

Original Research Article

Evaluation of Performance of Third MBBS Phase II Students in Nasogastric Tube Insertion in Simulation by Peyton's Four-Step Method

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ABSTRACT

Background: Nasogastric tube (NGT) insertion is an essential clinical skill for medical students, especially in neonatal care, where procedural accuracy is vital. Traditional teaching methods often fail to support adequate skill retention. Peyton's Four-Step Method, a structured teaching approach, has demonstrated effectiveness in clinical skills training but requires further evaluation regarding its impact on immediate performance and skill retention at follow-up.

Aim & Objectives: This study aimed to evaluate the effectiveness of Peyton's Four-Step Method in teaching Third MBBS Phase II students the skill of nasogastric tube insertion. Specific objectives included assessing immediate post training performance and retention of skills at a one-month follow-up.

Methodology: An educational interventional study was conducted with 50 Third MBBS Phase II students, excluding those with prior experience in neonatal NGT insertion. A structured three-hour training session was delivered to groups of 25 students by two instructors (student to instructor ratio 25:2) using a Neonatal Feeding Tube Insertion Simulator, following Peyton's Four-Step Method (demonstration, deconstruction, comprehension, and performance). Students were permitted to engage in voluntary, self-directed practice on the simulator during the one-month interval preceding the retention assessment, according to their individual needs. Performance was assessed through the Objective Structured Clinical Examination (OSCE) at baseline (pretest), immediately after the training session (post-test 1), and one-month later (post-test 2). Data analysis utilized paired t-tests to compare mean OSCE scores across assessment phases.

Results: Statistically significant improvements in mean OSCE scores were observed: pretest (11.09 ± 3.53), post-test 1 (16.92 ± 5.25), and post-test 2 (18.42 ± 5.64). Paired t-test comparisons yielded: pretest vs. post-test 1: $t = 4.73$, $p < 0.05$; post-test 1 vs. post-test 2: $t = 2.69$, $p \approx 0.01$; pretest vs. post-test 2: $t = 5.61$, $p < 0.05$. These findings indicate substantial skill acquisition following the intervention and retention of NGT insertion skills at the one-month follow-up.

Conclusion: Peyton's Four-Step Method significantly enhanced procedural performance in NGT insertion in a simulated setting. Retention of the acquired skill was observed at the one-month follow-up assessment.

Keywords: Peyton's Four-Step Method, Nasogastric Intubation, Simulation Training, Medical Education, Skill Retention

INTRODUCTION

Nasogastric tube (NGT) insertion is a crucial skill for medical students, especially in neonatal care, where precision is critical due to the complexity and risks associated with the procedure.¹ Effective teaching methods are necessary to ensure that students not only acquire but also retain this skill for future clinical practice.² Traditional methods often fail to provide comprehensive training, potentially impacting students' competence and performance.³ Peyton's Four-Step Method offers a structured approach to teaching clinical skills. This method breaks down the procedure into clear, actionable Steps — demonstration, deconstruction, comprehension, and performance — allowing students to engage actively in their learning.⁴ By understanding each component of the process and receiving hands on supervised practice, students are better prepared to perform NGT insertion accurately and confidently.⁵ Traditional approaches often fall short in ensuring both immediate performance and sustained skill retention over time. While Peyton's Four-Step Method has been shown to be effective for teaching various procedural skills, its impact on skill acquisition and retention in the context of NGT insertion among undergraduate medical students warrants further investigation. This study therefore aims to evaluate the method's impact on skill development among Third MBBS Phase II students, with the goal of improving medical education and better preparing students for clinical practice. The importance of competent performance in nasogastric tube insertion, especially for neonatal patients, has been well documented due to the procedure's complexity.⁶ Performance in NGT insertion, particularly in neonatal patients, is critical given the potential for serious complications.⁷ Peyton's Four-Step Method — comprising demonstration, deconstruction, comprehension, and performance — has been shown to effectively enhance procedural skills.⁸ This structured approach involves the instructor demonstrating the procedure, breaking it down into detailed Steps, ensuring student comprehension, and finally guiding students through performing the procedure under supervision.⁹ The effectiveness of this method in improving skills has been supported by multiple studies, highlighting its utility in undergraduate medical education.¹⁰ Evidence indicates that Peyton's method supports not only immediate skill acquisition but also skill retention over time.¹¹ However, gaps remain in the literature regarding the real-world application and sustained retention of these skills.¹²

MATERIAL AND METHODS

This educational interventional study was carried out in the Department of Pediatrics at C.U. Shah Medical College and Hospital. It involved Third MBBS Phase II students, with participation open to those without prior experience in neonatal nasogastric tube insertion. Students who had previously performed the procedure were excluded to ensure uniformity in baseline learning. A total of 50 students were selected through purposive sampling, and the study took place between August and December 2024. Before commencing participation, all students provided informed written consent. The study received ethical clearance from the institutional ethics committee (CUSMC / IEC(HR) / RP / 39 / 2024 /Final-Approval / 277/2024). Strict confidentiality was maintained and ethical standards were rigorously upheld throughout the study.

Intervention

The training intervention was conducted as a structured three-hour session for groups of 25 students, facilitated by two instructors (student to instructor ratio 25:2). Simulation was performed using a Neonatal Feeding Tube Insertion Simulator. The training followed Peyton's Four-Step Method, comprising the following sequential stages:

- 1. Demonstration:** The instructor performed nasogastric tube insertion on the simulator, providing a verbal commentary for each Step. This included equipment preparation, tube measurement, insertion technique, and verification of placement.
- 2. Deconstruction:** The instructor repeated the procedure, this time breaking it down into discrete, clearly defined Steps and providing detailed explanations for each. Key aspects emphasized included correct measurement of the nasogastric tube, adequate lubrication, insertion technique, and verification of tube placement.

3. Comprehension: Students were required to describe the entire procedure back to the instructor in their own words, to confirm understanding. This Step involved direct questioning by the instructor and clarification of any misunderstandings.

4. Performance: Each student performed nasogastric tube insertion on the Neonatal Feeding Tube Insertion Simulator under the instructor's direct supervision. Students were permitted to practice according to their individual requirements and at their own pace; the number of practice repetitions was not fixed. Immediate feedback and correction were provided by the instructors throughout this stage to ensure proper technique and adherence to best practice.

Following the initial three-hour structured training session, students were permitted to engage in voluntary, self-directed practice of NGT insertion on the simulator during the one-month period preceding the retention assessment (post-test 2), according to their individual needs or level of confidence. No additional structured teaching session was delivered during this interval. Practice during the one-month period was therefore entirely student directed and not standardized in terms of frequency or duration.

Data Collection

OSCE Checklist and Scoring Rubric:

Performance was evaluated using a validated Objective Structured Clinical Examination (OSCE) rubric comprising 25 points across four domains. The OSCE rubric was validated through expert review for content alignment and relevance to core competencies, followed by pilot testing with students to assess clarity and practicality.

1. Preparation (5 points):

Step 1: Correct assembly and arrangement of nasogastric tube, lubricant, and other necessary equipment (3 points).

Step 2: Proper positioning and simulation setup of the mannequin (2 points).

2. Measurement and Insertion Technique (10 points):

Step 3: Accurate measurement of nasogastric tube length based on mannequin size (3 points).

Step 4: Application of lubricant to the nasogastric tube (2 points).

Step 5: Correct and gentle insertion of the nasogastric tube into the mannequin, avoiding complications and ensuring proper placement (5 points).

3. Verification of Placement (5 points):

Step 6: Verification of correct nasogastric tube placement by injection of air through the tube, with simultaneous auscultation over the epigastrium using a stethoscope to detect the characteristic gurgling sound confirming gastric placement (3 points).^[13] It should be noted that auscultation following air injection is the method employed in this study for simulation-based assessment purposes; current evidence and clinical guidelines recommend confirmation of NGT placement using pH testing of aspirate or radiographic verification as more reliable methods in clinical practice [17].

Step 7: Accurate recording of the procedure (2 points).

4. Overall Performance (5 points):

Step 8: Adherence to guidelines and appropriate handling of any complications (3 points).

Step 9: Efficient identification and correction of any errors or problems arising during the procedure (2 points).

Data Collection Procedure

Preintervention Assessment: Baseline performance was evaluated using the OSCE prior to the training intervention (pretest score).

Postintervention Assessment: Performance was reevaluated immediately following the training session (post-test 1) and one-month later (post-test 2) to assess skill retention at follow-up.

Statistical Analysis: Paired t-tests were performed to compare pre and postintervention OSCE scores at each assessment phase, in order to determine the effectiveness of Peyton's Four-Step Method on skill acquisition and retention. Statistical analyses were conducted using SPSS version 26 (IBM Corp. Released 2019. IBM SPSS Statistics for Windows, Version 26.0. Armonk, NY: IBM Corp). A p value of less than 0.05 was considered statistically significant.

RESULTS

The comparative analysis between assessment phases (Table 1) demonstrates statistically significant improvements in mean OSCE scores across all phases of evaluation. Paired t-test comparisons yielded: Pre-Test vs. Post-test 1 ($t = 4.73$), Post-test 1 vs. Post-test 2 ($t = 2.69$, $p \approx 0.01$), and Pre-Test vs. Post-test 2 ($t = 5.61$), all with p values < 0.05 . These findings indicate that the training intervention had a significant impact on procedural skill development and that NGT insertion skills were retained at the one-month follow-up assessment.

Table 2 illustrates the progressive improvement in performance over time. The mean score prior to the intervention was 11.09 ± 3.53 , reflecting baseline competency. Following the training intervention, the mean score at Post-test 1 was 16.92 ± 5.25 , and at Post-test 2 was 18.42 ± 5.64 , demonstrating progressive skill acquisition and retention at one month.

Figure 1 illustrates the stepwise mean scores for nasogastric tube insertion across the three assessment phases: pretest, post-test 1, and post-test 2.

1. Pretest (Red line): Scores remained relatively low across all steps, with minimal variation. The average score was approximately 1.5 across all steps.
2. Post-test 1 (Yellow line): There was a notable improvement in scores for most steps compared to the pretest. Peak score was observed at Step 5 (~ 3.5). Scores decreased again after Step 5.
3. Post-test 2 (Blue line): Further improvement in scores was observed compared to both the pretest and post-test 1. The highest mean score was recorded at Step 5 (~ 4.5), indicating continued skill development. Scores after Step 5 remained higher than at pretest and post-test 1.

Post-test evaluations indicate a progressive improvement in competency for nasogastric tube insertion, most prominently at Step 5, consistent with meaningful procedural skill development following the intervention.

Table -1: Comparative analysis between the test phases

Comparison	t-Value	p-Value	Significance
Pre-Test vs Post-Test 1	4.73	<0.05	Significant
Post-Test 1 vs Post-Test 2	2.69	<0.05	Significant
Pre-Test vs Post-Test 2	5.61	<0.05	Significant

The sharp increase from Pre-Test to Post-Test 1 suggests that the intervention had an immediate positive effect. The smaller yet significant change between Post-Test 1 and Post-Test 2 indicates that some progress was retained over time. The highest t-value seen in Pre-Test Vs Post-Test 2 highlights the long-term impact of the intervention.

Table -2: Mean score of the test phases

Test	Mean $\pm$ SD
Pre-Test	11.09 ± 3.53
Post-Test 1	16.92 ± 5.25
Post-Test 2	18.42 ± 5.64

The scores improved over time, with the Pre-Test (11.09 ± 3.53) showing the starting point. Post-Test 1 (16.92 ± 5.25) reflects a strong initial boost, while Post-Test 2 (18.42 ± 5.64) shows continued progress and retention.

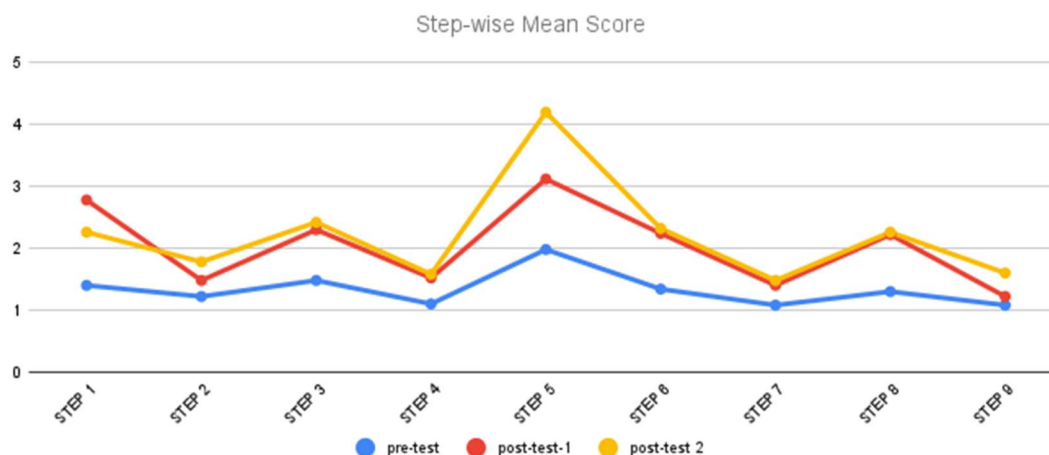


Figure- 1: Step-wise mean scores for nasogastric tube insertion across the three assessment phases. X-axis: Steps involved in nasogastric tube insertion (Steps 1 to 9). Y-axis: Mean score for each step.

DISCUSSION

The findings of this study demonstrate that Peyton's Four-Step Method had a significant positive effect on the performance of Third MBBS Phase II students in nasogastric tube (NGT) insertion. There was a substantial improvement in skill acquisition following the intervention, as reflected in posttest scores compared with pretest evaluations, and NGT insertion skills were retained at the one-month follow-up assessment. These findings are consistent with recent studies that have emphasized the effectiveness of simulation-based training techniques in medical education.

Elendu et al. (2024) reviewed simulation-based training and concluded that such methods significantly enhance the development of procedural skills, providing students with a safe, controlled environment in which to practice without risk of harm to patients.¹⁴ This is consistent with the findings of the present study, in which Peyton's method, delivered within a structured simulation environment, enhanced students' ability to perform the NGT insertion procedure.

Mackay et al. (2002) demonstrated in a randomized controlled trial that distributed practice in procedural skills training produces better retention outcomes than massed practice confined to a single continuous session.¹⁵ This principle is evident in the approach adopted in the present study: following the initial structured training session, students were permitted to engage in voluntary, self-directed practice during the one-month interval according to their individual needs and confidence levels. It is important to acknowledge that the opportunity for voluntary practice during this period may have contributed to the observed retention of skills at one month. The present study therefore assesses skill retention under conditions that included the availability of optional practice, rather than measuring retention in the complete absence of any intervening practice opportunity. This distinction is important when interpreting the one-month follow-up results.

The students demonstrated improvement not only immediately after the structured training but also maintained their performance at the one-month follow-up. This supports the view that structured, feedback enriched simulation-based training — such as that provided by Peyton's Four-Step Method — facilitates skill acquisition and supports subsequent retention. Nevertheless, the contribution of voluntary self-directed practice to the observed one-month performance cannot be fully disaggregated from the effect of the initial structured training alone.

This study is also consistent with recent findings highlighting the significance of integrating applied learning with clinical practice. Albert et al. (2024) conducted a systematic review on the retention and application of basic science knowledge in clinical practice, concluding that teaching methods should support both acquisition and retention of skills over time, and that simulation based approaches may help translate theoretical knowledge into clinical competence.¹⁶ Similarly, Nestel et al. (2011) reviewed the evidence base for simulation in procedural skills training and noted that structured simulation based training provides students with the opportunity to develop clinical competency in a consequence free environment.¹⁷ The present study extends this evidence by demonstrating meaningful improvements in procedural skills and their retention at one-month under conditions that included an opportunity for voluntary practice.

CONCLUSIONS

This study supports the use of Peyton's Four-Step Method as an effective structured approach to teaching procedural skills in the simulation setting. Significant improvements in NGT insertion performance were observed immediately following the training session, and retention of the acquired skill was observed at the one-month follow-up assessment. The results are consistent with the broader evidence indicating that simulation-based training methods can enhance the competence and confidence of medical students in performing complex clinical procedures. Future research should focus on validating such methods in clinical practice settings and investigating the influence of variables such as instructor experience and individual student learning styles on training outcomes.

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