
ORIGINAL ARTICLE**A Delphi Consensus Study to identify most valuable assessment tools and to assess anatomy competencies in CBME curriculum***Pushpalatha K^{1*}, Manjunatha B², Meenakshi Swamy³**¹Department of Anatomy, ²Department of Forensic Medicine, JSS Medical College, JSS Academy of Higher Education Research, Mysore-570015 (Karnataka) India ³The Medical School, Framlington Place, Newcastle University, UK*

Abstract

Background: Over recent years, wide-ranging changes have occurred in undergraduate medical curricula with reduced hours allocated for teaching anatomy. Anatomy forms the foundation of clinical practice. However, the challenge of acquiring sufficient anatomical knowledge in undergraduate medical education for safe and competent clinical practice remains. Assessment is an essential component of the teaching and learning process and is more important than teaching methods. It is essential to assess anatomy competencies for competent clinical practice. A single tool is not sufficient to assess anatomy competencies, so multiple methods are employed to assess anatomy in Competency-based Medical Education (CBME). *Aim and Objectives:* The present study was undertaken to identify the most appropriate tools to assess anatomy competencies in CBME curriculum. *Material and Methods:* A modified Delphi technique with three rounds involving twenty renowned anatomists across the country was conducted. Anatomy assessment tools were generated from the opinions of this expert panel in the first round. The relevance of these tools was rated with a five-point Likert scale in the subsequent two rounds to generate consensus. *Results:* Response rates were 80% for the first round and 100% for the next two rounds. After three Delphi rounds, seven assessment tools were identified as the most valuable following iterations. *Conclusion:* The findings of this study provide anatomists with the current required essential tools for assessing anatomy competencies of higher-order cognitive domains and psychomotor domains for the CBME curriculum.

Keywords: Anatomy Assessment, Competency Based Medical Education, Delphi, Portfolio

Introduction

Anatomy forms the foundation of clinical practice. It is essential for clinical evaluation, radiological image interpretation, understanding pathology, and performing surgical procedures [1]. It is a foundation subject not only for medical graduates but for all healthcare professionals [2]. Anatomy course prepares future clinicians for managing the patients by identifying normal body structure [3]. Clinicians should understand the basic and clinical sciences to practice medicine. So that they not only have skill but also an

understanding of what they are doing [4].

Extensive changes have happened in undergraduate medical education in India [5] and anatomy teaching hours are reduced. Medical education has shifted towards competency-based and outcome-based education that needs integration of knowledge, skill, attitude, and communication. Converting these into observable and measurable competencies is very challenging [6]. However, acquiring sufficient anatomical knowledge for safe and competent clinical practice is still a

challenge. Competency-based Medical Education (CBME) provides a new challenge for faculty as they must be trained to be observers and assessing a student's progress is more challenging in CBME than traditional curriculum [7].

Assessment drives learning. It is an essential component of the teaching-learning process, and is more important than teaching methods. It is essential to assess anatomy competencies for competent clinical practice. Preparing and conducting the assessment is time-consuming as multiple tools are employed multiple times [8]. Anatomy is assessed by written as well as practical assessment methods. Written assessment tools assess the understanding of anatomy in a clinical context whereas practical assessment tools assess the ability of students to identify specimens concerning clinical significance [3].

Assessment of competencies in anatomy is very challenging, as the traditional assessment tools test only knowledge and to some extent skills. Any single assessment tool is not sufficient to assess anatomy competencies, so multiple methods are employed to assess anatomy in competency-based medical education. Traditional long essay tests only recall but in CBME we must assess the problem-solving skills. Spotters and specimen discussion assess only “knows how” level in Miller's pyramid, but we need to climb the ladder to “shows how” level. Assessment tools like scenario based questions, Objective Structured Practical Examination (OSPE), portfolios, rubrics and reflective writing skills will augment in assessing problem solving skills and to reach “shows how” level in Miller's pyramid.

Assessment methods should be standardized so as to differentiate the competent from the non-competent. A single assessment tool cannot assess

all the different competencies and CBME needs multiple tools at multiple times to achieve the desired outcome. Assessing cognitive domain objectives needs a different assessment tool than objectives from psychomotor domains. There is no standardized assessment tool to test competency and there is no assessment tool that will assess all the domains of learning [9]. The Delphi Technique is an approach to answering a research question through consensus among subject experts. It allows for reflection among participants and can reconsider their view based on the opinions of other experts. It uses multiple rounds of questionnaires to panel of experts to reach a consensus opinion. The present study was undertaken to identify the most appropriate assessment tools to assess anatomy competencies in the CBME curriculum through Delphi Consensus.

Material and Methods

Ethical approval was obtained from the Institutional Ethics Committee of JSS Medical College, Mysore (ESR/387/Inst/KA/2013/RR-19). The modified Delphi technique with three rounds involving twenty renowned anatomists across the country as Delphi panelists was conducted to identify the most relevant assessment tools to assess anatomy competencies. Twenty faculty with nine or more than nine years of experience across the country were selected as Delphi panelists. A survey was carried out in three rounds to ensure the panelists would finally reach a strong agreement on the assessment tools. Questionnaire was sent as google forms personally through mail and WhatsApp to all participants. Reminders were sent through WhatsApp messages and the link was kept active for 50 days so that we could get maximum responses. First question in the questionnaire was

participants consent and it was made mandatory to respond and they could quit the survey at any point. First round with six questionnaires to list the five most relevant assessment tools that could assess the anatomy competencies with their advantages & disadvantages were sent out to participants. The assessment tools obtained from first round was compiled and a second-round questionnaire was developed. In the second round, the participants were asked to rate the significance of each of the assessment tools, using a five-point Likert Scale (5=Very Important, 4=Important, 3=No idea, 2=Not important, 1=Useless), and to give an explanation to support their rating where applicable. The results of the second round were analyzed for frequency of responses. The third-

round questionnaire was prepared with responses from the second round, with the participants' scores. It provided the participants with an opportunity to change their answers and add an explanation if needed, since it was a consensus study.

Results

The first round of questionnaires was sent to twenty anatomists, and 16 responded (80% response rate). Sixteen assessment tools (Table 1) were obtained after the first round of the Delphi study and it was categorized into knowledge, skills and professionalism/communication skills assessment tools. In the second round, these 16 tools were sent to participants to rate the most important tool and the response was 100%.

Table 1: Assessment tools with >50% respondents marked as very important in 2nd round

Domains	Assessment tools	Respondents marked very important N (%)
Knowledge	Modified/ structured essay	8 (50)
	Case based essay	15 (93.75)
	Scenario based Multiple Choice Questions	12 (75)
	Short answers	8 (50)
	Viva-Voce	8 (50)
Skills	Spotters	9(56.25)
	Specimen discussion	11(68.75)
	Objective Structured Practical Examination	16 (100)
	Records	8 (50)
Affective	Reflective writing,	9(56.25)
	Portfolios	9(56.25)
	Rubrics	8 (50)

Responses were analyzed and the tool which had more than 50% of respondents marked as very important was considered and 12 tools emerged as most important. In the third round, these were sent to participants with their responses and given an opportunity to change their responses. There was 100% response rate in the third round too and seven assessment tools were finalized with the consensus of Delphi panelists. The assessment tools for which consensus was achieved after three rounds of questionnaires were Structured Essay questions, Scenario-based Essay questions, Scenario-based Multiple Choice Questions (MCQs), OSPE, Reflective writing, Portfolios, and Rubrics for assessing professionalism (Table 2).

Discussion

CBME necessitates a robust assessment system with different assessment tools to be implemented to achieve the desired outcome. Redesigning the assessment method is an important step in moving towards competency-based education [10].

Assessing the students' progress in anatomy essentially does not differ from assessing in other disciplines. Assessing anatomy must obey the same general parameters as objectivity, validity, and reliability.

If assessment is a measure, we need to know what it is measuring. Competency is one such measure and refers to the specific skill that has been taught and is now being measured. Measurement must be

Table 2: Assessment tools respondents marked as very important in 3rd round

Domains	Assessment tools	Respondents marked very Important N (%)
Knowledge	Modified/ structured essay	5 (31.25)
	Case based essay	15 (93.75)
	Scenario based MCQs'	13 (81.25)
	Short answers	2 (12.5)
	Viva-Voce	3 (18.75)
Skills	Spotters	7 (43.75)
	Specimen discussion	6 (37.5)
	Objective Structured Practical Examination	16 (100)
	Records	7 (43.75)
Affective	Reflective writing,	11(68.75)
	Portfolios	12 (75)
	Rubrics	10 (62.5)

judged against a certain standard or benchmark to be achieved. The development of competent medical personnel depends upon the knowledge and skills they acquire during their medical teaching. Any assessment whether formative or summative generally taken in a medical college education setting, has intense effects on learning [9].

Objectivity is the main concern when redesigning assessment methods. Assessment tools should be satisfactory, and they should be able to distinguish the real ability of students which reflects the understanding of the material or skill taught, and identify whether they are ready to proceed to the next stage of teaching or learning. There is much diversity concerning the assessment of anatomical knowledge, skills, and attitudes in medical courses and there needs to be agreement about the best strategies and methodologies to be pursued to ensure consistency, reliability, (clinical) validity, and standardization across the country/world. The four factors like relevance of the assessment, its content, enthusiastic teachers, and group dynamics can motivate students to learn. If the assessment is well framed it can not only be used to assess but also help in better retention of that knowledge or skill. The assessment tool is structured for deep learning of anatomy but if students do not dedicate themselves, they may not benefit, and the tool may not be as effective as it should be [11]. Complexity in cognitive assessment enhances deep learning rather than surface learning [12]. Assessment of anatomy practical should include higher order skills and integration with other disciplines but preparing a practical question is a very essential component of practical evaluation [3]. Spotters can be stationed in OSPE to assess structural and applied anatomy knowledge [13].

The assessment method should not only assess but also be able to endure the analysis of validity, and reliability, and at the same time it should discriminate the performance levels of the students [14]. Assessment and evaluation are key concepts and components of any educational activity. Sound knowledge of assessment tools is fundamental in a competency-based curriculum. Different levels of anatomy cannot be assessed by a single assessment tool. It can be assessed by essay, MCQs, practical, OSPE, spotters, viva, etc [9].

The most common type of questions used to test the higher cognitive domain is case-based essays [15]. Case-based and structured essay questions are useful in assessing higher-order cognitive domains like interpretation and application skills. Well-framed modified essay questions and scenario-based MCQs will assess the student's ability to approach in solving the case, reasoning than just recall [16]. Students' performance is higher with case-based questions and image-based questions [1]. OSPE is a reliable, effective, and useful assessment tool though it is taxing mentally and physically both for students and faculty [10].

A rubric is an important tool for communicating the expectations of assessment tasks from students and completing tasks against various performance levels. It also helps to assess a large number of students with consistency in scoring. One challenge of rubrics is that many times there is disconnect between what faculty specified grades and what students understand those criteria to be. A rubric assessment tool shows the achievement criteria across all the components of student work, from written to oral to visual. Rubric acts as a multipurpose scoring guide [17] and helps in assessing performance, facilitates communication, encourages critical thinking, and gives feedback.

Assessing using a rubric requires faculty to exercise it differently so that it is more transparent and meaningful for students [18].

The portfolio could be a single or a group assessment as a group of students is involved in the dissection of the cadaver. It can assess the different components like ethics, teamwork, and reflection. Arranging the evidence in a portfolio according to the competencies is helpful for both the learner and assessor [19]. The portfolio acts as an assessment for learning as well as an assessment of learning. It also helps to assess the areas that are difficult to assess by traditional methods like reflection, self-directed learning, and professionalism [20-21]. Though the face and content validity of the portfolio is high, its use should be no more than 10% of the maximum score as its reliability is low [9].

Reflective writing is an essential component of CBME which helps in deep and lifelong learning and achieving a higher level of professional practice [22]. It helps the graduates to review their thoughts and emotions, and its impact on their professional and personal development [23]. It helps to assess communication skills and improves the ability for critical analysis and problem-solving. Reflective writing skills can be assessed based on the depth of content [24-25]. Reflective writing can be achieved by integrating clinical subjects with anatomy. Use it as an assessment method by framing the questions with clinical cases where it tests the ability to analyze and problem-solving [25]. According to John Sandras, reflection is a metacognitive process that creates a greater understanding of self and situations to inform future action [26].

Any assessment tools should provide an understanding of the relationship between objectives

and outcomes and aligning outcomes and assessments is the basis for interpreting learning. Assessment in medical education should be based on observable performance indicators. Assessment with feedback throughout the medical education training will yield competent clinicians equipped for independent practice [27].

Limitations

Limitation of this study is number of participants; however, literature review suggests that number can be varying from nine to seventy. This study helps in arriving at the best assessment tools for anatomy in CBME but does not provide guidance regarding the process of implementing these tools.

Conclusion

Assessment drives learning. Anatomy assessment tools are no different from other assessments, they must be reliable and valid. Sound knowledge of assessment tools is fundamental in a competency-based curriculum. Different levels of anatomy cannot be assessed by a single assessment tool. It can be assessed by essay, MCQs, OSPE, and spotters. Assessment tools like rubrics, portfolios, and reflective writing help in deep and lifelong learning and achieve the higher level of professional practice. CBME necessitates continuous and frequent assessment, it should meet the minimum quality requirements. In CBME assessment, feedback plays a major role and helps students to self-reflect.

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