Application of the CDIO Model in Provincial Clinical Practice Training for TCM Nursing Professionals

Authors: Yanfei Cheng, Jianign Li, Fengmei Wang, Xixia Zhang, Zhenhong Chen, Jian Zhou, Bei Wang, Bei Wang

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Abstract

Background

With the advancement of Traditional Chinese Medicine (TCM) and the shifting public perceptions of health, the development of TCM nursing is gaining increasing attention. TCM nursing talents are human resources essential to the field' s development. A significant challenge to the cultivation of TCM nursing talent is raising the standard of clinical practice instruction. In this study, to improve the quality of TCM nursing instruction and advance the field of TCM nursing, we established a clinical practice plan based on the CDIO (Conceptualization-Design-Implementation-Operation) concept and implemented it in the province' s professional nurse training program.

Methods

In our hospital, 32 nurses who took part in the Jiangsu Provincial TCM Nursing Professional Nurse Training Program from August to September 2023 were selected. The clinical practice stage of the training was conducted utilizing the CDIO model. After the training, the practical operation ability, syndrome differentiation nursing ability, and autonomous learning ability were assessed. We also assessed their satisfaction with the training.

Results

After the training, the clinical practice ability, syndrome differentiation nursing ability, and autonomous learning ability were all significantly higher than they were previously (all $P<0.05$). Nurses were more satisfied with the use of the CDIO model for clinical practice training.

Conclusion

The CDIO model can improve clinical practice ability, enhance syndrome differentiation nursing ability, stimulate autonomous learning ability, and increase

satisfaction with training. Furthermore, it offers novel ideas, methods, and strategies for future clinical practice training.

Full Text

Preamble

Applying the CDIO Model in Provincial Clinical Practice Training for TCM Nursing Professionals

Yanfei Cheng#, Jianing Li#, Fengmei Wang, Xixia Zhang, Zhenghong Chen, Jian Zhou, Bei Wang*

Nursing Department, Affiliated Hospital of Integrated Traditional Chinese and Western Medicine, Nanjing University of Chinese Medicine, Nanjing, China

Co-first authors: Yanfei Cheng, Jianing Li

*Correspondence: Bei Wang, wwthk1998@163.com

Abstract

Background: The development of Traditional Chinese Medicine (TCM) nursing is receiving increasing attention amid the advancement of traditional medicine and evolving public health perceptions. TCM nursing professionals constitute essential human resources for the field' s development, yet improving the quality of clinical practice training remains a significant challenge in TCM nursing talent cultivation. To address this, we developed and implemented a clinical practice training program based on the CDIO (Conceptualization-Design-Implementation-Operation) framework within the provincial professional nurse training program, aiming to enhance TCM nursing education quality and advance the discipline.

Methods: Thirty-two nurses participating in the Jiangsu Provincial TCM Nursing Professional Nurse Training Program from August to September 2023 were selected for this study. The clinical practice phase employed the CDIO model, after which participants were assessed on practical operation skills, dialectical nursing ability, and autonomous learning capacity. Training satisfaction was also evaluated.

Results: Post-training assessments revealed significant improvements in clinical practice ability, dialectical nursing ability, and autonomous learning capacity (all $P<0.05$). Nurses reported higher satisfaction with the CDIO-based clinical practice training compared to traditional methods.

Conclusion: The CDIO model effectively enhances nurses' clinical practice abilities, strengthens their capacity for syndrome differentiation-based care, stimulates autonomous learning, and increases training satisfaction. This approach

offers novel ideas, methods, and strategies for future clinical practice training initiatives.

Keywords: CDIO teaching model, TCM nursing, clinical practice training, syndrome differentiation and care, autonomous learning capacity

Introduction

With the vigorous development of Traditional Chinese Medicine and the transformation of public health concepts, TCM nursing has gained increasing emphasis from national policy makers [1, 2]. According to the National Nursing Career Development Plan (2021-2025) [3], strengthening the training of TCM nursing professionals is essential for promoting the advancement of TCM nursing. Clinical practice training represents a vital component in developing TCM nursing talent, serving as a crucial stage for nursing staff to improve their professional knowledge, master specialized skills, and enhance their post-competence.

Our hospital previously employed traditional training methods in the Jiangsu Provincial TCM Nursing Professional Nurse Training Program, which primarily relied on teacher instruction and demonstration with nurses passively receiving knowledge. While this approach yielded some benefits, it struggled to meet the demands of cultivating nurses' clinical practice competence and failed to encourage their subjective initiative, making it unconducive to mastery and practical application of the specialized knowledge system [5]. Consequently, there is an urgent need to identify solutions that can establish an effective clinical practice training mode, stimulate interest among both students and teachers, and enhance training outcomes.

The CDIO model [6] is an advanced engineering education concept developed by the Massachusetts Institute of Technology and other universities in the United States, consisting of four steps: conceive, design, implement, and operate. Based on the theory of "learning by doing,"this model [7] emphasizes a student-centered approach, advocates project-based learning, and encourages nursing students to acquire knowledge through active, hands-on, and organically linked methods across courses—all of which align with contemporary talent development principles. The CDIO model has been widely applied in applied talent training programs [8].

Numerous studies [8-10] have demonstrated that CDIO concept-based nursing training facilitates the acquisition of specialized nursing skills and related knowledge while comprehensively enhancing overall nursing capacity. Consequently, our hospital implemented the CDIO model in the Jiangsu Provincial TCM Nursing Professional Nurse Training Program to promote continuous improvements in instruction quality and provide a reference for in-hospital practical teaching.

Materials and Methods

Participants

The research subjects comprised 32 nurses enrolled in the Jiangsu Provincial TCM Nursing Professional Nurse Training Program from August to September 2023. Inclusion criteria were: (1) clinical registered nurse; (2) more than 5 years of clinical nursing experience; (3) possessing some level of technical TCM operation experience; (4) holding a bachelor' s degree or higher; and (5) providing informed consent and voluntarily participating. Exclusion criteria included those who dropped out of the training program. All 32 nurses were female, aged 27 to 44 years (34.22$\pm$4.61), and each held a bachelor' s degree. Additional demographic details are provided in Table 1 .

Training Methods

Training Team Formation. A training team of 20 teachers, comprising 1 training manager, 8 head nurses, and 11 specialist nurses, conducted the clinical practice training. The Nursing Department had recognized all instructors as possessing requisite teaching qualifications, with each having served as a clinical nurse for more than five years and holding the position of supervising nurse or above. Prior to clinical practice training, the Nursing Department assembled team members to familiarize them with the CDIO model's teaching philosophies, methods, and curriculum design.

Clinical Practice Training Schedule. The training plan emphasized prevalent diseases in key specialties and TCM nursing technologies at our hospital, developed in conjunction with the Nursing Department' s syllabus. The four-week clinical practice training schedule is outlined in Table 2 . Nurses participating in the training during the same period were formed into teams of two to four members based on the clinical practice rotation table, with each group selecting a team leader to oversee learning project implementation and manage labor allocation. Before training, the nursing officer provided instructors and learners with training schedules, requiring 100% participation.

CDIO Model Implementation. The CDIO framework was implemented through four structured steps:

Step 1: Project Conception. Instructors integrated theoretical expertise with practical ability to conceive cases based on typical illness characteristics, addressing crucial and challenging nursing care issues while encompassing all disease development stages and essential nursing process steps from admission to discharge. Using cases as guides, instructors presented learning tasks and facilitated critical thinking. Nurses constructed theoretical and practical knowledge frameworks regarding conditions through textbooks, literature, and other sources, seeking theoretical foundations for solving case problems and developing initial solution ideas.

Step 2: Project Design. Groups collaborated on project design, with team lead-

ers clarifying task allocation according to each member' s personality traits and skill level while organizing collective case analysis and discussion. Leaders maintained prompt communication with instructors when issues arose. Based on conceptualization and group discussion, instructors aided nurses in designing two major scenario simulation projects: "syndrome differentiation" and "nursing care." The syndrome differentiation project included utilization of the four diagnostic methods, eight-principle pattern identification, categorical identification by causes, and viscera syndrome differentiation. The nursing care project encompassed medication, diet, TCM nursing technology, psychological counseling, and other interventions centered around syndrome differentiation. During the design process, instructors helped group members sort through pertinent knowledge points, identify difficulties and crucial aspects of each module, and guide nurses in integrating professional knowledge into the project while designing, producing, demonstrating, and modifying specific implementation plans.

Step 3: Project Implementation. Implementation comprised two components: scenario-based simulation training and practical clinical practice. Teams collaboratively completed simulation exercises through role-playing as doctors, nurses, and patients in groups of two to four, based on division of labor and individual features. Following exercises, participants conducted self-evaluation and peer evaluation, identifying deficiencies. Instructors provided feedback, reviewed videos to reinforce key operational procedures and knowledge points, corrected problems, and facilitated discussion and sense-making of theoretical knowledge and practical operations related to syndrome differentiation and care. During clinical practice, nurses participated in patient management under instructor guidance, managing one to two patients each and applying acquired knowledge to independently perform syndrome differentiation and provide care across disease progression stages. Nurses completed daily self-evaluation, with instructors providing guidance to achieve integration of knowledge and clinical practice.

Step 4: Project Operation. Following each eight-hour clinical practice day, instructors engaged in interactive question-and-answer sessions with nurses via WeChat groups to identify individual strengths and weaknesses in skill operation while continuously improving comprehension of taught content. At training completion, teachers assessed nurses and conducted teaching quality analysis, optimizing the curriculum based on assessment results and nurse evaluations.

Observation Indicators

Operational Assessment. Nurses randomly selected two items from a list including moxibustion, auricular point sticking, cupping, scraping, massage, etc. The evaluation team assessed nurses one-on-one using unified operation assessment criteria. The full score was 100 points, with 80 points considered the standard for passing.

Dialectical Nursing Ability Assessment. The day before evaluation, the assessment team reviewed nurse rostering and patient circumstances, selecting one

patient from each nurse' s caseload to familiarize themselves with the patient' s condition and nursing care. On assessment day, examiners graded, commented, and provided instructions based on direct observation of dialectical nursing scenarios. We designed our own "Record Chart for Nurses' Ability in Syndrome Differentiation and Care" based on Jiangsu Province clinical nurse work ability assessment criteria and prior studies [11]. The instrument comprised four parts: general information, cross-sectional scenario assessment, clinical ability assessment, and evaluation results. General information included nurse and patient demographics. The cross-sectional scenario assessment contained 18 items including patient admission assessment, TCM inspection diagnosis, auscultation and olfaction, inquiry, pulse feeling and palpation, pathogenesis distinction, disease location determination, and syndrome type analysis. The clinical competency assessment included six items evaluating four diagnostic content comprehension, symptom analysis skills, TCM nursing diagnostic capacity, etc., with a maximum score of 10 points and 6 points required for passing. Each assessment content' s difficulty coefficient ranged from 0.9 to 1.1 based on patient condition severity and assessment complexity. Nurses' dialectical nursing ability scores were calculated by multiplying the clinical competency assessment score by the mean difficulty coefficient, with 60 points as the passing grade on a 100-point scale.

Self-Directed Learning Ability Evaluation Scale. We employed the Self-Directed Learning Ability Evaluation Scale developed by Xiao Shuqin [12] in 2008, consisting of 34 items across four dimensions: self-motivated belief, task analysis, self-monitoring and regulation, and self-evaluation. Each item used a 5-point Likert scale from "completely inconsistent"to "completely consistent"(1-5 points), with total scores ranging from 34 to 170 points (higher scores indicating stronger autonomous learning ability). The scale' s Cronbach' s alpha coefficient was 0.944. In this study, 64 questionnaires were distributed before and after training, with 54 collected for a valid recovery rate of 84.38%.

Training Satisfaction Evaluation. The training satisfaction questionnaire covered six dimensions: teacher condition, training content, training form, training attitude, training atmosphere, and training effect, with five response options from "extremely dissatisfied" to "satisfied." A total of 64 questionnaires were issued before and after training, with 64 valid questionnaires recovered (100% effective recovery rate).

Statistical Analysis

Data were analyzed using SPSS 25.0 statistical software. Enumeration data were expressed as frequency and percentage. Measurement data following normal distribution were presented as mean ± standard deviation ($\bar{x} \pm s$) and analyzed using paired t-tests. Non-normally distributed measurement data were presented as median (M) with quartiles (P25, P75) and analyzed using Wilcoxon rank sum tests. A p-value < 0.05 was considered statistically significant.

Results

Comparison of nurses' operational assessment scores before and after training is shown in Table 3 . Following training, nurses' dialectical nursing ability scores were 87.88$±$6.64 points, significantly higher than pre-training scores (t = 17.531, P < 0.001), as detailed in Table 4 .

Self-learning ability evaluation results for 32 nurses showed pre-training total scores of 124.50 ± 18.04 points and post-training scores of 131.46$±$19.16 points, with the difference being statistically significant (t = 3.066, P < 0.05). Detailed results are listed in Table 5 .

Nurse satisfaction with instruction was high, with no nurses expressing dissatisfaction, as shown in Table 6 .

Discussion

The CDIO Model Enhances Nurses' Clinical Practice Capabilities

Clinical nursing abilities are fundamental competencies that significantly impact patient satisfaction and care quality [13]. Syndrome differentiation and care represent the cornerstone of TCM nursing and serve as the fundamental principle guiding TCM clinical practice [14]. Therefore, enhancing nurses' operational proficiency and their capacity for syndrome differentiation-based care is essential. Consistent with previous studies [4], our results demonstrated significant improvements in nurses' operational skill levels and syndrome differentiation capacity following training (P<0.05), revealing that the CDIO model can effectively enhance clinical practice abilities. The essential philosophy of "learning by doing" effectively integrates hands-on skill development with specialized knowledge consolidation. Through self-reference, group discussions, and scenario simulation exercises, nurses continuously organized knowledge and TCM nursing processes during initial training phases. In later stages, nurses engaged in patient management, completing medical history collection, four-diagnosis assessment, dialectical analysis, TCM nursing operations, wellness instruction, and documentation to master essential syndrome differentiation and care skills for common diseases. Through self-assessment, peer evaluation, and instructor feedback throughout the "design-implementation-operation" process, nurses gained deeper understanding of their own issues and improved their operational level and syndrome differentiation competence in a targeted manner.

Furthermore, our research revealed that most nurses performed less proficiently on syndrome differentiation and care compared to their operational assessment scores, indicating that while they mastered operational processes, they lacked flexibility in applying them based on patient symptoms. Future training should therefore focus on strengthening nurses' capacity to select appropriate TCM nursing operations based on syndrome types, etiology, and pathogenesis, building upon their mastery of technical procedures to explore deeper significance of TCM nursing techniques.

The CDIO Model Promotes Nurses' Self-Directed Learning Capacity

A nurse' s autonomous learning capacity encompasses the ability to perceive requirements, evaluate resources, select strategies, set objectives, and analyze outcomes [15]. Fostering self-directed learning facilitates consolidation of clinical roles, generation of positive professional values, and development of career resilience [16]. Our study demonstrated a statistically significant increase in overall autonomous learning ability scores following training ($P<0.05$), indicating that the CDIO model effectively cultivates this capacity, consistent with Zhou Tong et al.' s findings [17]. The CDIO model represents a high-participation training approach that breaks through conventional methods, transforming one-way indoctrination into two-way active learning with the trainee at the center and emphasizing active inquiry, discovery, and learning.

During the project conception stage, instructors used cases as primary examples to spark learning interest and motivation, encouraging nurses to use leisure time to review material and conduct preliminary learning task analysis. The establishment of scenario simulations, group discussions, and instructor feedback during design and implementation stages enlivened the training environment, increasing interactivity and participation while enhancing learning initiative. Throughout implementation, lead instructors provided daily WeChat group guidance, addressing questions and highlighting strengths and weaknesses, which encouraged nurses to monitor, regulate, and evaluate themselves, leading to continuous improvement in autonomous learning capacity. We recommend that clinical instructors assume a strong "guiding" role in future training, fully engaging nurses in their own learning to facilitate the transition from "having learned" to "knowing how to learn," achieving knowledge internalization and spiral increases in core competency.

The CDIO Model Receives Excellent Feedback From Nurses

Our findings indicated that over 95% of nurses were generally satisfied with faculty, training content, format, attitude, atmosphere, and effect, validating the training approach. All clinical instructors in this study were specialist nurses with extensive teaching experience who could comprehensively apply theoretical knowledge to solve clinical problems. Instructional content was developed according to the Jiangsu Nursing Association' s training outline, hospital specialty features, and trainee needs, covering four diagnostic methods, dialectical analysis, appropriate TCM nursing operations, and health education to effectively increase nurses' sense of access.

The hands-on training phase employed flexible modes including case analysis, group discussions, simulation training, and practical exercises, with instructors facilitating active engagement and discussion while providing feedback and addressing questions to enhance the learning environment and foster greater instructor-nurse engagement. Through WeChat interactions and in-person conversations, instructors understood nurse requirements during training, focusing

on feedback and humanistic care to increase belongingness. Additionally, to ensure training effectiveness and quality, this program established a three-tiered management structure of "Nursing Department - Head of Nursing Unit - Tutor" to manage major training nodes and quality-influencing factors.

Conclusion

In conclusion, integrating the CDIO model into provincial clinical practice training for TCM nursing specialists significantly improves nurses' operational level, syndrome differentiation and care ability, and self-directed learning capacity, while generating high satisfaction. However, CDIO application in TCM nursing clinical practice training remains in its infancy. On one hand, the training team' s comprehensive competence must be enhanced and instructional case quality further improved. On the other hand, some students experienced temporary over-pressure and reluctance to embrace the new model due to limited information gathering, insufficient understanding of TCM fundamental theories, and rigid thinking patterns, resulting in poor learning efficiency and negative coping. Future efforts should enhance the scientific rigor, standardization, and accuracy of teacher training, harmonize instructional case design standards, and progressively implement the CDIO model according to training objectives.

Author Contributions

Study design: Yanfei Cheng, Bei Wang, Jianning Li. Data collection: Yanfei Cheng, Jianning Li, Fengmei Wang, Xixia Zhang, Jian Zhou, Zhanghong Chen. Statistical analysis: Yanfei Cheng. Manuscript writing and editing: Yanfei Cheng, Bei Wang, Jianning Li. All authors approved the final manuscript.

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Note: Figure translations are in progress. See original paper for figures.