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Optimizing resident training in obstetrics and gynecology: a new perspective on the refined Peyton four-step teaching method

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Abstract

Objective In the surgery-focused field of obstetrics and gynecology (OB-GYN), the development of residents' skills is paramount. This study aims to evaluate the impact of an enhanced Peyton Four-Step Teaching Model on the foundational skill training of first-year OB-GYN residents.

Methods Utilizing a cohort study design, we assessed 116 first-year residents from the OB-GYN residency program at Shengjing Hospital of China Medical University from June 2021 to June 2023. The 57 residents beginning their training in 2022 were part of the Refined Peyton (RP) group, introduced to the RP method; the 59 residents from 2021 served as the Traditional Teaching-mode (TTM) group, receiving conventional simulation-based instruction. Teaching effectiveness was assessed by comparing theoretical knowledge and skill performance assessments, National Medical Licensing Examination (NMLE) pass rates, direct observation of procedural skills (DOPS) one year post-training, and survey feedback.

Results The theoretical knowledge scores for both groups were comparable at 78.78 ± 4.08 and 78.70 ± 3.83 , with no significant difference ($P=0.76$). However, the experimental group demonstrated superior performance in skill operation assessments, first-time NMLE pass rates, and DOPS evaluations one year after training [(77.05 ± 5.39) vs. (84.60 ± 5.65), 100.0% (57/57) vs. 86.4% (51/59), and (75.22 ± 3.56) vs. (82.54 ± 3.43)], as well as higher teaching satisfaction scores [(4.63 ± 0.46) vs. (3.92 ± 0.62)], with all differences being statistically significant ($P < 0.05$).

Conclusion The refined Peyton Four-Step Teaching Model significantly improves the immediate acquisition and long-term retention of clinical basic skills among OB-GYN residents, enhancing both teaching efficacy and resident satisfaction.

Keywords Obstetrics and gynecology, Residents, Peyton four-step teaching method, Skill operation

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Obstetrics and Gynecology (OB-GYN) is a critical domain within clinical medicine, where the development of residents' surgical skills is of paramount importance. The unique challenges of the OB-GYN field, such as abbreviated rotations and the complexity of procedures, necessitate the evolution of educational models that can effectively train residents amidst these constraints. [1] The Peyton Four-Step Teaching Method, which integrates demonstration, deconstruction, comprehension, and performance, has been recognized for its efficacy in various medical fields due to its comprehensive approach to skill acquisition and retention [2, 3].

The introduction of the Peyton method in OB-GYN education is not merely a significant change but a deliberate strategy expected to yield substantial improvements in educational outcomes. We anticipated that this method would address key issues in OB-GYN training, such as enhancing the procedural skills of residents, improving their understanding of complex surgical techniques, and fostering a learning environment that promotes interaction and reflection [4–6].

However, the mere adoption of a method is not sufficient; its validation within the specific context of OB-GYN is crucial. To this end, we delved into the existing literature to understand the theoretical underpinnings and empirical evidence supporting the Peyton model. Studies have shown that structured teaching methods like Peyton's can lead to better retention of knowledge and improved technical skills [7, 8]. Furthermore, the Peyton method's emphasis on deliberate practice and reflection aligns with constructivist learning theories, which posit that learning is most effective when it is active, collaborative, and reflective [9, 10].

Our study, therefore, aims to evaluate the impact of this refined Peyton method on the foundational skill training of first-year OB-GYN residents. We expect that this approach will significantly improve the immediate acquisition and long-term retention of clinical basic skills, thereby enhancing teaching efficacy and resident satisfaction. The results of this study will provide a clear rationale for the implementation of the Peyton method in OB-GYN education and contribute to the ongoing discourse on medical education innovation.

Methods

Study participants and approach

From June 2021 to June 2023, 116 first-year OB-GYN residents at the residency program in Shengjing Hospital of China Medical University were enrolled in this study. All participants were without prior clinical experience. The 57 residents beginning their training in 2022 were part of the Refined Peyton (RP) group, introduced to the RP method; the 59 residents from 2021 served as the Traditional Teaching-mode (TTM) group, receiving traditional

simulation-based instruction. All participants provided informed consent, and the study adhered to the ethical principles of medical research as outlined in the Declaration of Helsinki. All participants provided informed consent.

Teaching implementation

Residents underwent basic skill operation training in OB-GYN three months prior to their first attempt at the National Medical Licensing Examination (NMLE), covering 16 specific procedures. Training spanned eight weeks, with each procedure receiving three hours of instruction, totaling 48 h.

Textbook and teaching content

Both groups used the "Clinical Basic Skill Operation Training Tutorial" published by People's Medical Publishing House in 2018 as their textbook. Teaching content and hours were identical for both groups.

Instructors

Instructors for both groups were the same and consisted of associate chief physicians qualified through clinical teaching training and assessment at China Medical University.

Traditional teaching-mode group

The TTM group's instruction utilized traditional simulation-based methods, completing the 16 basic skill operations over eight weeks. Each week, two projects were trained over four consecutive days (divided into four batches) from 17:30 to 20:30. Residents could choose to participate in one to two batches, with 14 to 18 participants per batch and two instructors. The process began with theoretical teaching in a dedicated skills training room, followed by hands-on practice where residents observed and practiced under the guidance of instructing physicians. After training, related operation videos, Powerpoints, and operation standards were uploaded to a teaching management system for residents' review.

Refined peyton group

The RP group's instruction employed the refined Peyton Four-Step Teaching Model. Prior to implementation, instructor training was conducted, standardizing each skill's specific operation steps and integrating patient communication skills and medical humanities. The "Clinical Basic Skill Operation Scoring Form" and a standardized teaching process were established. The process involved dividing each batch of 12 to 16 residents into four groups of 3 to 4 people each, with one instructing physician for every two groups. The specific steps are detailed in Table 1. It provided a wealth of learning resources, such as instructional videos and lecture slides,

Table 1 Implementation steps of the refined peyton four-step teaching method in obstetrics and gynecology basic skill training

Teaching method	TTM group instruction	RP group instruction	Teaching formats
Demonstration	Instructor explains and demonstrates without elaboration.	Instructor uploads operation videos, lecture PPTs, and assessment criteria to the teaching management platform three days before the course, allowing residents to study independently. (Unlimited video playback.)	Video Demonstration
Deconstruction	Instructor operates and describes steps in detail, but without resident questions.	Instructor demonstrates each step of the standard operation procedure, explaining specific requirements and precautions. Encourages residents to ask questions about challenging concepts and operations, with on-the-spot clarification.	Operational Demonstration with Interactive Teaching
Comprehension	Instructor performs the operation for the third time, with residents describing and explaining each step	In teams of 3 to 4 residents, one member (A) recites each procedural step, another (B) demonstrates the operation, while resident C or D oversees with the scoring sheet, providing checks and reminders, and noting any issues. They also observe the performance of members A and B, contemplating the entire process, before rotating through the roles. The supervising physician and team members offer immediate feedback on any problems or deficiencies, ensuring that each resident completes a full operational practice, which includes one recitation of the steps, one demonstration of the procedure, and one to two scoring observations, with feedback received at each stage.	Group Exercise with Peer-to-Peer Learning
Execution	Skill assessment with immediate feedback from the instructor.	On-site assessment and feedback, where each resident independently completes the entire operation (while explaining), with other group members observing silently. Instructors score and provide PEARLS feedback, encouraging residents to reflect on their strengths and areas for improvement. If performance is poor, residents repeat the session to achieve a "mastery" standard (score > 80).	Skill Assessment and Reflective Review

TTM: Traditional Teaching-mode; RP: Refined Peyton

along with clear assessment criteria, to encourage independent learning among resident physicians. During the teaching process, the instructor demonstrated each step in a detailed manner and explained the requirements and precautions, while also encouraging active questioning and interaction from the resident physicians to enhance their understanding and retention. The resident physicians were organized into groups, with members taking turns to recite the steps, demonstrate the procedures, and provide mutual scoring and feedback. Ultimately, through the skill assessment and reflective debriefing sessions, feedback was used to identify each resident physician's strengths and areas for improvement, thereby achieving in-depth learning and comprehensive mastery of skills.

Teaching effectiveness evaluation

A questionnaire was developed based on relevant literature and expert consultation to assess resident teaching satisfaction, covering ten items such as stimulating learning interest and enhancing self-learning ability. The Likert 5-point scale was used, with scores ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The questionnaire's Cronbach's alpha was 0.852. The survey was administered online by medical teaching management staff within one week after training, with residents submitting their responses anonymously.

Within one month after training, a theoretical knowledge exam was conducted, with a full score of 100 points. Additionally, a basic skill operation assessment was organized using an eight-station objective structured clinical

assessment (OSCE) [11], with each assessment lasting one day. Each station was scored by two examiners (with the title of Associate Chief Physician or above) using a uniform standard, and the average score of multiple skill operations was taken. To minimize bias, the national examinations were conducted by an external third party who were unaware of the intervention, and the first-time pass rate was serve as an evaluation metric.

One year after training, direct observation of procedural skills (DOPS) [12] was used to evaluate the clinical practice operation performance of the two groups of residents, assessing 11 items such as understanding of operation indications and related anatomy, obtaining patient consent, and pre-operation preparation. Each item was scored out of 9 points, with 1–3 points, 4–6 points, and 7–9 points indicating areas for improvement, standard compliance, and excellence, respectively. Scores were provided by two examiners with the title of Associate Chief Physician or above, and examiners were provided with standardized criteria and were not informed of the specific teaching methods used with the residents they assessed.

Statistical analysis

Data analysis was conducted using SPSS 26.0. Quantitative data conforming to a normal distribution were expressed as mean \pm standard deviation ($\bar{x} \pm s$), with group comparisons made using t-tests. Count data were expressed as rates, frequencies, and percentages [e.g. (%)], with group comparisons made using chi-square

tests or Fisher's exact test. A P -value < 0.05 indicated a statistically significant difference.

Results

Participant characteristics

The RP group included 9 males and 48 females with an average age of (24.53 ± 2.36) years, scoring (74.51 ± 6.10) in the resident recruitment examination for theoretical knowledge and (72.81 ± 7.92) for skill operation. The TTM group comprised 9 males and 50 females with an average age of (24.41 ± 1.90) years, with scores of (75.19 ± 6.02) for theoretical knowledge and (72.68 ± 6.15) for skill operation. There were no significant differences between the two groups in terms of gender ($X^2=0.006$, $P=0.937$), age ($t=0.301$, $P=0.764$), theoretical knowledge scores ($t=0.602$, $P=0.548$), and skill operation scores ($t=0.098$, $P=0.922$), as detailed in Table 2.

Theoretical knowledge and skill performance assessments

The theoretical knowledge exam scores between the two groups after training were not significantly different ($P=0.916$). However, the RP group demonstrated superior performance in skill operation assessments (84.60 ± 5.65 for RP group vs. 77.05 ± 5.39 for TTM group, $P<0.001$), indicating enhanced practical skill acquisition through the refined Peyton method.

National medical licensing examination pass rates

The RP group achieved a 100.0% pass rate in the practical skills of NMLE, compared to 86.4% for the TTM group ($P=0.04$), reflecting the effectiveness of the RP method in preparing residents for national standardized evaluations.

Direct observation of procedural skills

One year after training, the RP group scored higher than the TTM group in DOPS evaluations, with statistically significant differences in all assessed items ($P<0.001$). The RP group exhibited better performance in obtaining patient consent, providing appropriate comfort and pain relief, skill operation, aseptic technique, seeking assistance as needed, communication skills with patients,

professional demeanor/humanistic care, and overall performance, as detailed in Table 3.

Teaching satisfaction survey

A total of 116 questionnaires were returned, with a 100.0% response rate. The RP group scored higher than the TTM group in all nine items, including stimulating learning interest and enhancing self-learning ability, with all differences being statistically significant ($P<0.05$), as shown in Table 4.

Discussion

The findings suggest that the Refined Peyton Four-Step Teaching Model significantly enhances residents' basic skill operation abilities, facilitating both immediate learning and long-term retention. Research indicates that the Peyton method, when integrated with other teaching strategies, can enhance educational outcomes [13]. The Peyton model's learning experience is actively standardized, aiding in the acquisition of knowledge, skills, and clinical operational capabilities [14]. The introduction of "group teaching" in the third step of the Peyton method effectively addresses the challenge of large class sizes in undergraduate and resident training programs [10]. These outcomes align with our initial aim of increasing learner engagement and initiative, fostering interaction, communication, and collaboration among residents, and improving teaching outcomes and satisfaction.

Our study's adaptation of the Peyton model incorporates video instruction, peer learning, and Promoting Excellence and Reflective Learning in Simulation (PEARLS) feedback, creating a synergistic and complementary approach. The first step, "video demonstration," allows for self-paced learning with the flexibility of pausing and replaying instructional videos. The second step, "operation demonstration with teacher-student interaction," encourages questions and real-time clarification, deepening the understanding of complex concepts and skills. The third step, "group practice with peer learning," facilitates a cycle of practice, reflection, and feedback. The fourth step, "skill assessment with debriefing," employs PEARLS feedback to foster reflective learning. The RP method's structured approach to teaching and

Table 2 Demographics and assessment scores of residents by group

Group	Sex		Age (Mean \pm SD)	Admission exam		Within 1 month after training		National medical licensing examination	1 year post-training DOPS (Mean \pm SD)
	Male	Female		Theoretical exam (Mean \pm SD)	Skill assessment (Mean \pm SD)	Theoretical exam (Mean \pm SD)	Skill assessment (Mean \pm SD)		
TTM group	9	50	24.41 \pm 1.90	75.19 \pm 6.02	72.68 \pm 6.15	78.78 \pm 4.08	77.05 \pm 5.39	86.4%	75.22 \pm 3.56
RP group	9	48	24.53 \pm 2.36	74.51 \pm 6.10	72.81 \pm 7.92	78.70 \pm 3.83	84.60 \pm 5.65	100%	82.54 \pm 3.43
t/χ^2	0.006		0.301	0.602	0.098	0.106	7.361	8.301	11.29
P	0.937		0.764	0.548	0.922	0.916	< 0.001	0.04	< 0.001

TTM Traditional Teaching-mode, RP Refined Peyton, DOPS Direct Observation of Procedural Skills, SD Standard Deviation

Table 3 One-year post-training direct observation of procedural skills assessment scores for two groups (Scores, Mean±Standard Deviation)

Evaluator qualifications	TTM group (n=59) (Mean ± SD)	RP group (n=57) (Mean ± SD)	t	P
Understanding and Preparation				
Knowledge of procedure indications and patient consent	7.20 ± 0.87	7.05 ± 1.09	0.825	0.411
Pre-operative preparation and setup	6.78 ± 1.10	7.44 ± 1.15	3.155	0.002
Anticipates and manages pain and discomfort	7.36 ± 0.94	7.39 ± 0.94	0.165	0.869
Technical Skills				
Precision and efficiency in performing the procedure	6.54 ± 0.16	7.21 ± 1.06	3.114	0.002
Adherence to aseptic technique	6.90 ± 1.12	7.63 ± 0.77	4.082	< 0.001
Appropriate use of instruments and equipment	6.70 ± 1.78	7.74 ± 0.95	5.22	< 0.001
Professional Interaction				
Seeks assistance when necessary	6.51 ± 0.97	7.68 ± 0.95	6.594	< 0.001
Effective communication with patient and team	7.05 ± 1.07	7.72 ± 0.90	3.625	< 0.001
Demonstrates professionalism and empathy	6.78 ± 0.98	7.53 ± 7.07	3.913	< 0.001
Post-Procedure Care				
Appropriate post-procedure care and management	6.73 ± 1.05	7.46 ± 0.91	3.990	< 0.001
Effectively communicates next steps to the patient	6.68 ± 1.12	7.70 ± 0.96	5.268	< 0.001

TTM: Traditional Teaching-mode; RP: Refined Peyton

learning, emphasizing demonstration, deconstruction, comprehension, and performance, has shown to be effective in enhancing residents' practical skills, as evidenced by higher skill operation assessment scores and NMLE pass rates. The method's focus on active participation, peer learning, and reflective feedback likely contributed to higher teaching satisfaction and self-learning ability among residents.

The refined Peyton model empowers students to guide their peers through operations, promoting a teacher's perspective and stimulating creative thinking and learning interest, which is beneficial for developing self-directed learning abilities, clinical practice skills, and professionalism [15]. The study's results indicate that the RP group residents outperformed the TTM group in enhancing self-learning abilities, expanding clinical

Table 4 Comparative analysis of teaching satisfaction scores for two resident groups post-training (Scores, Mean ± Standard deviation)

Items	TTM group (n=59) (Mean ± SD)	RP group (n=57) (Mean ± SD)	t	P
Stimulates Learning Interest and Enhances Self-Directed Learning	3.93 ± 0.58	4.39 ± 0.62	4.062	< 0.001
Offers Experiential and Repetitive Learning to Alleviate Exam Anxiety	4.07 ± 0.58	4.39 ± 0.60	2.848	0.005
Fosters a Positive Learning Environment and Improves Study Efficiency	4.09 ± 0.60	4.35 ± 0.70	2.219	0.028
Promotes Communication and Collaborative Assistance Among Residents	4.03 ± 0.59	4.44 ± 0.63	3.591	< 0.001
Facilitates Timely Feedback and Support	3.98 ± 0.57	4.37 ± 0.67	3.331	0.001
Aids in Rapid Comprehension of Operative Details and Memorization of Procedures	4.05 ± 0.62	4.45 ± 0.63	3.474	0.001
Expands Clinical Thinking and Practical Skills	4.05 ± 0.66	4.47 ± 0.60	3.621	< 0.001
Boosts Medical Humanism and Professionalism	4.02 ± 0.56	4.46 ± 0.59	4.037	< 0.001
Reasonable Training Duration	4.13 ± 0.60	4.35 ± 0.69	1.788	0.76
Overall Satisfaction Assessment	4.00 ± 0.59	4.39 ± 0.64	3.220	0.002
Average Score	4.04 ± 0.18	4.40 ± 0.23	9.846	< 0.001

TTM: Traditional Teaching-mode; RP: Refined Peyton

thinking, and refining clinical practice skills, as well as in non-technical skills such as communication with patients and professional demeanor, as assessed by DOPS one year after training. The DOPS results after one year serve as a proxy for skill retention, reflecting the residents' ability to apply learned skills in a clinical setting over an extended period. While acknowledging the multifactorial influences on skill retention, such as varying clinical experiences and individual learning trajectories, the consistent superior performance of the RP group in all DOPS items indicates a strong foundation of skills built through the refined Peyton method. This method's emphasis on deliberate practice, peer interaction, and continuous feedback likely reinforced the learning and retention of procedural skills.

The critical third step of the Peyton method, which involves reciting and reflecting on all sub-steps, was enriched by the introduction of group practice and peer

learning. This not only addresses the challenges of limited teaching-staff and training time but also transforms traditional lecture-based teaching into concept-driven self-directed learning and collaborative inquiry, significantly boosting residents' enthusiasm and proactivity. This approach effectively promotes the understanding of abstract concepts and enhances problem-solving abilities, contributing to cognitive expansion and core skill development, while avoiding the pitfalls of a dull classroom atmosphere and insufficient interaction. Constructivist theory suggests that explaining correct operations and engaging in reasoning with peers activates existing cognitive resources, integrating them with new knowledge, and enhancing metacognitive abilities. Furthermore, peer recitation, demonstration, evaluation, and feedback enrich emotional experiences, deepen self-awareness of strengths and weaknesses, and reinforce memory and reflective learning, forming a mutually supportive and complementary mechanism that aids in meaning construction and positively impacts residents' social development and professional identity [16–18].

The refined Peyton model's use of simulation training provides a safe, repeatable, and forgiving environment for residents. By breaking down complex skill operations into structured learning steps, it fosters an autonomous and relaxed learning atmosphere, boosting confidence and a sense of achievement. Resident-to-resident evaluation and feedback are more readily accepted, resonating more deeply and accelerating understanding and memory retention. Research indicates that peer learning and feedback, under the guidance of instructing physicians, are essential for effective learning in a simulated environment [19]. The refined Peyton model emphasizes “student-student interaction” and “teacher-student interaction,” allowing each resident to guide and be guided in operations. Crucially, instructing physicians play a pivotal role in organizing and supervising the teaching process and providing PEARLS feedback, helping participants establish a sense of psychological safety and deeply reflect on the entire learning process, ultimately improving cognitive thinking patterns and future medical behavior, enhancing residents' confidence and satisfaction when facing real clinical practice.

Despite the promising results, this study has several limitations. It was conducted at a single institution, which may limit generalizability. The follow-up period was only one year, and potential confounding variables, such as individual learning styles and clinical exposure, were not fully controlled. The teaching satisfaction survey relied on self-reported data, which may introduce response bias. Assessment methods used, while comprehensive, might not capture all aspects of clinical competence. Instructor variability and cultural context may also influence the findings. Future research should

include multi-center studies with longer follow-up periods and additional objective assessment tools to validate the refined Peyton Four-Step Teaching Model in diverse settings.

Conclusion

The Refined Peyton Four-Step Teaching Model has proven to be an effective and acceptable method for enhancing the training of first-year OB-GYN residents in basic skill operations. The structured and interactive approach of the RP method significantly improves teaching outcomes and resident satisfaction, providing a valuable addition to medical education. Future studies should further explore its application across different specialties and educational contexts to fully realize its potential in medical training.

Abbreviations

RP	Refined Peyton
TTM	Traditional Teaching-mode
DOPS	Direct Observation of Procedural Skills
OB-GYN	Obstetrics and Gynecology
NMLE	National Medical Licensing Examination
PEARLS	Promoting Excellence and Reflective Learning in Simulation
OSCE	Objective Structured Clinical Assessment

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Author contributions

DZ, XZ, and KZ designed the study and drafted the manuscript. DZ and XW participated in teaching activities. XW, XC, and YL designed the statistical analysis plan. XZ has reviewed and co-authored the manuscript with KZ.

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Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

Ethics approval and consent to participate: The study was approved by the Ethics Committee of Shengjing Hospital of China Medical University (No. 2021PS744K, Date:07/10/2021). All participants provided informed consent.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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