



# The use of multiple true/false and single-best-answer questions across the medical curriculum: strengths and limitations from an evidence-informed perspective

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## ABSTRACT

The adoption of Single Best Answer (SBA) and Multiple True or False (MTF) questions in the assessment of medical students within an Outcome-Based Education (OBE) framework continues to evolve toward competency-based training. This necessitated an urgent effort to evaluate the effectiveness of various assessment methods in fostering clinical reasoning, knowledge application, and decision-making skills.

The current viewpoint highlights the strengths and limitations of both SBA and MTF formats, emphasizing their suitability in different stages of medical education. While MTF questions offer broad content coverage and efficiency in assessing foundational knowledge in preclinical years, SBA questions are better suited for higher-order cognitive skills and real-world clinical decision-making in the later clinical years. The discussion underscores the necessity of a strategic combination of these formats to align with OBE principles, ensuring that medical graduates are well-equipped for professional practice.

This viewpoint is an attempt to provide insights for medical educators, curriculum designers, and policymakers seeking to refine assessment strategies in undergraduate medical training. By advocating for a balanced approach to assessment, the article contributes to ongoing efforts to enhance the validity, reliability, and effectiveness of medical examinations. This topic aligns well with the journal's focus on medical education innovation and curriculum development, making it a timely and relevant addition to your publication.

**Keywords:** Education (MeSH); Education, Medical (MeSH); Outcome-Based Medical Education (Non-MeSH); Single Best Answer (Non-MeSH); One Best Answer (Non-MeSH); Multiple True or False (Non-MeSH); Educational Measurement (MeSH).

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became prevalent.<sup>1</sup> In this article, MTF refers specifically to formats that present multiple statements under a single question stem, each of which must be independently classified as true or false, rather than selecting one correct response from a list of options.<sup>5</sup> MTF questions allowed for a broader evaluation of a student's factual knowledge and offered the advantages of standardized testing and efficient grading processes. However, critiques of the MTF format highlighted its tendency to promote rote memorization over the development of clinical reasoning skills.<sup>3</sup>

**Contemporary approaches in assessment:** In recent decades, the landscape of medical education has undergone transformative changes, with a pronounced emphasis on clinical relevance and the cultivation of higher-order thinking skills.<sup>1</sup> This evolution has been influenced by the adoption of integrated medical and dental curricula, which prioritize the attainment of specific competencies and learning outcomes.<sup>2</sup> Within this context, the Single Best Answer (SBA) format has gained prominence, particularly in high-stakes examinations such as the United States Medical Licensing Examination (USMLE).<sup>3</sup> SBA questions are meticulously crafted to present several plausible options, requiring students to employ critical thinking and clinical reasoning to identify the most appropriate answer. This format closely mirrors real-world medical decision-making processes, thereby aligning assessment methods with the practical demands of clinical practice.<sup>4</sup> In this viewpoint, we draw on Bloom's cognitive taxonomy when referring to "C1-C6" levels, which together

## INTRODUCTION

Assessment is a cornerstone of medical education for evaluating students' competencies, guiding their learning trajectories, and ensuring that future physicians meet the requisite standards for clinical practice.<sup>1</sup> In an integrated curriculum framework, assessments are meticulously designed to determine whether students have achieved specific, predefined learning outcomes, emphasizing the application of knowledge, critical thinking, and clinical decision-making skills.<sup>2</sup> This approach marks a significant shift from traditional content-focused models to one that prioritizes competency and

real-world preparedness.<sup>3</sup>

**Historical evolution of assessment methods:** In the early 20<sup>th</sup> century, medical education assessments predominantly utilized essay-type questions and oral examinations. These formats aimed to delve deeply into a student's understanding but were often marred by subjectivity and inconsistencies in grading, leading to potential biases.<sup>4</sup> As the century progressed, particularly by the mid-1900s, a paradigm shift towards more objective assessment occurred. The introduction of Multiple-Choice Questions (MCQs), especially the Multiple True or False (MTF) format,

describe progression from simple recall of facts to the ability to create.<sup>6</sup> We also use Miller's pyramid of competence, which distinguishes the levels knows, knows how, shows how, and does in the development and assessment of professional performance in cognitive, psychomotor, and affective learning domains.<sup>6,7</sup>

**Single best answer questions:** SBA questions require students to select the single most appropriate answer from several plausible options. They are widely used in medical assessments, including licensing examinations. One of the key advantages of SBAs is that they encourage clinical reasoning by testing higher-order cognitive skills, requiring students to differentiate between closely related options. Unlike MTF questions, SBAs reduce guessing bias by compelling students to critically evaluate options rather than simply recognizing true statements. Additionally, SBAs align well with an integrated curriculum as they promote the application of knowledge rather than rote memorization. From a psychometric perspective, well-constructed SBA items can contribute to the validity and reliability of written assessments, particularly in the clinical years, when they are embedded within a blueprinted examination, sample content broadly, and are subject to regular item analysis and standard setting.<sup>8</sup> In other words, SBA format can support robust assessment, but it is the combination of blueprinting, adequate test length, item difficulty and

discrimination indices, and defensible standard-setting procedures that primarily determine overall validity and reliability of an examination, rather than item format alone. However, SBAs also have some limitations. There is potential for cueing, as poorly constructed distractors can allow students to rely on test-taking strategies rather than genuine reasoning. Furthermore, each SBAs question assesses only one clinical concept, meaning a greater number of questions may be required to cover a broad syllabus comprehensively.<sup>9</sup>

**Multiple true or false questions:** MTF questions present a series of statements that students must classify as true or false, with or without a preceding clinical scenario. Unlike multiple-response items, where more than one option in a single list may be correct, MTF items require a separate true/false judgment for each statement linked to the same stem. They offer several advantages, particularly in the preclinical years, as they allow for broad content coverage by assessing multiple aspects of a topic within a single question. Their binary structure enables straightforward and objective marking, making them efficient for grading large groups of students. MTF questions are particularly useful for testing preclinical knowledge, as they efficiently evaluate factual recall, which is essential in the early years of medical training. Despite these benefits, MTF questions have notable drawbacks. They tend to encourage rote learning, as they

primarily assess factual recall and basic understanding (C1-C2 levels) rather than the application of knowledge (C3 level). From the perspective of Miller's pyramid of clinical competence, MTF items are typically located at the lower levels, mainly assessing "knows", whereas performance-based assessments (e.g., OSCEs and workplace-based assessments) are required to reach the 'shows how' and 'does' levels.<sup>9,10</sup> Moreover, the format is prone to higher guessing, as students have a 50% chance of selecting the correct answer by chance alone, which can lead to inflated scores. Finally, MTF questions are less reflective of real-world clinical decision-making, as they fail to mimic the complexities of diagnostic and management dilemmas encountered in medical practice.<sup>11,12</sup> Table I summarizes the suitability of each type of MCQ question according to the curriculum stage.

Regardless of format, the reliability of an assessment depends more on the number of well-constructed items, blueprinting, item difficulty, and discrimination indices, than the item type alone. MTF and SBA can both produce high-quality assessments if guided by item-total correlation, internal consistency, and reviewed through psychometric analyses. Scoring modifications such as confidence-based marking, corrections for guessing, or no-penalty scoring with enhanced review have been proposed to mitigate guessing effects.<sup>13</sup> Recent comparative studies have produced mixed results regarding the psychometric performance of MTF versus SBA formats. While SBA is often favored for clinical reasoning, MTF can offer high reliability in factual domains when constructed properly. Some studies show SBA has better discrimination indices, while others note MTF allows broader coverage per question.<sup>14</sup> Additionally, clinical skill assessments have evolved with the integration of competency-based evaluations. For example, tools for assessing the ability of medical students to conduct standard deliveries have been studied, highlighting how various assessment methods can measure competency in hands-on clinical tasks.<sup>12</sup> This shift in evaluation methods reflects the broader

**Table I: Comparative suitability of SBA and MTF question formats across preclinical and clinical phases of medical education**

Criterion	Preclinical Years (Basic Sciences)	Clinical Years (Clinical Application)
Knowledge Type Assessed	Primarily factual recall	Application of clinical reasoning
Suitability of SBA	Moderate (may be used to test pathophysiological concepts)	High (assesses decision-making in clinical scenarios)
Suitability of MTF	Context-limited; can be useful as a supplementary format for efficient testing of foundational factual knowledge when items and scoring are carefully designed and psychometrically monitored	Limited role: not recommended as a primary assessment format for integrated or clinical outcomes, may be used only for focused checks of factual knowledge.

SBA: Single Best Answer; MTF: Multiple True or False

recognition that assessments should not only test theoretical knowledge but also practical proficiency, ensuring that graduates are prepared for real-world medical challenges.

The transition towards SBA and other competency-focused assessment tools reinforces the importance of aligning medical education with the demands of patient care.<sup>2</sup> By implementing structured and well-validated assessment methods, medical schools can ensure that graduates are not only knowledgeable but also clinically competent.<sup>12</sup>

## CONCLUSION

The evolution of medical assessment from subjective methods to structured, competency-based approaches reflects the growing emphasis on outcome-oriented medical education. Aligning assessment strategies with clearly defined learning outcomes is essential to prepare graduates for contemporary clinical practice. Rather than rigidly assigning MTF questions to preclinical years and SBA questions to clinical years, we advocate an evidence-informed, mixed-format approach. MTF items may efficiently sample foundational knowledge when carefully designed and psychometrically monitored, while SBAs and other application-focused formats, such as EMIs, Very Short Answer, MEQs, OSCE/OSPE, and workplace-based assessments, are better suited to evaluating clinical reasoning and higher-order competence.

Ultimately, assessment quality depends less on item format and more on robust blueprinting, adequate content sampling, systematic item development, psychometric evaluation, and defensible standard setting. A balanced, programmatic assessment strategy grounded in quality assurance is more consistent with contemporary educational evidence than a strict stage-based allocation of formats.

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