

Original Research Article

Are we assessing them right? A study on the content validity of undergraduate pathology question papers and role of blueprinting in assessment

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ABSTRACT

Background: Assessment forms a very essential and critical part of the learning process in medical education. Written examinations are widely used to test the knowledge component of learning. For a written examination to be valid, it should match the contents of the course and should provide proportional weightage to each of the content. A periodic evaluation of question papers to examine the weightage of each topic and the use of blue printing is necessary to ensure the validity of the written assessments.

Methods: The ten year question papers (2007-2016) of II MBBS summative written examinations in Pathology conducted by Rajasthan University of Health Sciences (RUHS) were analysed and the appropriateness of weightage given to content areas was examined in relation to the syllabus.

Results: The syllabus distribution in Paper 1 and Paper 2 was highly skewed with extreme concentration of topics in Paper 1 (due to clubbing of both general and systemic pathology) which led to under-representation of many topics despite their high Impact and Frequency. There was also evidence of paper setter's bias leading to disproportionate (over/under) representation of many topics. An ideal blueprint for paper 1 and 2 was prepared with appropriate syllabus distribution and allotment of marks as per weightage of each topic according to its impact and frequency score.

Conclusions: Frequent analysis should be carried out to provide feedback and to ensure that the assessments are aligned with the learning objectives. A blueprint is a vital component and helps us to plan written assessments in a rational and balanced manner.

Keywords: Assessment, Blueprinting, Weightage

INTRODUCTION

The term assessment refers to a systematic way of gaining information about student learning using a variety of methods and procedures. It involves the process of gathering, analysing and reflecting on evidence to make informed and consistent judgments about the extent of student learning.¹ Further, assessment serves to define the expected professional standards and

measure the level of proficiency of the students vis-s-vis the standards. Assessment answers the critical questions Have the goals and objectives of the curriculum been met? Has the desired competency level been reached?

Imparting correct education to students is a very critical part of a curriculum and assessing whether the students have imbibed what has been taught is equally important and both are two sides of a coin.² Assessment drives

education, this classic statement by George E. Miller encloses in a single phrase the central role of assessment in any form of education. Assessment, properly planned and implemented, has a powerful positive steering effect on learning and the curriculum. It conveys what we value as important and acts as the most convincing motivator of student learning.

No matter what/how much students are taught in classes, they concentrate and learn only topics which appear in exams and therefore due care should be taken while planning assessments to ensure that they are in alignment with the curriculum and also with the purpose and expected outcomes.^{3,4}

In medical education various methods are employed for assessment of different aspects of student learning. Written examinations are widely used to test the knowledge component of learning.^{2,6} Validity is the sine qua non of assessment, as without evidence of validity, assessments in medical education have little or no intrinsic meaning.⁷

For a written examination to be valid, it should match the contents of the course and should provide proportional weightage to each of the content and since students learn what is asked in the examination, it is important to ask the right questions.^{5,6,8,9} Hence, it is essential that a periodic evaluation of the question papers is done to study the extent to which the validity criteria are being fulfilled.

Aims and objectives

Primary objective: To examine the content validity and weightage given to different areas in the subject of pathology in II MBBS summative written examinations held by Rajasthan University of Health Sciences (RUHS) over the last 10 years.

Secondary objective: To prepare a blue print that can be used in the II MBBS summative written examination in the subject of pathology.

METHODS

The study was based on the analysis of pathology question papers of last 10 years. (2007-2016) used in the II MBBS summative examinations held by RUHS. The written assessment in pathology comprises of two question papers – Paper 1 and Paper 2, each being of 40 maximum marks. The topics of the papers were studied and the syllabus was organized accordingly into Paper 1 and Paper 2.

The main topics in each paper were further subdivided into subtopics. These subtopics were then allotted weightage according to their perceived Impact, Frequency and Clinical application for MBBS students.^{10,11}

Calculation of weightage of a topic based on impact and frequency

Impact/perceived importance on health (I) (Impact score)

- Non-Urgent/Non-serious with little prevention potential (1)
- Serious but not life threatening (2)
- Life threatening emergency (3)

Frequency of occurrence of the particular disease/ health problem (F) (Frequency score)

- Rarely seen (1)
- Relatively common (2)
- Very common (3)

Weightage score = Impact × Frequency

Weightage of a Topic (in %) = $\frac{\text{Weightage Score of a topic}}{\text{Total Weightage Score}} \times 100$

Allotment of weightage to a topic based on clinical application of the topic

Clinical application of the topic (Weightage)

- The topic has no or little clinical application (1)
- The topic has moderate clinical application (2)
- The topic has high clinical application (3)

The question papers were then analysed for the distribution of topics into paper- I and II (according to the syllabus distribution in the question papers studied). Further, the desired weightage of each topic (in %) was calculated and then compared with the actual percentage weightage (as per allocation of marks) to content areas over a period of 10 years. For the purpose of creating the blue print, the entire pathology syllabus was divided into paper I and II taking care to ensure proportional representation of the topics. Then marks were allocated to each topic, based on its Weightage. A table of specifications was then prepared and the number of items and the total weightage was first calculated and from this the individual weightage of that particular content area was calculated as $I \times F/T$.^{10,11} This was then multiplied with 50 (total marks in paper I/II) to arrive at the desired marks to be allotted to each topic.

RESULTS

The question papers (Both paper I and II) carried a maximum of 40 marks each and comprised of two Long Answer Questions (LAQ) of 10 marks each, implying that 50% of the total marks were devoted to mainly 2 topics while the rest of the topics had to be accommodated in the remaining 50%. This goes against one of the main principles of an assessment that it has to give appropriate/adequate representation to all the topics.

Further, the division of syllabus based on the analysis of the question papers was as shown in the Table 1.

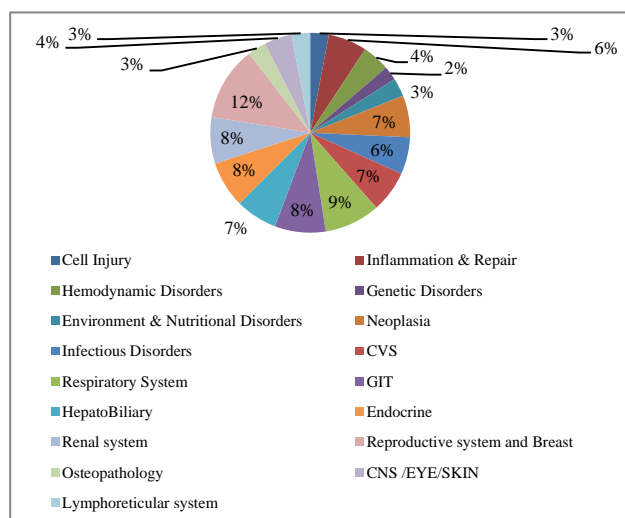


Figure 1: Desired weightage based on current observed syllabus distribution in paper 1.

It is obvious that the distribution of Syllabus in Paper 1 and Paper 2 was highly skewed with extreme concentration of topics in Paper 1 (due to clubbing of General and Systemic Pathology in the same paper) which invariably led to a relative under-representation of many topics despite their high Impact and frequency.

Table 1: Current observed division of syllabus based on the analysis of the question papers was as under.

Paper 1	Paper 2
General pathology	Hematology and blood transfusion medicine
Systemic pathology	Immunopathology
	Clinical pathology and cytology

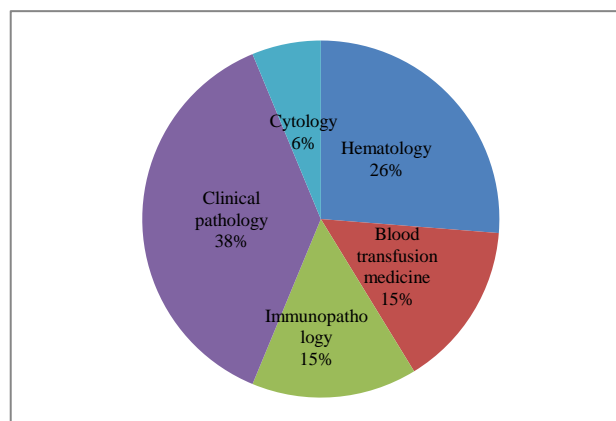


Figure 2: Desired weightage based on current observed syllabus distribution in paper 2.

This division is in total divergence from the syllabus distribution guidelines issued by RUHS at the time of inception (2006-07).¹²

Table 2: Comparison of desired weightage (in %) with actual weightage allotted in question papers over 10 years (paper 1).

Topic	Desired weightage (%)=I×F/T ×100	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
Cell injury	3	23.4	13.4	26.6	13.4	13.5	3.3	6.8	3.4	8.4	Nil
Inflammation & repair	6.25	3.3	13.4	6.8	6.6	20	6.8	23.4	10	12.5	20
Hemodynamic disorders	4.5	3.3	20	6.8	Nil	3.3	23.3	3.3	20	4.16	12.5
Genetic disorders	2.25	3.3	Nil	Nil	10	3.3	Nil	Nil	Nil	Nil	Nil
Environment & Nutritional disorders/diseases of infancy & childhood	3	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
Neoplasia	6.75	6.8	13.4	16.6	13.5	10	10	6.8	10	8.4	10
Infectious diseases	6	6.8	Nil	3.3	Nil	Nil	6.8	10	3.3	Nil	Nil
Cardiovascular system	6.75	3.3	3.3	16.6	20	6.6	16.6	20	16.8	Nil	4.16
Respiratory system	9	3.3	Nil	3.3	3.3	20	3.3	3.3	3.3	4.16	4.16
Salivary glands	3	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	4.16	Nil
GI system	5.25	3.3	20	3.3	3.3	3.3	N	3.3	6.8	4.16	4.16
Liver & biliary tract	6.75	16.6	Nil	Nil	20	Nil	3.3	6.6	3.3	16.6	20
Endocrine pathology	7.5	3.3	3.3	Nil	Nil	3.3	Nil	6.6	3.3	Nil	4.16
Renal & urinary tract pathology	7.5	3.3	3.3	3.3	3.3	6.8	3.3	Nil	3.3	4.16	8.38
Reproductive system	7.5	6.8	Nil	3.3	Nil	3.3	3.3	Nil	Nil	8.4	Nil
Breast	4.5	3.3	3.3	Nil	Nil	Nil	3.3	Nil	3.3	Nil	Nil
Osteopathology	3	3.3	Nil	3.3	Nil	3.3	N	Nil	3.3	4.16	4.16
Neuropathology /eye/skin	4.5	3.3	Nil	Nil	Nil	Nil	3.3	3.3	Nil	Nil	4.16
Lymphoreticular	3	Nil	Nil	Nil	Nil	3.3	6.8	Nil	3.3	4.14	Nil
Not specified in Syllabus		3.3	6.6	6.8	6.6	-	6.6	6.6	6.6	16.6	4.16

Further, the desired weightage as per the current observed syllabus distribution (in %) of each topic in both paper I & II was calculated and depicted in Figures 1 and 2. The

Weightage (in %) given to each topic/content over 10 years (Paper 1 and Paper 2) as compared to the desired weightage (in %) is tabulated in Tables 2 and 3.

Table 3: Comparison of desired weightage (in %) with actual weightage allotted in question papers over 10 years (paper 2).

TOPIC	Expected weightage (%)= (I×F/T×100)	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007
Hematology	26.25	35.5	47.5	37.5	42.5	45	35	28	38	32.5	34.5
Blood Transfusion Medicine	15	5	5	2.5	2.5	Nil	5	22	10	15	2.5
Immuno-pathology	15	2.5	Nil	Nil	Nil	Nil	Nil	7	5	5	2.5
Clinical pathology	37.5	57	47.5	52.5	45	52.5	35	20	40	32.5	40
Cytology	6.25	Nil	Nil	7.5	10	2.5	25	10	7	15	2.5
Not specified in Syllabus		-	-	-	-	-	-	13	-	-	18

Table 4: Recommended blueprint for theory paper-1 (General pathology, hematology - including transfusion medicine).

Content/System/Topic	Weightage I×F/T	Total marks	Long answer questions (LAQ) 06 Marks. (Answer any 2 out of 3)	Short answer questions (SAQ) 04 Marks. (Answer any 5 out of 6)	MCQ'S 0.5 Marks. (Attempt all)
Haematology Including Transfusion Medicine	0.209	11	1	1	2
Neoplasia	0.139	7	1	-	2
Inflammation & Repair	0.139	7	1	-	2
Cell Injury & Adaptations	0.093	4.5	-	1	1
Immunopathology	0.093	4.5	-	1	1
Haemodynamic Disorders	0.093	4.5	-	1	1
Infectious Diseases	0.093	4.5	-	1	1
Environmental & Nutritional Disorders/Diseases Of Infancy & Childhood	0.093	4.5	-	1	1
Genetics	0.046	2.5	-	-	5
Total Marks	-	50	18	24	8
Total No Of Questions	-	-	3	6	16

Table 5: Recommended blueprint for theory paper -2 (systemic pathology & clinical pathology).

Content/System/Topic	Weightage	Total marks	Long answer questions (LAQ) 06 Marks. (Answer any 2 out of 3)	Short answer questions (SAQ) 04 Marks Answer any 5 out of 6	MCQ'S 0.5 Marks. Attempt all
Clinical Pathology	0.176	8	1	-	4
Cardiovascular System	0.117	6	1	-	-
Hepato-Biliary System	0.117	6	1	-	-
Reproductive System & Breast Pathology	0.117	6	-	1	4
Respiratory System	0.078	4	-	1	-
GIT System	0.078	4	-	1	-
Renal & Urinary Tract Pathology	0.078	4	-	1	-
Endocrine System	0.078	4	-	1	-
Osteopathology	0.078	4	-	1	-
Neuropathology/Eye/ Skin	0.039	2	-	-	4
Lymphoreticular System	0.039	2	-	-	4
Total Marks	-	50	18	24	8
Total No Of Questions	-	-	3	6	16

It is clear from the above results that there is definite need to address the problem of non-uniform syllabus distribution between papers I and II and develop a blue print which can be used in setting up of a question paper. The suggested distribution of topics between Paper 1 and 2, along with the blue print and distribution of marks is given in Table 4 and 5.

DISCUSSION

Assessment and Evaluation are important components of teaching and learning. What is assessed and evaluated, how it is done and how results are communicated send a clear message to students about what is really valued, what is worth learning and how it should be learnt, what elements of study are most important and how well students are expected to learn.^{4,13} For the validity of any assessment it is important to have a proper coverage of the curriculum. The validity of the assessment is said to be the degree of accuracy with which it measures the aspect which is to be assessed.⁷ It is assumed that a physician should be assessed on practical skills only and that knowledge is of mere academic interest. However, knowledge is the best predictor of clinical competence and the most convenient means of checking it is a written assessment.⁸

The analysis revealed that the distribution of syllabus in Paper 1 & Paper 2 was highly skewed with extreme concentration of topics in Paper 1 (due to clubbing of General & Systemic Pathology in the same paper) which invariably led to a relative under-representation of many topics despite their high Impact and frequency. No clear demarcation was being followed in allotting certain topics between paper 1 and 2, especially with reference to Immunopathology, which at times was represented in Paper 1 (2016 to 2011) and at times in both papers (2010 to 2007). Questions on Systemic pathology were asked in paper 2 in 2010 (Respiratory system -2, CVS-1, Lymphoreticular -1) as against the observed trend of syllabus distribution.

Certain topics were consistently given more weightage over the others while some were not represented at all. For instance, in years 2015, 2014,2013,2010,2007, there were multiple questions asked from the same topic while 8-10 major organ systems including Respiratory, Hepatobiliary, Endocrine, Reproductive, Breast, Osteopathology, Neuropathology, Lymphoreticular were totally unrepresented.

There was an over representation of some General Pathology topics (as against expected weightage) most notably being Cell injury, 26.6% (2014), 23.4% (2016), 13.4% (2012-2015); Inflammation and repair, 23.4% (2010), 20% (2007, 2012), 13.4% (2015), 12.5% (2008.); Hemodynamic Disorders, 23.3% (2011) 20% (2015, 2009), 12.5% (2007) and Neoplasia-16.6% (2014),13.4% (2015, 2013). Certain important topics like Genetics and salivary gland tumours were not given due

recognition, with Genetics appearing in only 3/10 years. And salivary gland tumours in none of the years. Lymphoreticular, Breast pathology and Neuropathology were represented in only 4/10 years.

We also observed Paper setter's bias and affinity for some topics, for instance in 2007 in Paper 2, one LAQ and three SAQ each were from Nutritional anaemia and Tuberculosis (almost 60 % marks allotted to just 2 topics), even in subsequent years this phenomenon was observed, though to a lesser extent. Another peculiar trend seen (In both Paper 1 and 2) was that some topics were given high weightage in some years and totally left unrepresented in others -Blood transfusion medicine-22% in 2010 and Nil in 2012; CVS -20% in 2013,2010 and Nil in 2008; Hepatobiliary -20% in 2013,2007 and Nil in 2015,2014,2012 and GIT-20% in 2015 and Nil in 2011.

While setting a paper, consistent representation of all topics according to their weightage can be ensured by 'Blueprinting'. Blueprint is a map and a specification for an assessment which ensures that all aspects of the curriculum and educational domains are covered. In simple terms, blueprint links assessment to learning objectives.

The aim of blue printing is to reduce two major threats to the validity of an assessment – construct under-representation (under sampling of course contents) and construct irrelevance variance (inclusion of flawed items formats, too easy or too difficult questions or examiner's bias). A blue print specifies the content areas, topics, the domains of learning and the appropriate methods or tools of assessment. It serves as a reference framework for the question paper setter to prepare questions according to the accepted norms and guidelines.^{14,15}

It also indicates the marks carried by each question. It is useful to prepare a blueprint so that the faculty who sets question paper knows about the content distribution and how many marks it would carry.^{10,11} A proper blueprint is the first crucial step in developing a valid examination and must not be overlooked.

The current pattern of Question papers had LAQ of 10 marks and SAQ varying from 1.25 to 2.5 marks each. MCQ type questions were not included at all, leaving many topics under represented or not represented at all due to utilization of the allotted marks in a limited number of questions. Decreasing marks allotted to a LAQ (not more than 6 instead of 10 as of now) and including MCQ's would allow coverage of a wide array of topics in a limited marks set up as adequate coverage of the course content is necessary to ensure validity of assessment.

CONCLUSION

Frequent analysis of methods of teaching and assessment should be carried out to ensure that the assessments are aligned with the learning objectives. Table of

specifications and Blue printing are critical in harmonizing course objectives with assessment content and help in achieving academic excellence.

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