Exploration and Practice of the "Modular Challenge-Based" Teaching Model in Pediatric Internship Nursing Education: Taking Pediatric Fever-Induced Seizures as an Example

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Abstract

To investigate the effectiveness of the "modular challenge-based" model in pediatric nursing internships for febrile seizures, nursing students undergoing pediatric internships at Deyang People's Hospital, Sichuan Province, China, were selected as subjects from July 2024 to July 2025. Using a random number table, they were divided into a control group and an experimental group, each comprising 37 interns. The control group received traditional nursing education on pediatric febrile seizures, while the experimental group received teaching using the "modular challenge-based" model for pediatric febrile seizures. The effectiveness of the two teaching approaches was compared and results showed that the experimental group's scores on the Self-Directed Learning Ability Evaluation Scale, the experimental group's scores on the Clinical Decision-Making Nursing Skills Assessment (CDMNS), the experimental group's teaching satisfaction scores, and the experimental group's theoretical examination scores at the end of the rotation were all significantly higher than the control group's (P < 0.05). Therefore, conclusions could be drawn as the "modular challenge-based" model could effectively enhance nursing students' self-directed learning abilities when studying pediatric febrile seizures. It improves clinical decision-making skills and teaching satisfaction while deepening theoretical knowledge mastery, making it worthy of clinical implementation in a larger scale and a deeper realm.

Keywords: modular challenge-based teaching, pediatric febrile convulsions nursing, nursing internship education, autonomous learning ability, clinical decision-making ability, satisfaction

1. Introduction

Pediatric febrile seizures, also known as febrile convulsions (FC), are a type of generalized seizure disorder occurring in infancy and early childhood (6 months to 5 years). They are associated with a sudden rise in body temperature (typically ≥38°C) and occur after ruling out intracranial infections and other identifiable causes. This condition represents a common pediatric emergency (Fang et al., 2023). The exact pathogenesis remains unclear, primarily linked to immature brain development in infants and sudden high fever triggered by bacterial or viral infections. Clinically, it is categorized into simple febrile seizures and complex febrile seizures based on seizure characteristics and duration, with simple febrile seizures being the most prevalent, accounting for approximately 70%-80% of cases (Ferretti et al., 2024). When receiving a child with febrile seizures, clinicians must promptly, calmly, and comprehensively conduct standardized nursing assessments and interventions to ensure patient safety. This involves actively treating the underlying condition, terminating the seizure episode, and preventing accidental injury, hypoxia, asphyxia, or irreversible brain damage resulting from delayed intervention. Such complications can adversely affect the child's growth and development and even threaten their life (Smith et al., 2019). This places heightened demands on the professional competence of pediatric nursing staff.

To cultivate outstanding pediatric nursing professionals, clinical education for pediatric nursing interns must be prioritized. However, in clinical nursing instruction, increased protective awareness among parents limits hands-on opportunities for interns. Interns also lack adequate problem-solving skills when confronting crying children and anxious parents. Furthermore, traditional, monotonous teaching methods diminish interns' learning motivation (Teles et al., 2020), resulting in suboptimal outcomes in pediatric clinical nursing education. To further enhance clinical competence, communication skills, problem-solving abilities, and critical thinking among nursing students, clinical educators have increasingly explored innovative teaching approaches in recent years. Among these, modularized (Chavda et al., 2016) and gamified (Muntasir et al., 2015) teaching methods have gained widespread adoption in clinical nursing education, demonstrating promising outcomes.

The "modular teaching method" centers on competency development by decomposing a course or knowledge system into several relatively independent yet interconnected learning units (modules). These modules are then combined in various ways based on teaching objectives. Characterized by flexibility, specificity, practicality, and cost-effectiveness, this model fully meets the training needs for cultivating skilled and practical nursing professionals (Mansoor et al., 2024). The "gaming-based teaching method" involves designing course content as a series of challenging, sequentially progressive or parallel-tracked task levels. Students must master the core knowledge and skills of the current level to unlock the next stage of learning. As a classic game-based teaching approach, this method effectively stimulates students' curiosity and learning interest, allowing them to experience the joy of learning through level progression (Bai et al., 2025). Specialized knowledge and emergency measures for pediatric febrile seizures exhibit relative independence among individual knowledge points, yet theoretical knowledge and specialized procedures complement each other. To further enhance pediatric nursing students' proficiency in both theoretical

knowledge and specialized emergency procedures related to febrile seizures, this study integrates "modular teaching methods" with "level-based teaching methods." By implementing a "modular level-based teaching approach," it aims to enhance the teaching quality for pediatric nursing interns and improve their self-directed learning capabilities.

2. General Information

This study is a quasi-experimental research in which nursing students undergoing pediatric clinical rotations at Deyang People's Hospital in Sichuan Province, Mainland China, from July 2024 to July 2025 were selected as research subjects. Inclusion Criteria: (1) Nursing students enrolled in full-time associate or bachelor's degree programs; (2) First-time clinical interns with no prior pediatric observation or internship experience; (3) Possession of basic communication and comprehension abilities, with voluntary participation in the study. Exclusion Criteria: (1) Concurrent psychiatric or behavioral disorders; (2) Inability to complete a full 4-week pediatric internship due to factors such as leave of absence or return to school. Following inclusion and exclusion criteria, 74 nursing students were selected for this study. They were randomly assigned to a control group and an experimental group using a random number table. The control group comprised 37 students: 10 males and 27 females. Among them, 25 held bachelor's degrees and 12 held associate degrees. Their ages ranged from 19 to 23 years, with a mean age of (20.78 ± 1.76) years. The 37 patients in the experimental group comprised 8 males and 29 females. Among them, 27 held bachelor's degrees and 10 held associate degrees. Their ages ranged from 19 to 22 years, with a mean age of (20.17 ± 1.58) years. No significant differences were observed between the two groups in terms of general characteristics $(P > 0.05)$.

3. Methods

3.1 Control Group

The control group received traditional pediatric febrile convulsions nursing education: (1) Initial Admission Phase: Theoretical instruction on the etiology, triggers, clinical manifestations, and treatment of febrile seizures was provided to deepen nursing students' understanding. Video-based teaching facilitated comprehension of standardized management protocols, establishing a theoretical foundation for subsequent clinical training. (2) Clinical Instruction: Instructors demonstrated skills including positioning, oxygen administration, oral secretion clearance, ECG monitoring placement, and protective restraints during FPS rescue procedures. Trainees then conducted simulated drills in small groups, followed by instructor-led debriefings to evaluate procedural compliance. (3) Clinical Practice and Reflection: When high-fever pediatric patients are present in the ward, instructors guide trainees in conducting assessments and implementing nursing interventions. During procedures, instructors should adopt a hands-off yet watchful approach, encouraging trainees to actively communicate with parents. (4) Assessment and Reflection: Before completing their rotation, the instructor evaluates the student's theoretical knowledge and practical skills. The instructor then organizes a group discussion for the student to share their challenges, insights, and emotional experiences encountered during the learning process.

3.2 Experimental Group

The experimental group implemented a "modular challenge-based" teaching model for pediatric febrile seizures.

3.2.1 Establishment of the "Modular Challenge-Based" Teaching Team

The teaching team comprised eight members, including experts in pediatric clinical nursing and nursing education, as well as nursing graduate students. All participating instructors had over five years of pediatric ward experience and obtained internship teaching certification through the Nursing Department's faculty training program. Prior to the study, team members categorized pediatric febrile seizures into the following modules through literature review and brainstorming: "Basic Disease Knowledge Module," "Nursing-Related Knowledge Module," and "Emergency Training Module." They established the "modular challenge-based" training approach and developed teaching plans and procedures. Concurrently, instructors received training in both traditional teaching methods and the "modular challenge-based" approach, including theoretical knowledge and practical skills, to ensure consistency in clinical instruction.

3.2.2 Implementation of the "Modular Challenge-Based" Teaching Model for Pedatric Febrile Seizures

"Modular Teaching": (1) Establish WeChat Groups: Invite each batch of newly assigned nursing interns to join the department's "Modular Challenge" WeChat group. Tailor teaching methods according to module type. (2) Teaching Implementation: ① "Disease Fundamentals Module": Pre-distribute learning materials via WeChat for student preview. Conduct weekly lectures led by instructors, emphasizing key concepts and addressing student queries. ② "Nursing-Related Knowledge Module": Utilize scenario simulations of pediatric febrile seizures. Instructors first demonstrate key nursing techniques, gradually transitioning to student-led practice. This method systematically enhances students' pediatric care skills, embodying the principle of "learning by doing, doing to learn." ③ "Emergency Training Module": Case studies based on pediatric febrile seizure management and essential emergency nursing techniques are distributed in advance via WeChat groups. Students are guided to research textbooks, literature, discuss with peers, and practice procedures. This encourages them to identify new issues and promptly consult instructors. On teaching days, nursing students conduct emergency drills for pediatric febrile seizures. After instructors pose questions, students take turns analyzing and discussing the case. Following the discussion, instructors identify errors or omissions in the emergency care procedures performed during the drill, providing supplementary explanations and demonstrations. Finally, instructors summarize the session, address new questions raised by students, and clarify key nursing operation points covered in the case.

"Progression Assessment": This phase employs a tiered advancement system where completion of one stage unlocks the next. Passing each stage earns base points, with additional points awarded for outstanding performance. The trainee with the highest cumulative score upon completing the rotation receives the title of Outstanding Nursing

Student. Assessment content comprises theoretical knowledge and practical skills from each module, such as: - "Disease Fundamentals" module: Primarily evaluates the pathogenesis, etiology, classification, clinical manifestations, and medication management of febrile seizures. The "Nursing Knowledge" module assesses key observation points, clinical care essentials, and related procedural skills for children with febrile seizures. The "Emergency Training" module focuses on operational procedures such as assisting in the rescue of children experiencing sudden seizures. After all trainees complete the assessment stages, the instructor guides them in reviewing common pitfalls encountered during the process and summarizes the key points for managing pediatric febrile seizures.

3.3 Evaluation Indicators

3.3.1 Nursing Interns' Self-Directed Learning Ability

The Nursing Intern Self-Directed Learning Ability Evaluation Scale developed by Zhang et al. (Zhang & Li, 2009) was used to assess the self-directed learning ability of both groups of nursing interns' post-intervention. This scale has a Cronbach's alpha coefficient of 0.822 and comprises four dimensions with 30 items. Each item is scored using a 1-5 Likert scale, yielding a total score ranging from 30 to 150 points, with h igher scores indicating stronger autonomous learning abilities among nursing students.

3.3.2 Clinical Decision-Making Ability of Intern Nurses

The Chinese version of the Clinical Decision Making in Nursing Scale (CDMNS) (Guo., 2011) was used to evaluate the clinical decision-making ability of both groups of intern nurses' post-intervention. Developed by Jenkins and translated into Chinese by Guo Xiuyan in 2011, this scale demonstrated an overall validity coefficient of 0.90 and a reliability coefficient of 0.72. and reliability of 0.72. It comprises four dimensions: seeking solutions, setting goals for problem-solving, repeatedly evaluating implementation outcomes, and re-searching relevant information. The 40-item scale is scored from 1 to 5 points for "never, rarely, sometimes, often, always," yielding a total score ranging from 40 to 200 points. Scores of 40.00–93.33 indicate low clinical decision-making ability among nursing students, 93.34–146.67 indicate moderate ability, and 146.68–200.00 indicate strong ability.

3.3.3 Intern Satisfaction

A customized satisfaction survey was administered to assess teaching satisfaction among interns' post-intervention. This 10-item scale, co-developed by the pediatric head nurse and teaching coordinator, assessed satisfaction with ward orientation, theoretical training, practical skills training, teaching rounds, as well as satisfaction with instructors, teaching coordinators, head nurses, and overall pediatric teaching. Each item used a 1–5 rating scale: 1 = Very Dissatisfied, 5 = Very Satisfied. with higher scores indicating greater satisfaction among student nurses.

3.3.4 Exit Theoretical Examination

Both the control and experimental groups used identical test papers. Questions were developed and revised by senior nurses and experienced nursing instructors. The exam

covered all three training modules and included multiple-choice, multiple-answer, and case analysis questions, totaling 100 points. Scores were directly proportional to the interns' mastery of theoretical knowledge.

3.4 Data Collection and Statistical Methods

Data collection for this study was conducted through face-to-face interviews. Prior to formal questionnaire completion, researchers provided in-person explanations to nursing students and obtained signed informed consent forms. After securing informed consent, questionnaires were distributed to participants. Students were permitted to ask researchers questions during the process. Completed questionnaires were collected immediately on-site. Any missing or incomplete entries were verified and supplemented on the spot to minimize data loss. Collected data were entered and summarized using Excel 2007 software and analyzed with SPSS 26.00. Quantitative data, including clinical decision-making ability scores, self-directed learning ability scores, student satisfaction with clinical rotations, and final theoretical examination scores, were tested for normality using the Shapiro-Wilk test. These data met the assumption of normal distribution and were expressed as mean ± standard deviation ($\bar{x} \pm s$). Comparisons between groups were performed using the independent samples t-test. Non-normally distributed quantitative data were expressed as median and interquartile range [M (P25, P75)] and analyzed using nonparametric tests. Qualitative data, such as gender and educational background in general information, were presented as counts (percentages) [n (%)], and group comparisons were performed using chi-square tests.

4. Results

Comparing the self-directed learning abilities of the two groups of nursing students after intervention, the experimental group's scores on the self-directed learning ability assessment scale were significantly higher than those of the control group (P < 0.05), as shown in Table 1.

Table 1. Comparison of Self-directed Learning Ability Assessment Scale Scores Between the Two Groups of Nursing Students After Intervention ($\bar{x} \pm s$)

Group	Number of Cases	Self-Directed Learning Ability Assessment Scale Score/Points
Control group	37	92.67±5.82
Experimental group	37	110.66±6.28
t		12.781
P		0.000

Comparing the clinical decision-making abilities of the two groups of nursing students after intervention, the clinical decision-making scale scores (CDMNS) of the experimental group were significantly higher than those of the control group (P < 0.05), as shown in Table 2.

Table 2. Comparison of Clinical Decision-making Ability Scale Scores Between the Two Groups of Nursing Students After Intervention ($\bar{x} \pm s$)

Group	Number of Cases	Self-Directed Learning Ability Assessment Scale Score/Points
Control group	37	134.67±5.82
Experimental group	37	167.83±6.21
t		23.699
P		0.000

Comparing the satisfaction levels with teaching methods between the two groups of nursing students after intervention, the experimental group scored significantly higher than the control group (P < 0.05), as shown in Table 3.

Table 3. Comparison of Teaching Satisfaction Scores Between the Two Groups of Nursing Students After Intervention ($\bar{x} \pm s$)

Group	Number of Cases	Satisfaction Rating / Points
Control group	37	38.52±1.77
Experimental group	37	43.78±2.68
t		9.962
P		0.000

Comparing the theoretical examination scores of the two groups of nursing students upon completing their rotation, the experimental group achieved significantly higher scores than the control group (P < 0.05), as shown in Table 4.

Table 4. Comparison of Theoretical Examination Scores for Nursing Students Upon Completing Rotation ($\bar{x} \pm s$)

Group	Number of Cases	Theory Exam Score/Points
Control group	37	38.52±1.24
Experimental group	37	43.78±2.03
t		13.450
P		0.000

5. Discussion

Unlike nursing education in general clinical departments, pediatric care involves infants, toddlers, and children in active growth and development phases. Their conditions can change rapidly, demanding that student nurses possess keen observational and judgmental skills. Additionally, the traditional family-centered care approach in pediatrics often leads to high expectations from parents regarding medical and nursing care. This necessitates that student nurses demonstrate exceptional communication and empathy skills, presenting significant challenges for pediatric clinical teaching. Traditional clinical teaching centers on the instructor, with students passively receiving information. This approach fails to stimulate

learning motivation or cultivate independent learning and clinical decision-making skills (Xin et al., 2020). Modular teaching approaches have gained widespread adoption in clinical education in recent years. By dividing theoretical knowledge into distinct modules, this method refines content while reducing learning pressure for clinical students (Xie et al., 2025). Gamified teaching methods, as an innovative approach in contemporary clinical education, leverage students' innate interest in games and novelty to stimulate engagement, transform learning attitudes, and activate independent learning capabilities. This encourages students to approach problems with an inquisitive mindset, making it highly favored by clinical trainees (L. Han et al., 2021). Currently, gamification is widely applied in nursing (Sanz-Martos et al., 2024), clinical (Khanna et al., 2021), and public health (Grech & Grech, 2021), yielding favorable intervention outcomes. This study implemented a "modular challenge-based" teaching approach, achieving positive educational results for nursing students learning pediatric febrile seizure care during their pediatrics rotation.

5.1 The "Modular Challenge-Based" Model Could Effectively Enhances Intern Nurses' Active Learning Abilities in Studying Pediatric Fever-Induced Seizure Care

Research (Kim & Castelli, 2021) indicates that implementing gamified teaching methods can stimulate students' learning motivation and improve their autonomous learning abilities. In this study, nursing students in the experimental group using the "modular challenge" model scored significantly higher in self-directed learning compared to the control group. This outcome primarily stems from the modular teaching approach establishing a systematic knowledge framework. It decomposes the knowledge of pediatric febrile seizures into three progressively structured modules: from etiology and pathophysiology (fundamental knowledge module) to clinical observation and routine care (nursing knowledge module), and finally to emergency intervention protocols (emergency training module). This approach constructed a comprehensive "knowledge map" for trainees, reducing cognitive load and clarifying learning objectives and pathways. The game-based level progression mechanism ignites trainees' intrinsic motivation. Passing each assessment delivers immediate achievement and positive reinforcement, This reward effect significantly ignites trainees' curiosity and competitive spirit, transforming passive "I have to learn" attitudes into active "I want to learn" exploration. To progress smoothly through levels, trainees proactively engage in learning, thereby enhancing their self-directed learning abilities—a finding consistent with research by Zafar et al. (2022).

5.2 The "Modular Challenge" Model Could Effectively Enhances Clinical Decision-Making Skills in Nursing Students Learning Pediatric Fever-Induced Seizure Care

Clinical decision-making is central to ensuring patient safety and serves as the bridge for nursing students to adapt to complex clinical environments and become qualified nurses. Therefore, clinical nursing education must prioritize cultivating students' clinical decision-making abilities (Q. Han et al., 2024). In this study, the implementation of the "modular challenge-based" model effectively enhanced clinical decision-making abilities among nursing students. This improvement stemmed primarily from the model's high-fidelity simulation of the nursing thought process in clinical practice. Students progressively

mastered foundational knowledge to accurately identify conditions (Module 1), then developed comprehensive care plans (Module 2), and finally performed emergency procedures rapidly and accurately within simulated scenarios. This integrated "theory-practice-decision-making" training compelled students to engage in clinical reasoning, enabling swift responses when confronting real-world cases. The challenge-based approach also provided repeated opportunities to review theory and practice procedures, thereby honing students' judgment, communication, and teamwork skills in complex scenarios. Consequently, their clinical decision-making abilities were significantly enhanced.

5.3 The "Modular Challenge" Model Could Effectively Enhances Intern Nurses' Satisfaction in Learning Pediatric Fever-Induced Seizure Care

Compared to the monotonous lectures and single-skill demonstrations in traditional teaching methods, the "modular challenge-based" approach provides the experimental group of nursing students with greater engagement and challenge during the learning process. This approach aligns well with the psychological characteristics of contemporary young nursing students, who prefer interactive learning and dislike didactic instruction. It transforms learning from a burdensome task into an adventure filled with the joy of exploration. Simultaneously, students facing learning difficulties can repeatedly practice until mastery is achieved. This approach fosters a strong sense of accomplishment and achievement among nursing students, thereby enhancing their satisfaction with the teaching process. This finding is consistent with the research by Yu et al. (2021).

5.4 The "Modular Challenge-Based" Model Could Effectively Improves Interns' Theoretical Scores in Pediatric Fever-Induced Seizure Care

The final theoretical exam serves as a comprehensive assessment of interns' phased learning outcomes. Interns in the experimental group achieved significantly higher scores than those in the control group. This primarily stems from the modular teaching approach adhering to the "chunking" principle in cognitive psychology, which integrates fragmented learning points into meaningful units, facilitating brain memory storage. The review and assessment before each challenge further solidified memory foundations, leading to more robust mastery of knowledge and skills. This finding is consistent with the research by Wang et al. (2025).

6. Limitations, Summary & Future Directions

Currently, applied research on the "modular challenge-based" model remains limited in experiences and practices in small parts of China. This teaching approach is still in its exploratory phase, requiring clinical preceptors to invest significant effort in developing instructional content, designing teaching processes, and creating challenge formats. This substantial workload may diminish clinical preceptors' enthusiasm and result in inadequate and incomplete instructions thereby. Additionally, during challenge implementation, nursing students may experience considerable pressure, necessitating repeated review of theoretical knowledge and practice of procedural skills beforehand. Finally, the relatively small sample size of this study limits its generalizability, necessitating future research with larger sample sizes in larger cities and more advanced hospitals in China and across the world. As shown in

this study, the "modular challenge-based learning" model could effectively enhance nursing students' self-directed learning abilities when studying pediatric febrile seizures, improves their clinical decision-making skills and satisfaction with instruction, and deepens their mastery of theoretical knowledge. We believe this brand new model could shed a light on relevant nursing education and clinical practices with both significant theoretical and practical meanings and values, and it warrants broader implementation in clinical settings.

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Macrothink Institute.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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