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Introduction to Assessment in Medical Education
(First of the Series)

ABSTRACT

This paper includes an operating definition of the assessment and further explanations of each unit of the definition. Some assessment principles and practical examples for undergraduate medical education are provided.

Keywords: Assessment, Definition, Principles, Medical education

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INTRODUCTION

The dictionary definition of "assessment" is "the action or an instance of making a judgment about something".[1] However, this definition never serves enough when we intend to use the term "assessment" as an educational concept. One of the best definitions of what the assessment is in medical education can be found in the booklet of the World Federation for Medical Education Global Standards for Quality Improvement 2020. The assessment in this booklet starts with the following statement: "*Assessment assures, drives, guides, creates, and optimizes learning while providing feedback. In the context of a medical school, a system of assessment must exist, which incorporates multiple assessments that achieve the purposes of the school and its stakeholders*".[2] This statement explains well what is expected from the assessment and what medical schools should do to meet this expectation. The current paper is structured around the abovementioned definition.

Assessment to assure learning?

All training programs are organized on the basis of previously defined aims and objectives. The objectives of the programs/program units can be defined as outcomes/competencies or pure learning objectives. Independent of what we call them, the objectives are the statements explaining the characteristics that students are expected to gain at the end of the program. If we define these characteristics in terms of observable behaviors (such as taking a medical history of a patient or counseling a patient about a certain health issue), then our expected characteristics will be "competencies". Today, medical schools generally define the characteristics expected from students at the graduation point as graduate competencies. If we define the expected characteristics in terms of knowledge, skills and attitudes, they may be called "learning objectives". Medical schools define the learning objectives to design programs that guide their students to gain the knowledge, skills and attitudes required for achieving graduate competencies at the end.

All competencies or learning objectives are defined under the assumption that they are attainable by all students. If assessment is expected to assure learning, all objectives must be tested to confirm that our assumption is met. This requirement is related to the concept of validity, which refers to one of the basic principles of assessment: "Assessment procedures must be valid". Validity is a term used to determine whether an assessment instrument truly tests what it is supposed to test. The concept of validity may be further expanded into the following:[3]

Content validity: Representativeness of learning objectives in the assessment.

Construct validity: Congruence of the assessment instrument with the purpose. For example, if we intend to test the procedural skill of a student, then we need to use a test in which we directly observe the student while he/she is performing that skill to ensure construct validity. If we prefer a paper and pencil test for the same purpose, the construct validity of the test would be low.

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Predictive validity: Ability of the assessment instrument to predict the future performance of examinees. For example, the relationship between the performance of a student in the final examination of any academic year and performance during training in the internship period.

Face validity: Acceptability of the instrument to the users (students, teachers) in determining its usefulness to measure what it is supposed to measure.

The content and construct validity need to be regarded as a "must" by medical schools to confirm that assessment ensures learning. Blueprints are used to check whether all defined objectives are tested (content validity) via proper assessment methods (construct validity). Blueprints are a table in which objectives (not subject headings) of the assessed program unit are matched with the assessment methods and test content. Blueprints should be used for every level of program units and their objectives. A proper blueprint is the first crucial step in developing a valid examination and must not be overlooked. Some examples are provided below:

Table 1. Blueprint for graduate competencies

Graduate Competencies	Assessment Methods
Learning objective 1: ……..	Multiple Choice Questions test, assay, oral exam, OSCE, bedside assessment, portfolio
Learning objective 2: ……..	Multiple Choice Questions test
Learning objective 3: ……..	Bedside assessment
Learning objective 4: ……..	Logbook etc.
Learning objective 5: ……..	……
Learning objective 6: ……..	……
Learning objective 7: ……..	……
…….	……

OSCE Objective Structured Clinical Examination

This table provides an opportunity for the medical school to check whether every graduate competency is assessed (content validity) via at least one proper assessment method (construct validity) throughout the medical education program (Table 1).

Table 2. Blueprint for the learning objectives of any program unit

Learning objectives of an academic semester/ year/block/module etc.	Cognitive domain	Assessment Methods
Learning objective 1: ……..	Knowledge (theoretical)	Multiple Choice Question test, assay, oral exam
Learning objective 2: ……..	Knowledge (theoretical)	Multiple Choice Question test
Learning objective 3: ……..	Skill (motor)	OSCE
Learning objective 4: ……..	Skill (motor)	OSPE
Learning objective 5: ……..	Knowledge (self learning)	Homework
Learning objective 6: ……..	Knowledge (critical thinking)	Student project etc.
Learning objective 7: ……..	Attitude	360 degree evaluation
…….	…….	……

OSCE Objective Structured Clinical Examination; OSPE Objective Structured Practical Examination

This table provides an opportunity for the medical school to check whether every learning objective is assessed (content validity) via at least one proper assessment method (construct validity) throughout the academic semester/year/block/module, etc. The table demonstrates that one type of exam would never be enough to test all the objectives of any program unit (Table 2). Multiple assessment methods should be applied to ensure the content and construct validity of the entire assessment process of any program unit.

Table 3. Blueprint for an individual test

Learning objectives that must be assessed by the test	Test content (questions, stations etc.)						
	1st	2nd	3rd	4th	5th	6th	….
Learning objective 1: ……..	x			x			
Learning objective 2: ……..		x					
Learning objective 3: ……..			x				
Learning objective 4: ……..					X		
Learning objective 5: ……..						x	
Learning objective 6: ……..							x
…….	…	…	…	…	…	…	…

This table provides an opportunity for the medical school to check whether every learning objective is assessed in the properly selected exam (content validity) using at least one question/station/observation, etc. In this kind of blueprint table, there must be no empty line or column to ensure that every learning objective related to this exam is tested (Table 3). The first column of the table should include the learning objectives of the period for which the exam is being performed. For example, if the test is a final exam, learning objectives of the academic

year, or if the test is a block exam, then the learning objectives of that block, committee, etc., should take part in the first (learning objectives) column of the table.

It is also possible to plan any assessment process in detail by using blueprints. In integrated curricula, detailed planning is important to ensure the validity of the assessment. If the medical school conducts a system-based integrated curriculum, different body systems should be represented in the assessment of any period, for example, in the final exam. In such a case, multiple blueprints arranged from general to specific can be used, as shown below (Table 4a, 4b, 4c):

Table 4a. Selection of student tasks and body systems to be held in the assessment process

System/Task	Cardiovascular	Respiratory	Gastrointestinal	……..
History taking	x			
Physical examination		x		
Clinical reasoning			x	
…….				x

Table 4.b. Selection of student tasks and clinical presentations to be held in the assessment process

System/Task	Cardiovascular	Respiratory	Gastrointestinal	……..
History taking	Chest pain			
Physical examination		Breathlessness		
Clinical reasoning			Epigastric pain	
…….				….

Table 4.c. Selection of student tasks and assessment methods to be held in the assessment process

System/Task	Cardiovascular	Respiratory	Gastrointestinal	……..
History taking	OSCE (simulated patient)			
Physical examination		Bedside assessment (real patient)		
Clinical reasoning			Structured oral exam	
…….				….

OSCE Objective Structured Clinical Examination

Assessment to create and guide learning?

One of the most referred statements in the assessment literature is “assessment drives learning,” which was stated by George E. Miller.[4] For assessment to drive student learning, some requirements are needed, as outlined below:

First, clearly defined learning objectives that describe the expectations of the learners as a whole or in any part of the medical education curriculum must be publicized by the school and known by the students. This will help the students design their learning journeys with respect to the strict aims and objectives to be achieved. Although it seems that this approach will produce standard types of students, this is not true. A type of flexibility is still available for students since they may adopt different paths in their learning experiences while considering their own preferred learning styles and interests to achieve the learning objectives.

Another requirement for assessment to create and guide learning is the existence of a robust system in which students can obtain help and counseling services in their learning journey. This would only be possible by using formative assessment methods and constructive feedback mechanisms. Formative assessment methods are applied with the aim of determining the learning deficiencies of the students throughout the learning process. Therefore, such assessment methods must be performed during the process, not at the end of any educational period. Frequent formative assessments may encourage students to distribute learning over time and review small amounts of information regularly rather than studying massive amounts of content at the last minute.[5] These assessments also help students stay engaged with the course content, resulting in better performance than single testing.[6] The use of formative assessments also allows students to self-assess their knowledge, identify gaps, and test their understanding.[7-9] Frequent formative testing also facilitates retrieval practices to strengthen retention over time so that the information learned serves as essential building blocks for new concepts and knowledge.[6] Additionally, retrieval practices can enhance students' ability to access stored information more readily.[10]

When feedback is provided on student performance in formative assessment processes, the student will be informed about his/her strengths and weaknesses. Throughout the rest of the educational program, the student will try to overcome the learning deficiencies regarding the provided feedback. Then, feedback must include not only strengths and learning deficiencies but also information on how the student can improve his/her performance or theoretical knowledge to achieve the learning objectives properly.[11]

Feedback is not specific to formative assessment only and must be provided subsequent to summative assessment as well. The aim of the summative assessment is to determine the extent to which learning objectives have been achieved by the students and to decide on students’ academic success. Therefore, such assessment procedures are applied at the end of each curriculum unit, not throughout the process. Students need to be informed about their exam performance (positive and negative aspects) after summative assessment procedures to gain insight into their

strengths and weaknesses. Medical education is a long journey, and feedback on a student's performance after a special unit of curriculum has been completed will have a guiding effect on the journey of the student throughout the whole curriculum.

Assessment to optimize learning?

If the expectation from assessment is to optimize the learning of the students, then medical schools and medical teachers should first decide what kind of learners they prefer. If the school or teaching staff desires a learner profile that memorizes the facts in the last few days prior to summative tests without any effort to understand the content deeply, then the assessment formats just testing the recall of facts (memorization skills of the students) are acceptable. On the other hand, if the school and teachers would like to walk with deep learners who understand and explain the underlying reasoning and mechanisms of the theoretical facts and/or who can perform close to real-life performance, then assessment approaches that urge the students to be such learners are needed. As a matter of major paradox, all medical schools and teachers desire to have deep learning students; however, they generally reward surface learners with the assessment methods they use. [12,13] In this manner, the expectation of creating deep learners by assessing their surface learning, such as memorization skills, can be realized only with the good will of the students, not with any intervention from the school.

Assessment is the most valuable power in our hands to direct the learning and studying habits of our students and cultivate a deep learning approach. Therefore, we should carefully select the assessment methods to direct our students to the learning style we desire. For this purpose, the literature suggests that assessment approaches requiring higher cognitive levels, such as reasoning and problem solving, and focusing on the application of information promote the use of effective learning strategies and permanent learning.[4,8,14-16] If we adopt assessment approaches and methods that require students to prepare for exams by learning the underlying logic and mechanics or by developing skills that simulate real-life performance, we can be sure that students will try their best to meet these requirements for academic success.

Assessment System

Competency-based medical education is the most common strategy used to design medical education programs. A programmatic assessment approach may be considered when trying to establish assessment systems for competency-based medical education curricula. Although assessment is a part of educational programs, the programmatic assessment approach considers the assessment system as if it is an independent program. Assessment is necessary for progress and award decisions; however, it may also be considered a learning program for students. Therefore, assessments deserve planning and continuous review and renewal, such as educational programs. In the programmatic assessment approach, the data derived from assessment should display the progress and development of students throughout their program. For this purpose, no one assessment point should determine progress or award; instead, such decisions should be based on an aggregation of data from multiple assessment points. Individual methods of assessment, purposefully chosen for their alignment with the curriculum outcomes and their information value for the learner, the teacher and the school, are seen as individual data points. The information value of these individual data points is maximized by giving feedback to the learner. Self-regulation of learning, through analysis of the assessment information and the achievement of the learning objectives, needs to be supported by a mentoring system.[17,18] An assessment should inform curriculum planners since the assessment results are the most reliable data for evaluating the effectiveness of a program.

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