

Impact of Formative Assessment on Students Learning: Evidence from Feedback-Based Study among Phase I MBBS Students

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Abstract

Background: Formative assessment is an important part of the learning process. It assists the teachers to identify what students already know, recognize learning gaps, and provide feedback that can guide further learning. Unlike formative assessment, Cumulative assessment is primarily used at the end of a learning period to judge achievement and assign grades to phase-1 MBBS students.

Objective: To assess Phase I MBBS students' perceptions of formative assessment and feedback, including perceived effects on learning, study behaviour, and university examination preparation, and to examine the association between use of formative-assessment feedback and perceived improvement in final examination performance.

Materials and Methods: A cross-sectional questionnaire-based study was performed using the supplied data-set of 250 Phase I MBBS student records. The questionnaire included demographic variables, 30 five-point Likert-scale statements, and categorical questions regarding feedback use and perceived learning/performance. Descriptive statistics were used to summarize participant characteristics and Likert responses. Pearson's chi-square test and Fisher's exact test were used to assess the primary 2×2 association. The odds ratio (OR) with 95% confidence interval (CI) and prevalence ratio (PR) with 95% CI were calculated.

Results: The mean age was 19.65 ± 1.16 years; 186 (74.4%) participants were male. Previous formative-assessment participation was reported by 193 (77.2%). Feedback was reported as usually received by 56 (22.4%) students, sometimes by 69 (27.6%), rarely by 108 (43.2%), and never by 17 (6.8%). Use of feedback to modify study strategy was reported by 213 (85.2%) students, while 227 (90.8%) reported improved summative examination performance. The primary association was statistically significant (Pearson $\chi^2 = 131.32$, df = 1, $p < 0.001$; Fisher's exact test, $p < 0.001$). The OR was 310.93 (95% CI 39.18–2467.39) and the PR was 2.46 (95% CI 1.66–3.63).

Conclusion: In this study, formative assessment and feedback were generally perceived positively, particularly in relation to study behaviour and university final exam preparation. The cross-sectional association between feedback use and perceived final performance was strong and statistically significant, but causality cannot be inferred from the study design.

Keywords: Formative Assessment, Feedback; Medical Education, Competency-Based Medical Education, MBBS, Final Assessment, Learning.

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Introduction

Competency-Based Medical Education (CBME) is a learner-centred approach that focuses on progressive acquisition of defined competencies. In undergraduate medical education, assessment is intended to provide information about learners' progress toward these competencies rather than function solely as an endpoint for grading.[1,2] The National Medical Commission (NMC) has incorporated competency-based education and competency-based assessment into undergraduate medical education in India; the revised CBME

Curriculum 2024 is applicable from the 2024–25 MBBS batch onward.[1] Formative assessment provides information during learning, allowing teachers and learners to identify areas of strength and areas requiring further work. Current medical-education guidance emphasizes alignment with learning objectives, appropriate timing, validity, learner involvement, and the effective use of feedback.[2] Feedback is a central component of formative assessment because it provides information that learners can use to maintain,

modify, or improve their performance.[2,3] A systematic review and meta-analysis of randomized controlled trials found that feedback was associated with better educational outcomes among medical students, although substantial heterogeneity existed across feedback interventions.[3]

The usefulness of feedback also depends on its credibility, context, source, characteristics, and the recipient's ability to interpret and use it.[4,5] Feedback literacy has therefore become an important consideration in health-professions education.

Phase I MBBS education establishes foundational knowledge in the basic medical sciences. Continuous formative assessment can provide opportunities to identify learning gaps and modify study strategies before high-stakes final assessment. A systematic review of assessment in undergraduate CBME identified formative assessment and feedback among major approaches used to support student involvement in assessment.[6]

Das et al. reported a cross-sectional study of 142 basic-science medical students in which 78% considered feedback from formative assessment important for addressing learning gaps, 76.8% felt that formative assessment helped faculty identify weak areas, and 80.8% felt that formative assessment encouraged deep learning and regular study. However, 36.4% perceived frequent formative assessment as potentially interfering with independent learning.[7]

Sarma et al., in a study of 47 undergraduate MBBS students, reported generally positive perceptions of formative assessment, including its role in identifying weak areas, supporting deeper learning, and providing feedback for improvement.[8] More recent evidence continues to support the importance of feedback while emphasizing the quality, credibility, and usability of feedback rather than assessment frequency alone.[2-5]

Materials and Methods

This was a cross-sectional, questionnaire-based descriptive study involving Phase I MBBS students. The study was conducted with 250 phase I MBBS students at Kurnool Medical College, Kurnool during the academic year 2022-2023. The participants were selected based on availability and willingness to participate. Data was collected on-site through paper-based questionnaires distributed to students at the end of the semester. The surveys were conducted in classrooms during a scheduled class period, ensuring that participation did not interfere with students' regular academic activities.

All participants voluntarily took part in the study, with no incentives offered for participation. Participation was entirely anonymous, and respondents were assured that their responses

would be treated confidentially. Ethical considerations were taken into account, and informed consent was obtained from all participants and their parents before data collection

A structured questionnaire was used to collect demographic and academic information and perceptions of formative assessment and feedback. The Likert section contained 30 statements scored from 1 (strongly disagree) to 5 (strongly agree). Additional categorical questions assessed receipt and use of feedback, perceived learning improvement, perceived Assumptive-performance improvement, and possible disadvantages such as reduced independent-study time and increased stress.

Statistical Analysis: Categorical variables were summarized as frequencies and percentages. Age was summarized using mean and standard deviation. Likert-scale items were summarized using mean $\pm$ standard deviation and the proportion of respondents selecting agree or strongly agree (scores 4 or 5). For the primary inferential analysis, use of formative-assessment feedback to modify study strategy was treated as the exposure variable and perceived improvement in assumptive examination performance as the outcome variable. Pearson's chi-square test and Fisher's exact test were used for the 2 $\times$ 2 table. The odds ratio with 95% CI was calculated using the log-scale standard error, and the prevalence ratio with 95% CI was calculated because the data are cross-sectional. A two-sided p value <0.05 was considered statistically significant.

Results

A total of 250 student records were available for analysis. The mean age was 19.65 ± 1.16 years. Most participants were female (186, 74.4%), and all were recorded as Phase I MBBS students. Previous formative-assessment participation by students was 193 (77.2%). Fortnightly formative assessment was the most frequently reported schedule (106, 42.4%), followed by weekly assessment (81, 32.4%). Feedback was reported as rare by 108 (43.2%) students and as sometimes received by 69 (27.6%). Most students rated their academic performance as average (188, 75.2%).

Likert-scale responses are summarized in Table 2. The highest mean score was observed for use of feedback to modify study strategy (4.31 ± 1.10), with 198 (79.2%) students selecting agree or strongly agree. Several learning-related statements had 226 (90.4%) positive responses, including motivation for regular study, deep learning, self-directed learning, retention, preparation for final assessment, and perceived improvement in university examination performance. Feedback was considered useful by 160 (64.0%) students and was reported to help identify mistakes by 172 (68.8%).

Only 99 (39.6%) selected agree or strongly agree that feedback was timely. The frequency of formative assessment being appropriate received a relatively low positive response (39, 15.6%).

Table 1: Demographic and academic characteristics of participants (N = 250)

Characteristic	Category	n (%)
Age	18	69 (27.6)
	19	20 (8.0)
	20	90 (36.0)
	21	71 (28.4)
Sex	Female	186 (74.4)
	Male	64 (25.6)
Phase	Phase I	250 (100.0)
Previous FA participation	No	57 (22.8)
	Yes	193 (77.2)
FA frequency	Weekly	81 (32.4)
	Fortnightly	106 (42.4)
	Monthly	29 (11.6)
	Less often	34 (13.6)
Feedback frequency	Never	17 (6.8)
	Rarely	108 (43.2)
	Sometimes	69 (27.6)
	Usually	56 (22.4)
Academic performance	Below average	34 (13.6)
	Average	188 (75.2)
	Above average	28 (11.2)

Table 2: Likert-scale responses regarding formative assessment and feedback

Item	Statement	Mean $\pm$ SD	Agree/Strongly agree n (%)
Q1	Formative-assessment participation	3.70 $\pm$ 1.43	163 (65.2)
Q2	Improves knowledge level	3.68 $\pm$ 1.43	161 (64.4)
Q3	Helps identify weak topics	3.60 $\pm$ 1.46	150 (60.0)
Q4	Frequency of formative assessment is appropriate	1.84 $\pm$ 1.08	39 (15.6)
Q5	Feedback is useful	3.37 $\pm$ 0.99	160 (64.0)
Q6	Feedback helps identify learning gaps	3.49 $\pm$ 0.65	135 (54.0)
Q7	Feedback helps identify mistakes	3.65 $\pm$ 0.58	172 (68.8)
Q8	Feedback is clear	3.51 $\pm$ 0.75	160 (64.0)
Q9	Feedback is timely	3.22 $\pm$ 0.79	99 (39.6)
Q10	Feedback is used to modify study strategy	4.31 $\pm$ 1.10	198 (79.2)
Q11	Formative assessment motivates regular study	4.02 $\pm$ 0.81	226 (90.4)
Q12	Formative assessment promotes deep learning	4.02 $\pm$ 0.81	226 (90.4)
Q13	Improves understanding of basic sciences	3.30 $\pm$ 0.96	141 (56.4)
Q14	Promotes self-directed learning	4.02 $\pm$ 0.81	226 (90.4)
Q15	Improves retention	4.02 $\pm$ 0.81	226 (90.4)
Q16	Prepares students for Final assessment	4.02 $\pm$ 0.81	226 (90.4)
Q17	Helps faculty identify weaknesses	3.27 $\pm$ 1.01	141 (56.4)
Q18	Facilitates remedial teaching	4.02 $\pm$ 0.81	226 (90.4)
Q19	Facilitates discussion of difficulties	4.02 $\pm$ 0.81	226 (90.4)
Q20	Improves summative examination performance	4.02 $\pm$ 0.81	226 (90.4)
Q21	Helps correct mistakes	3.27 $\pm$ 1.01	141 (56.4)
Q22	Improves summative preparation	3.30 $\pm$ 0.95	141 (56.4)
Q23	Reduces time for independent study	3.32 $\pm$ 0.94	142 (56.8)
Q24	Increases academic stress	3.39 $\pm$ 0.81	141 (56.4)
Q25	Negatively affects Final performance	4.02 $\pm$ 0.81	226 (90.4)
Q26	Causes excessive focus on marks	4.02 $\pm$ 0.81	226 (90.4)
Q27	Has a positive effect on learning	4.02 $\pm$ 0.81	226 (90.4)
Q28	Feedback is valuable	4.02 $\pm$ 0.81	226 (90.4)
Q29	Students would continue formative assessment	3.87 $\pm$ 1.15	170 (68.0)
Q30	Appropriate formative assessment improves performance	2.73 $\pm$ 1.11	85 (34.0)

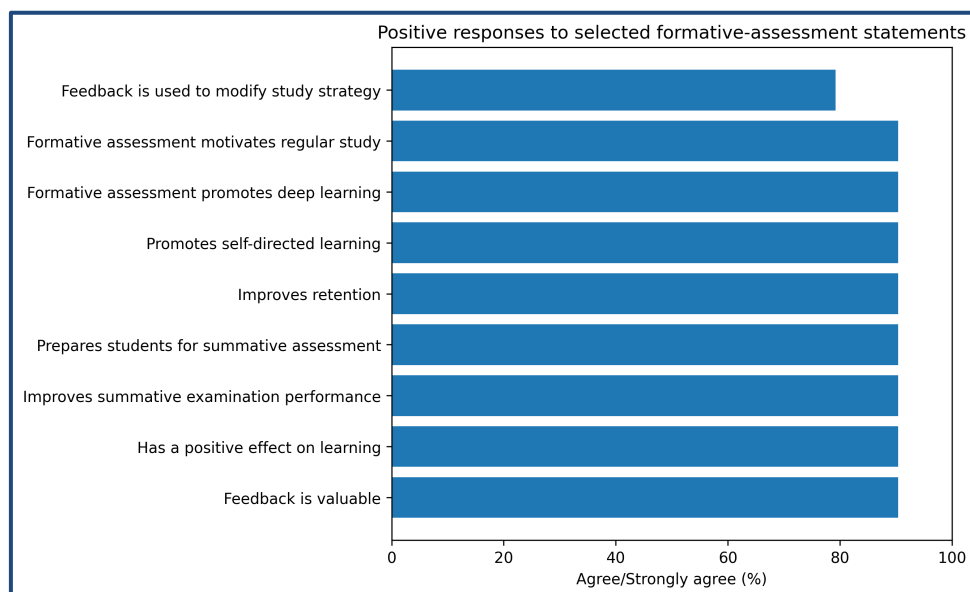


Figure 1: Percentage of students selecting agree or strongly agree for selected formative-assessment statements. Positive response was defined as a Likert score of 4 or 5.

For the primary 2×2 analysis, 213 (85.2%) students reported using formative-assessment feedback to modify their study strategy. Among these students, 212 (99.5%) reported improved for university examination. In comparison, 15 of 37 students (40.5%) who did not report using feedback to modify their study strategy reported improved performance.

Table 3: Association between use of feedback and perceived improvement in university examination performance

Use of feedback	Improved: Yes, n (%)	Improved: No, n (%)	Total
Yes	212 (99.5)	1 (0.5)	213
No	15 (40.5)	22 (59.5)	37
Total	227 (90.8)	23 (9.2)	250

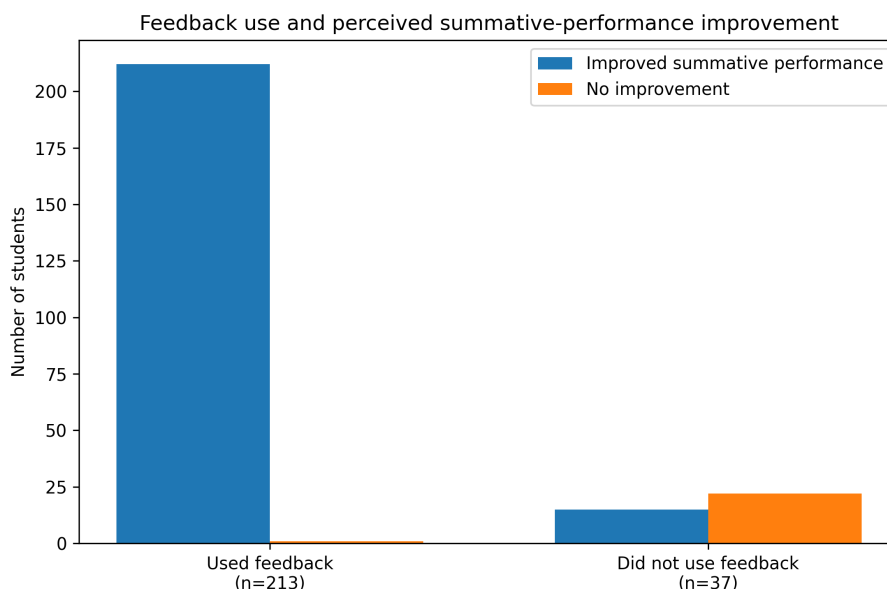


Figure 2: Distribution of perceived summative-performance improvement according to whether students reported using formative-assessment feedback to modify their study strategy.

There was a statistically significant association between use of feedback to modify study strategy and perceived improvement in summative [final university] examination performance (Pearson $\chi^2 = 131.32$, $df = 1$, $p < 0.001$).

Fisher's exact test was also statistically significant (two-sided $p < 0.001$). The odds ratio was 310.93 (95% CI 39.18–2467.39), while the prevalence ratio was 2.46 (95% CI 1.66–3.63).

Table 4: Inferential statistical analysis of the primary association

Measure	Estimate	95% CI / p-value
Pearson χ^2	131.32	df = 1; $p < 0.001$
Yates-corrected χ^2	124.35	df = 1; $p < 0.001$
Fisher's exact test	—	two-sided $p < 0.001$
Odds ratio	310.93	39.18–2467.39
Prevalence ratio	2.46	1.66–3.63

Discussion

The present analysis demonstrates generally positive perceptions of formative assessment and feedback among Phase I MBBS students. A large proportion of participants reported that formative assessment supported regular study, deep learning, self-directed learning, retention, and preparation for summative [final university] exams. These findings are broadly consistent with previous medical-education studies and systematic reviews emphasizing the role of formative assessment and usable feedback in supporting learning.[2-8]

The finding that 85.2% of students reported using feedback to modify their study strategy is particularly relevant to the concept of feedback as an active learning process. Feedback is educationally meaningful when learners can interpret it and use it to guide subsequent action; contemporary guidance therefore emphasizes feedback quality, timeliness, alignment with learning objectives, and learner engagement rather than assessment frequency alone.[2,4,5]

The strong association observed between feedback use and perceived improvement in summative performance should be interpreted with the study design. Students who reported using feedback to modify their study strategy were much more likely to report improved summative performance.

However, the data are cross-sectional and both variables are self-reported; therefore, the association does not demonstrate that feedback caused the improvement. The very large OR is also influenced by the small number of students in the cell representing feedback use without perceived improvement, resulting in a wide confidence interval. The finding that only 39.6% of students considered feedback timely highlights an implementation issue. Feedback may have limited educational value when it is delayed or insufficiently actionable.[2-5] Similarly, the relatively low positive response regarding the appropriateness of assessment frequency suggests that students may distinguish between the value of formative assessment and the burden associated with how often it is administered. Previous studies have also emphasized the importance of adequate frequency and immediate feedback.[7,8] Potential

disadvantages were also reported. More than half of participants agreed or strongly agreed that formative assessment reduced independent-study time (56.8%) and increased academic stress (56.4%). These findings support a balanced approach to continuous assessment in which the educational purpose, workload, scheduling, and feedback process are considered together.

Conclusion

Formative assessment and feedback were generally perceived positively by the Phase I MBBS students represented in the results, particularly in relation to regular study, deep learning, self-directed learning, retention, and preparation for summative assessment. Most students reported using formative-assessment feedback to modify their study strategies, and this behaviour was strongly associated with perceived improvement in summative examination performance. Nevertheless, the cross-sectional nature of the study prevents causal inference. Effective formative assessment should therefore emphasize meaningful, timely, actionable feedback and an appropriate assessment frequency that supports learning without unnecessarily increasing student workload or stress.

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