



A TRADITION OF
INDEPENDENT
THINKING



Blueprinting Examinations in Medical Education

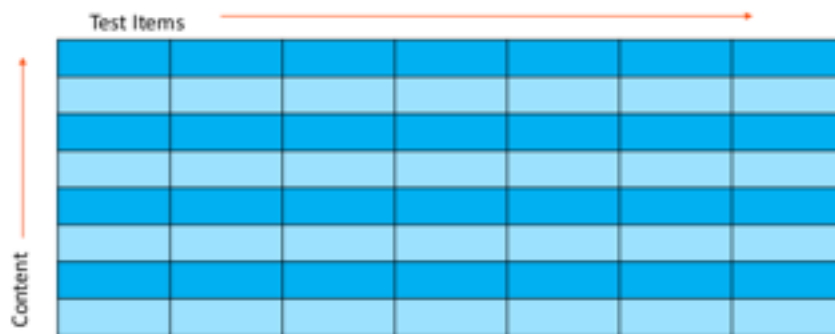
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This presentation, prepared by the Medical Education Unit at University College Cork focuses on how to prepare an Examination Blueprint.



What is a Blueprint?

At its simplest a test Blueprint is 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.¹



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What should be in the Blueprint?^{2,3}

NBME Guide ²

A test blueprint contains a list of key components defining your test, including:

- The purpose of the test (To assess knowledge prior to moving on the the next stage of training? To assess competence prior to beginning supervised or independent practice?)
- The content framework (Clinical skills, clinical knowledge, scientific knowledge, research skills)
- The testing time
- The content weighting (number of items per content area)
- The item formats (e.g., MCQ, essay question, OSCE, research proposal etc)

The US National Board of Medical Examiners have produced 2 Guides on how to select the correct type of assessments and how to write an examination blueprint.

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Start with the module description and Learning Outcomes

On successful completion of this module, students should be able to:

- Conduct a clinical consultation demonstrating effective communication skills, comprehensive recording of a history, comprehensive examination of all relevant systems and interpretation of the relevant findings (both positive and negative)
- Generate a list of diagnoses in order of probability, specific to the patient
- Initiate and interpret basic laboratory, radiological and other investigations pertinent to the patient's presentation
- Manage common presentations of medical and surgical problems
- Perform a prescribed set of procedural skills
- Etc...

The best place to start is with the module description and learning outcomes. The list on this slide shows a set of learning outcomes for a clinical module half way through a medical degree programme.



How can we best assess each of the Learning Outcomes?

Conduct a clinical consultation demonstrating effective communication skills, comprehensive recording of a history, comprehensive examination of all relevant systems and interpretation of the relevant findings (both positive and negative)

Possible methods of assessment:

Conduct a clinical consultation demonstrating:

| | |
|---|--|
| Effective communication skills | OSCE / Mini-CEX / Tutor evaluation |
| Comprehensive recording of a history | OSCE / Mini-CEX / Tutor evaluation / Case write-up |
| Comprehensive examination of all relevant systems | OSCE / Mini-CEX / Tutor evaluation |
| Interpretation of the relevant findings | OSCE / Mini-CEX / Tutor evaluation / Case write-up |

Next we need to look at each learning outcome individually and decide what way can we assess that the outcome has been achieved.

- In the case of the learning outcomes on the last slide, for assessing effective communication skills, we can use an Objective Structured Clinical Examination, or a Mini-Clinical exam, or tutor evaluation after direct observation of practice.
- For assessing the students' ability to record a history we can use all of the previously mentioned exam types and also use an evaluation of a case write up.
- Performing a comprehensive examination of all relevant systems is best assessed by OSCE, Mini CEX or Tutor evaluation.
- Interpretation of relevant findings can be assessed by OSCE, Mini-CEX, Tutor evaluation or by a case write-up.

How can we best assess each of the Learning Outcomes?

| Learning Outcome | Possible Assessment Method |
|--|--|
| Generate a list of diagnoses in order of probability, specific to the patient | Case write up, OSCE |
| Initiate and interpret basic laboratory, radiological and other investigations pertinent to the patient's presentation | MCQ, EMQ, Data Interpretation Short answer questions |
| Manage common presentations of medical and surgical problems | MCQ, EMQ, Short answer questions, essay questions |
| Perform a prescribed set of procedural skills | OSCE, Direct Observation of Practice |

- Generating a list of diagnoses in order of probability, specific to the patient can be assessed using a case write up or an OSCE style exam.
- When we are looking to assess whether students can interpret laboratory and radiological findings, we can do this using Multiple Choice Questions, Extended Matching Questions, Short Answer Questions and even OSCEs.
- Managing common presentations of medical and surgical problems can be assessed by MCQ, EMQ, and Data Interpretation Short Answer questions
- Procedural skills are best assessed by OSCE or direct observation of practice, depending on the level of training.



Choose the methods of assessment

Choose your methods of assessment to ensure that all of the learning outcomes can be assessed.

In most cases this will mean a number of different assessment methods including continuous assessment and end of module assessments.

Outline which learning outcomes will be assessed by which assessments and include this in the Blueprint.



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Content weighting

Consider the importance of each topic in order to determine the best content weighting for the test as a whole.

The number of questions for each content area should reflect the importance of that content area.

For example if one quarter of the teaching and learning time in the module was devoted to neurology, then approximately one quarter of the test weighting and content should be given to neurology questions.



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Simple Example – 7 Station OSCE

| | History | Examination | Procedures |
|----------------------|--|---------------------------|--------------------|
| Cardiovascular | St 1: Chest pain Hx | St 4: Diabetic Foot Exam | |
| Respiratory | St 5: Explanation of inhaler technique | | |
| GIT | | St 2: GIT Exam | |
| Musculoskeletal | | St 3: Examination of Knee | |
| Neurology | St 6: Headache Hx | St 4: Diabetic Foot Exam | |
| Procedures | | | St 7: IM Injection |
| Patient Safety | St 5: Explanation of Inhaler Technique | | St 7: IM Injection |
| Communication Skills | St 5: Explanation of Inhaler Technique | | |

This is a simple version of a Blueprint that was drawn up to represent a 7 station Objective Structured Clinical Examination (OSCE).

The competencies listed are History, Examination and Procedures and the content is listed as Cardiovascular, Respiratory, GIT, Musculoskeletal, Neurology, Procedures, Patient Safety and Communication Skills. We can see that certain stations test more than one competency.



| Sheet 1: Content/ Competency and Assessment Modality Selector | | | | | | |
|---|--|------------------|--|---------------------|---------------|--------------------------|
| | | Suggested Topics | | PRES Level 3 | | |
| Theme | | | | Data Interpretation | Communication | Practical and Procedures |
| Patient Safety / Quality Care | | | | | | |
| Relating to patients | | | | | | |
| Communication/ Interpersonal skills | | | | | | |
| Communication / Teamwork | | | | | | |
| Management including self | | | | | | |
| Professionalism including ethics | | | | | | |
| Clinical skills including procedures | | | | | | |
| Scholarship | | | | | | |
| See headings in clinical topics below | | | | | | |
| General Medicine / Surgery | Cardiovascular and Peripheral Vascular | | | | | |
| | Respiratory | | | | | |
| | Gastrointestinal | | | | | |
| | Renal | | | | | |
| | Neurological | | | | | |
| | Musculoskeletal | | | | | |
| | Endocrine | | | | | |
| | Dermatology | | | | | |
| | Haematology / Oncology | | | | | |
| | Infectious diseases | | | | | |
| | Breast | | | | | |
| | Genitourinary | | | | | |
| | Gerontology | | | | | |
| | Surgical practice | | | | | |
| | Emergency Medicine | | | | | |
| | Ophthalmology / ENT | | | | | |
| | Therapeutics | | | | | |
| Pediatrics | | | | | | |
| Obstetrics / Gynaecology | | | | | | |
| Psychiatry / Behavioural | | | | | | |
| General Practice | | | | | | |

This is a more complex version of a Blueprint that was created for the Medical Council's Pre Registration Examination for International Medical Graduates based on the Medical Council's 8 domains of practice.



Summary

Blueprinting will improve the validity of your examination by helping you to:

- Assess the instructional objectives of the module
- Avoid over- or under-representing a topic in your test
- Use appropriate formats for the competencies and skills being assessed
- Show students the topics you value
- Ensure similar exam content from year to year

For more detailed information, please see the NBME guides which are linked from the next slide.

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- Ensure similar exam content from year to year.

For more detailed information, please see the NBME guides ^{2,3} which are linked from the next slide.

References

1. Bridge PD, Musial J, Frank R, Roe T and Sawilowsky S. Measurement practices: Methods for developing content-valid student examinations. Medical Teacher 2003;25:414–421.

2. Test Blueprinting I – Selecting and Assessment Method: NBME 2019:
<https://www.nbme.org/sites/default/files/2020-01/Test-Blueprinting-Lesson-1.pdf>

3. Test Blueprinting II – Creating a Test Blueprint: NBME 2019:
<https://www.nbme.org/sites/default/files/2020-01/Test-Blueprinting-Lesson-2.pdf>