

ORIGINAL ARTICLE

Evaluating the Level of Cognitive domain for Postgraduate Summative Assessment in Forensic Medicine

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Abstract:

Summative assessments hold significant sway over a student's learning journey. However, there is a noticeable scarcity of literature addressing the validity of postgraduate summative assessment question papers within the domain of Forensic Medicine & Toxicology. This study endeavours to fill this gap by scrutinizing 48 question papers sourced from 12 healthcare universities spanning India for the year 2023. The question paper was evaluated based on several criteria, which included employment of structured & unstructured questions, presence or absence of action verb, distribution of marks based on competencies & level of cognitive domain assessed. From the results of the study, the content validity of the postgraduate summative question papers in Forensic Medicine and Toxicology fell short of expectations. This underscores the imperative for a comprehensive evaluation of the clarity and effectiveness of the blueprints employed by universities. It is evident that faculty training is indispensable to inspire and catalyse a shift in mindset, ultimately leading to a course correction.

Keywords: Summative assessment; Action verbs; Content validity.

Introduction:

Forensic Medicine and Toxicology in India serves as a platform to equip undergraduates with the aptitude to apply their medical knowledge within the legal framework. It amalgamates the domains of Forensic Pathology, Medical Jurisprudence, and Toxicology, forming a comprehensive discipline. At its core, it aims to empower postgraduate students by enabling them to proficiently address medical-legal matters and effectively employ their medical expertise to facilitate justice.¹ This branch focuses on equipping individuals with the aptitude to navigate the intricacies of the nation's medicolegal system. To ensure the excellence of postgraduates in this specialty, it is essential to implement meticulous certification procedures by utilizing appropriate assessment techniques.² Since assessment drives learning, the assessment of competence; measuring the student's or physician's abilities- ought to offer a window into real-world performance, including their habitual actions when not under observation. Furthermore, this assessment should gauge their capability to navigate change, discover and innovate new knowledge, and enhance overall performance.³

Summative assessment for postgraduates in FMT across diverse Indian universities encompasses both written theory examinations and clinical evaluations. Ideally, postgraduate

theory examinations should be designed to assess cognitive domains of a higher level, such as critical thinking, evaluation, and synthesis skills. It is crucial to assign appropriate importance to all components of the curriculum to ensure the validity of the examination paper.²

It's important to note that higher levels of skill attainment aren't inherently superior to lower levels, as one cannot master the higher levels without a solid foundation in the lower ones. Yet, as individuals progress to higher levels, the skills become increasingly relevant and applicable to the demands of daily life.⁴ Forensic Medicine, characterized by its emphasis on practical application, calls for assessments that evaluate critical thinking and synthesis skills. Within this study, we conducted an analysis and comparison of postgraduate summative examination question papers in Forensic Medicine & Toxicology from 12 esteemed universities across India. The focus of our analysis encompassed content distribution, cognitive domain levels, and the structural construct of the questions.¹

Methodology:

A retrospective cross-sectional record-based observational study was undertaken at Pramukhswami Medical College, following the acquisition of ethical approval from the Institutional Ethics Committee. The study involved the selection of 48 summative examination question papers from 12 distinguished medical universities across India. The criteria for selection were based on the accessibility of the respective university's question papers in the public domain. All the chosen question papers pertained to the Doctor of Medicine University Assessment for the year 2023. Question papers for the subject of Forensic Medicine & Toxicology were sourced from university websites and college

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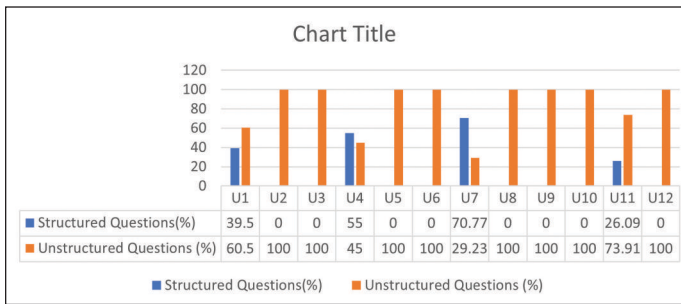


Chart 1. University wise distribution of structured & unstructured questions in question papers.

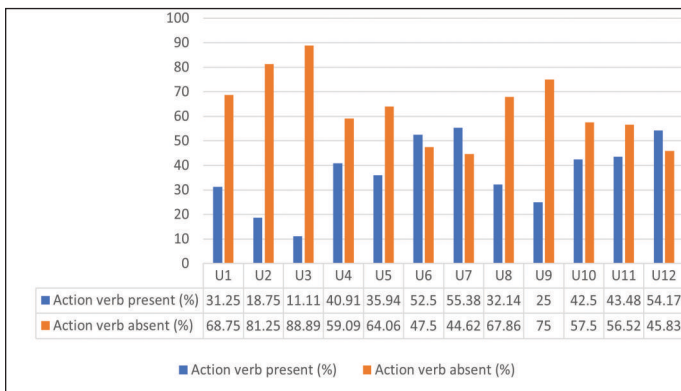


Chart 2. University wise distribution of action verb as per revised Bloom's taxonomy in question papers.

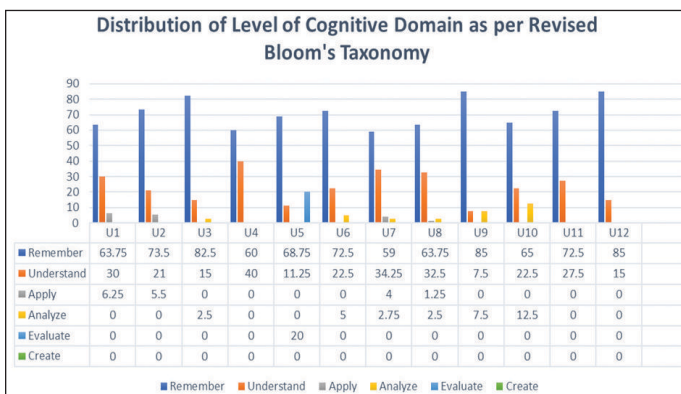
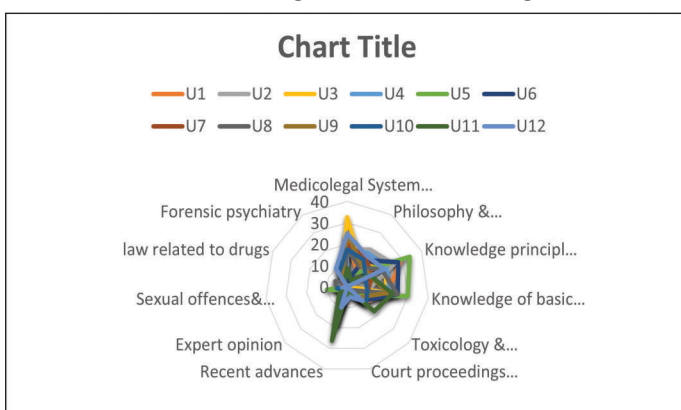


Chart 3. University wise comparison of percentage mark distribution based on the cognitive domain of learning.



Radar graph 1. Distribution of marks based on competencies.

records of affiliated institutions through a comprehensive web search. Throughout this process, the identities of the universities were maintained in an anonymous manner during result analysis. All data was collected from publicly available sources, eliminating the requirement for explicit consent. The confidentiality of the medical universities' identities was upheld during the assessment of the question papers.

As per the regulations outlined by the National Medical Commission (NMC), the summative postgraduate theory examination in Forensic Medicine & Toxicology comprises four theory papers, collectively amounting to a total of 400 marks. For the analysis, questions were categorized based on their structured and unstructured formats, as well as assessing the presence or absence of action verbs as per revised blooms taxonomy. Additionally, questions were classified according to the level of cognitive domains they corresponded to. The subjects within the domain of Forensic Medicine & Toxicology can be effectively categorized into distinct subheadings, as per the Guidelines for Competency Based Postgraduate Training Programme for MD Forensic Medicine by the Medical Council of India. These guidelines outline the essential competencies expected within the postgraduate curriculum for forensic medicine.

The gathered data was meticulously organized into an Excel Sheet, facilitating the documentation of percentage allocations of marks across diverse subtopics. This data was subsequently utilized to create visual representations through radar graphs and bar diagrams. These visualizations offered a means to effectively comprehend and compare the distribution of marks within various topics across each question paper. Throughout this analysis, particular emphasis was placed on assessing the weightage assigned to subtopics.

Ethical clearance was taken from Institutional Ethics Committee (IEC/BU/2023/Ex.78/314/2023)

Results:

This study involved the evaluation of 48 question papers from a diverse range of 12 medical universities spread across India. All the 12 universities marked U1-U12 respectively. Specifically, the assessment focused on the MD examination format. In this examination, each university administers four papers, with each paper carrying a total of 100 marks in the summative assessment in Forensic Medicine. Chart 1 provides a breakdown of the percentage distribution of structured and unstructured questions for each university during their respective final postgraduate summative examinations. Among the 12 universities, a total of 8 universities opted not to include structured questions in their MD assessments. Among the remaining 4 universities that incorporated structured questions, University 7 allocated the highest proportion with 70.77% structured questions, followed by university 4 with 55%. The two remaining universities, University 1, and University 11 allocated 39.5% and 26.09% of structured questions, respectively.

Chart 2 demonstrates a noteworthy trend across the universities, except for U6, U7, and U12. It was noted that a significant number of questions in these papers did not include action verbs that align with the revised Bloom's Taxonomy. The presence of

Table 1. Various previous research articles.

Sr No.	Author's name and year	Place of study	Question paper considered	Universities considered	Conclusion
1.	Mehta SJ and Kikani KM, 2019 ⁹	Gujarat	March 2005-January 2015	Saurashtra University	The findings indicated that a significant majority of the questions (approximately 97%) were based on familiar topics from the syllabus, and they primarily assessed the foundational knowledge level (approximately 95%) within the cognitive domain. The conclusion drawn from this study underscores the critical need for a standardized blueprint to establish consistency in theory examinations
2.	Swart AJ et al., 2010 ¹⁰	Republic of South Africa (RSA)	2002-2006	Vaal University of Technology, South Africa	The findings revealed that in the final examination papers of the electronics academic field, a higher proportion of questions (approximately 52%) were oriented toward lower-order cognitive skills, while a slightly smaller proportion (approximately 48%) focused on higher-order cognitive skills
3.	Chauhan RP 2019 ¹¹	Maharashtra	2001-2018	Maharashtra University of Health Sciences (MUHS)	A minority of paper setting in the field of community medicine at MUHS (approximately 39%) was found to be inadequate in terms of aligning with the syllabus representation
4.	Kar SS et al., 2016 ¹²	Puducherry	December 2008-May 2012	JIPMER, Puducherry	Majority (68.9%) questions tested the knowledge skills of the students.
5.	Choudhary R et al., 2012 ¹³	Rajasthan	2001-2006	Rajasthan University of Health Sciences	The conclusion drawn is that the absence of weightage for different subdivisions has made the process of question setting somewhat challenging.

action verbs was noted at percentages of 52.5%, 55.38%, and 54.17% in U6, U7, and U12, respectively. For the remaining universities, the proportion of questions in their MD assessments that included action verbs was consistently less than 50%.

The distribution of marks in each question paper was meticulously analysed and visualized through a bar diagram (Chart 3) for comprehensive representation. The analysis distinctly illustrates the distribution of marks among the 12 universities. Notably, 3 universities assigned over 80% of marks, while another 3 universities allocated marks within the range of 70-80% for remember domain. Additionally, 5 universities designated marks in the range of 60-70%, and a single university assigned 59% marks specifically for the remember domain. Specifically, four universities designated percentages of 6.25%, 5.5%, 4%, and 1.25% for the 'Apply' domain. Five universities, on the other hand, allocated marks for the 'Analyse' domain, with varying proportions of 2.5%, 2.75%, 2.5%, 7.5%, and 12.5%. Interestingly, out of the 12 institutions under examination, merely one university included marks allocation for the 'Evaluate' domain. A surprising observation emerges that no university allotted marks for the create domain.

In 2017, the Medical Council of India divided the competencies within Forensic Medicine and Toxicology for the purpose of curriculum development. Radar graph 1 provides a detailed analysis of postgraduate summative question papers, breaking down the distribution of marks among these competencies as a percentage. Clearly, a noticeable pattern emerges (Radar graph 1) in the distribution of marks across various competencies in nearly all universities. The emphasis on competencies such as medicolegal autopsy, basic sciences, and the medicolegal system of India is quite pronounced, with a significant allocation of marks. In contrast, competencies like toxicology, medical jurisprudence, expert opinion, sexual offences, and forensic psychiatry receive a notably lower share of marks.

Discussion:

Examinations exert a significant influence on students' reading habits. They communicate to students what is deemed important

from the perspective of examiners. Moreover, these assessments can impact a student's self-esteem, career aspirations, and overall achievements in a substantial way.⁵ According to research conducted by Bheeshma P, Shyamala S, and Sunethri P involving 205 undergraduate students, a comparison was made between the performance of structured essay questions and unstructured essay questions. The findings of the study indicated that a substantial portion of the students achieved higher scores when they were presented with structured essay questions in contrast to unstructured ones.⁶ Current study also revealed that out of the 12 universities examined, a combined total of 8 universities made the choice to exclude structured questions from their MD assessments. Within the subset of the four universities that integrated structured questions, University 7 allocated the largest percentage, accounting for 70.77% of structured questions. Following closely, University 4 allotted 55% of structured questions. The remaining two universities, University 1, and University 11 allocated 39.5% and 26.09% of structured questions, respectively. As per CBME Curriculum 2019 issued by National Medical Council, it is essential to provide well-structured questions with clear problem statements and indicate the marking distribution for transparency in grading (Medical Council of India. Assessment Module for Undergraduate Medical Education Training Program, 2019: pp 1-29.). Study done by Zeller et al also suggested that Evaluations using unstructured questions often fall short of attaining satisfactory levels of reproducibility.⁷

Educators have long acknowledged that assessing learning outcomes can serve to enhance both learning and teaching (Halpern, 1988). Assessing specific types of acquired skills can offer instructors valuable insights into areas where students excel and areas where they may need improvement in relation to these skills. Prioritizing the use of action verbs allows instructors to clearly define the skill sets students are expected to develop because of completing the course. According to John Biggs' study, the choice of verb in the Intended Learning Outcomes (ILOs) plays a pivotal role in establishing alignment between the ILO itself, the teaching and learning activities, and the

assessment tasks. Different ILOs call for different levels of verbs. For instance, some ILOs may require low-level verbs like "describe," "enumerate," or "list." Others may involve middle-level verbs such as "explain," "analyze," "apply to familiar situations," or "solve standard problems." In contrast, advanced-level ILOs would necessitate the use of verbs like "hypothesize," "reflect," or "apply". These verbs help articulate the depth and complexity of the intended learning outcomes and guide the design of teaching, learning, and assessment activities accordingly. The utilization of action verbs facilitates the efficient evaluation of specific Intended Learning Outcomes (ILOs) through well-defined assessment tasks.⁸ The current study has uncovered that among the 12 medical universities nationwide, a notable finding is that 9 of these universities did not incorporate action verbs in a substantial portion of their questions, exceeding 50%, based on the revised Bloom's Taxonomy.

Evaluations often guide students in focusing their learning efforts toward achieving the intended learning outcomes (ILOs). They serve as instruments for enhancing the transfer and retention of knowledge. Typically, learning outcomes that involve higher cognitive processes like comprehension, interpretation, and practical application are more likely to be retained for an extended period and are better suited for application in various contexts compared to outcomes centred solely on memorization.⁹ According to a study conducted by Kautilya et al., theory question papers are designed to assess students' knowledge and cognitive abilities. However, confining these questions solely to recall-type queries have a detrimental impact on the overall quality of the question paper. Fields like Forensic Medicine demand the application of knowledge rather than mere recall. Consequently, it is imperative to incorporate questions that evaluate higher-order cognitive skills to ensure the validity of the assessment.¹ In a study conducted by Rajalakshmi M et al., the content analysis of theory examination question papers yielded some noteworthy findings. They discovered that questions evaluating higher cognitive domains were present in a limited proportion, specifically 15% in PU, 3.75% in TN, and 2.5% in KR Universities. Additionally, their analysis revealed that most essay questions (72.5% in PU, 92.5% in TNMU, and 90% in KUHS) predominantly assessed the Level-1 of Bloom's taxonomical domain in postgraduate Community Medicine examinations across all the examined Universities (PU, TNMU, KUHS).⁽²⁾ In line with the results of the current study, previous research has similarly noted a prevalence of lower-order questions (Table 1) in comparison to higher-order ones. To create a fair and comprehensive postgraduate examination paper, it's essential to incorporate questions of varying difficulty levels and allocate marks according to a well-defined blueprint. This approach ensures that the assessment accommodates the diverse capabilities of students. Validity is a crucial attribute of effective assessments, and one of the primary threats to validity in medical education is the underrepresentation of constructs. According to the current study as well as previous studies, there is a consistent pattern of mark distribution towards the specific competencies in nearly all universities.⁹⁻¹³

Conclusion:

It is advisable to widely disseminate the design of question papers to all relevant parties at the commencement of the academic year. Therefore, it is recommended that national-level workshops be organized, bringing together competent and enthusiastic educators who can collectively establish a shared consensus on the design of Postgraduate Summative Assessment paper in Forensic Medicine & Toxicology. This collaborative effort will help maintain consistent standards across assessments. Furthermore, it is suggested that the implementation of blueprinting plays a crucial role in achieving a balanced distribution of weightage and questions across various topics. Integrating a blueprint into the assessment process is highly recommended, as it ensures fairness and consistency in evaluating different subject areas.

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