

Research on Project-Based Teaching Mode of Nursing Profession Based on STEM Education Concept



Liu Weihong, Su Xin*

Department of Pediatrics, Affiliated Hospital of Beihua University, Jilin 132011, China

Abstract: With the increasing demand for nursing professionals in society, the traditional nursing education model is gradually showing limitations that are not compatible with the requirements of modern medical environments. This reality has prompted educators to seek more effective teaching methods to cultivate nursing talents with innovative thinking and practical abilities. In this context, the STEM education concept has emerged as a cross disciplinary integrated educational approach that combines science, technology, engineering, and mathematics, providing new directions and ideas for the reform of nursing education. This study aims to explore the feasibility and effectiveness of applying project-based teaching models based on STEM education concepts to nursing education. Through systematic analysis of relevant literature and practical cases at home and abroad, it is found that the introduction of STEM education concepts can not only improve students' professional knowledge level, but also significantly enhance their innovation ability and practical skills. In the actual teaching process, teachers can encourage students to use scientific principles, technical means, and mathematical models to solve practical nursing problems by designing and guiding interdisciplinary collaborative projects. This project-based teaching model not only enhances students' overall quality and stimulates their creativity, but also makes them more competitive in their future careers. The research results indicate that project-based teaching models based on STEM education concepts can significantly improve the quality and effectiveness of nursing education. By participating in project-based learning, students not only deepen their understanding of nursing knowledge in practical scenarios, but also enhance their practical operational abilities. In addition, this model provides students with a platform to showcase themselves and enhance their abilities, enabling them to cope with challenges more calmly in complex medical environments.

Keywords: STEM Education; Project-based Teaching; Nursing Profession; Interdisciplinary Integration; Innovative Thinking

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1 Introduction

With the continuous development and progress of the global healthcare industry, there is an increasing demand for high-quality and versatile nursing talents in society [1-5]. The traditional nursing education model mainly

focuses on imparting basic theoretical knowledge and training skills [6]. Although it has laid a solid foundation for the development of modern nursing, its limitations are gradually becoming apparent in the face of rapidly

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*Corresponding author: Su Xin, 842272759@qq.com

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changing medical technology and complex clinical environments [7, 8]. Specifically, it is manifested as a disconnect between nursing education content and actual clinical needs, insufficient students' innovative thinking and interdisciplinary integration abilities, and difficulty in dealing with complex problems in modern medical services [9].

In this context, how to cultivate composite nursing talents with solid theoretical foundations, proficient operational skills, innovative thinking, and interdisciplinary integration abilities has become an important issue that urgently needs to be addressed in the field of nursing education [10, 11]. In recent years, the STEM education concept, as an interdisciplinary education model, has gradually attracted widespread attention from the education community [12, 13]. STEM education emphasizes the comprehensive application of science, technology, engineering, and mathematics, and focuses on cultivating students' practical abilities and innovative spirit, which coincides with the goals of modern nursing education reform [14].

The core of STEM education lies in combining theoretical knowledge with practical applications through interdisciplinary integration and project-based teaching models, cultivating students' ability to solve practical problems [15, 16]. Project based teaching mode is a student-centered teaching method that allows students to learn and apply knowledge and develop comprehensive abilities through the design and implementation of specific projects [17-19]. It can not only enhance students' learning interest and hands-on ability, but also cultivate their teamwork spirit and innovative thinking, thus being widely applied in various educational fields [20].

In the nursing profession, project-based teaching models based on STEM education concepts also have important application value [21-23]. The nursing discipline itself has strong practicality and interdisciplinary characteristics [24]. Nursing work not only requires solid medical knowledge, but also proficient mastery of modern medical technology, as well as good communication skills and humanistic care spirit [25]. By introducing the STEM education concept, nursing education can better integrate knowledge from disciplines such as science, technology, engineering, and mathematics, enhance students' practical abilities and innovative consciousness, and improve their comprehensive quality in solving complex clinical problems [26].

Specifically, project-based teaching models based on STEM education concepts can improve the quality and

effectiveness of nursing education through the following aspects [27]. By integrating interdisciplinary knowledge, help students establish a more systematic and comprehensive knowledge system [28]. For example, in the course of pathophysiology, relevant content from biomedical engineering can be combined to help students understand the mechanisms of disease occurrence and the principles of diagnosis and treatment techniques [29]. Enhance students' hands-on ability and practical skills through practice oriented project design [30]. For example, in clinical nursing skills training, simulation scenarios and experiments can be designed to allow students to operate in a near real environment. Through project-based learning, cultivate students' innovative thinking and teamwork spirit [31]. For example, in the process of solving practical nursing problems, students can be encouraged to engage in brainstorming and teamwork to explore innovative solutions together [32].

In order to verify the application effect of project-based teaching mode based on STEM education concept in nursing profession, this study systematically explored the research progress and practical experience in this field at home and abroad through literature analysis and actual case studies [33-35]. The literature analysis section mainly summarizes the theoretical basis, teaching methods, and application effects of STEM education concepts in other disciplines and fields [36-40]. In the practical case study section, some nursing schools and training institutions that have successfully implemented STEM project-based teaching at home and abroad were selected to specifically examine their teaching design, implementation process, and teaching effectiveness [41, 42].

The research results indicate that the application of project-based teaching mode based on STEM education concept in nursing profession can significantly improve students' learning effectiveness and comprehensive quality. Specifically, students have a more solid grasp of theoretical knowledge, significantly improved practical skills, and effectively cultivated innovative thinking and interdisciplinary integration abilities. In addition, through project-based teaching mode, students' learning interest and participation have significantly increased, and the teaching process is more vivid and attractive.

The project-based teaching model based on STEM education concepts provides a new approach and method for nursing education reform [43-45]. It can not only improve the quality and effectiveness of nursing education, but also cultivate composite nursing talents with comprehen-

sive qualities and innovative abilities, meeting the needs of modern medical services. Therefore, how to better introduce and implement STEM education concepts in nursing education has become an important direction for nursing education research and practice.

This article will further explore the specific application methods and strategies of project-based teaching mode based on STEM education concept in nursing profession, and summarize its advantages and challenges in practical teaching through specific case analysis, providing reference and inspiration for nursing education reform.

2 Background and Literature Review

2.1 The Origin and Development of STEM Education Concepts

The origin and development of STEM education concepts can be traced back to several key historical and geographical nodes, reflecting the emphasis on science, technology, engineering, and mathematics education in different periods and regions.

The emergence of STEM education philosophy can be traced back to the labor education ideas in Europe. Labor education emphasizes the cultivation of students' hands-on and problem-solving abilities through practical labor and practical activities, laying the foundation for the future practice of STEM education. The industrial revolution of the 19th century promoted the development of science and technology, and the demand for technical talents increased sharply. This also prompted the education sector to reflect on the limitations of traditional education models and gradually shift towards educational concepts that focus more on practical operation and application abilities.

In the United States, STEM education has been more systematically developed and applied. After World War II, the competition pressure in the field of science and technology in the United States increased significantly, especially during the Cold War. The United States faced technological competition pressure from the Soviet Union, which prompted the government and various sectors of society to pay attention to the cultivation of scientific and technological talents. In 1957, the Soviet Union successfully launched the artificial satellite "Sputnik 1", trigger-

ing the "Sputnik Crisis" in the United States. The US government quickly took action to promote reforms in the field of education, with a focus on strengthening science, technology, engineering, and mathematics education. In 1965, the United States passed the Elementary and Secondary Education Act, providing significant funding to support the development of science and mathematics education programs.

In Europe, Germany, as a pioneer in vocational education, has also carried out relevant teaching reforms in the field of vocational education. Germany has proposed project-based teaching method, emphasizing the cultivation of students' comprehensive abilities through the implementation of specific projects in the teaching process. The project-based teaching method not only focuses on imparting knowledge, but also emphasizes students' learning and problem-solving abilities in practical operations, which coincides with the core concept of STEM education. The vocational education model in Germany is renowned for its high practicality and close integration with industry, providing valuable experience for other countries.

The concept and practice of STEM education have been widely recognized and promoted worldwide. Asian countries have also followed suit and learned from each other, especially China, Japan, and South Korea, which have included STEM education as a key focus of national education reform. China has explicitly stated in the 13th Five Year Plan to strengthen science and technology education and promote the development of STEM education through various policies and measures.

In summary, the origin and development of STEM education concepts not only reflect the pursuit of education reform in different eras, but also demonstrate the strategic choices of countries in responding to global technological competition. Through continuous practice and innovation, STEM education will continue to play an important role in cultivating innovative talents and promoting social progress.

2.2 Research and Application of STEM Education Concept

With the rapid development of globalization and technology, there is an increasing demand for composite talents with diverse skills and interdisciplinary integration abilities in society. The traditional single subject education model is gradually exposing its limitations. In this

context, project-based teaching mode has been widely applied and researched in domestic higher education institutions. The project-based teaching model emphasizes students' active learning and practical abilities in actual projects, cultivating their comprehensive qualities and innovative abilities through solving real problems and challenges.

The concept of project-based teaching mode is highly compatible with the STEM education philosophy. The STEM education concept originated from the labor education ideology in Europe, emphasizing the cultivation of practical and hands-on abilities. Afterwards, STEM education was further developed and applied in the United States. The US government elevated STEM education to a national strategy and promoted its development through a series of policy documents and plans, aiming to cultivate innovative talents with scientific, technological, engineering, and mathematical literacy. This concept emphasizes interdisciplinary integration and practical application, focusing on cultivating students' critical thinking, problem-solving skills, and innovative spirit.

Germany has also carried out relevant teaching reforms in the field of vocational education, proposing project-based teaching methods to promote the transformation of vocational education from a subject structured teaching paradigm that focuses on imparting knowledge to an action oriented teaching paradigm. This teaching paradigm requires students to solve practical problems in real-life situations, acquire knowledge and skills through the implementation and completion of projects. This method not only improves students' practical ability and professional ethics, but also cultivates their teamwork and communication skills.

In the field of nursing, the application of project-based teaching mode based on STEM education concept has gradually attracted the attention of researchers. The characteristics of nursing profession determine that its teaching content not only involves medical and nursing knowledge, but also requires students to have strong practical and interpersonal communication skills. Traditional teaching methods often struggle to comprehensively cultivate students' abilities, while project-based teaching models introduce practical nursing cases and projects to enable students to learn and grow while solving real problems.

For example, in a nursing program based on STEM education concepts, students may need to design and implement a comprehensive plan for elderly health man-

agement. This project not only requires students to apply biomedical knowledge to analyze the health status of the elderly, but also requires them to use technological means for health monitoring and data analysis, design health aids suitable for the elderly using engineering principles, and finally evaluate the effectiveness of the plan by combining mathematical models. Through such projects, students can not only deepen their understanding of knowledge, but also improve their interdisciplinary integration ability, problem-solving ability, and innovative thinking.

The project-based teaching model also emphasizes the cultivation of teamwork and communication skills. During the project implementation process, students need to work closely with team members to discuss and solve problems together. This collaboration not only enhances students' teamwork skills, but also strengthens their leadership and communication skills, laying a solid foundation for their future career development.

With the increasing demand for versatile talents in society, project-based teaching mode has important application value in higher education. The project-based teaching model based on STEM education philosophy, through interdisciplinary integration, practical problem solving, and teamwork, can not only comprehensively improve students' comprehensive quality and innovation ability, but also better meet the demand of society and industry for high-quality talents. In the field of nursing, the application of this teaching model helps cultivate excellent nursing talents with practical ability, innovative spirit, and teamwork ability, and contributes to the development of medical and health care.

3 Application of Project-Based Teaching Mode Based on STEM Education Concept in Nursing Profession

3.1 Integration of Interdisciplinary Knowledge

With the rapid development of globalization and technology, there is an increasing demand for composite talents with diverse skills and interdisciplinary integration abilities in society. The traditional single subject education model is gradually exposing its limitations. In this

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By combining knowledge from disciplines such as science, technology, engineering, and mathematics with nursing practice, students' comprehensive abilities and innovative thinking can be further developed. For example, introducing biomedical engineering content into nursing courses can help students understand and apply modern medical equipment and technology. In such courses, students not only learn how to operate and maintain medical equipment, but also understand the working principles and technical background of these devices. Through this interdisciplinary learning, students can better apply theoretical knowledge to practice, improve their practical skills and problem-solving abilities.

For example, in a nursing program based on STEM education concepts, students may need to design and implement a comprehensive plan for elderly health management. This project not only requires students to apply biomedical knowledge to analyze the health status of the elderly, but also requires them to use technological means for health monitoring and data analysis, design health aids suitable for the elderly using engineering principles, and finally evaluate the effectiveness of the plan by combining mathematical models. Through such projects, students can not only deepen their understanding of knowledge, but also improve their interdisciplinary integration ability, problem-solving ability, and innovative thinking.

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Table 1 Impact of each project

Discipline	Contribution to Nursing Practice
Contribution to Nursing Practice	Provides a foundation in human body mechanics, disease processes, and health promotion.
Technology	Offers tools for health monitoring, data analysis, and the development of health aids.
Engineering	Principles are used to design and evaluate health-related products and equipment.
Mathematics	Provides the necessary analytical and quantitative skills for data interpretation and mathematical modeling.
Nursing Practice	Application of biomedical knowledge, operation of medical equipment, patient care, and health management.
Interdisciplinary Integration	Facilitates the combination of theoretical knowledge from various disciplines to solve practical

Discipline	Contribution to Nursing Practice
	problems in nursing.
Project-based Teaching Model	Emphasizes the development of comprehensive abilities, problem-solving skills, teamwork, and communication skills through real-world applications.
Elderly Health Management Plan	Example of a project that requires the application of biomedical knowledge, technological skills, engineering principles, and mathematical models.
Career Development	Prepares students for future roles by enhancing teamwork, leadership, and communication skills.

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3.2 Practice Oriented Teaching Activities

In today's increasingly complex and high-tech medical environment, nursing education is facing the challenge of cultivating professional talents with high-level practical skills and problem-solving abilities. By designing and implementing practical nursing projects, students' practical skills and problem-solving abilities can be effectively cultivated. This educational model not only helps students better understand theoretical knowledge, but also enhances their understanding of the intrinsic connections between disciplines, thereby improving their overall quality.

The design and implementation of actual nursing projects are based on real-world medical needs and contexts. Students can face various complex situations and challenges in clinical nursing when participating in these projects, and learn how to apply their learned knowledge and skills in stressful environments. For example, students can participate in practical nursing projects in hospitals, such as geriatric care, emergency care, chronic disease management, etc. By collaborating with professional nursing staff, they can personally experience the actual operational processes and standards of nursing work. In this process, students not only need to apply the professional

knowledge of anatomy, physiology, pharmacology, etc. learned in the classroom, but also master and apply modern medical equipment and technology, such as electrocardiographs, infusion pumps, ventilators, etc.

Through in-depth participation in such practical projects, students can better understand and master the core skills and processes of nursing work. For example, in emergency nursing programs, students need to master how to quickly assess a patient's condition, develop and implement emergency measures, and communicate and collaborate efficiently with medical teams. The cultivation of these practical skills not only relies on textbook knowledge, but also requires repeated practical operations and experience accumulation.

Practical nursing projects can also help students develop systematic and interdisciplinary problem-solving skills. In a comprehensive nursing project, students may need to face the integration and application of knowledge from multiple disciplines. For example, in a chronic disease management project, students need to combine knowledge from physiology, pharmacology, nutrition, psychology, and other fields to develop a comprehensive nursing plan. Through this interdisciplinary learning and practice, students can gain a deeper understanding of the intrinsic connections between various disciplines and learn how to approach and solve clinical problems from a holistic perspective.

The implementation of these projects not only enhances students' practical abilities, but also promotes their self-directed learning and innovative thinking. In practical projects, students need to constantly explore and try new solutions, cultivate independent thinking and innovation abilities. For example, in elderly care projects, students can try to design and apply new nursing methods or technologies, such as remote monitoring systems, intelligent health management platforms, etc., to improve the quality of life and nursing effectiveness of elderly patients.

The participation in practical nursing projects also helps students develop good communication and teamwork skills. During the project implementation process, students need to communicate effectively with other medical staff, patients, and their families, learn how to

collaborate in a team, and handle and resolve conflicts. The cultivation of these soft skills is crucial for future career development.

In summary, by designing and implementing practical nursing projects, students can not only transform theoretical knowledge into practical operational skills, but also cultivate and enhance their problem-solving ability, interdisciplinary integration ability, self-learning and innovation ability, as well as communication and teamwork ability in practice. This educational model helps cultivate well-rounded nursing talents who can better adapt to the needs of modern medical environments and make positive contributions to improving the quality of medical services and patient care outcomes. Through this practice oriented teaching approach, nursing education can achieve more efficient and targeted training objectives, promoting the development and progress of the nursing profession.

4 Research Method

4.1 Literature Analysis Method

Literature analysis is a method of systematically reviewing and analyzing existing literature to obtain relevant research results and current status. In the field of educational research, especially in the study of project-based teaching models, literature analysis is widely used to help researchers clarify the research progress, theoretical framework, application effects, as well as existing problems and challenges in this field [46-50].

The project-based teaching model has been widely applied and deeply researched globally since its proposal. At the international level, PBL, as a student-centered teaching method, has been recognized and promoted by many national education systems. Especially in the United States and Europe, PBL has become an important teaching strategy for many schools and educational institutions. A large number of empirical studies have shown that PBL helps students with deep learning, improves problem-solving skills, enhances teamwork and communication abilities. In China, the research on project-based teaching mode started relatively late, but significant progress has been made in recent years. Domestic researchers are concerned about the application effects of PBL in different educational stages and disciplines. The application of PBL in science education in primary and secondary schools has been found to significantly enhance students' scientific literacy and inquiry abilities. Domestic

research focuses more on the adaptation and improvement of PBL in local educational environments. The application of PBL in high school physics teaching in China has been found to effectively enhance students' physics literacy through appropriate adjustments and improvements.

Research has shown that PBL has good application effects in multiple disciplines such as Chinese, mathematics, science, and society. The application of PBL in primary school Chinese language teaching has been found to enhance students' reading comprehension and writing abilities. With the development of information technology, the combination of PBL and educational technology has become a hot research topic in China. Research has shown that the implementation effectiveness of PBL can be further improved through information technology means such as virtual reality, online collaboration platforms, etc.

Through the review and analysis of relevant literature at home and abroad, it can be found that project-based teaching mode has received widespread attention and research worldwide. The research results from abroad provide rich theoretical and practical references for PBL practice in China. Domestic researchers have conducted a lot of beneficial explorations and practices based on the reference to foreign experience and combined with the local educational environment.

As a comprehensive teaching method, PBL's interdisciplinary application will be an important research direction in the future. How to effectively integrate PBL in different disciplines and enhance students' comprehensive quality will be a question worth exploring in depth. With the continuous development of educational technology, how to organically combine information technology with PBL to improve teaching effectiveness will become a research hotspot in the future. The role of teachers in PBL is crucial, and future research needs to focus more on how to effectively train teachers to be competent in implementing PBL and improving teaching quality.

Through literature analysis, we can not only comprehensively understand the research results and current situation of project-based teaching mode, but also discover its application effects and existing problems in different educational environments, providing scientific basis and reference for future research and practice.

4.2 Questionnaire Survey and Interview

In contemporary education research, questionnaire surveys and interviews are two important research methods, especially in evaluating the effectiveness of educational

models and understanding the needs of employers. These two methods have unique advantages. In the nursing profession, project-based teaching models based on STEM educational concepts (i.e. science, technology, engineering, and mathematics) have attracted widespread attention. In order to comprehensively understand the demand for nursing professionals and verify the effectiveness of this teaching model, questionnaire surveys and interviews with employers have become key research methods.

Questionnaire survey is a method of collecting a large amount of data through standardized questions, which can effectively reflect the views and attitudes of the respondents. By designing targeted questionnaires, investigate the specific needs of nursing students, graduates, and employers for nursing talents. These requirements may include professional knowledge, practical skills, communication abilities, teamwork skills, and other aspects. For example, questions can be designed to understand the expectations of hospitals and other medical institutions for nursing staff in terms of clinical skills, interdisciplinary collaboration, and innovation capabilities. To verify the effectiveness of project-based teaching models based on STEM education concepts, a questionnaire survey can be designed to investigate students' feedback on different teaching models. By comparing the differences between traditional teaching mode and project-based teaching mode in improving students' comprehensive quality and professional abilities, evaluate the actual effectiveness of the new mode. Questionnaire surveys can also collect suggestions from students and teachers for improving existing teaching models, helping researchers understand the problems and room for improvement in the teaching process. For example, students may provide feedback on specific difficulties and challenges encountered in project-based learning, while teachers can offer professional insights on curriculum design and implementation. Interview is a method of gaining a deeper understanding of the interviewee's perspectives and experiences through face-to-face communication, particularly suitable for obtaining in-depth information. In nursing research, interviews with managers and senior nursing staff from employers such as hospitals, clinics, and nursing institutions can provide a deeper understanding of their specific needs for nursing professionals. These interviews can reveal details that are difficult to capture in questionnaire surveys, such as the actual performance and expectations of nursing staff in specific work environments. Interviews with employers can also verify the practical effectiveness

of project-based teaching models based on STEM education concepts. Employers can provide first-hand feedback on how graduates who have received this educational model perform in the workplace, whether they meet their needs and expectations. Interviews can also provide insights into employers' demand trends for future nursing talents, as well as suggestions and expectations for educational models. This has important reference value for adjusting and optimizing the curriculum design and teaching methods of nursing profession.

Through questionnaire surveys and interviews with employers, researchers can obtain a large amount of data and in-depth information about the demand for nursing professionals and the effectiveness of teaching models. These data and information can be comprehensively analyzed through a combination of quantitative and qualitative analysis methods, in order to draw more comprehensive and in-depth research conclusions. Integrating quantitative data from questionnaire surveys with qualitative data from interviews can form a more comprehensive analytical framework. For example, statistical analysis can reveal the improvement in learning effectiveness of nursing students under project-based teaching mode, and thematic analysis can summarize the specific needs and expectations of employers for talents.

Based on the results of comprehensive analysis, it can be concluded that the project-based teaching model of nursing profession based on STEM education concept is effective, and corresponding improvement suggestions can be proposed. These suggestions can include adjustments to course content, optimization of teaching methods, and strengthening of teacher training. Through questionnaire surveys and interviews, researchers can not only comprehensively understand the demand for nursing professionals, but also verify and improve project-based teaching models based on STEM education concepts, thereby providing scientific basis and practical guidance for cultivating high-quality nursing professionals.

4.3 Practical Activity

In the modern education system, practical activities are an important way to cultivate students' comprehensive abilities and innovative thinking. Especially in the nursing profession, the design and implementation of teaching projects based on STEM (Science, Technology, Engineering, Mathematics) educational concepts can not only enhance students' professional skills, but also strengthen their ability to solve practical problems. The following

will discuss in detail how to design and implement these teaching projects, as well as evaluate their effectiveness in enhancing students' comprehensive abilities and innovative thinking.

It is necessary to clarify the objectives of the teaching project. These goals should include enhancing students' clinical skills, interdisciplinary collaboration abilities, innovative thinking, and problem-solving skills. For example, a project can be set as "Design of a Health Management System Based on Patient Care Data", with the goal of enabling students to apply multidisciplinary knowledge and develop an effective patient management system. The project content should cover four aspects: science, technology, engineering, and mathematics. For example, students can collect and analyze patient data (science), design and develop health management systems (technology and engineering), and use mathematical models for data prediction and analysis. The specific content can include steps such as data collection and analysis, system design and development, project implementation and evaluation. In order to simulate a real work environment, the project should be carried out in the form of teamwork. Each team can be composed of students from different grades and professional backgrounds to promote interdisciplinary communication and collaboration. For example, the team can include nursing students, biomedical engineering students, and computer science students working together to complete projects. The guidance of the mentor is crucial during the project implementation process. Mentors not only need to provide professional knowledge and skills support, but also help students solve problems encountered in projects and guide them in expanding their innovative thinking. Mentors can come from multiple fields such as nursing, engineering, and computer science to provide guidance from multiple perspectives.

During the project initiation phase, the mentor needs to provide students with a detailed introduction to the project objectives, content, and evaluation criteria. Students need to form teams and clarify their respective roles and responsibilities. For example, nursing students are responsible for collecting and analyzing patient data, engineering students are responsible for system design and development, and computer science students are responsible for software programming and testing. During the project execution phase, students need to carry out data collection, system design, software development, and data analysis according to the plan. During the process, the mentor

should regularly check the progress of the project and provide necessary guidance and support. In addition, students should hold regular team meetings to report on their work progress, discuss issues encountered, and negotiate solutions. After the project implementation is completed, a comprehensive evaluation of the project is required. The evaluation should include the presentation and evaluation of project results, students' work performance, and teamwork. For example, project results can be evaluated through project reports, system demonstrations, and defenses, while methods such as questionnaire surveys and interviews can be used to understand students' gains and feelings during the project implementation process.

By evaluating project outcomes and student performance, we can understand the overall improvement of students' abilities. For example, by evaluating the quality of system design and development, students' professional abilities in clinical data analysis, system design, and software development can be understood. The cultivation of innovative thinking is one of the important goals based on the STEM education philosophy. By evaluating the innovative solutions and problem-solving abilities proposed by students in the project, we can understand the improvement of their innovative thinking. For example, system optimization schemes and data analysis model improvement schemes proposed by students in projects can serve as important indicators for evaluating innovative thinking. Student feedback is an important reference for evaluating the effectiveness of teaching projects. Students' overall evaluation of the project, difficulties and challenges encountered during project implementation, as well as suggestions and expectations for future teaching projects can be obtained through methods such as questionnaire surveys and interviews. For example, students can provide feedback on technical challenges encountered during data collection and analysis, as well as engineering problems encountered during system design and development.

By designing and implementing teaching projects based on STEM educational concepts, it is possible to effectively enhance the comprehensive abilities and innovative thinking of nursing students. The design of the project should focus on the integration of multidisciplinary knowledge and teamwork, the implementation of the project should emphasize process management and mentor guidance, and the evaluation of the project should focus on the presentation of results and student feedback. Through the systematic design and implementation of

teaching projects, strong support can be provided for cultivating high-quality nursing professionals and promoting the innovative development of nursing education.

5 Research Results and Discussion

5.1 Improvement of Teaching Quality

With the increasing demand for high-quality nursing talents in society, improving the quality of nursing education has become particularly important. Research has shown that project-based teaching models based on STEM (Science, Technology, Engineering, Mathematics) educational concepts can significantly improve the quality of nursing education and enable students to better adapt to social needs. The following will explore in detail how this teaching model is applied in nursing education and its specific impact on improving teaching quality.

The STEM education philosophy emphasizes the integration and practical application of interdisciplinary knowledge, aiming to cultivate students' comprehensive abilities and innovative thinking. The project-based teaching model is an important implementation form of STEM education philosophy, which allows students to apply their learned knowledge and solve practical problems in real situations through the design and implementation of actual projects. This model is not only widely used in science and engineering, but also gradually recognized and promoted in nursing education.

Interdisciplinary knowledge integration: The educational content of nursing profession involves multiple disciplines such as biology, medicine, psychology, etc. The project-based teaching model promotes students to organically integrate these subject knowledge by designing comprehensive nursing projects. For example, in a "chronic disease management system" project, students need to apply medical knowledge to understand disease mechanisms, apply biological knowledge to analyze patients' physical data, and apply psychological knowledge to provide psychological nursing support.

Nursing work has strong practicality, and the project-based teaching model simulates real nursing situations to enhance students' practical abilities. For example, students can participate in the "Hospital Emergency System Optimization" project to learn how to quickly and accurately perform emergency operations in emergency situations, and improve their emergency response capabilities through practical exercises. The continuous devel-

opment of the nursing industry requires nursing staff to have innovative thinking and be able to propose and implement new nursing methods and strategies. The project-based teaching model encourages students to propose innovative solutions in projects and cultivates their innovative thinking. For example, in the "Elderly Health Management" project, students can design new health monitoring devices or nursing processes to improve the quality of elderly care.

Through project-based teaching mode, students' comprehensive abilities have been significantly improved. Specifically, it manifests as their enhanced abilities in knowledge application, problem-solving, technical operations, and teamwork. For example, in the "Patient Health Data Management" project, students need to collect, analyze, and manage data, which enhances their data processing and information technology application abilities. The requirements of modern society for nursing staff are not limited to professional knowledge and skills, but also include communication skills, teamwork skills, and innovation abilities. The project-based teaching model enables students to achieve comprehensive development in these areas and better adapt to social needs through practical project training. For example, in the "Community Health Promotion" project, students need to communicate with community residents, understand their health needs, and design corresponding health promotion plans, which enhances their communication and organizational abilities. The project-based teaching model can stimulate students' interest and enthusiasm for learning. Due to the fact that projects typically involve solving practical problems, students are able to see the results of their efforts, thereby increasing their motivation and sense of achievement in learning. For example, in the "Children's Health Education" project, students see an improvement in children's health knowledge through the design and implementation of health education activities, which enhances their sense of professional identity and mission. The project-based teaching model provides a new method for teaching evaluation. By evaluating the project outcomes, teachers can gain a comprehensive understanding of students' learning situation and ability development. For example, through the "Nursing Quality Improvement" project, teachers can evaluate students' innovative and practical abilities based on their proposed improvement plans and implementation effects, and provide timely feedback and guidance, as shown in Table 2.

Table 2 Comparison before and after the project

Aspect	Before Project-Based Teaching Model	After Project-Based Teaching Model
Knowledge Integration	Students' learning and application of knowledge from different disciplines are relatively isolated.	Students integrate and apply knowledge from biology, medicine, and psychology through comprehensive nursing projects.
Practical Skills	Limited practical training, primarily relying on traditional lectures and simulations.	Students enhance emergency response skills through real-life projects, such as "Hospital Emergency System Optimization."
Innovative Thinking	Limited emphasis on fostering innovative thinking, with a focus mainly on theoretical learning.	The project-based approach encourages students to propose and implement innovative solutions, such as designing new health monitoring devices in the "Elderly Health Management" project.
Comprehensive Abilities	Students' abilities in knowledge application, problem-solving, and technical operations are relatively isolated.	Students improve their abilities in knowledge application, data processing, and information technology through projects like "Patient Health Data Management."
Communication and Teamwork	Communication and teamwork skills are less emphasized, primarily relying on individual assignments and group discussions.	Students enhance their communication and organizational skills through projects like "Community Health Promotion," which involve real-life interactions and planning.
Learning Interest and Motivation	Students' interest and motivation may be lower, primarily relying on traditional lectures and exams.	Students' interest and motivation significantly increase due to the visible results and practical problem-solving in projects.

The application of project-based teaching mode based on STEM education concept in nursing education not only enhances students' comprehensive abilities and innovative thinking, but also enables them to better adapt to social needs. This teaching model significantly improves the quality of nursing education through interdisciplinary knowledge integration, practical ability cultivation, and innovative thinking development. In the future, with the development of the nursing industry and changes in social demand, project-based teaching mode will play an increasingly important role in nursing education, providing strong support for cultivating high-quality nursing talents.

5.2 The Cultivation of Students' Abilities

Nursing education is facing constantly changing social demands and rapidly evolving medical technology challenges. In order to cultivate high-quality nursing talents that meet the needs of the new era, project-based teaching models based on STEM (Science, Technology, Engineering, Mathematics) educational concepts are gradually being introduced and promoted. This model effectively cultivates students' interdisciplinary integration ability, problem solving ability and innovative thinking, and significantly improves students' comprehensive quality in practical nursing work. The specific impact of this model on student ability development will be discussed in detail below.

Nursing education requires students to master knowledge in multiple disciplines such as biology, medicine, psychology, and information technology. The project-based teaching model based on STEM education philosophy designs interdisciplinary nursing projects, allowing students to naturally integrate and apply

knowledge from different disciplines in practice. For example, in a project about "diabetes management", students need to understand the insulin metabolism process involved in biology, the treatment of diabetes in medicine, and the psychological nursing skills of patients in psychology. Through this comprehensive project, students can not only firmly grasp the basic knowledge of various disciplines, but also learn how to integrate interdisciplinary approaches in practical nursing work, enhancing their overall quality.

Nursing work often requires facing complex and sudden practical problems. The project-based teaching model cultivates students' practical problem-solving abilities by simulating real nursing situations. For example, in the "Emergency Care" project, students need to make judgments and operations in simulated emergency scenarios to solve various emergency care problems. Through repeated practice and training, students can proficiently master first aid knowledge and skills, and enhance their emergency response abilities in practical work. In addition, in the "Nursing Quality Improvement" project, students need to analyze problems in the nursing process, propose improvement plans, and implement them. Through this practical activity, their ability to analyze and solve problems has been cultivated.

Modern nursing work not only requires solid professional knowledge and skills, but also innovative thinking to cope with the constantly changing medical environment and patient needs. The project-based teaching model encourages students to propose innovative solutions, implement new nursing methods and strategies in projects, and cultivate their innovative thinking. For example, in

the "Elderly Care" project, students can design innovative health monitoring devices or propose new nursing processes to improve the quality and efficiency of elderly care. Through this innovative practice, students not only

understand the importance of innovation in nursing work, but also learn how to apply innovative thinking in practical work, enhancing their professional competitiveness, as shown in Table 3.

Table 3 Comparison before and after the project

Aspect of Student Ability Development	Before Project Practice	After Project Practice
Interdisciplinary Knowledge Integration	Isolated subject knowledge, lacks application	Interdisciplinary project promotes organic integration of knowledge, enhanced comprehensive application ability
Practical Problem Solving Ability	Lacks practical experience, weak ability to deal with complex problems	Simulates real nursing scenarios, significant improvement in problem-solving ability
Innovative Thinking	Traditional teaching, lacks innovation stimulation	Project-driven, innovation thinking is exercised, able to propose innovative solutions
Team Collaboration Ability	Individual exercises, lacks teamwork experience	Team projects, significantly improved communication and collaboration abilities, formation of teamwork habits
Self-Learning Ability	Relies on teacher guidance, lacks autonomy	Emphasizes independent exploration, enhanced self-learning ability and habit
Professional Identity and Mission	Learning-focused, insufficient understanding of professional value	Involved in project practice, experiencing the professional value firsthand, enhanced professional identity and mission

Through project-based teaching mode training, students' comprehensive quality has been significantly improved. Firstly, students' teamwork ability has been enhanced. In many projects, students need to collaborate in groups to complete tasks. Through division of labor and cooperation, they learn how to effectively communicate and collaborate within a team. Secondly, students' self-learning and self-directed learning abilities have been cultivated. The project-based teaching model emphasizes students' independent exploration. Through researching materials, exploring problems, and hands-on practice, students gradually develop the habit of self-directed learning. Finally, students' sense of professional identity and mission has been enhanced. During the process of participating in the project, students can personally feel the value and significance of nursing work, thereby enhancing their sense of identity and mission towards the nursing profession.

6 Summary

The application of project-based teaching mode based on STEM education concept in nursing profession has shown significant educational effects, not only improving students' interdisciplinary knowledge integration ability, but also enhancing their ability to solve practical problems and innovative thinking. The practical and innovative orientation of this model enables students to effectively apply theoretical knowledge to real-life scenarios, cultivating comprehensive qualities and professional identity.

Looking to the future, further optimization and promotion of this teaching model is crucial to ensure that more nursing students can benefit from it. An important direction for future research is to explore in depth how to effectively enhance teachers' interdisciplinary guidance abilities, especially their roles and impacts in project-based teaching. At the same time, designing and implementing more complex interdisciplinary projects that combine advanced technology with nursing education also provides vast space for future research.

Exploring how to better stimulate students' initiative and autonomy in project-based teaching, studying the differences in learning outcomes among students from different backgrounds in this mode, will also open up new fields for future research. Through these studies, we can continuously improve the project-based teaching model, cultivate more nursing talents with innovative abilities and practical skills, thereby meeting the growing social demand and promoting the sustainable development of nursing education and the medical industry. This will not only improve the overall quality of nursing education, but also bring more technological innovation and professional breakthroughs to the medical field.

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