

Concept of Formative assessment and Strategies for its effective implementation under Competency-Based Medical Education: A Review

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ABSTRACT

Internal assessments are routinely conducted by faculty in Medical Institution to evaluate students. In most institutions, it is done with the main objective of documenting internal assessment marks to be included in the final University Examination. Under the new curriculum for Indian Medical Graduates 2019, there has been a paradigm shift from conventional to Competency-Based Medical Education with major revisions in the assessment methods. Focus has shifted from purely summative to a combination of both formative and summative assessment. Formative assessment involves giving regular feedbacks to students which helps them to learn better and motivates faculties to improve their teaching skills. Therefore, it becomes essential for all faculties in medical institutions to know these changes through faculty development programs and understand the key strategies for its successful implementation. This article highlights the perspective of formative assessment, different methods commonly used, and the scope for future research in our settings.

Key word: Formative Assessment, Summative Assessment, Feedback, Competency-Based Medical Education.

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INTRODUCTION

Medical education in India has undergone a paradigm shift from the traditional to competency-based education which is defined as an outcome-based approach to the design, implementation, assessment, and evaluation of a medical education program using an organizing framework of competencies.¹ Apart from the change in teaching modalities, the new curriculum also demands a competency-based assessment characterized by its longitudinal nature with regular feedback and in a different context to achieve certification of competency. Thus, the system of only one summative or year-end examination is not suited for this purpose.² Most teaching faculties are familiar with the terms formative and summative

assessment. But its application is unknown or felt not important with the traditional system of medical education. The role of formative assessment (FA) in student learning is well acknowledged, but it is still not well understood across higher education.³ Evidence states that students can get trained in certain competencies within 6 to 7 months by teachers practicing FA which would otherwise take 1 year.⁴ With the implementation of Competency-Based Medical Education (CBME) it becomes essential for every medical teacher to understand how formative assessment differs from summative and effective methods for its implementation. This article throws light on some of

these aspects and provides a need for further research in our Indian setting.

Understanding Formative assessment in comparison with Summative assessment

The assessment constitutes an important component of any curriculum. It is broadly classified as a summative and formative assessment. The conventional medical education system has a lot of emphasis and weightage given to summative assessment which mostly happens at the university level and is used to decide pass or fail. Under the CBME curriculum, a major importance is given to formative assessment which is an ongoing process with an opportunity for the students to attain the competency through feedbacks from the faculty. The distinction between formative and summative assessment is primarily related to how assessment results are used, as many assessments developed for formative purposes can be used for summative purposes and vice versa.⁵ Other differences have been given by Dixson and Worrell³ (Table 1).

Table 1: Dante D. Dixson Frank C. Worrell³

Characteristic	Formative assessment	Summative assessment
Purpose	To improve teaching and learning to identify difficulties faced by students	Evaluation of learning outcomes mainly for promotion
Formality	Usually, informal	Usually, formal
Timing of administration	Ongoing, before and during instruction	Cumulative, after instruction
Level of stakes	Low stakes	High stakes
Types of questions asked	What is working? What needs to be improved?	Is the student prepared for the next level of activity?
Examples	Observations, Homework, Self-evaluations	Model exams and University exams

Concept and principles of Formative Assessment

Black and William⁴ defined assessment as all activities that teachers and students undertake to get information that can be used diagnostically to alter teaching and learning, which includes teacher observation, classroom discussion, and analysis of student work such as homework and tests. Assessments become formative when the information

is used to adapt teaching and learning to meet student needs through feedbacks. Sadler⁶ had identified three criteria essential for this feedback to be effective. Firstly, students must have a concept of what is expected to be learned. Secondly, they should be able to compare their present level of knowledge/performance with the expected level. Lastly, they should engage themselves in appropriate action that will lead to a decrease in this gap. Student’s autonomy with regards to learning and assessment is very important and is found to be directly correlated with increasing levels of motivation to learn, thus medical educators should actively seek out opportunities to increase student control over their educational practices.⁷

The basic element of FA is providing feedback to the students based on their performance on the assigned task. Hattie & Timperley⁸ defined feedbacks as ‘information provided by an agent (teacher, peer, self, etc.) regarding aspects of one’s performance or understanding. This information will ultimately reduce the discrepancy between the present understanding and performance to the desired level. Unfortunately, the culture for giving true feedback has not yet developed in the medical professional, unlike the others.⁹ Butler and Winne¹⁰ had stated the seven principles of feedback (Table 2) that support and develop self-regulated learning among students. Adoption of these measures will result in improved performance of not only students but also assist teachers in identifying areas of difficulty needing more instructional teaching. Moreover, meta-analysis also highlights the role of feedback given during FA as a useful tool for better learning.^{8, 11}

FA plays a key role in improving the process of learning rather than grading the students. The role of educators is primarily to motivate the intrinsic desire to learn rather than extrinsic motivation, where the concept of learning becomes the goal.⁷ Eventually it results in training students to become a life-long learner rather than exam-oriented reading. FA can be effective to serve specified purposes only when strategically implemented. Prashanthi and Ramnarayan¹² have aptly described the ten principles to effectively implement FA, known as 10 Fs- Faceless, facilitates learning, Feedback, Feedforward, Focus on learning, Flexibility, Fast, Frequent, Friendly, and Fun. Of these, faceless i.e anonymity is considered very important to identify contents difficult to learn. But this principle has a big

drawback since individual feedback is not possible. Solely relying on feedback given to students to improve their learning is not sufficient but must be accompanied with necessary action that will be taken by them to improve future learning, this principle is called the feedforward. It includes both retrospective and prospective approaches in the practice of FA.

Table 2: Seven principles of Feedback given in FA¹⁰

S.No.	Principles of good feedbacks
1	Facilitates the development of self-assessment by students in learning
2	Encourages teacher and peer dialogue around learning
3	Helps clarify what good performance is
4	Provides opportunities to close the gap (Resubmission of task/assignment)
5	Delivers high-quality information to students about their learning
6	Encourages positive motivation towards reading and self-esteem
7	Provides information to teachers to help shape their teaching

Assessment methods

The assessment methodology employed in FA is not significantly different from those used for summative. No single method is perfect but involves different methods used multiple times to compensate for flaws in any one method.^{13, 14} Cowie and Bell¹⁵ classified FA as planned and unplanned, both have their implication and benefits. A planned form is similar to conducting a summative assessment while an unplanned way of conducting FA, is one that occurs spontaneously in the classroom. Planned FA helps to assess the performance of the whole class while unplanned FA, which is interactive, mediates the learning process. The study of literature finds interactive FA as central to teaching and learning which is more relevant in medical education.¹⁶ Several methods can be used for FA, we summarize the few standard methods for assessment during

theory (Table 3) and practical session (Table 4) commonly used.

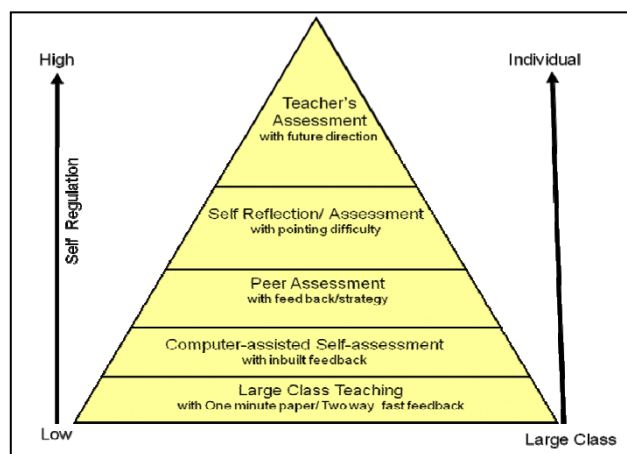
Table 3: FA Methods commonly used during theory session¹⁷⁻²¹

Type of Assessment	Procedure	Feedback
Minute-paper	At the end of class, ask students to write “what is the most important point you learned today?” and “What is the least clear to you?”	Collect and review students’ responses and ensure that they have obtained the correct message. In the next class, comment on the findings or ask for peer review to discuss any discrepancies.
One-sentence summary	Can be used at any time during class to test knowledge about an important topic you expect them to be able to summarize.	Ensure the students have the message.
Directed Paraphrasing	Ask students to write a layman’s summary of any principle taught. This assesses their ability to comprehend and transfer concepts.	Peer or teacher assessed. Ensure the salient points are covered.
Muddiest point	Ask students to write down the concept or content of the lecture that they have not understood or found confusing.	Collect written answers or allow them to discuss with their peers. This provides feedback to both faculty and students to improve further teaching and learning respectively.
Knowledge probe	At the beginning of class, ask students to answer preset questions (open or multiple choice) to assess their existing knowledge.	Note any weaknesses of knowledge that need to be addressed. If open-ended could also be utilized for peer assessment.
Application cards	Ask students to write about a real-world application for a theory, principle, or procedure that was just covered.	Collect and pick out a broad range of examples to present to the class or allow peers to assess and discuss.

Written exercise (MCQs, SAQs, Essay)	MCQs and SAQs are preferred to assess knowledge gained while essays help to assess in-depth understanding of the subject.	Feedback can be given immediately for MCQs and SAQs when conducted for small groups, while for essays it might take a few days depending on the teacher's correction ability.
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assessment by peer and teacher with one-to-one feedback will have intermediate and maximum effect respectively.

Figure 1: A model for formative assessment strategy proposed by Jeyakumar & Zed³²



A review of literature recommends the following strategies^{4,21,33-39}

Frequent short tests are better than infrequent long tests.

Assessment should be conducted within a week of teaching the topic.

The quality of questions should be kept in mind while framing the questionnaire. Tasks given to students should be relevant to real-life examples, therefore students realize the application of theoretical knowledge and importance of the topic.

Multiple methods and assessors should be used depending on the competency that is being assessed and feedback should be frequent and constructive. Feedbacks from peers also need to be obtained.

Students with poor performance should be given increased opportunities for resubmission of assignments.

Assessment based on direct observation of the trainee is better done using “qualitative approaches” such as words of judgment (e.g., satisfactory) or narrative description (trainee greeted the patient appropriately before history taking)

Feedback session can begin with the learner's self-assessment. It helps to soften the perception of harsh comments and makes corrective feedback feel more acceptable.

MCQs- Multiple choice questions, SAQs- Short answers questions

A decision on the method to be used can be done based on five criteria as stated by Van der Vleuten.²⁸ These are reliability (the degree to which the measurement of assessment is accurate and reproducible), validity (whether the assessment measures what it claims to measure), impact on future learning and practice, acceptability to learners and faculty (level of difficulty and time taken), and costs (to the individual trainee, the institution, and society at large).

Recently, many studies^{12, 29, 30} have focused on the use of FA through online mode, which is proved to be effective in given quick feedback to many students. The major advantage of this mode of assessment is that it can be done at a pace comfortable to students which can also be easily repeated according to the individual needs.

Strategies for effective implementation of FA

Black and William⁴ stated that any strategy adopted in FA should have clear goals, appropriately designed learning, and assessment tasks, including communication of criteria assessment, and providing quality feedback to students. This ultimately empowers students to assess their progress in knowledge and promote self-regulated learning,³¹ thus preparing themselves to be eager to acquire knowledge on the latest scientific development. FA is more effective and better accepted when students realize its importance in curriculum and unavoidable practice in medical education.⁴

Jayakumar and Zed³² proposed a model (Figure 1) showing the relation between the FA used and motivation towards self-regulated learning among students. Based on the model, FA methods used in lecture session have minimal effect on motivating students to improve their learning while individual

Table 4: FA Methods commonly used during practical session ²¹⁻²⁷

Type of Assessment	Procedure	Feedback
Mini-Clinical Evaluation Exercise (mini-CEX)	A student performs clinical tasks (history taking or physical examination) and provides a summary of the patient encounter. Faculty members grade students on 7 parameters (interviewing skills, physical examination, professionalism, clinical judgment, counseling, organization and efficiency, and overall competence) using a 9-point rating scale for each parameter. A score of 1–3 is unsatisfactory, 4–6 is satisfactory and 7–9 is superior.	Provide structured feedback based on observed performance on interviewing skills, physical examination, professionalism, clinical judgment, counseling, organization and efficiency, and overall competence.
One-Minute Preceptor (OMP)	It is a 5 steps framework that helps the assessor to evaluate students’ presentation skills, clinical reasoning, and knowledge. The steps involved are getting a commitment from students, probe for supporting evidence, provide general rules, reinforce what was done correctly, and lastly correct mistakes	This can be used in the OPD setting or viva session of a clinical case. It is more useful to teach about disease-specific points and differential diagnosis rather than history taking or examination skills. This framework involves giving both positive and negative feedback during the clinical training session.
SNAPPS	This framework differs from OMP by requiring both assessor and trainee to know the steps. It has 6 steps i.e., summarize the history and findings, narrow the differential to 2 or 3 possibilities, analyze the differential by comparing/contrasting the possibilities, probe the preceptor by asking questions, plan management for the patient’s medical issues, and select a case-related issue for self-directed learning. The assessor is involved only after the 3 rd step.	This technique is more useful for advanced and self-motivated learners in the clinical setting. Feedback encourages critical thinking and identifying topics for self-directed learning.
Clinical Encounter Cards (CEC)	Similar to mini-CEX, scores were given on 7 parameters (history-taking, physical examination, professional behavior, technical skill, case presentation, diagnosis, and therapy) each on a 6-point scale with 1 being unsatisfactory and 6 indicates above the level of a medical graduate.	The quality of a student’s performance is captured on a 4 x 6 scorecard with space for the assessor to record the feedback given to the student at the end. Useful for comparison on subsequent training sessions.
Blinded Patient Encounters (BPE)	Students in groups of 4–5 participate in a bedside tutorial. It starts with a period of direct observation when one of the students in the group is observed performing a focused interview or physical examination as instructed by the clinician-educator conducting the teaching session. Thereafter the student is expected to provide a diagnosis, including a differential diagnosis, based on the clinical findings.	It concludes with a feedback session in which the student receives personal private advice about his/her performance. Peer feedback is also possible in this method.
Direct Observation of Procedural Skills (DOPS)	Like CEC, the student is expected to perform procedures such as endotracheal intubation, nasogastric tube insertion, administration of intravenous medication, venipuncture, peripheral venous cannulation, and arterial blood sampling	Students are given specific feedback based on direct observation of each step to improve their procedural skills.
Standardized patients (SP)	This method uses actors who are trained to portray themselves as patients. The assessor uses a checklist to grade the students.	Feedback is given to students based on the assessor scoring and also comments from the SP.
Chart Stimulated Recall (CSR)	It involves dual assessment of the trainee’s documentation and clinical reasoning skills. The assessor uses the case sheet documented by the trainee as a reference for structured clinical reasoning.	Assessors give feedback to students for both written and clinical decision-making skills.

MultiSource Feedback (MSF) or 360° global rating	It involves the collection of performance data and feedback for an individual trainee, using structured questionnaires completed by several stakeholders (peers, senior consultants, junior specialists, nurses, and allied health service professionals) which is completed and returned to a central location for processing. Trainees should also submit a self-assessment questionnaire form. Done on routine performance, rather than performance during a specific patient encounter.	The questionnaires are collated, and individual feedback is prepared for trainees. Data are provided in a graphic form that depicts the mean ratings of the assessors and the standard mean rating. Trainees review this feedback with their supervisor and together work on developing an action plan.
Portfolio	Portfolios include documentation about specific areas of a trainee’s competence along with self-reflection. Includes procedure logs, peer assessments, patient surveys, literature searches, quality-improvement projects, and any other type of learning material. It also frequently includes self-assessments, learning plans, and reflective essays.	It is maximally effective when closely mentoring by teachers on its assembly and interpretation of the content, requiring considerable time and effort.

OPD- out-patient department, SNAPPS- summarize, narrow, analyze, probe, plan, and select

Use of two-stage assignments where feedback from one stage helps to improve performance in the next stage.

Encourage bidirectional feedback i.e., allowing students to give feedback on faculty teaching. A student might be hesitant to do so, in such case ask more specific questions such as “Where would you like to see more teaching occur?”

Capacity building of all teaching staffs should be done through the faculty development program, for effective implementation of FA

Challenges in implementing FA

Several challenges have been faced even by developed countries with advanced teaching-learning environments while implementing CBME. A review article by Carraccio et al.⁴⁰ found 30 years of lag between the implementation and the actual practice of CBME. Understanding these challenges prior will help identify possible solutions. The biggest barrier to implement FA has been identified as a lack of faculty participation in conducting the assessment and giving feedback.²² Formative assessments can be negatively perceived as time-consuming by both students and teachers, especially in the clinical departments.^{39, 41} Students may lack enthusiasm initially in these assessments or with regular use, but once they recognize the concept of FA being a normal routine of an academic curriculum, it will be accepted.^{4, 42}

Most of the FA on clinical training is done among simulated patients or skill labs using mannequins. This requires training of faculty to be good observers and better assessors of student’s performances, which becomes more complex when it involves grading of

communication and emotional skills in a simulated environment rather than actual patients.³³

The infrastructural prerequisite required for implementing CBME is very demanding. Smart classrooms with voting pads and high-speed internet connection are essential for implementing unplanned FA during the lecture session. Simulation labs and patients will be needed specially to attain competency at the pre and para clinical levels. The financial support from the administration in this regard is a big challenge.³⁹

It is well known that assessment drives learning, however, it can have some unintended consequences especially with changes in the examination pattern. Training exclusively on FA can result in more focus on clinical aspects than theoretical aspects.^{28, 43} Feedback from peers promote professionalism, communication, and teamwork. This can result in students cramming for the final assessment and substituting their superficial knowledge for reflective learning.⁴⁴

It is often seen that students in medical school come from a culture that focuses on individual achievement^{45,46} and may not be prepared to accept constructive or positive feedback. They may underestimate the value of FA if it does not contribute to their overall grades.⁴⁷ The present educational culture of grading students is another barrier to the implementation of authentic formative assessment.⁴⁸ Medical students should realize that the aim is to become a holistic doctor in the real world rather than passing an exam with excellence

Scope for Future Research

Medical education research in India is the need for the hour to estimate the current level of knowledge, attitude, and perception towards conducting FA and giving feedback. We also need to understand the challenges faced by faculty and students in our setting. Only a few studies^{11,49-51} have been conducted on FA and its impact in improving students' performance. Future research to understand the benefits and barriers in implementing FA in our setting will assist in the effective implementation of CBME.

There is no agreed methodology to approach FA that demonstrates positive effects on learning that could be solely attributed to FA,⁵² therefore the other contributing factors need to be identified. New assessment tools and innovative approaches to assessing competencies such as teamwork, professionalism, empathy, etc. should be recognized to fully realize the promise of CBME.³³ There is a need to determine the feasibility of using FA tools in both theory and practical sessions in our setting, with limited resources, infrastructure, and manpower.

The basic idea behind the use of FA is to enable deep learning and feedback. Whether FA can completely replace summative assessment for health care education in the future needs to be evaluated. Research in these aspects will guide bringing about medical education reforms.

Conclusion

Research in medical education supports the shift towards CBME, where there is an alignment of training and learning with outcomes and assessment of students' performance concerning real work conditions on professional expectations.⁵³ FA has a major advantage in effectively evaluating and improving communication skills, teamwork, professionalism, ethical practice, and other procedural skills which is an essential competence that should be acquired by medical students but is not feasible to assess during the University examination due to time constraints.² Timing of assessment under CBME emphasizes more on the formative over summative assessments,⁴⁰ which has presently gained importance in our setting. This is in comparison to Western countries which focus on assessment frameworks providing a structured conceptual map of the learning outcomes of a program and allow test developers to more easily create robust assessment

instruments.⁵⁴ Purposeful assessment should be conducted with the greatest possible clarity going beyond its simple categorization as summative or formative.⁵⁵ We must repeatedly ask what the real purpose of conducting assessments is and be sure of the agenda.

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