected relevant data and found that the accumulation of expired medications not only led to wasted resources but also posed risks such as poisoning, allergies, and even death for residents who consumed them. Furthermore, expired drugs entering the environment could lead to pollution and environmental damage.

The teachers organized a group discussion to address this social issue. Proposed solutions included recycling medications within their shelf life, sharing family medicine cabinets among community residents, and promoting the idea that "everyone should be healthy and not need medicine." However, the idea that people could live their entire lives without needing medicine was deemed unrealistic, and these solutions were rejected due to their lack of practicality.

Given the severity of this social problem, the class decided to turn it into an innovation project. They continuously researched information, consulted relevant teachers and experts, and engaged with the community. After much effort, they devised a solution: the establishment of an intelligent medicine cabinet in the community. This system, leveraging advanced information technology and the recent online drug licensing policies introduced by the government, would allow residents to bypass traditional restrictions and conveniently purchase medications at any time. This innovative approach not only reduces waste but also ensures medication safety to a certain extent, offering a comprehensive solution to the problem.

#### **4.2 Occupational Environment and Health project unit**

Through project-based learning, students come to understand that labor intensity, labor environment, pathogenic microorganisms, toxic chemicals, and dust concentration are the main causes of occupational diseases among workers. One of the most effective preventive measures is the process of reform, such as through intelligent manufacturing and remote operation to reduce occupational exposure, thereby mitigating occupational hazards. Zibo, an old industrial city and one of the "Four Great Porcelain Capitals," has long relied on manual labor for tasks like enamel tank wall production. Workers not only face high labor intensity but are also more prone to occupational diseases like pneumoconiosis, caused by direct exposure to dust. As a result, manufacturers, even offering high salaries, struggle to recruit suitable workers. This situation prompts students to better understand the challenges and continually optimize solutions, drawing on knowledge from electromechanics, intelligent manufacturing, and alumni experience. Ultimately, they successfully design an automatic intelligent spraying device, capable of completing the spraying task through intelligent remote operation. The project won the third prize of "Lianqiao Cup" in the second Shandong Provincial Medical Care and Health Innovation and Entrepreneurship Competition. Such projects also include the "Intelligent Sterility Quarantine Point" project designed for COVID-19 and nucleic acid testing, which also won the third prize in the Shandong Provincial College Students Medical Care and Health Innovation and Entrepreneurship Competition.

### **5. Conclusion**

In short, "integration of curriculum and innovation" and "promoting innovation through competition" to promote the improvement of "innovation literacy" is an educational concept and practice mode that closely combines specialized course teaching, innovation and entrepreneurship education and competition activities. That project-driven and case-based teaching methods help break the constraints of traditional educational models. By precisely aligning with student needs and exploring teaching project units of moderate difficulty, these methods effectively stimulate students' innovative potential and entrepreneurial awareness. However, fostering innovation in students is not enough; success is not achieved overnight. It is essential to guide students to embrace the spirit of persistence, with a highly focused and long-term commitment. Participation in competitions at all levels serves as an effective platform to maintain continuous innovation vitality. Finding the right fulcrum and maintaining consistent efforts help students develop innovation habits and enhance their ability to solve practical problems creatively. This, in turn, improves their overall innovation literacy and promotes better employment and entrepreneurship opportunities for medical students. Ultimately, it has contributed to the reform and development of higher vocational education.

## Acknowledgments

This paper is the series of results of "Research on the influencing Factors of Innovative Literacy in Higher Vocational Medical Students under Cognitive Theory Mode" (Project approval number: 2022CYB387).

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