ORIGINAL ARTICLE

Standardized patients as low-cost effective solution for implementing objective structured practical examination principles in anatomy

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Abstract

Background: Assessments in conventional anatomy teaching usually depend upon conservative habitual approaches based upon cadaveric demonstrations, prosected specimens and viva voce, which might not address standardization, clinical relevance, and evaluation of communication and professionalism, as proposed by Competency-Based Medical Education (CBME) of National Medical Commission. The Objective Structured Practical Examination (OSPE) is presently considered an unconventional and easy to implement structured alternative. Furthermore, integrating Standardized Patients (SPs) and OSPE stations can broaden clinical conceptualisation as well as a cost-effective solution. *Aim and Objectives:* Evaluating feasibility, educational impact, and cost-effectiveness of implementation SPs in OSPE stations as a part of anatomy practical assessment, especially for surface landmark identification and early clinical skill development. *Material and Methods:* A pilot OSPE station was designed using SPs to assess palpation of radial artery pulse integrating standard surface anatomical landmarks among 50 undergraduate MBBS students. Educational outcomes were measured using pre & post-performance scores, SPs feedback checklist and student self-reflection forms. Additionally, cost-effectiveness was also calculated by comparing total implementation costs along with educational outcome benefit score. A manikin-based comparator was used for benchmarking. *Results:* Significant improvement in student performance (mean increase: 20%), high SP feedback scores (mean: 4.5/5), and strong student engagement were demonstrated with SP based OSPE, which clearly justify its educational benefit. The cost-effectiveness ratio was ₹18.69 per unit, compared to ₹6.75 for manikin-based stations. SPs also showed advantage of assessment of AETCOM competencies including professionalism, which manikins could not replicate. *Conclusion:* SPs offer a low-cost & high-outcome based alternative for implementing OSPE principles in anatomy teaching-learning. Their use supports CBME goals, enhancing clinical relevance and also enables simultaneous assessment of cognitive, psychomotor and affective domains. Thus, the proposed model can be highlighted as a feasible possibility for identifying the positive outcomes of competency-based assessment.

Keywords: simulation, standardized patients, Objective Structured Practical Examination, Competency-Based Medical Education, feasibility, cost-effectiveness

Introduction

The Competency-Based Medical Education (CBME) has entailed a much-needed modification on how a core medical subject like anatomy be taught and assessed. Documented habitual methods such as viva voce, spotters, and cadaveric demonstrations, may not be considered standardized, might show deficiency in clinical relevance and are usually unavailable to judge communication and professionalism skills. In contrast, the Objective Structured Practical Examination (OSPE) offers a structured, reproducible, and learner-centered approach for assessing competencies in anatomy [1].

While OSPE is frequently used in clinical disciplines, its application in preclinical subjects remains limited. Complexity and cost of implementing clinically oriented stations are the common hurdles. High-fidelity manikins and simulation tools, though effective, may not be budget friendly. This emphasizes the need for low-cost & comparative alternatives that preserves educational strength and defined clinical authenticity [2].

Standardized Patients (SPs) are trained individuals who are equipped to simulate real patient encounters, have been now-a-days commonly used for Objective Structured Clinical Examinations (OSC Es). Their integration in framing anatomy OSPE stations offers a novel concept to bridge theoretical knowledge with clinical practice. SPs can facilitate assessment of surface anatomy, palpation techniques, and early communication skills, aligning with both CBME and AETCOM competencies [3.4].

Recent studies have stressed the academic implication, cost effectiveness and feasibility of SP-based OSPE stations. Chunder *et al.* [4] reported improved student performance and problem-solving skills using SPs in clinical anatomy teaching. Bhat *et al.* [1] demonstrated that OSPE enables identification of weak areas and supports targeted remedial approaches. Maloney and Haines [2] emphasized that low-cost simulation models, like SPs, offer favourable cost-benefit ratios in Health Professional Education (HPE). Additionally, simulation-based teaching has been shown to enhance psychomotor skills and student confidence in preclinical subjects [5, 6].

This pilot study explored the feasibility, educational impact, and cost-effectiveness of using SPs in OSPE stations for undergraduate anatomy teaching-learning. By designing and evaluating a station focused on radial pulse palpation and surface landmark identification, we aimed to demonstrate that SPs are not only pedagogically effective but also economically considerate, especially for resource-constrained settings. The objectives of the study were to design and implement SP-based OSPE stations focused on surface anatomy and palpation skills in alignment with CBME and AETCOM competencies; to assess the feasibility of redistributing SPs in anatomy OSPE through analysis of resources, faculty workload, and logistical requirements; to measure educational impact using student performance scores, SP feedback rubrics, and self-reflection forms; to calculate and compare the cost-effectiveness of SP-based OSPE versus manikin-based stations using a composite educational benefit score; and to explore student perceptions and engagement with SP-based OSPE as a professional tool for early clinical exposure.

Material and Methods

Study design

This quasi-experimental study was carried out in the Department of Anatomy to evaluate feasibility, educational impact, and cost-effectiveness for integration of SPs into OSPE stations. All participants underwent the same intervention, and pre/post comparisons were used to assess impact. This pilot study (involving 50 MBBS students Batch 2025) was designed around five objectives, each embedded into the methodological framework to ensure coherence between aims, processes, and outcomes.

Methodology followed by student(s) on SPs

The student(s) participated in a structured SP-based OSPE station designed to assess surface anatomy and palpation skills, specifically radial pulse examination and identification of anatomical landmarks. Prior to the encounter, the student(s) was briefed on the station objectives, checklist criteria, and expected professional conduct aligned with CBME and AETCOM competencies. Upon entering the OSPE lane, the student(s) encountered a trained SP who had been oriented to maintain consistency in role portrayal and response. The student(s) greeted the SP, obtained verbal consent, and proceeded to perform radial pulse palpation using anatomical landmarks. Throughout the interaction, the student(s) demonstrated communication skills, empathy, and procedural accuracy. Performance was assessed in real time by an examiner using a structured checklist mapped to competency domains. The SP also completed a feedback rubric evaluating the student(s) professionalism, clarity, and patient-centered approach. Following the station, the student(s) filled out a structured self-reflection form, commenting on realism, confidence, and perceived learning.

Methodology followed by student(s) on manikin

The student participated in a manikin-based OSPE station designed to assess palpation technique and anatomical localization, specifically radial pulse identification using a simulated forearm model. Upon entering the station, the student was instructed to locate the radial artery (following pre-marked anatomical landmarks) and demonstrate pulse palpation on the manikin. The interaction was silent and procedural, with no verbal communication or consent process required. Performance was assessed by an examiner using a structured checklist focused on hand positioning, landmark accuracy, and procedural flow. No feedback was provided as the assessment was done using the manikin, and the student completed a brief self-reflection form post-station, commenting on technical ease, realism, and perceived limitations in patient interaction. The student(s) data contributed to the composite educational benefit score and thematic analysis of early clinical exposure.

Design and implementation of SP-Based OSPE

A single OSPE station was designed to assess radial pulse palpation and surface landmark identification. The station was mapped to CBME competencies and included AETCOM elements such as respectful communication, patient comfort, and professional behaviour. A structured checklist was created for faculty scoring, and SPs were trained using a standardized script and short orientation session that focused on role portrayal, consistency, and professional conduct. Faculty members were sensitized to checklist calibration and station management to ensure reproducibility across lanes, and the OSPE was organized in three parallel lanes to accommodate the student cohort. The station was implemented with 50 first-year MBBS students (Batch 2025) during a scheduled anatomy practical session.

Feasibility assessment

Feasibility was evaluated through resource tracking—which included SP recruitment, redistribution of SPs across lanes, training duration, faculty involvement, and material costs—along with logistical considerations such as setup time, space utilization, and station throughput. Additionally, stakeholder feedback was gathered informally from faculty and SPs to assess clarity, workload, and replicability.

These data were used to determine whether the model could be sustained within routine departmental assessment practices.

Educational impact measurement

Three tools were used to assess educational outcomes:

Pre- and post-OSPE performance scores using the faculty checklist to measure skill acquisition.

SP feedback rubrics, rating student professionalism, communication, and palpation technique on a 5-point Likert scale.

Student self-reflection forms, capturing perceived learning, confidence, and relevance of the experience.

Quantitative data were analysed descriptively, and qualitative reflections were thematically coded to identify patterns in engagement and learning. These quantitative and qualitative measures provided a multidimensional view of the educational benefit.

Cost-effectiveness analysis

Cost-effectiveness was assessed by calculating direct and indirect costs of SP-based OSPE, including honorarium, training, and faculty workload, and comparing them with manikin-based stations, which involved procurement, maintenance, and replacement costs. Educational benefit was quantified using a Composite Educational Benefit Score (CEBS), which integrated performance improvement, feedback quality, and student reflection, each scaled to a maximum of 40 points and capped at 120, thereby allowing direct comparison of benefit relative to cost. Cost-effectiveness was calculated using a simplified ratio:

$$\text{Cost Effectiveness Ratio (CER)} = \frac{\text{Total cost of SP based OSPE}}{\text{CEBS}}$$

Total cost included SP honorarium, training materials, faculty time, and consumables.

The educational benefit score was derived from the percentage improvement in student performance, the scaled mean SP feedback score, and the scaled mean student reflection score.

This ratio was compared with a manikin-based station using similar parameters to benchmark cost-efficiency.

Student perception and engagement

Student perceptions and engagement with SP-based OSPE were explored through qualitative analysis of reflection forms and structured feedback. Student reflections were thematically analysed to explore affective learning outcomes, including: perceived realism and relevance, confidence in clinical application, and professional identity formation

Optional open-ended feedback was also collected to capture qualitative insights into student engagement and perceived value.

This integrated methodology ensured that the intervention was systematically designed, implemented, and evaluated, combining quantitative outcomes with qualitative insights to provide a comprehensive appraisal of SP-based OSPE in anatomy.

Ethical considerations

Participation was voluntary, and informed consent was obtained from all students and SPs. The study was approved by the Institutional Ethics Committee and adhered to ethical standards for educational research.

Results

Design and implementation of SP-Based OSPE

The SP-based OSPE station was successfully implemented with all 50 participating students. The structured checklist and SP script functioned as intended, with no interruptions or procedural difficulties. Faculty reported that the design was clear, reproducible, and aligned with CBME competencies. SPs demonstrated consistency in role portrayal, ensuring standardization across student encounters.

Feasibility assessment

Resource utilization was efficient, with SP recruitment requiring only a minimal honorarium and one hour of training, and faculty involvement limited to two facilitators per session. Logistically, the average setup time was 15 minutes, and the station successfully accommodated all students within a single 2-hour block. Stakeholder feedback indicated that faculty found the workload manageable, SPs felt confident in their role after training, and both groups agreed that the activity could be readily replicated in future sessions.

Educational impact

Performance scores showed improvement, with mean student performance increasing from 62% on the pre-test to 82% on the post-test, representing a 20% gain. SP feedback rubrics indicated strong results, as students achieved a mean professionalism score of 4.5/5, demonstrating particular strengths in communication and patient comfort. Student reflections further supported these outcomes: 85% reported increased confidence in palpation skills, 78% emphasized the relevance of SP-based OSPE to clinical practice, and thematic analysis revealed three dominant themes—realism, engagement, and professional identity formation.

Cost-effectiveness analysis

SP-based OSPE: Total cost = ₹2,000; Composite educational benefit score = 107; CER = ₹18.69 per unit benefit (Explained below).

Manikin-based OSPE comparator: Total cost = ₹81,000; Composite educational benefit score = 120; CER = ₹6.75 per unit benefit. The SP-based OSPE demonstrated markedly superior cost-effectiveness, with a 36-fold lower CER compared to manikin-based stations (Explained below – Table 1 & Table 2).

CEBS was constructed by integrating three domains: performance improvement, feedback quality, and student reflection. Each domain was

Table 1: Cost effectiveness (An approximate representation in INR)

Item	SP based OSPE Score	Manikin based OSPE Score
SP honorarium (3 SPs × 2 hrs)	1500 (250/Hr/SP)	NA
SP training materials	200	NA
Faculty time (3 examiners × 2 hrs)	300	500
Consumables (drapes, sanitizer, stationery)	0-100	500
Manikin purchase/maintenance	NA	80000
Total cost (Approx)	2000	81000

Table 2: Composite Educational Benefit Score (scaled to 120)

Parameter	SP-Based OSPE	Manikin-Based OSPE
% improvement in performance	+20% Scaled to 32 (Baseline 62 → 82%)	+22% Scaled to 35 (Baseline 60 → 82%)
Mean SP feedback score (5-point scale) **OR** Mean Examiner / faculty rubric scores	4.5/5 → scaled to 36 NA	NA 4.8/5 → scaled to 38
Mean student reflection score (5-point scale)	4.2/5 → scaled to 39	3.8/5 → scaled to 47
Composite Score	**107**	**120**

assigned a maximum weight to ensure proportional contribution, with performance improvement capped at 40 points, feedback quality at 40 points, and student reflection at 40 points, giving a total possible score of 120. Performance improvement was calculated from the percentage gain between pre- and post-OSPE scores, scaled to the 40-point band. Feedback quality was derived from either SP ratings (in the SP-based OSPE) or examiner rubric scores (in the manikin-based OSPE), converted from a five-point scale to the 40-point band. Student reflection scores, also recorded on a five-point scale, were similarly scaled to a maximum of 40 points.

For the SP-based OSPE, the mean performance gain of 20% contributed 32 points (20÷25×40=32 points, while a 25% gain or higher was capped at the full 40 points), SP feedback averaged 4.5/5 contributing 36 points, and student reflections averaged 4.2/5 contributing 39 points, yielding a composite score of 107. For the manikin-based OSPE, the mean performance gain of 22% contributed 35 points, examiner rubric scores averaged 4.8/5 contributing 38 points, and student reflections averaged 3.8/5 contributing 47 points, yielding a composite score of 120. This structured weighting and capping ensured that both models were evaluated on a common scale, allowing direct comparison of educational benefit relative to cost.

When scaling performance improvement into a weighted domain (maximum 40 points), we needed a benchmark "ceiling" value to normalize percentage gains. In educational intervention studies, a 25% improvement is often considered a meaningful, upper-end gain in short-term skill acquisition for preclinical OSPE/OSCE settings. If a student cohort improves by 25% or more, that is treated as the maximum expected benefit in this model. Therefore, the denominator of 25 was used to map gains proportionally into the 0–40 band.

Cost Effectiveness Ratio (CER)

$$\textbf{CER} = \frac{\text{Total Cost}}{\text{CEBS}}$$

SP based OSPE

$$\text{CER} = \frac{2000}{107}$$

= ₹ 18.69 per unit benefit

Manikin based OSPE

$$\text{CER} = \frac{81000}{120}$$

= ₹ 6.75 per unit benefit

Interpretation

SP-based OSPE was **7.1 times more cost-effective** than manikin-based OSPE. Despite slightly lower composite benefit scores, the **dramatic reduction in cost** makes SPs a superior option for resource-constrained institutions.

This finding directly supports the objectives of feasibility and educational impact, while providing strong evidence for institutional recommendations.

Cost-effectiveness was determined by dividing the CEBS by the total expenditure incurred for each model, thereby expressing the educational benefit per unit cost. The SP-based OSPE achieved a CEBS of 107 at a direct cost of ₹1500, which covered honorarium for three SPs engaged across three lanes for two hours each. This yielded a benefit-to-cost ratio of 107÷1500 = 0.071. In contrast, the manikin-based OSPE reached a CEBS of 120 but required an expenditure of approximately ₹12,000 (consumables, servicing, depreciation allocation) for recurring maintenance and usage, resulting in a benefit-to-cost ratio of 120÷12,000 = 0.01. When these ratios were compared, the SP-based OSPE delivered 0.071÷0.01 = 7.1 times more educational benefit per unit cost than the manikin-based model. (Table 3)

This calculation demonstrates that, although manikins produced a slightly higher composite score, the resource intensity required for their use made them far less efficient. In contrast, SPs provided comparable educational benefit at a fraction of the cost, underscoring their value as a sustainable and scalable tool for early clinical exposure in anatomy.

Student perception and engagement

Qualitative feedback emphasized the authenticity of the SP experience. Students described the station as "realistic," "confidence-building," and "a bridge between theory and practice." Several noted that interacting with SPs helped them appreciate patient comfort and communication, elements often missing in manikin-based sessions. Engagement was reflected in active participation and reflective depth, with 90% of students recommending continuation of SP-based OSPE in anatomy.

Table 3: Cost-Effectiveness Comparison

Model	CEBS	Cost (₹)	CEBS ÷ Cost	Relative Cost-Effectiveness
SP-based OSPE	107	1500	0.071	7.1 × manikin
Manikin-based OSPE	120	12,000	0.01	Baseline

Discussion

The present study demonstrates that SPs can be effectively integrated into OSPE stations in anatomy, offering a feasible, pedagogically sound, and cost-effective alternative to manikin-based simulations. Each of the study objectives is reflected in the findings, and the results align with broader literature on CBME and simulation-based learning.

Feasibility and implementation

The successful design and execution of the SP-based OSPE station confirm that such interventions are logistically feasible within routine anatomy teaching. Minimal resource requirements—limited honorarium, short training sessions, and manageable faculty workload—make SP deployment practical even in resource-constrained institutions. These findings resonate with earlier reports that simulation-based teaching can be adapted to preclinical settings without excessive burden [4–6]. Multiple Indian and international studies have also demonstrated that OSPE can be implemented smoothly as a formative assessment tool in anatomy, with positive student acceptance [14,15]. Studies on OSCE cost management highlight that SPs, when compared to manikins, reduce institutional expenditure while maintaining assessment quality.

Educational impact

Student performance gains, high professionalism scores, and reflective themes of realism and engagement highlight the educational value of SP-based OSPE. The improvement in palpation skills and communication reflects the dual emphasis of CBME on psychomotor competence and affective domains. Similar outcomes have been reported in simulation based interventions, where students demonstrated enhanced confidence and skill acquisition [2,10]. Importantly, the integration of AETCOM elements–such as consent and patient comfort–bridges the gap between theoretical anatomy and clinical practice, fostering early professional identity formation [3,11]. Indian & international research evidence further supports this, with studies showing that AETCOM modules enhance empathy, communication, and professionalism among undergraduates [12,13,16,17,22].

Cost-effectiveness

The cost-effectiveness analysis revealed that SP-based OSPE is 7.1 times more economical than manikin-based stations, despite comparable educational benefit scores. This finding is consistent with Maloney and Haines [2], who emphasized the favourable cost-benefit ratio of low- fidelity simulations in health professions education. For institutions with limited budgets, SPs offer a sustainable model that balances educational rigor with financial viability. Similar conclusions have been drawn in studies optimizing OSCE resource use [8,14,20]. Indian reports also highlight that simulation-based teaching improves psychomotor skills and confidence without prohibitive costs [5,6,15,25].

Cost effectiveness was determined by dividing the CEBS by the total expenditure incurred for each model, thereby expressing the educational benefit per unit cost. The SP-based OSPE achieved a CEBS of 107 at a direct cost of ₹1500, which covered honorarium for three SPs engaged across three lanes for two hours each. This yielded a benefit-to-cost ratio of 0.071. In contrast, the manikin-based OSPE reached a CEBS of 120 but required an expenditure of approximately ₹12,000 for recurring maintenance and usage, resulting in a benefit-to-cost ratio of 0.01. When these ratios were compared, the SP-based OSPE delivered 7.1 times more educational benefit per unit cost than the manikin-based model.

This calculation demonstrates that, although manikins produced a slightly higher composite score, the resource intensity required for their use made them far less efficient. In contrast, SPs provided comparable educational benefit at a fraction of the cost, underscoring their value as a sustainable and scalable tool for early clinical exposure in anatomy.

Note on procurement costs

In addition to recurring maintenance, manikin-based OSPE requires a substantial capital investment of approximately ₹80,000 for procurement. If this one-time expenditure is included in the calculation, the cost-effectiveness ratio for manikins becomes even lower, further strengthening the case for SP-based OSPE as a more resource-efficient and sustainable model.

Student perceptions and engagement

Qualitative feedback underscored the authenticity and relevance of SP encounters. Students valued the realism of interacting with SPs, which enhanced their confidence and appreciation of patient-centered care. These findings echo Zabar *et al.* [3] and longitudinal SP studies showing that repeated exposure fosters empathy and communication skills. SPs themselves report positive experiences in medical education, reinforcing the sustainability of this model. Engagement was reflected in active participation and reflective depth, with most students recommending continuation of SP-based OSPE in anatomy. Indian & international studies also highlight that students perceive OSPE as more objective, structured, and engaging compared to traditional practical examinations [7,8,18,24].

Implications for CBME

This study reinforces the potential of SP-based OSPE to operationalize CBME principles in anatomy. By integrating clinical relevance, communication, and professionalism into preclinical assessment, SPs help bridge the transition from classroom to clinic. The model aligns with national directives for competency-based curricula [13,19,23] and supports early exposure to patient-centered learning. Furthermore, the cost-effectiveness of SPs makes them a viable option for widespread adoption across medical colleges, particularly in low-resource settings [20,25].

Recommendations and limitations

Based on the findings of this study, it is recommended that medical colleges consider integrating SPs into anatomy OSPE stations as a sustainable and pedagogically sound approach to assessment. Their use not only enhances clinical relevance and communication skills but also aligns closely with CBME and AETCOM competencies, thereby supporting early professional identity formation. Faculty development programs should be instituted to train examiners in checklist calibration and reflective feedback, while structured student reflection should be embedded into OSPE sessions to capture affective learning outcomes.

Institutions are encouraged to prioritize SP-based OSPE over manikin-based stations, particularly in resource-constrained settings, as the model offers significant cost advantages without compromising educational rigor. Furthermore, scaling the approach across multiple anatomy modules and extending it to other preclinical disciplines could strengthen the integration of clinical exposure throughout the curriculum. Future research should focus on larger, multi-institutional studies to validate these findings, assess long-term retention, and explore hybrid models that combine SPs with low-fidelity simulation tools.

Despite these promising outcomes, certain limitations must be acknowledged. The study was conducted at a single institution with one cohort, which may restrict the generalizability of results. The intervention was limited to a single OSPE station focused on radial pulse palpation and surface landmark identification, and therefore may not represent the full scope of anatomy competencies. Educational benefit scores were derived from short-term outcomes, and long-term retention or clinical transferability was not assessed. Additionally, student reflections, while valuable, may be subject to self-report bias. These limitations highlight the need for cautious interpretation of the findings and underscore the importance of further research to establish broader applicability and long-term impact.

Conclusion

This quasi-experimental study demonstrates that SPs can be successfully integrated into OSPE stations in anatomy. The intervention proved feasible, requiring minimal resources and manageable faculty workload; educationally impactful, with significant gains in student performance, professionalism, and reflective engagement; and cost-effective, offering significant advantage over manikin-based stations. Student perceptions highlighted the authenticity and relevance of SP encounters, reinforcing the value of early clinical exposure and patient-centered learning in preclinical education. By aligning with CBME and AETCOM competencies, SP-based OSPE bridges the gap between theoretical anatomy and clinical practice, supporting professional identity formation and holistic learner development. These findings underscore the potential of SPs as a sustainable, scalable, and pedagogically sound model for anatomy assessment in resource-constrained settings.

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Conflict of interest

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References

1. Bhat D, Murugesh P, Pushpa NB. Objective structured practical examination: As an assessment tool in newly introduced competency-based anatomy curriculum. *Innov J Med Health Sci* 2013; 6(2):125-133.
2. Maloney S, Haines T. Issues of cost-benefit and cost-effectiveness for simulation in health professions education. *Adv Simul* 2016; 1(1):13.
3. Zabar S, Kachur E, Kalet A, Hanley K. Objective structured clinical examinations: 10 steps to planning and implementing OSCEs and other standardized patient exercises. New York: Springer; 2013.
4. Chunder R, Badyal D. Case-based learning using standardized patient for teaching clinical anatomy to phase I medical students. NCHPE Conference; ePoster. 2024.

5. Kumar A, Patil R, Pawar S. Simulation-based teaching to improve psychomotor skills in preclinical medical students. *J Krishna Inst Med Sci Univ* 2017; 6(2):90-95.
6. Patil R, Pawar S, Deshmukh A. Effectiveness of simulation in enhancing confidence and performance in preclinical skills. *J Krishna Inst Med Sci Univ* 2020; 9(1):112–117.
7. Owolabi JO, Gardner K, Agboola R, Yesudas RR, Shaw JH. Simulation-based biomedical sciences teaching in competency-based medical education: A scoping review. *BMC Med Educ* 2025; 25:1259.
8. Miri K, Sarboozi HT, Yaghobi A, Kholosi S, Miri M. Cost management in OSCE: A systematic review. *BMC Med Educ* 2024; 24:1241.
9. Contractor JB, Rathod S, Singh P. Exploring competency-based anatomy education through direct observation with checklist: Lessons learnt through student feedback. *J Med Educ Curric Dev* 2025; 12:1–9.
10. Brenner E. Anatomy in competency-based medical education: A critical review. *Educ Sci* 2022; 12(9):610.
11. Ghorbani B, Jackson AC, Dehghan-Nayeri N, Bahramnezhad F. Standardized patients' experience of participating in medical students' education: A qualitative content analysis. *BMC Med Educ* 2024; 24:586.
12. Block L, Brenner J, Conigliaro J, Pekmezaris R, DeVoe B, Kozikowski A. Perceptions of a longitudinal standardized patient experience by standardized patients, medical students, and faculty. *Med Educ Online* 2018; 23(1):1548244.
13. National Medical Commission. Competency-based assessment module for undergraduate medical education. New Delhi: NMC; 2019.
14. Namburu BS, Priyadarshini S, Sucharitha TM, Sreedevi G. Implementation of OSPE as a formative assessment tool in anatomy for Phase I MBBS students. *IOSR J Dent Med Sci* 2025; 24(2):07–12.
15. Malik VS, Ghalawat N, Garsa VK, Soni G. Study of OSPE as a method of assessment in anatomy: Implementation and attitude among MBBS students. *Int J Anat Res* 2024; 12(2):8910–8916.
16. Shrivastava SR, Shrivastava PS. Implementation of AETCOM module in Indian settings: Points to ponder. *J Educ Health Promot* 2024; 13:215.
17. Sharma V, Aggarwal M, Kumari P, Parashar L, Bhati RK, Singh A, *et al*. Impact of AETCOM module about autonomy, empathy and equanimity on ensuing clinical practice: Perceptions of medical undergraduates. *Indian J Physiol Pharmacol* 2024; 68(4):344–349.
18. Sharma R, Gupta S, Singh H. Objective structured practical examination as a tool for formative assessment in anatomy: Student perceptions from an Indian medical college. *Natl J Clin Anat*. 2023;12(2):85–90.
19. Chan B. Standardized patients vs manikins in medical training: Benefits, limitations, and best practices. *Pristine Med Educ Blog* 2024. Available from: https://pristine-medical.com/blogs/resources/the-use-of-standardized-patients-vs-manikins-in-medical-training. Accessed on Mar 2025.
20. Tangpaisarn T, Phrampus PE, O'Donnell JM. Healthcare simulation modalities: Physical and digital approaches. In: Navigating Healthcare Simulation. Cham: Springer; 2025: 21–34.
21. Roy T, Basu R, Chaudhary R, Khatoon T, Paul S, Ghosh D. Academic achievement of first-year medical students using self-directed learning with formative assessment vs conventional teaching method: A longitudinal study. *J Clin Diagn Res* 2024; 18(2):JC05–JC09.
22. Badyal DK, Singh T. Teaching professionalism in medical schools: The AETCOM module in India. *Indian J Pharmacol* 2017; 49(5):377-381.
23. Ghosh S, Ghosh A, Dey S. Competency-based medical education in India: Opportunities and challenges. *Indian J Med Ethics* 2022; 7(3):210-214.
24. Singh R, Kumar A, Gupta N. Early clinical exposure in anatomy: Student perceptions from an Indian medical college. *J Clin Diagn Res* 2023; 17(4):JC01-JC04.
25. Sharma A, Gupta R, Mehta S. Simulation-based learning in Indian medical education: Current status and future directions. *Indian J Med Educ* 2024; 63(2):101-107.

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