

Cultivation Path of Nursing Undergraduates' Scientific Research and Innovation Ability

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Abstract

Objective: The cultivation of the innovation ability and scientific research is one of the nursing learning objectives for undergraduate students. To explore the method and effect of training system of scientific research innovation ability of nursing undergraduates based on “3332”. **Methods:** Three course learning modules are constructed: stage-based course learning module, systematic project practice training module and comprehensive practice training module. A practical training platform for scientific research innovation projects is built, and undergraduate scientific research innovation ability training is carried out from both in-class and out-of-class lines. **Results:** Since 2017, the students have obtained 7 national innovation and entrepreneurship training programs, 52 university-level undergraduate scientific research projects, published more than 10 academic papers, and obtained 2 patent authorization. **Conclusions:** The training system of scientific research innovation ability of nursing undergraduates based on “3332” is conducive to the development of scientific research innovation ability of nursing students, and to cultivate nursing talents who can adapt to the development of the new era and have better post competence.

Keywords

Nursing Undergraduates, Scientific Research, Innovation Ability, Learning Module, Cultivation Path

1. Introduction

In March 2018, the Ministry of Education issued the national standard for quality teaching in nursing science. It prescribed three training objectives of undergraduate nursing education: to cultivate and adapt nursing training to China's socialist modernization priorities and health care development needs; compre-

hensive development of moral, intellectual, and physical nursing resources with mastery of basic nursing theory, knowledge and skills; and develop professional talents with basic abilities in clinical work, preliminary teaching, management, scientific research and innovation, and able to engage in nursing and preventive care in various medical and health care institutions [1].

In the context of healthy China, the cultivation of core competence of nursing professionals is the focus of the construction and training of high-quality nursing talents. In terms of core competence evaluation criteria, the International Medical Interdisciplinary Committee, the United States, Australia and other countries regard the field of evidence-based practice as the field of core competence evaluation [2] [3] [4], and Japan lists the undergraduate scientific research ability of nursing as the training goal [5].

The International Council of Nurses (ICN) defines evidence-based nursing practice as the process by which nurses use the latest and best evidence, clinical expertise, patient wishes, and evaluation of value to provide clinical care decisions for patients [6]. Evidence-based nursing practice is a highly skilled work, which is closely related to scientific research ability. Nurses are required to have the ability to raise clinical nursing problems, and master literature retrieval skills, literature evaluation capabilities, and scientific research design capabilities [7].

Studies conducted in other countries have shown that the scientific research ability of nurses is beneficial to the nursing profession and crucial for stronger post competency [8]. J.G. Ross and S.A. Burrell found Nursing students have generally positive attitudes toward research and see the value of research to professional nursing practice. Engaging in a research course or other active research-related activity improves attitudes toward nursing research [9]. Wang Hu [10] *et al.* found that the level of innovation ability of undergraduate nursing students is not high, and the influencing factors include internal factors, such as general self-efficacy, independent learning ability and learning initiative, and other influencing factors, such as participation in scientific research activities and interest in nursing.

In China, medical colleges and universities provide nursing training mainly through nursing research courses designed to cultivate undergraduates' scientific thinking ability. The core learning goals are to improve undergraduate student nurses' mastery of basic nursing theory and nursing research among, capacity to provide quality nursing care in the future, and application of scientific research methods to clinical work. However, teaching nursing research faces some challenges, including use of a single form of teaching activities, unsatisfactory teaching effect, and limited practical exposure of students to nursing research [11]. We offer a training course on scientific research thinking, which is based on "three projects" designed to cultivate scientific research ability. To combine innovative thinking and scientific research ability training, the school, set up a classroom platform for extracurricular practical activities comprising two lines of undergraduate scientific research training to cultivate and adapt learners to the

new era of nursing and improve their post competency.

2. Construction of Scientific Research and Innovation Ability Training System for Nursing Undergraduates

In teaching scientific research ability, important areas of focus include scientific research consciousness, thinking, interest and practice [12]. To cultivate scientific research ability in nursing undergraduates, our hospital has constructed the “3332” scientific research ability training system comprising three modules, three stages, three projects and two links (Figure 1). The three modules are stage course learning module, systematic project practice training module and comprehensive practice training module, which contain courses delivered in three stages, three practical training items, and two links of practical training, respectively.

The goal of the school of nursing is cultivating scientific research ability in undergraduates. In the course of the training, the three modules are fully covered in the four years of study (Figure 2). This ensures that the scientific research training of undergraduates is phased, systematic, comprehensive, and fully reflects the competence-oriented “outcome based education” teaching concept.

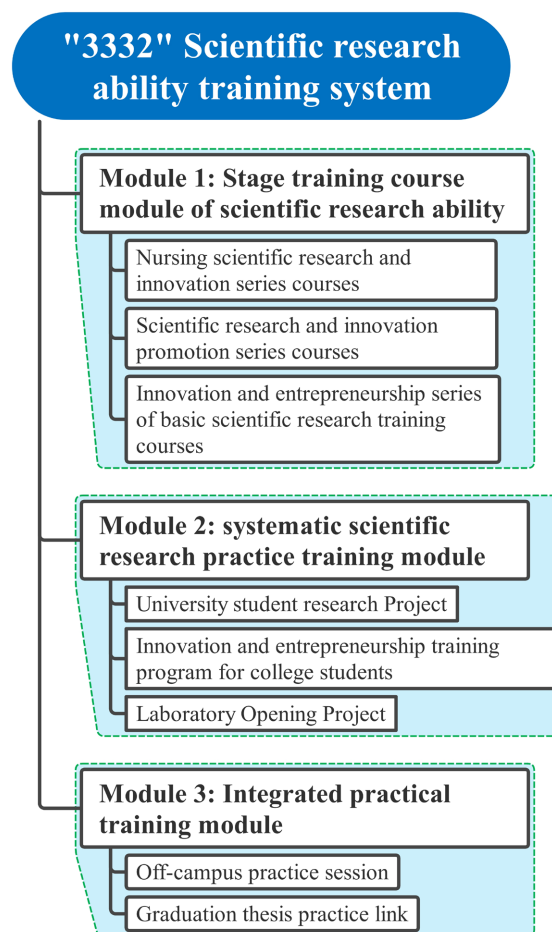


Figure 1. “3332” scientific research ability training system.

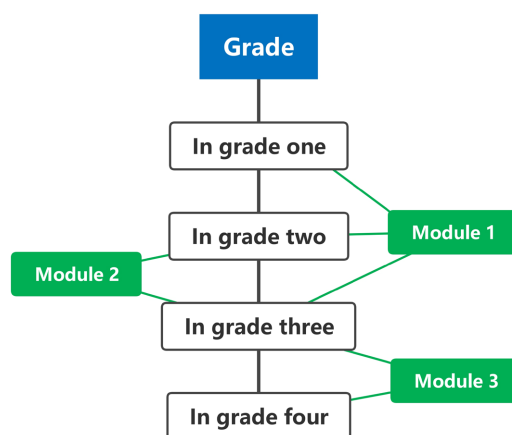


Figure 2. Study schedule for “3332” scientific research ability training system.

2.1. Stage-Based Scientific Research Ability Training Course Module

The school has developed a series of student-centered curriculum systems for full coverage of nursing research courses and to make the scientific research training of undergraduates more systematic. Stages of the course module (Figure 3) provide a series of foundational courses for grades one, two, and three ladder undergraduates.

Through the study of stage-based scientific research training courses, to improve the students’ scientific research consciousness and interest, and cultivate students’ scientific research thinking and practical ability.

2.1.1. Basic Scientific Research Training Courses: Innovation and Entrepreneurship Series

The core objective of cultivating awareness of innovation and entrepreneurship is to improve recognition of the intersection between personal development and social needs [13]. To address poor awareness of innovation and entrepreneurship and insufficient understanding of social development needs of nursing students, we developed innovative thinking training, nursing students’ career planning and innovative practice for quality of life courses. The new courses were designed for the first year of college. Innovative thinking training mainly revolves around innovation thinking method and application, whereas the nursing career planning course is mainly designed to introduce students to nursing development trends both at home and abroad and evolving needs of society, career path and planning steps. The innovative practice for quality of life course aims to consciously cultivate the students’ ability to develop their career, innovation, entrepreneurship and social demand, and realize their self-worth.

2.1.2. Setting up Nursing Scientific Research and Innovation Course Series

In the first year of the nursing research and innovation course series, students learn preventive medicine, medical statistics and related tools to prepare them

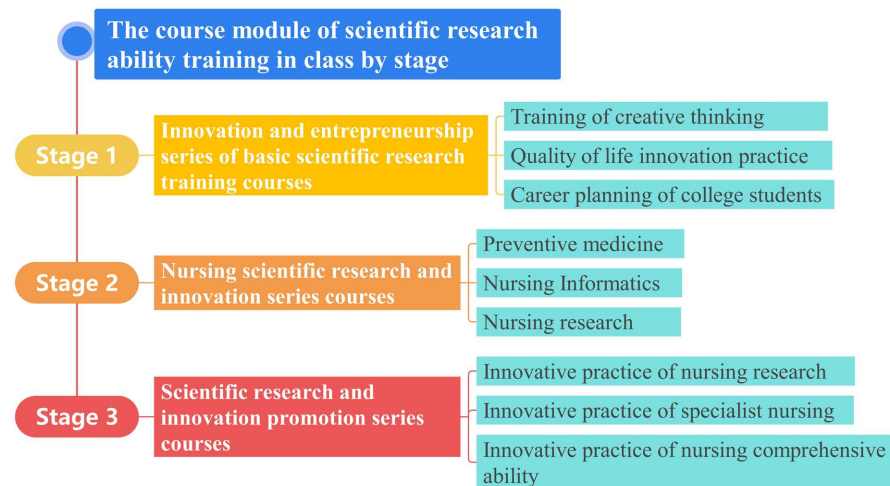


Figure 3. Stages of the course module of scientific research ability training in class.

for the future. To equip students with professional knowledge in information technology, they should not be taught nursing informatics, nursing development, global health, interdisciplinary integration and different aspects affecting human health until the second year. The aim is to teach students the relationship between health and nursing school, and trends and direction in the field of nursing. This course series is also designed to stimulate students' interest in nursing major and cultivate the students' critical thinking, communication, teamwork and other abilities. It affords students an opportunity to broaden their research ideas and cultivate their own innovation ability. As a compulsory course offered in the spring semester of the second year of nursing research, the nursing scientific research and innovation series is crucial to higher nursing education. Students are taught how to apply the scientific method to explore, answer and solve problems in the field of nursing, contributing to development of nursing knowledge system, directly or indirectly, to guide nursing practice. The series includes online course resources, which allow students to prepare in advance before class. In class, case studies are used to guide students through scientific research thinking. After class, the theoretical knowledge is further consolidated through data analysis and additional training in the computer room. This plays an important role in cultivating students' scientific research consciousness and ability.

2.1.3. Scientific Research and Innovation Promotion Course Series

Scientific research and innovation education is very important to improve nursing practice ability and nursing quality. The key to cultivating nursing students' scientific research and innovation ability is to improve their ability to identify and solve clinical problems innovatively. The college, in addition to scientific research ability training in clinical thinking to promote innovation ability, set up a "practical innovation" course system. This system included scientific research and innovation training for better specialized nursing practice, comprehensive innovation practice ability, enhanced integration of scientific research ability

and innovation ability training. The goal is to improve the creative consciousness of nursing students. “Practice and innovation” training is also crucial for mastery of professional knowledge and skills, high innovation and entrepreneurship ability, stable and quality basic innovation and creative personality characteristics, high student development potential, comprehensive competitiveness and social adaptability, and improved career adaptation and post competency.

2.2. Implementation of Systematic Scientific Research Practice Training Module

In the process of student training, the practical results as the guidance, on the basis of classroom learning to carry out extended learning, practice and innovation. The school verifies students’ theoretical knowledge in practice through “three projects”. These projects afford students an opportunity to apply scientific research knowledge in specific practical activities, helping build a systematic extracurricular scientific research practice training module (Figure 4).

2.2.1. Cultivating Team Spirit, Building a Good Academic Atmosphere, and Actively Facilitating University Students’ Scientific Research Projects

The implementation of students’ practice project on scientific research and innovation exposes them to fundamental laboratory procedures, research topics on a practical experience area, and the design and implementation of scientific research innovation subject. Its primary purpose is to validate classroom theoretical knowledge, cultivating students’ ability to integrate theory with practice. A second goal is to develop students’ practical, analytical and problem-solving abilities. Scientific research and innovation project also improves the innovation ability, medical literacy and teamwork ability that are needed to promote the organic combination of theory and practice, and train contemporary high-quality innovative college students [14]. Our hospital actively encourages university students in the second and third grades to undertake various research projects. In addition, the hospital has set up special funds to support students in scientific research at the undergraduate level as declared by the court. Colleges are also required to provide funds for projects, besides conducting lectures, salons, scientific research practice, academic competitions and other activities.

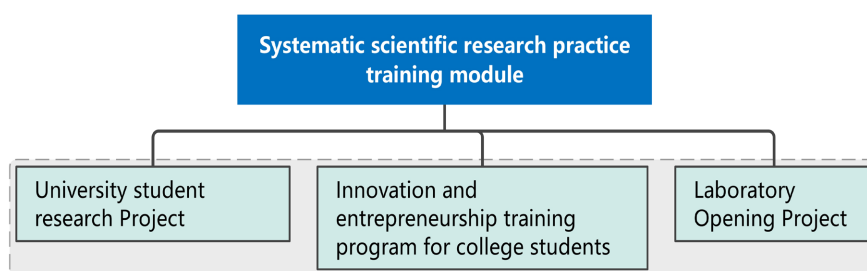


Figure 4. Systematic scientific research practice training module.

2.2.2. Innovation and Entrepreneurship Training Program for College Students

In 2012, the Department of Higher Education in the Ministry of Education issued a notice on the Implementation of the National College Students' Innovation and Entrepreneurship Training Plan for "Undergraduate Teaching Project". As a consequence, innovation and entrepreneurship training programs has been implemented in colleges and universities across the country. The school actively supports students to apply for college students' innovation and entrepreneurship training programs, and with the strong support of the Youth League Committee of the school, the know about business Entrepreneurship Association has been established. Through the collection of expert lectures, investors and entrepreneurial activities, it has provided students with a practical platform for innovation and entrepreneurship projects. For nursing majors, innovation and entrepreneurship activities can promote the in-depth understanding of relevant theories of nursing and contribute to the formation of scientific research thinking.

2.2.3. Open Laboratory Projects

In colleges and universities, the laboratory is a good place for students to develop self-study ability, innovation ability and scientific research thinking. Before commencing a laboratory project, the project leader will draw up the research plan, apply for the laboratory equipment needed for the project, and convene team members to carry out the project. Problems encountered in the implementation process are resolved through discussions between teachers and students. As members of the project team, students participate in all the practice process, thereby acquiring organization and coordination ability, learning the spirit of teamwork, and most importantly, further improving their scientific research and innovation ability.

2.3. Implementation of Comprehensive Practice Training Module

2.3.1. Off-Campus Practice

The school has formed a clinical teaching network composed of directly affiliated hospitals, teaching hospitals, community health service centers and old-age service institutions. In total, 28 clinical practice teaching bases undertake clinical teaching in our nursing school. With vacation social practice, course probation, concentrated probation, clinical practice, and other opportunities, students can achieve the module's purpose: "early exposure to clinical practice, more exposure to clinical". These learning strategies also strengthen critical thinking and problem-oriented thinking in actual clinical situations and foster application of scientific research thinking to clinical problems. Students can identify scientific research problems in their practice and use scientific research methods to solve them, promoting the translation of evidence into clinical practice and scientific research training. In addition, the module is designed to enable students to recognize the interrelationships between clinical practice and scientific research.

2.3.2. Graduation Thesis

Graduation is the culmination of undergraduate education. To graduate, the college requires each student to complete a graduation thesis on a topic that conforms to individual professional characteristics and the needs of today's society. To ensure quality in thesis supervision, the college has stipulated that the maximum number of students each tutor can guide is 6. The supervisor focuses on quality control of various aspects of the thesis, including reasonable topic selection, standard style and format, breadth of the content, validity and reliability of data, and plagiarism-free writing. Students are required to submit both paper and electronic versions of graduation thesis, graduation thesis review report and thesis manual two weeks before the defense for cross-review by the instructor who submits a report one week before the defense. The content covers the analysis of practicality, science, standardization, feasibility and other aspects, as well as consideration of the student's willingness to participate in the defense. The college adopts a centralized defense format, with three experts and one secretary in each group. Students will give a 10-minute PowerPoint presentation and respond to questions raised by the experts. Students who fail to pass the thesis will not be awarded degrees. In the process of writing the graduation thesis, students' scientific research and innovation ability is also assessed. Through training, students can master skills in paper writing completely to achieve the training goals for scientific research integration.

3. Practical Results

Systematic training in scientific research innovation ability can improve the scientific research interest and participation rate of undergraduates nursing students. In addition, through this training, their scientific research ability has been greatly improved, and impressive results have been achieved. Since 2017, the college has applied for funding for more than 100 scientific research projects by college students and secured funding for 52 projects. The number of projects has been increasing year by year, covering a wide range of topics including clinical nursing, nursing device improvement or invention, geriatric nursing, college students' career development and mental health. Students have published more than 10 papers in professional journals as first authors and obtained 1 utility model patent. Participated in the National Innovation and Entrepreneurship Training Program project, China Nursing Association Student Working Committee Innovation and Entrepreneurship Forum in Yunnan sub-Forum Entrepreneurship Forum, National College students E-commerce "Innovation, Creativity and Entrepreneurship" challenge competition, Yunnan Province "Internet+" College students Innovation and Entrepreneurship competition, Yunnan University students Extracurricular Academic Science and Technology Festival science and technology works competition and other various levels and awards. In 2021, a student from our school won the second prize in the Southwest and Northwest Division of the 10th China College Students' Medical Technical Skills

Competition.

Teachers, through training courses on teaching and guidance for scientific research practice projects, realize the value of teaching and research. In addition, teachers also show obvious improvement in teaching skills and scientific research. In 2019, teachers participated in the national nursing skills contest and won the second prize. In 2021, a historic breakthrough was achieved when the National Social Science Fund approved a project submitted by teachers. The scientific research ability of our teachers has particularly been enhanced in the past three years.

4. Think

The scientific research and innovative thinking training system for nursing undergraduates has been implemented for more than five years. During this period, some significant results have been achieved. However, the nursing curriculum and teacher team construction need to be strengthened in the following ways. The specific improvement measures are as follows.

4.1. Strengthening the Foundation and Optimizing the Basic Scientific Research Courses in Nursing

The scientific research innovation activities provided through this course are basic. To develop the innovative ability of nursing undergraduates and simultaneously promote learning of specialized courses, foundational courses in scientific research and innovation, such as “preventive medicine” should be strengthened. Innovative scientific research in creative thinking training courses could provide basic knowledge in learning and thinking, laying a solid foundation for innovation in scientific research.

4.2. Strengthening Teacher Development to Expand the Benefits of Scientific Research and Training

The key to ensure the quality of undergraduate scientific research ability is to constantly strengthen the construction of teaching staff, improve the teaching staff structure for cultivating innovative talents, and build a team of skilled and energetic teachers. We can introduce high-level talents such as academic leaders and doctors in a planned and step-by-step way to improve the overall faculty strength of the college. We should actively cultivate the backbone of teachers, expand the academic horizon, constantly improve the comprehensive quality of nursing teachers and strengthen the scientific research level of teachers through on-campus training and inter-school exchanges. At the same time, teachers’ guidance on undergraduate scientific research should be taken as an important basis for their performance assessment and professional title evaluation. Through the incentive mechanism of undergraduate tutors, teachers’ enthusiasm for the cultivation of undergraduate scientific research ability and the quality of nursing personnel training should be improved.

5. Conclusion

This study studied the cultivation path of scientific research ability of nursing undergraduates, built a cultivation system of scientific research innovation ability of nursing undergraduates based on “3332”, and found that systematic cultivation of scientific research innovation ability can improve the interest and participation rate of nursing undergraduates in scientific research. At the same time, teachers can realize the mutual promotion of teaching and research through teaching training and the guidance of scientific research practice projects.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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