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Assessment Blueprinting: A Tool for Anatomy Question Paper Construction

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Abstract
Background: Theory examinations are widely used to assess learning in medical education. However, a lack of Standardization of assessment leads to incomplete assessment. Blueprinting of question papers can be a crucial tool for the maintenance of validity and uniformity of assessment. **Objective**: The objective of the present study was to develop an assessment blueprint for constructing question papers for the undergraduate anatomy curriculum. **Methodology**: The blueprint of the question paper for the anatomy curriculum was developed with the help of relative weightage assigned to each part or section of anatomy. The weightage of each part/region of anatomy was calculated with the help of hours allotted to that part for teaching and training purposes divided by the total hours assigned by NMC for the anatomy curriculum. The blueprint of the question paper was validated by experts. **Results**: The weightage of each part/section was calculated. Maximum weightage was given to 25.48% of the abdomen and pelvis followed by Head and Neck, 23.54%. The minimum weightage of 3.22% was given to general anatomy. **Conclusion**: An assessment blueprint can be a guiding tool for constructing a valid question paper with appropriate coverage of each subsection/part of the curriculum. It will solve the issue of over or underrepresentation of content.

Keywords
Bluprinting; Assessment; Anatomy; Curriculum

Introduction
The assessment system of our health care system is changing but not at a pace as required. On introspection, we can see that there are lots of lacunas in our assessment system. Assessment should reflect the level of learning required to be a competent healthcare professional. Usually in any education system, there are teachers, question Paper setters, and examiners/assessors and all of them have their own choices and biases. (1,2) In subjects like Anatomy where a total of 82 topics and 409 outcomes are recommended by the National Medical Commission complete representation of each subsection of anatomy is a challenge. (3) Usually, the assessment remains incomplete due to under or overrepresentation of content in the question paper. In an authentic assessment, the learning of the entire content needs to be

assessed. It requires lots of time and effort. Blueprinting of the question paper can solve this issue. Blueprint provides a map that helps in the development of a question paper that is based on the weightage of content. It ensures optimal coverage of the subject curriculum in question paper.(4)

Question papers are prepared as per instructions or guidelines provided by institutes. There are research articles on but studies on blueprinting of anatomy question paper preparation are very few. The present study was focused on developing a blueprint of question papers for the Department of Anatomy which is based on the weightage assigned to each part of anatomy.

Material & Methods

Mixed method educational study. Study Participants were faculties/facilitators of the Department of Anatomy of AIIMS Jodhpur. After the ethical approval study participants were sensitized about the blueprint of assessment. 5 group discussions about the blueprint of assessment of the anatomy curriculum were conducted to develop the blueprint of question paper for anatomy. NMC has allotted a total of 620 hours to the anatomy curriculum (Guidelines undergraduate Medical Education Regulation 2023 Dated the 12th June 2023).

The entire anatomy curriculum was subdivided into different parts like general anatomy, upper limb, head and neck, brain, thorax, abdomen, lower limb, embryology, and histology. Based on the number of core topics number of hours were assigned to each part.

Calculation of relative weightage for each part of the anatomy was done by dividing the hours allocated to that part by the total hours assigned to the anatomy curriculum. NMC has assigned 200 marks for the theory paper of the first professional examination so marks for each subsection out of 200 were calculated.(5)

A blueprint of marks distribution for Papers 1 & 2 of 100 marks each was prepared.

The blueprint of assessment was validated by 5 experts. Experts were asked to score each item based on its clarity and relevance and score them between 1-4. Score 4 mean item is appropriate, score 3 mean item is appropriate but needs minor correction, score 2 means the item needs major correction, and Score 1 mean item is inappropriate. Item-based Content validity index was calculated.(6)

Scores 4 and 3 were considered as 1& Score 2 and 1 was considered as 0

CVI-I = Sum of the total score given by experts/total number of experts

The content validity index(CVI) for each Item (part/section) was calculated and items with CVI ≥ 0.79 were included in the blueprint.

Ethical Approval – The study was approved by ethics committee vide no AIIMS/IEC/2022/4100

Results

Out of a total of 620 hours minimum hours of 20 were given to general anatomy and genetics and its relative weightage was 3.22% followed by 24 hours for General embryology & General histology at a weightage of 3.87% each. A maximum of 156 hours were allotted to gross anatomy, embryology & histology of the abdomen and pelvis, and out of 200 marks approximately 51 marks were given to that section. For gross anatomy, corresponding embryology & histology of the head & neck 148 hours were assigned, and a total of 47 marks were allotted to this part. Marks calculated for the thorax was 22.5. The upper limb and Lower limb were given 18 &19 marks respectively. Neuroanatomy with related embryology and histology was given 60 hours and 19 marks were allotted to this section of anatomy. (Table 1)

Table 1 Blueprint of different parts of the anatomy curriculum

SN	Topic	Number of Hours	Weightage (No. of hours/Total hours) percentage (%)	Marks assigned Out of 200
1.	General Anatomy, Genetics	20	3.22	6.44
2.	General Embryology,	24	3.87	7.74
3.	General Histology	24	3.87	7.74

SN	Topic	Number of Hours	Weightage (No. of hours/Total hours) percentage (%)	Marks assigned Out of 200
4.	Upper Limb	60	9.67	19.34
5.	Lower limb	58	9.35	18.7
6.	Thorax, Embryology, Histology	70	11.29	22.58
7.	Abdomen and Pelvis, Embryology, Histology	158	25.48	50.96
8.	Head and Neck, Embryology, Histology	146	23.54	47.08
9.	Brain, Embryology, Histology	60	9.67	19.34
	TOTAL	620	99.96 ≈ 100%	200

Two question paper blueprints of 100 marks were constructed. Paper 1 blueprint was prepared for assessment of General Anatomy, Genetics, General Histology, Upper Limb, Head and Neck, and Brain/neuroanatomy. (Table2)

Paper 2 blueprint was prepared for assessment of General Embryology, Thorax, Abdomen and pelvis, and Lower limb. (Table3)

The time, weightage, and marks assigned to each part/subsection were validated by experts. All items were included in blueprinting as their CVI-I was more than 0.79. (Table 4)

Table 2 shows a blueprint of Paper 1 for the anatomy professional examination

Topic	Number of Hours	Weightage (No. of hours/Total hours) percentage (%)	Marks assigned
General Anatomy, Genetics	20	3.22	6.44
General Histology	24	3.87	7.74
Upper Limb	60	9.67	19.34
Head and Neck, Embryology, Histology	146	23.54	47.08
Brain, Embryology, Histology	60	9.67	19.34
TOTAL	310	49.97 ≈ 50%	100

Table 3 shows a blueprint of Paper 2 for the anatomy professional examination

Topic	Number of Hours	Weightage (No. of hours/Total hours) percentage (%)	Marks assigned
General Embryology	24	3.87	7.74
Lower limb	58	9.35	18.70
Thorax, Embryology, Histology	70	11.29	22.58
Abdomen and Pelvis, Embryology, Histology	158	25.48	50.96
TOTAL	310	49.99≈ 50%	99.98≈ 100

Table 4 shows item based content validity index for each item (Part/section of anatomy)

Item No.	E1	E2	E3	E4	E5	I-CVI
1	4	2	3	3	4	5/6=0.83
2	4	3	2	4	4	5/6=0.83
3	4	3	2	4	4	5/6= 0.83
4	3	3	3	4	4	6/6= 1
5	3	3	3	4	4	6/6=1
6	4	4	3	3	3	6/6= 1
7	3	4	3	3	4	6/6= 1
8	3	4	4	4	3	6/6= 1

Discussion

An assessment blueprint can provide a framework for question paper setting. It provides a tool that ensures consistency &clarity. Marks assigned to that part provide an idea about of number and types of questions required (Long answer, short answer, MCQ, etc.). (6,7)

The present study observed that hours assigned to a particular part/section can help in the calculation of the weightage of that region or part of the anatomy. From the weightage assigned to that subsection marks to be allotted to that part can be calculated. For example, if 70 hours were given to gross anatomy, embryology and histology of the thorax region then its weightage would be 11.29% (70/620x100), and marks allotted to the thorax in 200 marks examination should be approximately 22.5.

National Board of Medical Examiners, in their document Test Blueprinting II: Creating a Test Blueprint has given this simplified method to prepare a broad blueprint guideline for any test.(4) Like in the present study marks based on the weightage of each part/section of anatomy were calculated by the total hours assigned to that part.

Weightage for each topic of every subsection can be calculated by anatomical importance and clinical relevance and the type and number of questions for that topic can be assigned as per that weightage. Blueprint of assessment will help faculties in planning teaching-learning sessions. It will also help students understand the relevance of content for the exams and plan their study accordingly. (8)

The blueprint of assessment helps in the Constructive alignment of three pillars of education learning objectives, learning activities, and assessment.(9) Bridge et al. conducted a study of assessment tool development methods in 144 medical schools and reported that test blueprinting is crucial for content-valid assessments.(10)

A study conducted by Hussein Abdellatif developed a test blueprint that developed with the help of total course credit hours. On analysis, they found that this method of blueprinting is equally valid and feasible as other methods of blueprinting.(11)

The present study developed an assessment blueprint for Papers 1& 2 of the anatomy undergraduate examination. This blueprint ensures even distribution of course content based on hours allotted (310 hours) and a relative weightage of 50% in each question paper. Although most universities have the same subdivision of course content it is not structured and marks distribution is variable. Marks calculated in the present study can help in assigning the number of questions for each part. If fewer marks are allotted and multiple topics need to be assessed then a Clinical vignette-based MCQ can be used.

Conclusion

Blueprinting of assessment can help in constructing an authentic and fair question paper. The use of hours in the calculation of weightage provides a simple, feasible, and reliable method for creating an assessment blueprint.

Authors Contribution

All authors have contributed equally.

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Conflict of Interest

There are no conflicts of interest.

Declaration Of Generative AI And AI Assisted Technologies In The Writing Process

The authors haven't used any generative AI/AI assisted technologies in the writing process.

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