Original articles

Evaluating the effectiveness of hybrid simulation in the practice of medicine (POM) module at University of Medicine and Pharmacy, Hue University

Ho Tran Tuan Hung[1], Tran Thi Ngoc Bich[1], Nguyen Thi Kim Anh[1*], Vinh Khanh[2,3,4], Nguyen Hoang Minh[3,4], Nguyen Vu Quoc Huy[1]

[1]*Department of Obstetrics and Gynecology, University of Medicine and Pharmacy, Hue University, Viet Nam*
[2]*Department of Internal Medicine, University of Medicine and Pharmacy, Hue University, Viet Nam*
[3]*Office for Undergraduate Academic Training, University of Medicine and Pharmacy, Hue University, Viet Nam*
[4]*Skillslab Center, University of Medicine and Pharmacy, Hue University, Viet Nam*

***Corresponding author:** Nguyen Thi Kim Anh; Email: ntkanh@huemed-univ.edu.vn
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Abstract

Background: Competency-based medical education (CBME), supported by simulation-based medical education (SBME), is a central direction in modern medical training. To enhance teaching methods, Hue University of Medicine and Pharmacy (HueUMP) piloted a hybrid SBME approach in the Practice of Medicine (POM) module. This pilot study aimed to evaluate the impact of hybrid simulation on third-year medical students in the POM module.

Materials and methods: This pilot study enrolled two independent, randomly selected samples of 100 third-year medical students: one group received a hybrid SBME session and the other standard non-hybrid SBME. Learner reaction was assessed using the Educational Practices Questionnaire, and internal consistency was examined with Cronbach's alpha. OSCE scores for gynecological examination and vertex delivery were compared between groups using the Mann–Whitney U test, with effect sizes reported as Cohen's d and Bonferroni correction applied; analyses were conducted in SPSS 26.0 with $p < 0.05$ as the significance threshold.

Results: Students reported positive perceptions of the hybrid simulation, with mean scores ranging from 4.18 to 4.48. The hybrid-trained group achieved significantly higher OSCE scores in gynecological examination than the comparison group (8.63 vs. 8.18; U = 828.5, p = 0.003; Cohen's d = 0.52), a difference that remained significant after Bonferroni correction. In contrast, vertex delivery scores did not differ significantly between groups (7.90 vs. 8.13; p = 0.149; d = -0.20).

Conclusions: Preliminary evidence suggested positive learning experiences with hybrid simulation, alongside preliminary, skill-specific improvement in OSCE performance for gynecological examination but not for vertex delivery. Future randomized or more rigorously controlled studies within a single cohort are needed to more robustly evaluate short- and long-term competency outcomes.

Keywords: *Competency-based medical education; simulation-based medical education; hybrid simulation; practice of medicine module.*

1. BACKGROUND

Competency-based medical education (CBME) has become a central paradigm in modern medical training, emphasizing clearly defined competencies aligned with health-care needs [1]. It promotes active learning and the development of essential skills such as communication, critical thinking, and lifelong learning [2, 3].

Simulation-based medical education (SBME) supports CBME by providing a safe, standardized environment for clinical practice and assessment [4, 5]. SBME includes approaches such as standardized patients (SP), low-fidelity models, and high-fidelity simulators. Hybrid simulation, which integrates standardized patients with physical models, enhances authenticity and supports the development of communication, clinical reasoning, empathy, and professionalism [6-10]. It can also serve as an effective alternative to high-fidelity simulators while providing a more comprehensive learning environment.

In Vietnam, the transition to CBME involves curriculum reform, adoption of educational technologies, and expanding collaborative efforts for capacity development [11]. This transformation is further supported by the development of robust institutional policies aimed at ensuring the sustainability and standardization of these educational reforms across medical universities [12]. At Hue University of Medicine and Pharmacy (HueUMP), the Practice of Medicine (POM) module, developed in collaboration with Harvard Medical School [13], integrates SBME to support students in the transition from basic to clinical sciences and to develop essential clinical skills for subsequent clinical clerkships. To further enhance training quality and modernize teaching approaches, this study was conducted among third-year medical students to evaluate the learner reaction, and preliminary impact of a hybrid SBME within the POM module at HueUMP.

2. MATERIALS AND METHODS

2.1. Participants

The population consisted of all third-year medical students who completed the POM module in the 2025 academic year. From this population, 100 students were randomly selected to attend the pilot hybrid simulation session, forming the hybrid-trained group (intervention group). An additional independent sample of 100 eligible students with available OSCE scores for the same gynecological examination and vertex delivery stations under standard non-hybrid SBME was randomly selected as the comparison group (control group).

2.2. Study Procedures

2.2.1. Study Setting and Duration

The study was carried out at Skillslab Center, Hue University of Medicine and Pharmacy, Hue University, from June to November 2025.

2.2.2. Study Design

The pilot course for the intervention group was developed following the ADDIE instructional design model (Analysis – Design – Develop – Implementation – Evaluation) [14]. The Analysis phase included needs assessment, learner surveys, and review of facilities, equipment, and the curriculum. In the Design phase, learning objectives and clinical scenarios were constructed based on previous research [15], ensuring alignment with the POM module objectives and institutional learning outcomes. The Development stage involved creating learning materials, designing simulation scripts, training standardized patients, and adopting the GAS model (Gather – Analyze – Summarize) for debriefing [16]. After implementation of the pilot class, it was evaluated according to the first two levels of the Kirkpatrick Model, assessing learner reaction and learning outcomes (Figure 1).

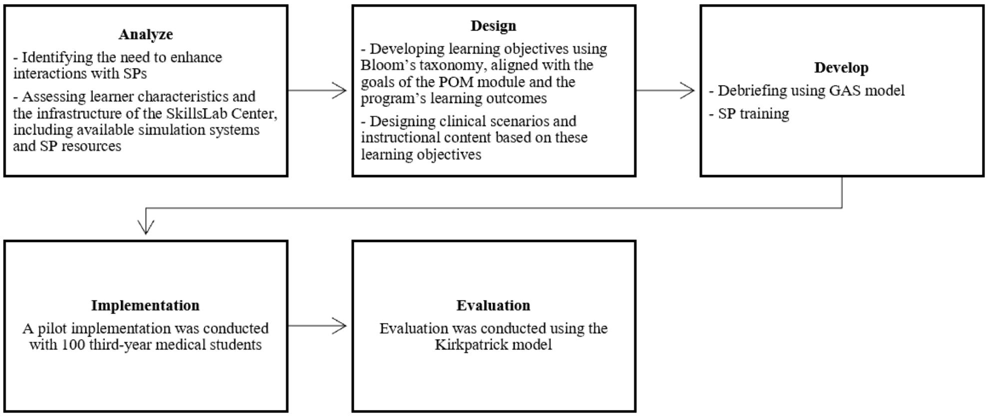

Figure 1. Developing process based on ADDIE model

The session was structured into three phases: pre-class, in-class, and post-class activities (Table 1). Prior to the session, learning materials were sent to each student via the university email system to help them prepare the foundational knowledge. The session began with an introduction to the learning objectives and the teaching methods to be used. This was followed by a faculty-led demonstration of essential skills and facilitated student practice through authentic clinical simulation scenarios. After the hands-on practice, a debriefing session was conducted to discuss, analyze, and reflect on the experiences. Finally, the instructor summarized and reinforced the key points to consolidate student learning.

SPs were prepared through two training sessions prior to implementation, in alignment with the Association of Standardized Patient Educators (ASPE) Standards of Best Practice [17]. The training process included orientation to the learning objectives and case scenarios, detailed role briefing with case scripts, rehearsal of clinical interactions, and calibration to ensure consistency in case portrayal.

Table 1. Structure of pilot class

Phase	Activities	Duration	Description
Pre-class	Learning materials were sent to each student via the university email system		
In-class	Briefing	15 mins	The instructor provided an overview of the session and its learning objectives, and explained the clinical scenarios as well as the integrated simulation methods that would be applied
	Lecture Gynecological examination skills/ Vertex delivery skills	45 mins	The instructor presents an overview of gynecological examination skills and vertex delivery skills
	Case simulation	45 mins	Students practice the skills in a hybrid simulation environment, engaging in role-played clinical scenarios that integrate standardized patients with simulation equipment
	Debriefing	15 mins	Instructors and students jointly analyze the events that occurred during the practice session, provide feedback, and derive key lessons using the GAS debriefing model, with the aim of improving knowledge and skills for future practice
Post-class	Conclusion and review	15 mins	The instructor summarizes the key content covered during the session, highlights essential points, and provides guidance for students to review independently in order to consolidate their knowledge and skills after the class.

2.3. Data Collection

Level 1: Reaction

Learner perceptions were measured using the Educational Practices Questionnaire (EPQ, Student Version), consisting of 16 items grouped into four domains: active learning (items 1 - 10), collaboration (11 - 12), diverse ways of learning (13 - 14), and high expectations (15 - 16). The instrument was translated into Vietnamese using forward–back translation and piloted with third-year medical students. Internal consistency in our sample was excellent, with Cronbach's alpha of 0.961 for the agreement subscale and 0.957 for the importance subscale.

Level 2: Learning

After completing the pilot session, students undertook an Objective Structured Clinical Examination (OSCE) corresponding to the clinical skill they had been trained in. Each OSCE station had a duration of 10 minutes. Performance was assessed using a standardized scoring rubric developed and periodically updated by the Department of Obstetrics and Gynecology, which is routinely used in institutional OSCE assessments. Students were informed that the OSCE results were for research purposes only and would not be included in their academic records. Post-session OSCE scores of the hybrid-trained sample were then compared with the existing OSCE scores of the independent, randomly selected comparison sample, obtained using the same standardized rubric following completion of the POM module through standard SBME.

2.4. Data analysis

Data from questionnaires and OSCE results were entered and analyzed using SPSS version 26.0. Descriptive statistics (mean, standard deviation) were used to summarize item and station scores. Internal consistency of the Educational Practices Questionnaire was evaluated using Cronbach's alpha for the agreement and importance subscales. OSCE scores of the intervention and control groups were compared for each skill using the Mann-Whitney U test for independent samples, and effect sizes were reported as Cohen's d. Because two independent station-level comparisons were performed, a Bonferroni-corrected significance threshold (adjusted alpha = 0.025) was applied as a sensitivity analysis. Statistical significance was set at $p < 0.05$ for the primary analysis.

2.5. Ethical Considerations

The study was approved by the Ethics Council of the University of Medicine and Pharmacy, Hue University (No: H2025/669). All procedures were conducted in accordance with the Declaration of Helsinki.

3. RESULTS

This study was conducted on third-year medical students at Hue University of Medicine and Pharmacy, from June to November 2025, involving two independent samples of 100 students each: an intervention group that participated in the hybrid simulation pilot session, and a control group of 100 students that had completed the POM module.

3.1. Learners' experiences following completion of the hybrid simulation–based training session

Table 2. Levels of agreement and perceived importance regarding positive learning experiences, collaboration, diversity of learning methods, and expectations

	Agreement		Importance	
	Mean	**SD**	**Mean**	**SD**
Active learning				
1. I had the opportunity during the simulation activity to discuss the ideas and concepts taught in the course with the teacher and other students.	4.24	1.099	4.22	0.686
2. I actively participated in the debriefing session after the simulation.	4.25	1.042	4.32	0.670
3. I had the opportunity to put more thought into my comments during the debriefing session.	4.26	1.066	4.20	0.741
4. There were enough opportunities in the simulation to find out if I clearly understand the material.	4.25	1.036	4.42	0.736
5. I learned from the comments made by the teacher before, during, or after the simulation.	4.39	1.015	4.35	0.658
6. I received cues during the simulation in a timely manner.	4.41	1.051	4.39	0.700
7. I had the chance to discuss the simulation objectives with my teacher.	4.18	1.079	4.16	0.710
8. I had the opportunity to discuss ideas and concepts taught in the simulation with my instructor.	4.22	1.082	4.24	0.742
9. The instructor was able to respond to the individual needs of learners during the simulation.	4.25	1.069	4.33	0.656
10. Using simulation activities made my learning time more productive.	4.48	1.009	4.45	0.674
Collaboration				
11. I had the chance to work with my peers during the simulation.	4.39	1.071	4.31	0.650
12. During the simulation, my peers and I had to work on the clinical situation together.	4.32	1.039	4.33	0.673
Diverse Ways of Learning				
13. The simulation offered a variety of ways in which to learn the material.	4.34	1.086	4.39	0.650
14. This simulation offered a variety of ways of assessing my learning.	4.30	1.080	4.33	0.689
High Expectations				
15. The objectives for the simulation experience were clear and easy to understand.	4.35	1.031	4.40	0.652
16. My instructor communicated the goals and expectations to accomplish during the simulation.	4.43	1.008	4.36	0.694

Among the 100 students in the intervention group, overall ratings of the hybrid simulation session were high, with mean scores ranging from 4.18 to 4.48. The highest-rated item was "Using simulation activities made my learning time more productive" (Mean = 4.48; SD = 1.01). Items related to instructor feedback and the clarity of learning objectives also received high scores (Mean = 4.35 - 4.43). Regarding perceived importance, mean scores ranged from 4.16 to 4.45. The lowest mean score was observed for the item concerning opportunities to discuss learning objectives (Mean = 4.18; SD = 1.08) (Table 2).

3.2. Comparison of OSCE between the intervention and control groups

Table 3. Comparison of OSCE of gynecological examination skills and vertex delivery skills between the intervention and control groups

OSCE station	Group	Mean score (SD)	U	Z	p	Cohen's d
Gynecological examination	Non-hybrid trained	8.18 (0.82)	828.5	-2.93	0.003*	0.52
	Hybrid-trained	8.63 (0.92)				
Vertex delivery	Non-hybrid trained	8.13 (1.35)	1041.5	-1.44	0.149	-0.20
	Hybrid-trained	7.90 (0.95)				

For gynecological examination, the hybrid-trained sample scored higher than the independent standard-training comparison sample (8.63 vs. 8.18; Mann–Whitney U = 828.5, Z = -2.93, p = 0.003). The corresponding effect size was medium in magnitude (Cohen's d = 0.52; r ≈ 0.21), and the difference remained significant under the Bonferroni-adjusted alpha of 0.025, suggesting that the observed difference is unlikely to be driven solely by sample size. For vertex delivery, no statistically significant difference was observed (7.90 vs. 8.13; U = 1041.5, Z = -1.44, p = 0.149; d = -0.20; r ≈ 0.10), consistent with a small effect and a null finding (Table 3).

4. DISCUSSION

4.1. Learners' experiences following completion of the hybrid simulation pilot session

Our findings suggest that students generally reported positive perceptions of the hybrid simulation-based learning experience, with relatively high levels of agreement and perceived importance. This aligns with previous studies highlighting the potential value of simulation-based approaches in supporting active learning, collaboration, and alignment with learner expectations [18, 19]. The excellent internal consistency of the EPQ (Cronbach's alpha 0.86 - 0.99 across domains) supports the reliability of these findings, although the very high overall alpha (> 0.97) may also indicate some redundancy among items.

Hybrid simulation may facilitate active engagement by placing students in structured clinical scenarios requiring decision-making and problem-solving, consistent with constructivist learning principles [9, 20]. The integration of SP and simulators with faculty guidance and structured debriefing provides a multimodal environment supporting reflection, critical thinking, and knowledge consolidation [21, 22], while peer interaction may further contribute to communication and collaboration skills even when the primary focus is individual performance [18], [19]. Students also reported that the sessions met their learning expectations, supporting perceived relevance and acceptability [23]. Taken together, these consistently high reaction scores across all four domains support the feasibility and acceptability of hybrid simulation as a teaching approach, an essential first step before evaluating its effect on measurable clinical performance.

4.2. Preliminary differences in OSCE performance between the hybrid-trained and comparison groups

The present study provides exploratory evidence that hybrid SBME may be differentially associated with obstetric and gynecological skill performance. The hybrid-trained group scored significantly higher than the independent comparison group in gynecological examination, a difference that remained significant after correction for multiple comparisons, whereas no clear difference was observed for vertex delivery, suggesting that the association between hybrid simulation and OSCE performance is skill-specific rather than uniform across procedural domains. Framed within competency-based medical education [1], these findings support viewing hybrid simulation as a targeted approach that may strengthen particular observable competencies, especially those that depend on communication, systematic examination, and interaction with the patient, while indicating that more technically demanding motor sequences such as vertex delivery may require additional practice time, repetitions, or different simulator characteristics to yield measurable gains. Because the two groups were independently sampled rather than randomly allocated from a single pool, these differences should be interpreted as associations rather than causal effects of the hybrid session.

These results are broadly consistent with literature on technology-enhanced and hybrid simulation, which emphasizes that outcomes depend on aligning instructional design, scenarios, and feedback with defined competency goals rather than on simulation technology alone [8, 24-26]. In our setting, preserving the original POM scenarios while overlaying SP, task trainers, and structured debriefing likely favored gynecological examination performance more than delivery skills. Within the ongoing reform of medical education in Viet Nam [11-13, 27], this study offers preliminary evidence that hybrid simulation is feasible and acceptable, while highlighting the need to iteratively refine designs, such as by increasing hands-on time and considering team-based scenarios, to better support complex obstetric procedures.

5. STRENGTHS AND LIMITATIONS

This pilot study is among the first in Vietnam to pair a validated learner-reaction instrument with objective OSCE performance and effect-size data in evaluating hybrid SBME for sensitive obstetric and gynecological skills, offering empirical groundwork for future adequately powered trials within the country's ongoing CBME reform. Limitations include non-randomized allocation to the hybrid session versus standard training, leaving comparisons unadjusted for confounders such as prior academic performance and baseline comparability unassessed; the absence of a priori power calculation and evaluation of only two of the module's skills, leaving Type II error risk for other skills unknown, though effect sizes inform future trials; a single skill assessed per student, precluding a composite OSCE score; unassessed inter-rater reliability; and the single-institution, cross-sectional design without long-term follow-up.

6. CONCLUSIONS

Preliminary evidence suggested that hybrid SBME is feasible and well accepted by third-year medical students, with high ratings for active learning, collaboration, diverse methods, and meeting expectations, supported by excellent internal consistency of the EPQ. Students reported positive learning experiences with hybrid simulation, alongside preliminary, skill-specific improvement in OSCE performance for gynecological examination but not for vertex delivery. Future randomized or more rigorously controlled studies within a single cohort are needed to more robustly evaluate short- and long-term competency outcomes.

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