Blueprinting in Assessment in Medical Education: A crawling concept in Nepal

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Abstract

Test blueprints are fundamental tools for assessment in medical education that guarantee curriculum alignment with teaching learning methodologies. The goal of this review is to highlight the utilities, types, components and construct of blueprints in medical education. Three main application of blueprints are to facilitate the construction of standardized assessments, provide instructional frameworks for curriculum design, and give learners competency guidelines. By providing thorough subject coverage and coordinating evaluation with learning goals, they guard against validity threats like content and construct under-representation. Commonly used three blueprint categories in medical education are program-level (comprehensive content-by-process matrices), process-oriented (skills and cognitive frameworks using Bloom's taxonomy or Miller's pyramid), and content-oriented (subject-based organization). Weightage are determined through impact-frequency scoring, classifying content as "must know", "should know", and "nice to know". There are five main steps involved in developing a blueprint. Blueprints are necessary for accurate, trustworthy medical education tests that successfully match assessment tools with curriculum goals.

Keywords: Assessment, blueprint, curriculum, medical education, specification grid

Background

There are often complaints from medical students about examination regarding the content and construct of questions in written exams and those asked by the examiners during practical and oral examination. Regarding the theory papers, the complaints include the length of the written papers, under representation of contents, unusual questions out of syllabus and vague questions confusing the students what to write and what not to.[1-3] Similarly, regarding the practical and oral examinations, students complain about rare cases for long and short cases, very subjective question in oral exams, difficult patient during exams, inadequate time and under representation of the contents.[2-5] This occurs because in the conventional assessment, a single teacher/examiner prepares the question paper while practical examinations are conducted by other teachers, including external faculty, often without much coordination among them.[2,5] Frequently, the determination of what to evaluate is entrusted to the examiners' judgment based on what she/he believes is relevant or significant. Students feel bewildered due to their lack of understanding what is truly anticipated

from them, leading to their struggles in exams. Blueprinting in assessment can largely address these problems, if not entirely, thereby enhancing the validity of the assessment.[7] Overall, both the 'informal curriculum' ('pet' topics, or different examination or procedure methods) and the 'hidden curriculum' (poorly modeled professionalism) are minimized by the application of blueprinting for the assessment.[6,7] This review focuses on the importance and the process of blueprinting in assessment in medical education.

What is blueprint?

The word "blueprint" comes from cyanotype, a photographic printing method created in 1842 by Sir John Herschel, which got their unique name from the procedure that created white lines on a blue background.[7,8] Blueprint as used in medical education, is a map and a specification for an assessment program that ensures that all aspects of the curriculum and educational domains are covered by assessment programs over a specified period of time.[6,7,9] It is also known as test blueprint or test plan or table of specifications or test specification or a grid, which allows examiners to generate content-valid exams by linking the required subject content and competencies to the items appearing on the test.[7] A blueprint outlines a structured multi-step method for an evaluation, specifying the objective (e.g. formative/summative and written/practical) and extent (e.g. for undergraduate or postgraduate learners) of the exam to establish the content and assessment approach.[10] An assessment blueprint is crucial for improving the validity of evaluations and ensuring constructive alignment, especially for high-stake tests.[7] The three components of education include intended learning outcomes, teaching and learning activities, and assessment tasks – this is known as constructive alignment. The alignment among these three pillars of education can be supported by a framework.[11,12] Effective assessment can occur only when the three components (course material, skills to be evaluated & assessment methods) reach the 'optimal alignment'. Hence, blueprint is an assurance of constructive alignment in medical education (Figure 1).[7, 10-12]

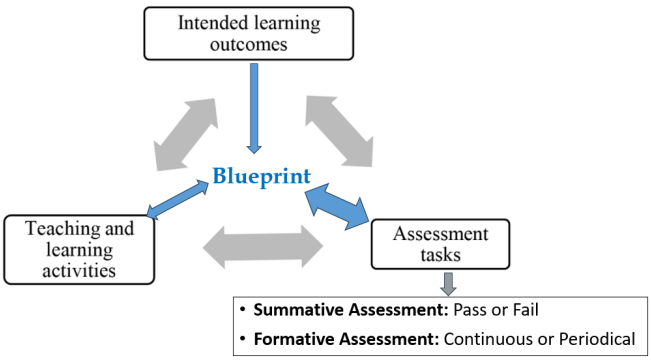


Figure 1: Blueprint in center of constructive alignment

What are the utilities of blueprint?

Blueprint has primarily three functions.[7-9] Firstly, it provides an instructor/teacher with a framework of key disciplines to be incorporated into instruction, serving as the foundation for a syllabus. Secondly, it offers a framework of essential understanding and abilities for learners who are getting ready for the test and striving for certification. And lastly, it permits the assessment to be developed in a uniform manner.[6,13] Test blueprints elucidate the relationships among planning, teaching, and evaluation, which can encourage faculty introspection.

Blueprint connects evaluation to learning goals straightforwardly helping a test creator to identify which question assesses which objective and content unit and the marks allocated to each of them.[14,15] The blueprint translates the design into practical terms, clarifying all aspects of a question (i.e., its goal, its structure, the subject area it addresses, and the points assigned to it) for the test creator. It can be a straightforward content matrix, but it can also incorporate additional details, such as evaluation and testing techniques. By documenting the knowledge and skills addressed by each assessment, test blueprints also serve as tools to facilitate sound curriculum design. The purpose of blueprint is to guarantee that evaluations align with objectives and goals of curriculum, to focus on significant behavioral learning outcomes, and to offer a teaching-learning method that outlines what students need to understand and demonstrate in every assessment.[12,16]

Furthermore, blueprint helps to avoid the common threat of validity like content and construct under-representation.[6,7,17,18] A test that does not sufficiently cover all of the pertinent content areas of a subject is said to be content under representative. Construct under-representation, on the other side, is when a test doesn't capture all the crucial characteristics of the construct it's designed to measure, even if the content is covered. Beyond guaranteeing test validity, test blueprints have other useful applications.[14] They can serve as study aids and convey instructor expectations to students; research backs up the practice of sharing blueprints with students.[15-17] The blueprints' subject categories and competency domains offer a structure for providing students with insightful feedback and aid in the creation of relevant assessment resources, such as scoring rubrics for workplace assessments and simulations.[18-21] They also help clarify the relationships between curriculum planning, instruction, and assessment, potentially prompting valuable faculty self-reflection on their teaching practices.

What are the types of blueprints in medical education?

There are different ways to categorize blueprint in medical education based on the specific context and assessment goals.[6-8]

Content-oriented blueprints: Content-oriented blueprint outline assessments based on the topics or subject matter addressed, typically dividing the test material based on conventional academic fields and the relative weight or proportion of questions dedicated to each (Table 1).[7]

Table 1: Academic subjects for MBBS (based on MBBS Curriculum of Tribhuvan University-Institute of Medicine)[22]

Integrated basic medical science subjects	Community Medicine	Organ System	Clinical subjects
Anatomy	Epidemiology	General concepts	Internal medicine
Physiology	Biostatistics	Musculo-skeletal system	Dermatology, venerology and leprology
Biochemistry	Demography	Neurosensory system (including special senses)	Psychiatry and mental health
Clinical Microbiology	Health promotion and education	Respiratory system	Radiology
Pathology	Medical sociology and anthropology	Cardiovascular system and hematopoietic system	General surgery
Pharmacology	Environment and occupational health	Gastrointestinal system and hepatobiliary system	Anesthesiology
	Family health	Renal and electrolyte system	Dentistry
	Applied epidemiology	Reproductive, endocrine and metabolic system	Pediatrics
	Health service management		Gynecology and obstetrics
			Ophthalmology
			Ear, nose, throat, head and neck surgery
			Orthopedics and traumatology
			Emergency medicine and family practice
			Forensic Medicine

* Curriculum also includes other core subjects like Medical Ethics and Communication skill.

Process-oriented blueprints: Test blueprints focus on processes outlining the procedural skills that students should show. The most commonly used process-oriented test blueprints incorporate skills from the cognitive domain of Bloom's taxonomy (Figure 2).[23,24] A teacher could utilize Bloom's taxonomy to show that 40% of a test focuses on understanding; 40% emphasizes applying knowledge to address clinical issues; and 20% pertains to analyzing an experiment.[24] Miller's pyramid (Figure 3) can similarly be applied to determine that, for instance, 70% of a statistics exam will consist of tasks at the knows and knows how levels, whereas 30% will necessitate students to demonstrate how.[25,26] Process-oriented frameworks are especially beneficial for clinical education, focusing on procedural abilities and the emotional aspect. Two process models particularly important for medical education are the Canadian Medical Education Directives for Specialists (CanMEDS) framework and the Accreditation Council for Graduate Medical Education (ACGME) competencies; various components of these frameworks can be helpful in creating assessments for the classroom.[27,28]

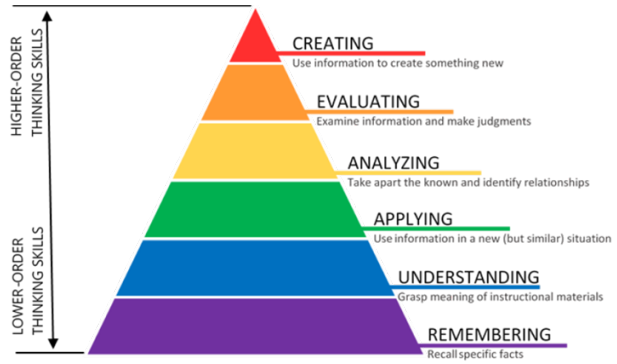
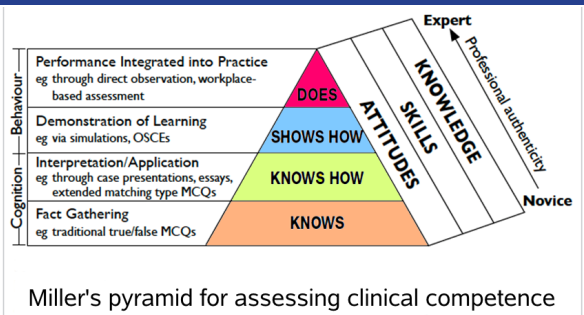


Figure 2: Bloom's Taxonomy- Cognitive domain[24]



Miller's pyramid for assessing clinical competence

Figure 3: Millers pyarmid[25]

Program-level blueprint: The specialized type of blueprint encompass both content and process oriented blueprint and act as a guide for aligning assessments across multiple courses or years of the medical program.[6, 27-29] Overall, program-level blueprint ensures the quality and effectiveness of medical education programs. This program-level blue print combines two aspects into one structure known as the content-by-process matrix. A content-by-process matrix aligns well with the curriculum design.

What are the components of blueprint in medical education?

The key components of blueprint in medical educations are mainly divided into curriculum-driven goals, learning outcomes, content (topics, domains, weighting) and assessment methods (Box 1).[6,7,10,14,17]

Box 1: Components of blueprint

Curricular directions
- i. Title
- ii. Purpose
- iii. Scope (for which semester or phase of study and academic session)
- iv. Examination guideline (which course, what assessment tools and how many questions)

Learning outcome
- v. SMART behavioral objective (s) for the clinical presentations or topics listed based on curricular setting

Content domain
- vi. Topics and subtopics or chapters
- vii. Weightage: Impact, frequency, weightage % (based on selected criteria)
- viii. Types of questions based on educational domain either from curriculum or blooms taxonomy or Millers pyramid or all
- ix. Marks allocation

Assessment
- x. Assessment tools
- xi. Number of questions
- xii. Identification of question setters
- xiii. Remarks

How to construct a blueprint in medical education?

Constructing a blueprint requires framework from the well-designed curricula and the detail syllabus. While constructing a blueprint for assessment, the principle: all that is expected cannot be taught and all that is taught cannot be assessed should be kept in mind. There are several tips and steps of developing a blueprint.[6, 7, 30-34]

1. **Specify the purpose, scope and curricular guidelines:** The blueprint's parameters should be clearly defined by establishing its purpose, scope and specific guidelines mentioned in the curriculum.It is necessary to select the academic session, the intended semester or study period, and the specific courses that are the focus of the evaluation for which the blueprint is being created. The total number of questions and the assessment instruments need to be identified. This fundamental stage guarantees conformity with educational goals and offers a structure for further planning.[6,7]
2. **Tabulate curriculum content:** Using the specified curriculum setting as a guide, all the topics or chapters or units along with learning objectives are systematically listed. Learning objective must be specific, measurable, achievable, relevant and time-bound (SMART). A thorough inventory should be created that guarantees wide coverage of the curriculum and acts as the basis for developing questions.[6,7,11,17,34]
3. **Determine weightage:** Components of the curriculum need to be assessed to find out how it affects students' learning and how often it appears in exercises or tests. The relative importance and prevalence of topics are determined using predefined criteria. Criteria should be based on evidence as far as practicable. Weightage can be decided on the basis of two parameters[6,33]
    - i. The perceived impact (I)/importance of a topic: For basic science or pre-clinical subjects, impact of topic is judged according to its importance in clinical years or applied phase. For clinical subjects, it is judged on the seriousness or urgency or prevention potential.
    - i. The frequency (F): For basic science or pre-clincial subjects, it is categorized based on the application of topic in clinical phase and for clinical science, frequency is the occurrence of a particular disease or health problem.

Every topic/subtopics or clinical competency needs to be scored between 1 and 3, 1 being minimum and 3 being maximum (Table 2). The ratio of the product (IxF) to the total IF is called "weightage". As a result, it is possible to determine the weights of each unit/chapter/topic/competency in an assessment.

Table 2: Criteria for scoring[3,5,6,7,9,13,30,34]

Possible score	Importance/Impact (I)	Frequency (F)	Product (I x F)	Weightage % (W)
For basic science or pre-clinical subjects				
1	Less important for clinical implication;	Rarely applied in clinical phase	1	(1/14)*100 = 7
2	Important for clinical implication	Commonly applied in clinical phase	4	(4/14)*100 = 29
3	Very important for clinical implication	Frequently applied in clinical phase	9	(9/14)*100 = 64
Total (I x F)			14	
For clinical science or clinical competency				
1	Non-urgent, little prevention potential; less important for medical officer	Rarely seen; Rarely applied in clinical practices	1	(1/14)*100 = 7
2	Serious, but not immediately life-threatening; important for medical officers	Relatively common in clinical practices	4	(4/14)*100 = 29
3	Life-threatening emergency and/or high potential for prevention impact; very important for medical officers	Frequently applied in clinical practices	9	(9/14)*100 = 64
Total (I x F)			14	

Assigning weightage is a challenging process which has elements of subjectivity, so consensus opinion is required within the specialty, across the specialty and from past learners. For example, consensus opinion of experts in the subject and other disciplines (like surgical faculty can be involved in deciding the weightage to anatomy) before allocating the weightage of anatomy assessment.[34, 35]

Use relative weighting to sort curricular content: The higher the weightage calculated, the more important is the curricular content. The course material an be sorted out into three different knowledge categories: "must know" (vital core knowledge), "should know" (important supplemental knowledge) and "nice to know" (extra useful knowledge). If the number of questions is less than the curricular content items and contents are of knowledge domain, it is better to follow must know, should know and nice to know with 60%, 30% and 10% load respectively.[6, 34-37] The score of product I x F is used to categorize must know, should know (desirable to know) and nice to know (good to know) (Table 3).

Table 3: Criteria for categorization of content[6,7,10,20,34,36,37]

I X F	Category	Percentage of weightage in assessment
6 or 9	Must Know	60%
3 or 4	Should Know	30%
1or 2	Nice to Know	10%

The hierarchical significance of clinical subject areas can be reflected either with the educational domains of Bloom's taxonomy (Cognitive domain: Remembering, Understanding, Applying, Analyzing, Evaluating, Creating) or Miller's pyramid (Knows vs Knows How vs Shows How vs Does), which also directs the distribution of assessment tools.[24, 26] Considering the knowledge and skills to evaluate, suitable assessment method(s) or tools should be determined. Then the weightage can be used to independently determine marks for different assessmet tools after calculating the marks based on the weightage of the topic or chapter. One of the crucial practical factor is time limit on testing. Practically speaking, using content weights or category weights to allocate time and space to different assessment purposes is crucial. The weights in written assessments correspond to the number or proportion of test items in each category which must be achievable in the given the length of testing.[36,37]

Choose the question type and numbers for every category: After determining the weightage of chapter/competency, there must be consensus on types and number of questions to be constructed for each category of curricular content. The predetermined percentages are translated into precise question's marks for identified curriculum content group. The number of questions are then determined from each educational domain level to fulfil the assessment's overall requirements. This step guarantees balanced coverage across all subject areas and gives specific goals for question development. The number of assessment tools (e.g. multiple-choice questions, true-false questions, oral exam, short and long essay questions, objective structured practical examination, objective structured clinical examination, extended matching questions, problem solving questions, mini clinical evaluation exercise, direct observation of procedural skills, etc.) that students can finish within the given time are assessed.[6,7,39,40] Weight (marks) to each primary category or domain are assigned in the test blueprint based on its overall significance and adequate number of assessment tasks are confirmed to back up the assertions intended to present and justify the intended conclusions.[6,7,31]

Number of question items cannot be equally distributed based on the list of curricular content. Increasing the number of test items is one way to improve the test's dependability. It is evident from various studies that minimum of 30-items should be asked for good reliability but to achieve a test reliability of 0.8, 50-60 items are required. The items beyond 100 provided no additional benefit in terms of reliability and feasibility must be considered.[31,33,34-37] Weightage of chapter/competency can determine the maximum number of marks that can be assigned to a specific chapter or competency during formative assessment like class test, system completion tests or internal assessments. During summative assessment tests, such as semester or university exams, chapter/competency weightage can guide the allocation of marks to each chapter/competency. Then, correspondingly, questions can be selected.[37,39] For example, in 50 marks paper, theory or subjective questions carry 40 marks and objective questions (MCQs) carry 10 marks, then the number of questions must be constructed on the provided marks and time-limit (Table 4). Practically, the question setters should be those who teach the topics, who are acquainted with the curriculum, teaching-learning methodologies and assessment tools.

Table 4: Example of blueprint for genera pharmacology for MBBS (Phase I Year 1)

Blueprint: Table of Specifications											
Purpose	**Block completion exam**										
Scope	**MBBS 1st Year, First Block, General Pharmacology**										
Guideline	**Full marks 50: 2 LAQs (10 marks each), 5 SAQs (4 marks each), 20 MCQs (0.5 mark each)**										
Content	**Topic**	**I**	**F**	**I*F**	**Weightage (%)**	**Marks allocation**	**Domain and sub-domains**	**Tools with marks allocation**	**No. of Qs**	**Total marks**	**Remarks**
General Pharmacology	Pharmacokinetics	2	2	4	17	8.5	Knows Knows how	MCQs (0.5) SAQs (4)	1 2	0.5 8	
	Pharmacodynamics	2	3	6	25	12.5	Knows Knows how	MCQs (0.5) LAQ (10)	5 1	2.5 10	
Antimicrobials	Cell wall synthesis inhibitors	2	3	6	25	12.5	Knows Knows how	MCQs (0.5) SAQs (4)	9 2	4.5 8	
	Protein synthesis inhibitors	2	3	6	25	12.5	Knows Knows how	MCQs (0.5) LAQ (10)	5 1	2.5 10	
	Others	1	2	2	8	4	Knows Knows how	SAQs (4)	1	4	
				24						50	
Question setters	1. Associate Professor Dr XYZ of Pharmacology 2. Associate Professor Dr ABC of Pharmacology										
Question Moderator	Professor Dr RST of Pharmacology										

LAQ=Long answer question, SAQ=Short answer question, MCQ=Multiple choice question

Impact (I)

1 Less important for Phase 2

2 Important for Phase 2

3 Very important for Phase 2

Frequency (F)

1 Rarely applied in Phase 2

2 Commonly applied in Phase 2

3 Frequently applied in Phase 2

What to do after preparing blueprint in medical education?

Questions setters for every subject area must be ascertained.. Faculty members should be assigned the task of preparing questions according to their areas of expertise and teaching duties.[6,7,37,39,40] To ensure that the assessment is completely transparent, the marking scheme should be unambiguous. Blueprint should be provided to the learners/students which aids them in building comprehension of the material by offering a structure or mental mode for mind mapping of the content, organizing their study approach, and identifying the topics of greatest importance for assessments. Essentially, a blueprint serves as a template for students, question paper setters, and evaluators.[38-41]

Conclusion

Blueprint is a tool for converting learning goals into assessment approaches, that outlines what will be evaluated based on categories like specific tasks, curriculum elements, and assessment tools. In addition blueprinting is a standard technique for aligning objectives with assessment. Moderation of any assessment should include the blueprint as a crucial component. Making the test blueprint and providing it to the students before the test or exam is beneficial.

References

1. Gautam N, Dhungana R, Gyawali S, Dhakal S, Pradhan PM. Perception of medical students regarding TU-IOM MBBS curriculum and teaching learning methods in Nepal. Kathmandu University Medical Journal. 2022 Jun 30;20(2):219-24. DOI: 10.3126/kumj.v20i2.51404
2. Mathur M, Verma A, Mathur N, Kumar D, Meena JK, Nayak S, Gaiki V, Parmar P. Blueprint designing and validation for competency-based curriculum for theory assessment in community medicine. Med J Armed Forces India. 2023 Dec;79(Suppl 1):S47-S53. DOI: 10.1016/j.mjafi.2021.10.003 PMID: 38144616 PMCID: PMC10746729
3. Patil SY, Gosavi M, Bannur HB, Ratnakar A. Blueprinting in assessment: A tool to increase the validity of undergraduate written examinations in pathology. International Journal of Applied and Basic Medical Research. 2015 Aug 1;5(Suppl 1):S76-9. DOI: 10.4103/2229-516X.162286 PMID: 26380218 PMCID: PMC4552073
4. Patke V, Dahake H, Kuyare S. Evaluation of quality of MBBS biochemistry theory question papers of medical institutions in Maharashtra. Int J Res Med Sci. 2017 Oct;5(10):4336-. DOI Article DOI: 10.18203/2320-6012.ijrms20174114
5. Goyal SK, Kumar N, Badyal D, Kainth A, Singh T. Preparation of blueprint for clinical assessment of undergraduate medical students in psychiatry. Journal of Research in Medical Education & Ethics. 2017;7(3):205-8. DOI: 10.5958/2231-6728.2017.00034.8,
6. Ismail MA, Pa MN, Mohammad JA, Yusoff MS. Seven steps to construct an assessment blueprint: a practical guide. RESOURCE. 2020 Mar 1;12(1). DOI: 10.21315/eimj2020.12.1.8,
7. Raymond MR, Grande JP. A practical guide to test blueprinting. Medical teacher. 2019 Aug 3;41(8):854-61. DOI: 10.1080/0142159X.2019.1595556 PMID: 31017518
8. Carpo M. The Photograph and the Blueprint. Notes on the end of some indices. InDas Auge der Architektur 2011 Jan 1 (pp. 467-480). Brill Fink. DOI: 10.30965/9783846750810_017
9. Fazio SB, Demasi M, Farren E, Frankl S, Gottlieb B, Hoy J, Johnson A, Kasper J, Lee P, McCarthy C, Miller K. Blueprint for an undergraduate primary care curriculum. Academic Medicine. 2016 Dec 1;91(12):1628-37. DOI: 10.1097/ACM.0000000000001302 PMID: 27415445
10. Shappell E, Carter K, Park YS, Gottlieb M. Educator's blueprint: Holistic applicant file review in undergraduate and postgraduate medical education. AEM Educ Train. 2023 Sep 15;7(5):e10904. DOI: 10.1002/aet2.10904 PMID: 37720308 PMCID: PMC10502667
11. Gilic F, Dalgarno N, Simpson MT. Applying constructive alignment and cognitive load in teaching: case study involving a foundational family medicine medical school course. Canadian Family Physician. 2022 Apr;68(4):308. DOI: 10.46747/cfp.6804308 PMID: 35418398 PMCID: PMC9007130
12. Kandlbinder P. Constructive alignment in university teaching. HERDSA News. 2014 Dec;36(3):5-6. Article
13. Kaur M, Kurmi N, Chauhan S, Singhal A, Sharma S, Chaudhary S. Blueprinting for assessment in undergraduate medical physiology curriculum. Indian Journal of Physiology and Pharmacology. 2021 Jun 2;65(1):60-5. DOI: 10.25259/IJPP_183_2020
14. Abdellatif H, Alsemeh AE, Khamis T, Boulassel MR. Exam blueprinting as a tool to overcome principal validity threats: A scoping review. Educacion Medica. 2024 May 1;25(3):100906. DOI: 10.1016/j.edumed.2024.100906
15. Ferris H, O'Flynn D. Assessment in Medical Education; What Are We Trying to Achieve?. International Journal of Higher Education. 2015;4(2):139-44. DOI: 10.5430/ijhe.v4n2p139
16. Banu S, Chacko TV. Blueprinting: a framework for health education programme evaluation. Medical Education. 2011 May;45(5):533-. DOI: 10.1111/j.1365-2923.2011.03966.x PMID: 21486358
17. Boulet JR, Durning SJ. What we measure and what we should measure in medical education. Medical Education. 2019 Jan;53(1):86-94. DOI: 10.1111/medu.13652 PMID: 30216508

18. Gottlieb M, Caretta-Weyer H, Chan TM, Humphrey-Murto S. Educator's blueprint: A primer on consensus methods in medical education research. AEM Educ Train. 2023 Jul 11;7(4):e10891. DOI: 10.1002/aet2.10891
PMID: 37448627 PMCID: PMC10336022

19. Edwards LM, Kim Y, Stevenson M, Johnson T, Sharp N, Reisman A, Srinivasan M. When it's needed most: a blueprint for resident creative writing workshops during inpatient rotations. BMC Medical Education. 2021 Oct 20;21(1):535. DOI: 10.1186/s12909-021-02935-x
PMID: 34670565 PMCID: PMC8529814

20. Edwards S, Swamy L, Cosimini M, Watsjold B, Chan TM. Educator's blueprint: A how-to guide for creating analog serious games for learning in medical education. AEM Educ Train. 2023 Nov 29;7(6):e10907. DOI: 10.1002/aet2.10907
PMID: 38046091 PMCID: PMC10685402

21. Lockyer J, Carraccio C, Chan MK, Hart D, Smee S, Touchie C, Holmboe ES, Frank JR, ICBME Collaborators. Core principles of assessment in competency-based medical education. Medical teacher. 2017 Jun 3;39(6):609-16. DOI: 10.1080/0142159X.2017.1315082
PMID: 28598746

22. Tribhuvan University (TU) Institute of Medicine (IOM) Curriculum for MBBS [Internet]. Medium. Digital Medicine; 2011 [cited 2025 Jul 22]. Available from: https://digitalmedicine.com.np/tribhuvan-university-tu-curriculum-for-mbbs-cc70dae71f3?gi=1c5c9cbdc149

23. Furst EJ. Bloom's taxonomy of educational objectives for the cognitive domain: Philosophical and educational issues. Review of educational research. 1981 Dec;51(4):441-53. DOI: 10.3102/00346543051004441

24. Pla RA, Cohen IT. Bloom's taxonomy. Professional, Ethical, Legal, and Educational Lessons in Medicine: A Problem-Based Learning Approach. 2024;274. DOI: 10.1093/med/9780197655979.003.0047

25. Design and teach a course: The Miller model [Internet]. lo.unisa.edu.au. Available from: https://lo.unisa.edu.au/mod/book/view.php?id=611025&chapterid=105881

26. Witheridge A, Ferns G, Scott-Smith W. Revisiting Miller's pyramid in medical education: the gap between traditional assessment and diagnostic reasoning. International Journal of Medical Education. 2019 Oct 25;10:191. DOI: 10.5116/ijme.5d9b.0c37
PMID: 31655795 PMCID: PMC7246123

27. Frank JR, Danoff D. The CanMEDS initiative: implementing an outcomes-based framework of physician competencies. Medical teacher. 2007 Jan 1;29(7):642-7. DOI: 10.1080/01421590701746983
PMID: 18236250

28. Batalden P, Leach D, Swing S, Dreyfus H, Dreyfus S. General competencies and accreditation in graduate medical education. Health affairs. 2002 Sep;21(5):103-11. DOI: 10.1377/hlthaff.21.5.103
PMID: 12224871

29. Harding A, Vallersnes OM, Carelli F, Kiknadze N, Karppinen H, Simmenroth A. European standards for undergraduate medical education in general practice; a blueprint-for action. Educ Prim Care. 2023 Jan;34(1):2-6. DOI: 10.1080/14739879.2022.2155997
PMID: 36730558

30. Gill JS, Sen S. Blueprinting of summative theory assessment of undergraduate medical students in microbiology. Medical Journal Armed Forces india. 2020 Apr 1;76(2):207-12. DOI PubMed DOI: 10.1016/j.mjafi.2018.12.012
PMID: 32476720 PMCID: PMC7244858

31. Villarroel V, Bloxham S, Bruna D, Bruna C, Herrera-Seda C. Authentic assessment: Creating a blueprint for course design. Assessment & Evaluation in Higher Education. 2018 Jul 4;43(5):840-54. DOI: 10.1080/02602938.2017.1412396

32. Sunita Y P, Nayana K H, Bhagyashri R H. Blueprinting in Assessment : How much is imprinted in our practice? J Educational Res & Med Teach 2014;2(1):4-6.

33. Coderre S, Woloschuk W, McLaughlin K. Twelve tips for blueprinting. Med Teach. 2009;31:322-4. DOI: 10.1080/01421590802225770
PMID: 18937095

34. Tormey W. Education, learning and assessment: current trends and best practice for medical educators. Ir J Med Sci. 2015 Mar;184(1):1-12. DOI: 10.1007/s11845-014-1069-4
PMID: 24549647

35. Bhardwaj N, Krishna H, Ghatak S, Singh K. Blueprinting of assessment for the lower limb in undergraduate anatomy curriculum. Cureus. 2023 Nov 24;15(11). DOI PubMed DOI: 10.7759/cureus.49357

36. Richlin L. Blueprint for learning: Constructing college courses to facilitate, assess, and document learning. Taylor & Francis; 2023 Jul 3.

37. O'Shaughnessy SM, Joyce P. Summative and Formative Assessment in Medicine: The Experience of an Anaesthesia Trainee. International Journal of Higher Education. 2015;4(2):198-206. Article DOI: 10.5430/ijhe.v4n2p198,

38. Schuwirth LW, van der Vleuten CP. A history of assessment in medical education. Advances in Health Sciences Education. 2020 Dec;25(5):1045-56. DOI: 10.1007/s10459-020-10003-0
PMID: 33113056 PMCID: PMC9765899

39. Rao RH, Rao KH. Perspectives in medical education 9. Revisiting the blueprint for reform of medical education in Japan. Keio J Med. 2010;59(2):52-63. DOI: 10.2302/kjm.59.52
PMID: 20601841,

40. Eweda G, Bukhary ZA, Hamed O. Quality assurance of test blueprinting. Journal of Professional Nursing. 2020 May 1;36(3):166-70. DOI: 10.1016/j.profnurs.2019.09.001
PMID: 32527639

41. Chiappinotto S, Galazzi A, Papastavrou E, Igoumenidis M, Cabe CM, Gastmans C, Wiisak J, Stolt M, Suhonen R, Palese A. Blueprint of ethics content in undergraduate education: A workshop-research study. Nursing Ethics. 2025 Jan 16:09697330251313784. DOI: 10.1177/09697330251313784
PMID: 39819274