Applicability of Classroom-Based Formative Assessments in Medical Education A Review

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Abstract: The present article reviews Formative Assessment (FA) with a special focus on attributes of making such assessments classroom based by suitable incorporation in routine instructional activity. Aligned to the constructivist theory of learning, classroom-based FAs, embedded within the instructional activities, can permit timely feedback, correctives and instructional alignment. These assessment practices need to be so well grounded in the instructional process that the information they reveal will identify whether and how instruction should be adapted to advance students' understanding. The Formative Assessment Classroom Techniques (FACTs) are designed to be easily embedded into classroom instruction. They are a group of specific teaching strategies designed to assess student learning by engaging them in reflective evaluation of the course material and thereby systematic collection of their reflections on learning. FACTs are linked to cognitive learning theories that relate to how the information is processed. Variation in FACT strategies, catering to different domains of learning and learning styles coupled with ease of administration makes the entire exercise more suitable and sustainable within medical classroom dynamics. Training of medical teachers and re-organization of instructional hours are two major challenges for such classroom based assessments in medical education. [T Srivastava Natl J Integr Res Med, 2018; 9(1):123-128]

Key Words: Classroom, Formative Assessment, Medical Education

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Introduction: Assessment is a central feature of any curriculum[1]. Formative assessments (FA) are synonymously addressed as 'Assessments for learning' with an existing vast literature support regarding its substantial impact on learning. Since medical teaching is largely classroom based, the present article reviews formative assessment with a special focus on concept and attributes of making such assessments classroom based by incorporating them into routine instructional activities. FA within classrooms can provide information that facilitates better pedagogical practices and instructional outcomes thereby encouraging the learner towards improved performance. Learning theories and evidences advocate that formative assessment practices should be integrated into minute-to-minute and day-by-day classroom activities.

The reference search, for the present study, was carried out electronically and by hand search. The electronic search was done for databases viz. Pub Med, Medline, Scopus, Index Copernicus and Google Scholar and for relevant websites like http://www.tandfonline.com, www.wiley.com, www.nap.edu, https://www.routledge.com/ and http://inpathways.net/role-interim.pdf.

In addition to research papers, the search includes books, discussion papers, reports, conference papers and briefings. Experts in the field of 'Classroom based Formative Assessments' were communicated through online forum 'Research gate'. The platform was explored to share publications and exchange of ideas. The inclusions of references were limited to English language. Studies pertaining to 'attributes of formative assessment' 'in-class formative assessments' within higher education were included as part of supporting evidence. References pertaining to learning theories, assessment tools or material and methods form a part of this review.

Formative Assessment: Definition and Principles: Since the introduction of the concept, formative assessment has evolved in its meaning and has spawned substantial interest and research. The roots of formative assessment can be traced to a monograph of the American Educational Research Association (AERA) in which Scriven (Scriven, 1967) first coined the term formative evaluation[2]. The publication in which Scriven's use of the term appeared was a volume of the AERA's Monograph Series on Curriculum Evaluation. Few years later, Benjamin Bloom in his book entitled the Handbook of Formative and Summative Evaluation of Student Learning stated that in formative evaluation one must strive to develop the kinds of evidence that will be most useful in the process, seek the most useful method of reporting the evidence and search for ways of reducing the negative effect associated with evaluation[3]. Cronbach (Cronbach, 1971) observed that an assessment is a system for making inferences. Whenever the inferences are related to the student's current level of achievement then the assessment is serving a summative function[4] and when the inferences are related to the kinds of

instructional activities that are likely to maximize future learning, then assessment is functioning formatively. The summative-formative distinction is therefore a distinction in terms of the kinds of inferences that are supported by the evidence elicited by assessment rather than the kind of assessment themselves. Needless to say; the same assessment evidence may support both kinds of inferences, but in general, assessments that are designed to support summative inferences (that is, inferences about current or future levels of achievement) are not particularly well-suited to support formative inferences (that is, inferences about next instructional steps). Benjamin Bloom and his colleagues continued to use the term "formative evaluation" in subsequent work and the term "formative assessment" was routinely used in higher education in the United Kingdom to describe "any assessment before the big one," but the term did not feature much as a focus for research or practice in the 1970s and early 1980s, and where it did, the terms "formative assessment" or "formative evaluation" generally referred to the use of formal assessment procedures, such as tests, for informing future instruction[5,6].

Formative or Summative role of assessment data is the key: Although assessments may be designed for formative or summative purposes, the resultant data may be interpreted either formatively or summatively. Literature defines formative evaluation and summative evaluation in terms of the use of assessment data and separate the issue of assessment instruments from assessment use. Assessments are instruments for collecting information, in this case information about students' academic performance, including the actual learning process. Evaluation is a separate, but related issue that has to do with the use of assessment-based data. Although an assessment may be designed to be formative or summative, the data acquired by the administration of either type of assessment may be used for formative or summative purposes. In other words, evaluation of assessment based data for the purposes of assessing academic progress at the end of specified time period for the purposes of establishing a student's academic standing relative to some established criterion is summative and evaluation of assessment-based evidence for the purposes of providing feedback and informing teachers, students, and educational stakeholders about the teaching and learning process is formative. Formative evaluation also informs policy that affects future evaluation practices. Hence, formative evaluation or summative evaluation may be applied to either formative and summative assessment data. (Karee E. Dunn & Sean W. Mulvenon)[7].The same assessment evidence may support both kinds of inferences, but in general, assessments that are designed to support summative inferences (that is, inferences about current or future levels of achievement) are not particularly well-suited to supporting formative inferences (that is, inferences about instructional next steps).

Classroom-based FA within Instruction: "Formative assessment is a planned process in which assessment-elicited evidence of students' status is used by teachers to adjust their ongoing instructional procedures or by students to adjust their current learning- tactics"
(W, James Popham, Transformative Assessment, (2008) [8]

The need to broaden the concept of formative assessment beyond formal assessment procedures was emphasized by Torrance (1993)[9]. He stated that research on assessment needs fundamental review. One aspect of such a review should focus on classroom formative assessment, and should provide a much firmer basis of evidence about the relationship of assessment to learning that can inform policy and practice[9]. Cowie and Bell adopted formative assessment as "the process used by teachers and students to recognize and respond to student learning in order to enhance that learning, during learning" (p. 32)[10]. They are assessments designed to monitor student progress during the learning process (i.e., assessment for learning) was also reinstated by Chappuis& Stiggins[11] and Shepard et al[12]. In their review of formative assessment practices across eight National and provincial systems, the Organization for Economic Cooperation and Development (OECD) emphasized the principle that the assessment should take place during instruction. One of the most comprehensive descriptions of formative assessment has been given by Shepard by a model of formative assessment as a tool to guide student learning as well as to provide information that teachers can use to improve their own instructional practice[13].Hence, Formative Assessments can be labelled as a process used by teachers and students during instruction that provides feedback to adjust ongoing teaching and learning to improve students' achievement of intended instructional outcomes[14,15].

One of the earliest researchers of formative classroom assessment was Benjamin Bloom. His

ground breaking work on the need to address the variance in student achievement was to vary (or differentiate) the instructional and assessment delivery to students. In 1984, Bloom published a summary of his research on the impact of mastery learning models on student learning, comparing standard whole-class instruction (the control condition) with two experimental interventions, a mastery learning environment and one-on-one tutoring of individual students. One hallmark of both Experimental conditions was the extensive use of classroom based assessment in support of learning as a key part of the instructional process. The analyses revealed significant differences in student achievement favoring the experimental conditions that relied on classroom assessment to support learning[16].In their 1998 research review, Black and William examined the research literature on assessment worldwide, seeking evidence whether improving the quality of classroom FAs improve student learning, as reflected in summative assessments. They studied over 250 articles and uncovered positive effects of student centric classroom assessment. Further, Black and William report that such assessments help low achievers more than other students and so reduces the range of achievement while raising achievement overall"[17].

A constructivist approach to teaching and learning posits that students' existing ideas make a difference to their future learning, so effective teaching needs to take these existing ideas into account[18]. Taking into account the constructivist theory classroom-based FA embedded within the instructional activities can permit timely feedback, correctives, and instructional alignment[19]. Analysing students' baseline ideas and monitoring their progress is the essence of an idea-focused, formative assessment classroom that promotes conceptual change.

A significant study in this regard (Stiggins R, 2005;) argued that the failure of 60 years of total reliance on assessment via standardized tests to help reduce achievement score gaps must compel us to rethink the role of assessment in this endeavour[16]. They advocated rebalancing assessment priorities to bring classroom assessment into the equation. In 2004, Rodriguez reported similar size achievement gains when examining the relationships among student characteristics, teachers' classroom assessment practices, and student achievement as measured in the Third International Math and Science Study (Rodriguez, 204)[20].There is strong evidence wherein William and Thompson (Wiliam, 2007 as cited in Mahwah) [21] denote the term "short-cycle" classroom FA that can have a profound impact on student achievement. Accordingly, Yeh summarized a number of studies proving that "rapid formative assessment" (assessments conducted from two to five times per week) can significantly improve student learning[22].(Erickson, (2007)[23] has used the term "proximal formative assessment" to indicate that it is an activity close to instruction. He denoted it as "the continual taking stock by paying first hand observational attention to students during the ongoing course of instruction with careful attention focused upon specific aspects of a student's under-standing" (p. 187) in order to make decisions about next steps in instruction. To facilitate this process, the teacher needs to use practices that will reveal not only whether a student appears to have mastered a concept but also how he or she understands it[24].The assessment practices need to be so well grounded in the instructional process that the information they reveal will identify whether and how instruction should be adapted to advance students' understandings.

Formative Assessment Classroom Techniques (FACTs): The locus of any formative assessment activities should typically be at the classroom level and the concept of formative assessment should strongly resonate with classroom teachers. Although a primary focus of formative assessment is that of information gathering in support of educators' instructional planning activities, it also promotes student engagement and responsibility for learning, student self-assessment, and self- direction. The Formative Assessment Classroom Techniques (FACTs) described in the book entitled 'Science Formative Assessment 'are designed to be easily embedded into classroom instruction. They are primarily used to assess before and throughout the learning process, rather than at an endpoint of instruction (except for reflection) [18]. Their main purpose is to improve student learning and opportunities to learn through carefully designed instruction. FACTs can be used to spark students' interest, surface ideas, initiate an inquiry, and encourage classroom discourse—all assessment strategies that promote learning rather than measure and report learning. A rich repertoire of FACTs enables learners to interact with assessment in multiple ways—through writing, drawing, speaking, listening, physically moving, and designing and carrying out investigations. FACTs help teachers continuously examine how students' ideas form and change over time as well as how students respond to particular teaching approaches. This information

is constantly used to adjust instruction and refocus learning to support each student's intellectual growth in science. There can be no prescription for what a single instance of formative assessment should look like. Any instructional activity that allows teachers to uncover the way students think about what is being taught and that can be used to promote improvements in students' learning can serve a formative purpose. These embedded tasks may be so integrated with instruction as to seem natural and unobtrusive, or they may be given to students at the end of a lesson as a separate activity.

FACTs are linked to cognitive learning theory [25]that focuses on how information is processed. Since the 1980s they have been used by thousands of University instructors, in various disciplines, in the US [26].According to Cross and Angelo (1993), FACTs are a group of specific teaching strategies designed to provide FA of student learning by engaging students in reflective evaluation of course material, and through the systematic collection of student reflections on learning. These student reflections provide the instructor with useful feedback on how much and how well students are learning, that helps to improve the quality of teaching and learning. Despite decades of demonstrated popularity in academia and the associated assertion regarding effectiveness of Classroom based FAs; literature reveals a dearth of quantitative empirical support that it significantly improves learning.

More than 75 FACTs are available in literature. According to Angelo and Cross (1993), the stages which should be deployed while implementing FACTs are:

- Planning – thinking about what may be gained from implementing FACTs.
- Implementing – explaining the purpose of the activity to the students before conducting the FACTs so that they understand the assignment, then collecting responses and immediately analyzing them.
- Responding – telling the students what has been learned from the assessment and what difference, if any, that information will make.

Regardless of the strategy adopted, FACTs encourage the view that teaching and learning is a formative process that evolves over time. By being able to react swiftly to student responses, they provide the opportunity for immediate feedback to the teacher which can be promptly acted upon, thereby giving a chance to close the feedback loop. Learning within this zone of proximal development, it encourages self-assessment by the student and reflection amongst both, the student as well as the teacher, however; care must be taken in choosing the appropriate FACT and allowing enough time in class to ensure that they are worthwhile.[27]

Challenges and concerns for FACT Implementation: Acceptability and practise of FACTs by medical teachers in routine instructional activities is a major challenge. Training of medical teachers in this regard is of prime importance if classroom based FA are to be adopted within the curriculum. Professional training, initiatives should be undertaken for concept development about various learning theories and role of assessment in learning. The training should focus towards enhancing assessment skills, giving appropriate feedback and tailor instructional modifications. A teacher should be able to decide future course of action in response to what they learn about their students from such FA and accordingly plan specific instructional modifications.

The other challenge is reorganising instructional time for effective inclusion of FACTs in the already existing time constraints within the curriculum. This can be tided over by proper planning in terms of specific areas within the subjects that are of prime importance and the judicious selection of the type of FACT (in terms of its suitability to the content being taught, time required for administration, and time required for analysis). Actual FACT should not take more than 8-10 minutes of classroom instruction time and should be simple and engaging for the learners[18]. The administration time can be further abridged by using technology based classroom assessments, though it has its own limitations[28-30]. The ideal interim period between two successive class (on the same topic) where FACT is administered should be of two days, thus providing adequate time for analysis of responses and instructional modifications. The cognitive demand for FACTs is yet another attribute which should be taken care of while planning for FACT. Literature suggests a mix of the levels of cognition. Ease of use is the most important indicator for acceptability of the technique. The probes within FACTs should be specifically based upon the learning objectives of the instructional activity. To conclude, variations in FACT strategies catering to different domains of learning and learning styles coupled with ease of administration makes it more suitable and sustainable within medical classroom dynamics.

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