Exploring the Impact of Formative Assessment on Summative Assessment Outcomes: A Feedback-Based Quasi-Experimental Study in Forensic Medicine Education.

Abdul Samad [1,*], Junaid Sarfaraz [2], Ayesha Junaid [3].

ABSTRACT:

Objective: To assess the effect of OSPE-based formative assessment with structured feedback on students' summative assessment performance.

Methodology: This quasi-experimental pretest-posttest study was conducted in the Department of Forensic Medicine and Toxicology, Liaquat University of Medical and Health Sciences, Jamshoro, from August 2025 to January 2026. A total of 97 third-year MBBS students were enrolled through non-probability consecutive sampling. Students completed a baseline pretest followed by three formative Objective Structured Practical Examinations (OSPEs), with structured feedback after each assessment. Academic performance was evaluated using pretest, formative and summative scores. Students' perceptions were assessed through a structured questionnaire. Data were analyzed using paired t-test, Pearson correlation and descriptive statistics.

Results: The mean posttest score was significantly higher than the pretest score (66.8 ± 9.1 vs. 59.2 ± 8.7; t=10.84, p=0.031). Performance improved progressively across the three OSPEs. Individual OSPE scores were not significantly associated with summative performance, but the mean OSPE score showed a significant positive correlation with summative scores (r=0.39, p<0.001). Most students reported positive perceptions, and 87.6% recommended routine use of this method.

Conclusion: OSPE-based formative assessment with structured feedback improved academic performance and showed a positive relationship with summative outcomes.

Keywords: Formative Assessment; Feedback; OSPE; Medical Education; Competency-Based Medical Education.

Cite as: Samad A, Sarfaraz J, Junaid A. Exploring the Impact of Formative Assessment on Summative Assessment Outcomes: A Feedback-Based Quasi-Experimental Study. J Muhammad Med Coll. 17(1) May-Oct 2026

Introduction:

Assessment is a very important part of undergraduate medical education. It helps students in learning, checks their skills and also prepares them for clinical practice. In recent years, the education system has changed a lot. Now it does not only depend on final high-stakes exams, but also focuses on continuous learning. Because of this, formative assessment has become an important method of "assessment for learning". It helps students to find out their weak areas, check their progress and improve their performance before the final exams. [1,2] Formative assessment becomes more useful when students are given proper and timely feedback. Good feedback helps students to think about their own performance, understand their strong points and improve their mistakes. It also motivates them to learn by themselves. In competency-based medical education, repeated formative assessments with feedback helps students to develop their skills slowly through regular practice and correction, instead of judging them only through one final examination.[3,4] Previous studies have also shown that formative assessment with proper feedback can improve academic results, student interest and preparation for examinations among medical students.[1,3]

Forensic medicine is a different and important subject because it combines scientific knowledge with legal reasoning, ethical decisions and practical documentation skills. Students of forensic medicine should be able to understand injuries correctly, prepare medico-legal reports and use legal principles in clinical practice. So, the assessment methods should check both their theoretical knowledge and practical skills. The Objective Structured Practical Examination, also called OSPE, is considered an objective and reliable method for testing practical skills. It uses fixed stations and structured checklists to assess students. Studies have shown that many students accept OSPE and find it useful for improving practical learning and exam preparation, especially when it is used with formative assessment and immediate feedback.[5,6]

Although competency-based assessment is becoming more common, there is still limited evidence about the effectiveness of repeated OSPE-based formative assessments with structured feedback in forensic medicine. This problem is more common in South Asian medical colleges. Most studies have mainly focused on what students think about OSPE, rather than checking whether it actually improves their performance in final examinations. Furthermore, structured formative assessment is not routinely incorporated into undergraduate forensic medicine teaching in Pakistan, creating an important gap in educational practice.[1,4,5] This study was conducted to evaluate the impact of

1. MSHPE Scholar & Associate Professor. Health Services Academy, Islamabad /Department of Forensic Medicine and Toxicology, Liaquat University of Medical & Health Sciences; Jamshoro.
2. Professor; Rector/ Director Academics. Health Services Academy, Islamabad
3. Assistant Professor of Linguistics. Department of English Language & Literature, College of Sciences & Humanities, Prince Sattam Bin Aziz University. Al-Kharj, Kingdom of Saudi Arabia.

*=corresponding author:
Email: drmemonmpk1970@gmail.com.

Received: July 2026, Revised; August 2026
Accepted: October 2026

repeated OSPE-based formative assessments with structured feedback on summative examination performance among third-year MBBS students. It also explored students' perceptions of this assessment approach to provide evidence for integrating structured formative assessment into routine undergraduate forensic medicine education.

Objective: To assess the effect of OSPE-based formative assessment with structured feedback on students' summative assessment performance.

Methodology:

This quasi-experimental pretest-posttest study was conducted in the Department of Forensic Medicine and Toxicology, Liaquat University of Medical and Health Sciences (LUMHS), Jamshoro, from August 2025 to January 2026. The study included third-year MBBS students enrolled in the Forensic Medicine course. A total of 97 students were recruited using a non-probability consecutive sampling technique after obtaining written informed consent. The research protocol was reviewed and approved by the Institutional Review Board of Health Services Academy, No HSA/Rector/003-26; 6th August 2025.

At the beginning of the academic module, all participants underwent a baseline (pretest) assessment to evaluate their existing knowledge and practical understanding of forensic medicine. The assessment was designed according to the departmental curriculum and covered major topics including identification, mechanical injuries, sexual offences, toxicology, medico-legal documentation, and medico-legal ethics.

Following the pretest, students received routine teaching through lectures, tutorials, practical demonstrations, and small-group discussions. During the course, three formative assessments were conducted at regular intervals using an Objective Structured Practical Examination (OSPE) format. Each OSPE consisted of multiple structured stations assessing core competencies namely injury interpretation, medico-legal documentation and specimen identification. Immediately after each OSPE, students received structured feedback from the examiners using a standardized feedback proforma. The feedback proforma comprised of strengths, learning gaps, common errors and specific recommendations for improvement. Students were encouraged to reflect on the feedback and incorporate the suggested improvements before the subsequent formative assessment. At the completion of the teaching module, all participants appeared in the routine departmental summative assessment, which served as the post-intervention assessment. Summative examination scores were obtained from official departmental records. In addition, students completed a structured perception questionnaire to evaluate the usefulness of formative assessment and structured feedback in improving their learning, confidence and examination preparedness.

SPSS v.29 was used for data analysis. The difference between pretest and posttest scores was analyzed using the paired t-test. The association between formative assessment scores and summative assessment performance was determined using Pearson's or Spearman's correlation coefficient and associations between perception variables and academic performance were analyzed using the Chi-square test where appropriate. A p-value of less than 0.05 was considered statistically significant.

Results:

A total of 97 third-year MBBS students participated in the study. The mean age of the participants was 21.3 ± 0.7 years, with 69 (71.1%) females and 28 (28.9%) males. The comparison of academic performance demonstrated a significant improvement in students' scores following the educational intervention. The mean posttest (summative) score (66.8 ± 9.1) was significantly higher than the mean pretest score (59.2 ± 8.7), with a mean increase of 7.6 ± 6.9 marks ($t = 10.84$, $p = 0.031$), indicating the positive impact of OSPE-based formative assessment and structured feedback on academic performance (Table 1).

Table No1. Comparison of Academic Performance Before and After the Educational Intervention (N = 97).

Assessment	Mean ± SD	Mean Difference	t-value	p-value
Pretest	59.2 ±8.7	7.6 ±6.9	10.84	0.031
Posttest (Summative)	66.8 ±9.1			
Paired t-test was applied.				

Students exhibited a gradual improvement in performance across the three consecutive formative OSPE assessments. The mean scores increased from 61.4 ± 9.5 in OSPE I to 63.2 ± 9.2 in OSPE II and 65.1 ± 8.8 in OSPE III, suggesting progressive enhancement in knowledge and practical competencies throughout the intervention (Table 2).

Table No 2. Performance Across Three Consecutive Formative OSPE Assessments (N = 97).

Assessment	Mean ± SD	Minimum	Maximum
OSPE I	61.4 ± 9.5	40	82
OSPE II	63.2 ± 9.2	42	84
OSPE III	65.1 ± 8.8	45	86

Correlation analysis revealed no significant association between the individual OSPE assessments and final summative examination scores. However, the mean OSPE score demonstrated a moderate positive correlation with summative examination performance ($r = 0.39$, $p < 0.001$), indicating that students with better overall formative assessment performance tended to achieve higher summative scores (Table 3).

Table No 3. Correlation Between Formative Assessment Performance and Final Summative Examination (N = 97).

Variable	Pearson Correlation (r)	p-value
OSPE I vs Summative Examination	0.16	0.119
OSPE II vs Summative Examination	0.18	0.082
OSPE III vs Summative Examination	0.21	0.051
Mean OSPE Score vs Summative Examination	0.39	<0.001
Pearson correlation analysis was performed.		

Most students expressed positive perceptions regarding formative assessment and structured feedback. More than three-quarters of the participants agreed or strongly agreed that formative assessments improved their understanding of forensic medicine, enhanced practical skills, helped

identify learning gaps, improved preparation for summative examinations and increased confidence. Furthermore, 87.6% of students supported the routine incorporation of structured formative assessment and feedback into forensic medicine teaching (Table 4).

Table No 4. Students' Perceptions Regarding Formative Assessment and Structured Feedback (N = 97).

Statement	Strongly Agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly Disagree n (%)
Formative assessment improved my understanding of forensic medicine.	36 (37.1)	41 (42.3)	12 (12.4)	6 (6.2)	2 (2.1)
OSPE-based assessment enhanced my practical skills.	39 (40.2)	38 (39.2)	13 (13.4)	5 (5.2)	2 (2.1)
Structured feedback helped identify my weaknesses.	43 (44.3)	37 (38.1)	10 (10.3)	5 (5.2)	2 (2.1)
Feedback improved my preparation for the summative examination.	40 (41.2)	39 (40.2)	11 (11.3)	5 (5.2)	2 (2.1)
Formative assessment increased my confidence.	34 (35.1)	42 (43.3)	13 (13.4)	6 (6.2)	2 (2.1)

Discussion:

The present study showed a significant improvement in academic performance after OSPE-based formative assessment with structured feedback. The mean posttest score was higher than the pretest score, indicating that repeated formative assessment can positively influence summative performance. This finding is consistent with Sirianansopa, who reported improved post-test achievement after formative assessment with timely feedback.[1] Similar improvement was also reported in practical anatomy and physiology studies, where formative assessment with feedback enhanced students' final practical examination scores.[7,8] The gradual increase in scores across OSPE I, OSPE II, and OSPE III suggests progressive development of knowledge and practical competency. This supports the principle of assessment for learning, where repeated low-stakes assessments help students identify deficiencies, correct mistakes and improve performance over time.[2,9] Shinde et al. also observed better student performance after structured feedback training during formative physiology practical's, supporting the role of repeated feedback in improving practical skills.[8]

In this study, individual OSPE assessments showed weak and non-significant correlations with summative performance, whereas the mean OSPE score showed a significant positive correlation. This suggests that a single formative assessment may not reliably predict final performance, but cumulative formative performance better reflects students' learning trajectory. This is consistent with evidence supporting programmatic and competency-based assessment, where multiple assessment points are preferred over single examination results.[4,6,10] The use of OSPE was particularly relevant in forensic medicine because the subject requires practical application, injury interpretation, medicolegal documentation and analytical reasoning. Previous studies have shown that OSPE is more objective, structured, and acceptable than conventional practical examinations.[5,7,11] The present results show that OSPE can be a useful formative assessment method for improving practical learning and helping students prepare for their final assessment.

Students expressed generally positive views about this assessment approach. The majority agreed that formative assessment enhanced their understanding of the subject, strengthened practical skills, highlighted areas for improvement, supported examination preparation, and boosted confidence. These findings align with earlier studies reporting favorable student perceptions of formative assessment and feedback in undergraduate medical education.[3,4,12] Similarly, Atwa et al. observed that students regarded formative assessment and feedback as valuable tools for learning and preparing for final examinations.[9]

A noteworthy finding was that 87.6% of students endorsed the routine incorporation of structured formative assessment into forensic medicine teaching, reflecting strong acceptance among undergraduates. Nevertheless, effective implementation requires adequately trained faculty, careful planning, sufficient time allocation, and institutional support. Prior studies have similarly highlighted challenges such as limited understanding, resource constraints, and increased faculty workload, which can hinder the successful integration of formative assessment into medical education.[13,14]

Limitations of the study:

This study was conducted in a single institution with a relatively small sample size, which may limit the generalizability of the findings. In addition, the absence of a control group restricts the strength of causal inferences. Furthermore, students' perceptions were based on self-reported responses, introducing the possibility of response bias.

Conclusion:

The integration of OSPE-based formative assessment with structured feedback was associated with improved academic performance in forensic medicine. While individual OSPE scores did not demonstrate a significant relationship with final examination outcomes, the cumulative formative assessment score showed a moderate positive correlation with summative results. In addition, students reported favorable perceptions of this approach, underscoring its educational value. Collectively, these findings support the routine incorporation of structured formative assessment into undergraduate forensic medicine curricula.

References:

1. Sirianansopa K. Evaluating students' learning achievements using the formative assessment technique: a retrospective study. BMC Med Educ. 2024 Nov 26;24 (1):1373. doi: 10.1186/s12909-024-06347-5. PMID: 39593083; PMCID: PMC11590208.
2. Mushtaq Q, Aslam P, Noor F, Ilyas T, Maqbool S, Sarfraz J. Implementation of Formative Assessment 'for' Learning: A Review. Journal of Health and Rehabilitation Research.2024; 4(2), 519-524. doi:10.61919/jhrr.v4i2.843
3. Goodwin RL, Nathaniel TI. Effective Feedback Strategy for Formative Assessment in an Integrated Medical Neuroscience Course. Med Sci Educ. 2023 May 16;33 (3):747-753. doi: 10.1007/s40670-023-01801-3. PMID: 37501810; PMCID: PMC10368590.
4. Otaki F, Gholami M, Fawad I, Akbar A, Banerjee Y. Students' Perception of Formative Assessment as an Instructional Tool in Competency-Based Medical Education: Proposal for a Proof-of-Concept Study. JMIR

Res Protoc. 2023 Mar 20;12:e41626. doi: 10.2196/41626. PMID: 36939831; PMCID: PMC10131604.

5. Farkhanda Jabeen, Sadaf Zia, Sumera Riaz. Objective structured practical examination (OSPE), as a tool for the assessment of practical skills of undergraduate M.B.B.S students. Journal of University Medical & Dental College.2016; 7(2), 1-5. Available from https://www.jumdc.com/index.php/jumdc/article/view/181.
6. Lall P, Rees R, Law GCY, Dunleavy G, Cotič Ž, et al. Influences on the Implementation of Mobile Learning for Medical and Nursing Education: Qualitative Systematic Review by the Digital Health Education Collaboration. J Med Internet Res. 2019 Feb (2):e12895. doi: 10.2196/12895. PMID: 30816847; PMCID: PMC6416537.
7. Lakum NR, Maru AM, Algotar CG, Makwana HH. Objective Structured Practical Examination (OSPE) as a Tool for the Formative Assessment of Practical Skills in the Subject of Physiology: A Comparative Cross-Sectional Analysis. Cureus. 2023 Sep 28;15 (9):e46104. doi: 10.7759/cureus.46104. PMID: 37900514; PMCID: PMC10612540.
8. Shinde SA, Joshi UU, Karanje NC, Ingale SS, Munjappa HB, et al. Effectiveness of Structured Feedback Training on Student's Performance in Formative Assessment of Physiology Practicals: A Comparative Study. Cureus. 2025 Mar 6;17(3):e80176. doi: 10.7759/cureus.80176. PMID: 40190946; PMCID: PMC11972165.
9. Atwa HS, Potu BK, Fadel RA, Deifalla AS, Fatima A, et al. Implementing Formative Assessment in Human Anatomy Practical Sessions: Medical Students' Perception and Effect on Final Exam Performance. Adv Med Educ Pract. 2024 Jun 10;15:551-563. doi: 10.2147/AMEP.S465384. PMID: 38884014; PMCID: PMC11178080.
10. Natesan S, Jordan J, Sheng A, Carmelli G, Barbas B, et al. Feedback in Medical Education: An Evidence-based Guide to Best Practices from the Council of Residency Directors in Emergency Medicine. West J Emerg Med. 2023 May 5;24(3):479-494. doi: 10.5811/westjem.56544. PMID: 37278777; PMCID: PMC10284500.
11. Schüttpelz-Brauns K, Karay Y, Arias J, Gehlhar K, Zupanic M. Comparison of the evaluation of formative assessment at two medical faculties with different conditions of undergraduate training, assessment and feedback. GMS J Med Educ. 2020 Jun 15;37 (4):Doc41. doi: 10.3205/zma001334. PMID: 32685669; PMCID: PMC7346285.
12. Stenberg M, Mangrio E, Bengtsson M, Carlson E. Formative peer assessment in higher healthcare education programmes: a scoping review. BMJ Open. 2021 Feb 9;11(2):e045345. doi: 10.1136/bmjopen-2020-045345. PMID: 33563627; PMCID: PMC7875268.
13. Almahal, E.A., Osman, A.A.A., Tahir, M.E. et al. Fostering formative assessment: teachers' perception, practice and challenges of implementation in four Sudanese medical schools, a mixed-method study. BMC Med Educ.2023; 23, 247. doi:10.1186/s12909-023-04214-3
14. AlAskari AM, Al Elq AH, Mohamed ER, Almulhem MA, Zeeshan M, et al. Faculty Members' Perception, Implementation, and Challenges of Formative Assessment in Undergraduate Medical Education: A Cross-Sectional Study. Cureus. 2024 Nov 20;16(11):e74107. doi: 10.7759/cureus.74107. PMID: 39568485; PMCID: PMC11578639.

Authors' Contribution	
Abdul Samad	Conceived and designed the study, collected and analyzed the data, drafted the manuscript and takes responsibility for the integrity and accura-
Junaid Sarfaraz	Supervised the study and critically reviewed the manuscript for important intellectual content.
Ayesha Junaid	Contributed to the interpretation of data and revision of the manuscript.