MEDICAL EDUCATION TECHNOLOGY

Hamdard Institute of Medical Sciences and Research
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Preface

Medical education is undergoing a paradigm shift. The traditional teacher-centered, content-driven model is giving way to a **learner-centered, competency-based approach** that emphasizes not just knowledge acquisition, but also the development of skills, attitudes, professionalism, and lifelong learning. In India, the Graduate Medical Education Regulations (GMER 2019) have formalized this shift, underscoring the need for systematic planning, innovative teaching–learning strategies, and robust assessment methods.

This manual, *Medical Education Technology*, has been designed as a practical resource for medical teachers, postgraduate students, and faculty development trainers. It brings together essential concepts of competency-based medical education (CBME), structured teaching–learning methods, effective assessment strategies, and innovations in pedagogy. Each chapter is written with clarity, supported by examples, and intended for direct application in classroom, clinical, and skill-laboratory settings.

The topics covered include:

- Understanding Competency-Based Medical Education and its regulatory framework
- Writing effective Specific Learning Objectives (SLOs)
- Teaching clinical and practical skills using structured methods such as Peyton's approach and simulation-based learning
- Principles of assessment, with emphasis on validity, reliability, and educational impact
- Designing better written assessments, including essay questions, SAQs, and MCQs
- Facilitating small group discussions and optimizing large group teaching
- Exploring emerging innovations in medical education, including flipped classrooms, blended learning, and technology-enhanced education

The purpose of this manual is not merely to provide theoretical knowledge but to equip educators with tools and strategies that can be implemented immediately. By aligning teaching and assessment with well-formulated objectives, we can ensure that learning is meaningful, measurable, and competency-driven.

I hope this manual serves as a companion to all those engaged in the challenging yet rewarding journey of training the next generation of doctors. May it inspire teachers to innovate, reflect, and continuously grow, so that students may, in turn, become competent, compassionate, and ethical healthcare professionals.

Prof. Sabina Khan

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Overview of Competency Based Medical Education (CBME)

Graduate Medical Education Regulations (GMER) 2019

The Graduate Medical Regulations, 2019 represents the first major revision to the medical curriculum since 1997. The salient feature of the revision of the medical curriculum in 2019 is the emphasis on learning which is competency-based, outcome oriented and learner-centric acquisition of skills and ethical & humanistic values.

Key Components of GMER 2019

- Competency based curriculum
- Foundation course
- Early Clinical Exposure
- Attitude Ethics and communication (AETCOM)
- Alignment and Integration
- Emphasis on skill acquisition and certification
- Learner doctor method of clinical teaching
- Self directed learning
- Electives
- Assessment changes

Paradigm of CBME

Health care delivery has **GOAL.**

To meet that goal, graduates have to perform many **ROLES**

To perform those roles, they need certain **COMPETENCIES**

To attain those competencies, they need to meet certain **OBJECTIVES**

Need ongoing monitoring

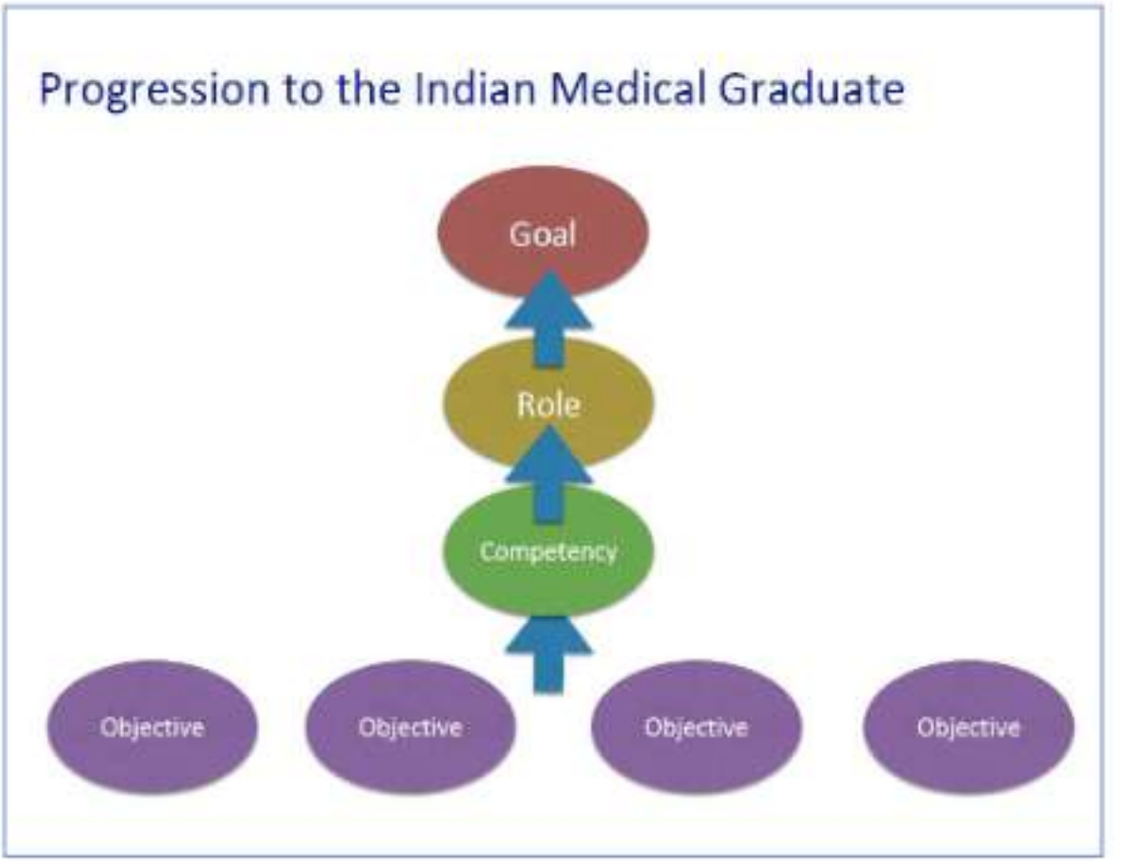

Figure 1: Progression to the Indian Medical Graduate

Roles of an IMG—

- Physician of first contact
- Clinician
- Leader & Member of the health care team
- Communicator
- Lifelong learner
- Professional

Roles of IMG requires certain competencies

COMPETENCY BASED MEDICAL EDUCATION (CBME) - Definition as per NMC

> *"An outcome based approach to the design, implementation and evaluation of a medical education program using an organizing frame work of competencies"*
> *International CBME Collaborators, 2009*

Competency-based medical education: theory to practice; Medical Teacher, 2010; 32:638-645

Definition of Competency

The habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served.

DOMAINS OF LEARNING

Three Domains of Learning

- Cognitive Domain - "Thinking"
- Affective Domain - "Feeling"
- Psychomotor Domain - "Doing"

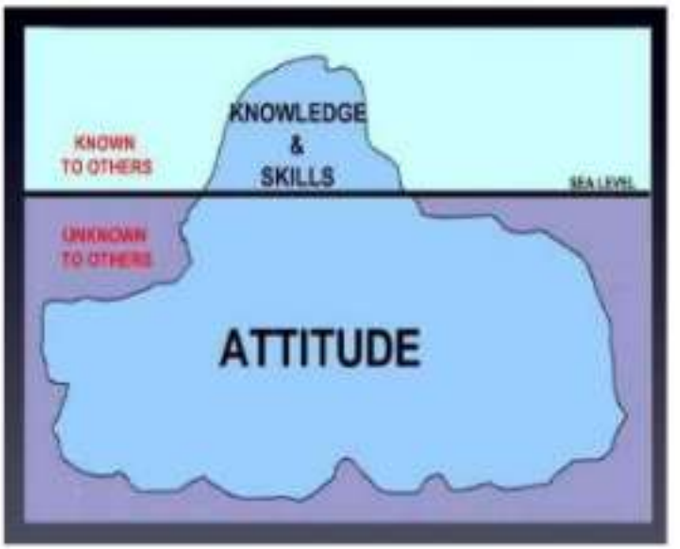

Figure 2:Domains of Learning

BLOOM'S TAXONOMY

Each domain has a taxonomy

All of the taxonomies are arranged so that they proceed from the simplest to more complex levels.

Bloom's Taxonomy is an order of learning with **six levels**.

Affective domain

An individual's emotions, attitudes, appreciations, interests, and/or values about "something" or someone

Psychomotor domain

Physical activities involving gross and/or fine motor skills, such as coordination, dexterity, strength, manipulation, precision and speed

Remember

Learning takes place in ALL 3 domains.

There has to be the intention for growth specifically in the selected domain area!

A teacher can never truly teach unless he is still learning himself
Rabindranath Tagore

Specific Learning Objectives (SLOs)

Introduction

In medical education, the design of teaching–learning activities requires clarity about what learners are expected to achieve. This clarity is provided through **Specific Learning Objectives (SLOs)**, which are precise, measurable statements of what learners should be able to demonstrate at the end of an instructional activity. Unlike vague intentions, SLOs focus on observable behavior or performance that can be assessed.

What Are SLOs?

A **Specific Learning Objective** is a clearly written statement that describes what a learner will be able to do upon completion of an educational activity. It focuses on:

- Observable learner behavior
- Measurable outcomes
- Alignment with teaching–learning activities and assessment

Thus, SLOs act as a bridge between teaching and evaluation, ensuring that learning outcomes are transparent and achievable.

Characteristics of Effective SLOs

An effective SLO must outline the **knowledge, skills, or attitudes** that learners are expected to gain. According to standard educational frameworks, a complete SLO should include the following five elements:

1. **Who** – The learner or audience (e.g., second-year MBBS student)
2. **Will do** – The specific action or behavior expected
3. **How much / how well** – The expected degree of competence
4. **Of what** – The subject matter or content area
5. **By when** – The timeframe or context of performance

By adhering to these elements, faculty can ensure that objectives are both measurable and assessable.

How to Write SLOs

When drafting SLOs, educators must address several key considerations:

- **Audience**: Who is performing the task? (e.g., intern, second-year student)
- **Activity**: What is the teaching–learning method (lecture, lab, hospital visit)?
- **Observability**: Can the performance be objectively observed?
- **Conditions**: Under what circumstances will the learner perform the task?
- **Competence**: To what degree of proficiency must the learner demonstrate the outcome?
- **Domain**: Which domain of learning is targeted – cognitive (knowledge), psychomotor (skills), or affective (attitude)?
- **Assessment**: How will achievement be measured (written test, OSPE, viva)?

Do's and Don'ts in Writing SLOs

- ✅ Focus on **one topic** per objective
- ✅ Focus on **one learning domain** at a time
- ✅ Use **action verbs** (e.g., define, describe, demonstrate)
- ❌ Avoid vague or subjective verbs (e.g., know, understand, appreciate)

The ABCD Framework of SLOs

A widely used model for writing objectives is the **ABCD framework**:

- **A – Audience**: Who will do the behavior?
- **B – Behavior**: What should the learner be able to do?
- **C – Condition**: Under what conditions should the behavior occur?
- **D – Degree**: How well must it be done?

This systematic approach ensures clarity and measurability.

Action Verbs in SLOs

The choice of action verbs is critical. Verbs should indicate observable performance. For example:

- **Knowledge domain**: Define, list, classify, describe
- **Skills domain**: Demonstrate, perform, operate, construct
- **Attitude domain**: Display, justify, support, participate

Avoid subjective verbs like *know*, *learn*, or *understand*, as they are not directly measurable.

Competencies and Example SLOs

Example 1: Biomedical Waste Management

- **SLO 1**: *At the end of an interactive lecture, a second-year MBBS student will be able to define Biomedical Waste (BMW) as per the Biomedical Waste Management Act, correctly.*
    - Domain/Level: Knowledge (K)
    - Assessment: MCQ, viva
    - Method: Interactive lecture
- **SLO 2**: *At the end of an interactive lecture, the student will be able to describe the color-coded categories of BMW and their disposal as per the BMW Act, correctly.*
    - Domain/Level: Knowledge (K + KH)
    - Assessment: SAQ, viva
    - Method: Lecture
- **SLO 3**: *At the end of a hospital ward visit, the student will be able to discuss identification, segregation, and disposal of BMW at the inpatient level, as per the BMW Act.*
    - Domain/Level: Knowledge (K/KH)
    - Assessment: Viva, SAQ
    - Method: Ward visit, group discussion
- **SLO 4**: *At the end of a skill lab session, the student will be able to demonstrate proper disposal of assorted BMW in color-coded containers in a simulated environment.*
    - Domain/Level: Skills (S + SH)
    - Assessment: OSPE
    - Method: Small group session, simulation

Critique of Sample SLOs

Not all learning statements qualify as effective SLOs. Consider the following examples:

1. *"Describe the chemical components of normal urine."*
    - Strength: Focused, measurable, knowledge domain
    - Weakness: Needs specification of learner and context
2. *"Describe attachment, nerve supply and action of Pectoralis Major and Minor."*
    - Strength: Knowledge-based, objective
    - Weakness: Covers multiple elements (should be split into separate SLOs)
3. *"Chemical transmission in the nervous system (including psychiatry element)."*

- Weakness: Too broad, not framed as observable behavior

4. *"Effect of exercise on blood pressure and heart rate (Lab experiment)."*
   - Strength: Practical skill, measurable
   - Weakness: Needs phrasing as: *"At the end of the laboratory session, the student will be able to record and analyze the effect of exercise on blood pressure and heart rate using standard techniques."*

Conclusion

Specific Learning Objectives form the backbone of structured medical education. They define what learners are expected to achieve, guide teaching–learning strategies, and shape assessment methods. By applying structured frameworks such as **ABCD** and ensuring clarity, measurability, and alignment, educators can design objectives that enhance both learning and evaluation.

Well-constructed SLOs ensure that the learning process is purposeful, transparent, and competency-driven—thereby equipping future doctors with the necessary knowledge, skills, and attitudes for clinical practice.

Effective Clinical and Practical Skills Teaching

Introduction

Clinical and practical skills form the cornerstone of medical education. The **National Medical Commission (NMC)** emphasizes that graduates must not only acquire theoretical knowledge but also develop the competence to perform essential skills safely and effectively. Skills include both **technical** (e.g., history taking, physical examination, clinical procedures) and **non-technical** (e.g., communication, teamwork, decision-making) aspects.

As per the **Competency-Based Medical Education (CBME) framework** and the **NMC skill modules**, every medical student should progress systematically through observation, supervised practice, and independent performance. This handout explores what skills are, why and where they should be taught, and effective methods for teaching them.

What is a Skill?

A **skill** is the ability to perform a task that leads to a specific, predefined outcome. It requires the integration of knowledge, psychomotor abilities, and attitudes.

Types of Skills

Figure 3: Skills for Medical Education

a) **Intellectual or cognitive skills** are defined as abilities such as application, analysis and synthesis as building on basic knowledge and are related to underlying component of knowledge. eg. ability to interpret haematological tests of a patient with anemia
b) **Psychomotor or procedural skills** require manual dexterity and include laboratory and clinical skills eg. ability to obtain a blood sample by venepuncture
c) **Communication skills** is defined as the ability to communicate with others in a given situation. eg. ability to motivate volunteers for blood donation
d) **Team Skill** is defined as the ability to work together in a team.
eg. Ability to work towards implementing a project/operating on a patient with the team

1. **Technical Skills**
    - Clinical history taking
    - Physical examination
    - Procedural skills (e.g., suturing, intravenous cannulation, intramuscular injection)
    - Communication with patients
2. **Non-Technical Skills**
    - Communication with colleagues
    - Decision making, teamwork, leadership
    - Professionalism and ethical practice etc.

Where Do We Teach Skills?

Teaching venues vary depending on the type of skill and stage of learning:

1. **Workplace (Clinical Setting)**
    - Bedside teaching in wards, outpatient clinics, operation theatres, laboratories
    - Real patient encounters enhance authenticity and contextual learning.
2. **Skill Laboratories / Simulation Centers**
    - Provide safe, controlled environments for deliberate practice.
    - Use of task trainers, mannequins, standardized patients, and virtual reality.
    - Especially useful for high-risk or infrequently encountered procedures.

Why Do We Teach Skills?

Our aim as medical teachers should be to help produce competent doctors as given in the definition of the IMG.

Learner doctors go through the following phases of the **Learning Cycle** in the process of skill acquisition, with an aim to reach unconscious competence.

1. Unconscious incompetence
2. Conscious incompetence
3. Conscious competence
4. Unconscious competence

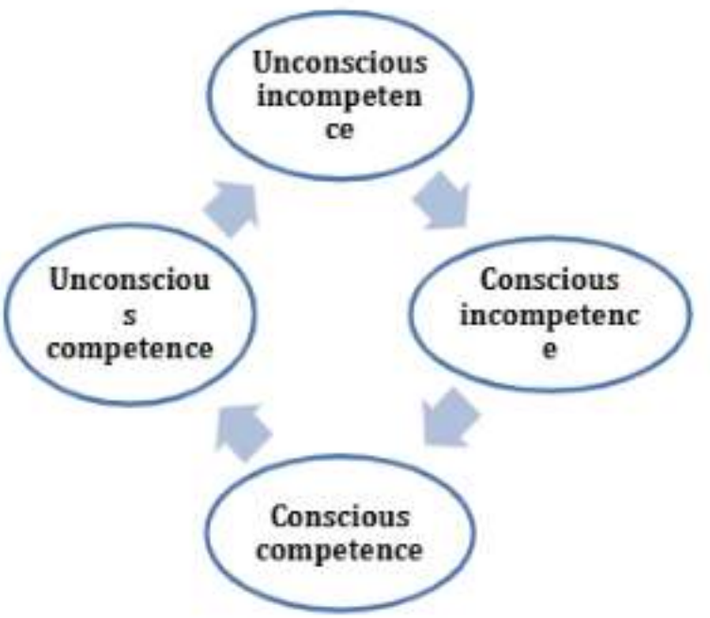

Figure 4: Learning Levels

How Do We Teach Skills?

The general principles of skill acquisition and its application are:
a) **Outcome is predefined** for the phase and level of training.
b) Standard approved process of acquisition including required **steps are clearly outlined**
c) Learners are provided **opportunity to progressively acquire and practice** repeatedly under supervision, in a structured format and in a safe, nonthreatening environment.
d) Opportunities are made available for **self-assessment and improvement**, feedback and assessment of performance

Figure 5: Criticality vs feasibility matrix in context to Skills training

1. Intellectual Skill:.
Best taught during real patient encounters.

- **Case Presentations:** Structured or unstructured; encourage clinical reasoning. Structured case presentation models: SNAPPS (Summarize, Narrow, Analyze, Probe, Plan, Select) and One Minute Preceptor (OMP).
- **Case-Based Learning (CBL):** Real or simulated clinical cases are used to link theory with practice. Learners analyze a case, identify issues, and apply knowledge from basic and clinical sciences to arrive at a diagnosis and management plan.
- **Chart Stimulated Recall:** Learner reviews patient records (charts) from their own clinical encounters and reflects on the reasoning behind diagnostic and management decisions. Facilitator asks probing questions to explore thought processes, justifications, and clinical decision-making.
- **Problem-Solving Exercises**
- **Reflection:** learning from past experiences in practice. (Format of reflection writing : What happened? So what? What next?)
- **Metacognition:** being aware of and regulating how one learns and reasons, both during and before tasks.

2. Psychomotor Skills Teaching

Peyton's Four-Step Approach (NMC recommended):

1. **Demonstration** – Instructor performs skill silently.
2. **Deconstruction** – Instructor explains each step.
3. **Comprehension** – Learner describes steps while instructor performs.
4. **Performance** – Learner performs skill independently.

3. Communication Skills Teaching

Communication is both a **technical** and **non-technical** skill. The **AETCOM module** provides structured teaching guidelines.

- **Kalamazoo Consensus Framework**:
    1. Build a relationship
    2. Open the discussion
    3. Gather information
    4. Understand the patient's perspective
    5. Share information

6. Reach agreement
7. Provide closure

- Methods: Role play, standardized patients, video recordings, feedback sessions.
- Assessment: Kalamazoo Communication Skills Assessment Form (multi-rater feedback).

5. Team Skill Teaching

Team skills are enhanced by Immersive Learning. A learner is placed in a situation as a part of a team in an immersive simulated learning environment. His performance is monitored and multilevel feedback is provided, leading to the acquisition and enhancement of skills..

Barriers in Clinical Skills Teaching

1. Lack of clear objectives.
2. Focus only on recall of facts.
3. Teaching not tailored to learner needs.
4. Teacher dominance ("teaching by humiliation").
5. Patient safety concerns.
6. Institutional challenges: inadequate infrastructure, limited time, and financial constraints.

Conclusion

Effective clinical and practical skill teaching is at the heart of competency-based medical education. Faculty must combine **structured teaching methods** (Peyton, OMP, SNAPPS), safe learning environments (skill labs, simulation), and **rigorous assessment strategies** (OSCE, DOPS, Mini-CEX) to ensure graduates achieve the expected competencies.

A culture of **feedback, reflection, and continuous quality improvement** is essential for success.

Principles of Assessment in Medical Education

Assessment is a cornerstone of medical education, serving both as a measure of student progress and a driver of learning itself. The maxim "**what is not assessed is not learnt**" underlines the central role assessment plays in shaping the knowledge, skills,
and attitudes of future healthcare professionals. Beyond assigning grades, assessment provides essential feedback, informs teaching practices, and ensures that medical education remains aligned with expected learning outcomes. This chapter explores the principles,
types, tools, and evolving practices of assessment in medical education, highlighting their impact on learners and educators alike.

Why Assessment?
Assessment is not a mere formality but a purposeful process that directly influences learning. At its core, assessment drives learning by motivating students to focus on content and competencies that are evaluated. It also provides timely feedback and
remedial direction, ensuring that learners can correct errors and reinforce strengths. Furthermore, assessment serves institutional needs such as ranking, certification, and promotional decisions, while also providing data to evaluate the
effectiveness of teaching and curriculum delivery.

In medical education, it helps determine whether essential learning outcomes
have been met, whether learners have achieved competence in core areas, and whether they are prepared to advance in their training. It is also a means to assess teaching and training methods themselves, creating opportunities for continuous course
improvement.

What Should Be Assessed?

A well-known principle states: "**We should assess what we teach and teach what we assess.**" This reciprocal relationship ensures that learning objectives and assessment strategies are aligned. In practice, medical educators classify knowledge into three
categories: the "**must know**" (core knowledge essential for safe and competent practice), the "**good to know**" (important knowledge that enhances understanding), and the "**nice to know**" (supplementary knowledge that broadens horizons). Prioritizing assessment
around these categories ensures that learners are evaluated on competencies that truly matter for clinical practice.

When and How to Assess?
Timing and methods of assessment are equally crucial.

Two broad categories of assessment dominate medical education: formative
and summative.

Formative assessment, often described as "**assessment for learning**," is continuous in nature. It emphasizes ongoing feedback, monitoring of progress, and identification of learning gaps. Formative assessments also provide valuable input to faculty
regarding the effectiveness of teaching methods. Because of their continuous nature, formative assessments are particularly useful for evaluating knowledge, skills, and attitudes.

Summative assessment, on the other hand, is the "**assessment of learning**." Often conducted at the end of a course or semester, it serves as a judgment tool—deciding pass or fail, promotion, or remediation. It has been compared to **"closing the stable
doors after the horses have bolted,"** since feedback is less immediate, but its role in certification and

accountability makes it indispensable.

Attributes of Good Assessment
For assessment to be effective and meaningful, it must meet certain key attributes:
validity, reliability, educational impact, acceptability, and feasibility.

- **Validity** refers to whether the assessment truly measures what it claims to measure. For example, a written test may be valid for assessing theoretical knowledge but may not effectively evaluate procedural skills.
- **Reliability** denotes the accuracy and reproducibility of the assessment. An assessment with high reliability produces consistent results under similar conditions.
- **Educational impact** reflects the influence of assessment on learning behavior. Assessments that reward critical thinking and problem-solving encourage deeper learning, while rote assessments may drive superficial preparation.
- **Acceptability** addresses whether the assessment is appropriate and fair for both students and faculty.
- **Feasibility** considers whether the assessment can be practically implemented given the constraints of time, resources, and context. Some assessment tools, while ideal in theory, may be impractical in real-world settings.

The concept of utility in assessment combines these attributes:

Utility = Validity × Reliability × Acceptability × Educational Impact × Feasibility.

An assessment method is valuable only when it balances these dimensions effectively.

Tools of Assessment
Medical education employs a wide range of assessment tools tailored to different **domains.**

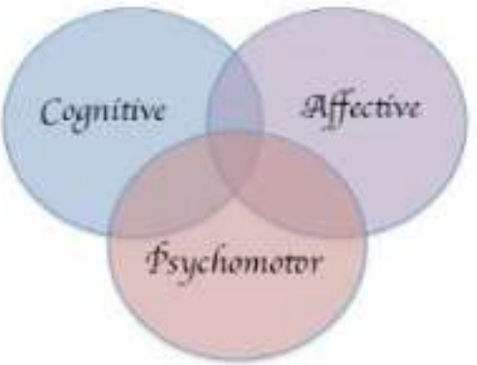

Figure 6: Domains of Learning

These tools can be mapped to **Miller's Pyramid of Clinical Competence**, which progresses from "knows" to "knows how," "shows how," and finally "does."

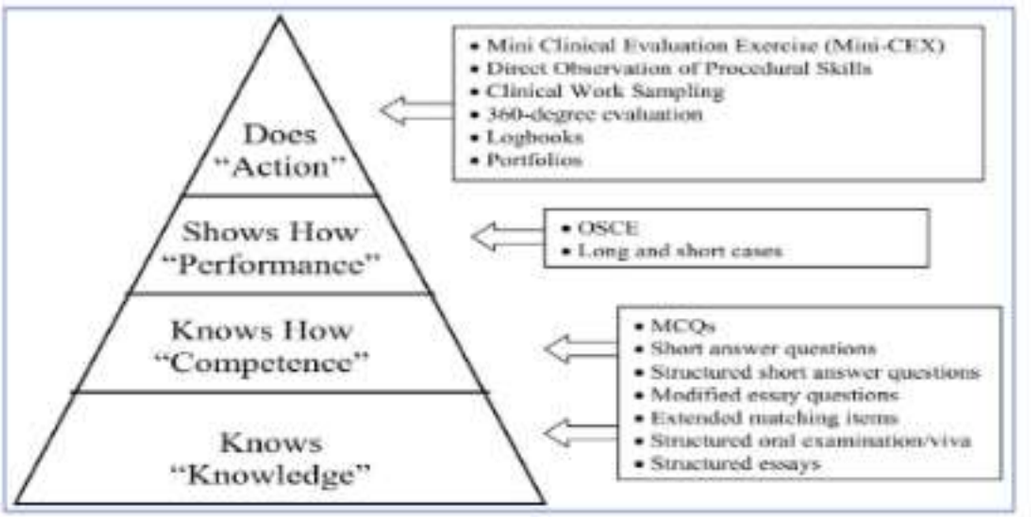

Figure 7: Miller's Pyramid of Clinical Competence

1. **Assessment of "Knows" and "Knows How":**
   - Long essay questions (LEQ)
   - Short answer questions (SAQ)
   - Multiple choice questions (MCQ)
   - Extended matching questions (EMQ)
   - Oral examinations (Viva voce)

2. **Assessment of "Shows How":**
   - Long and short clinical cases
   - Objective Structured Clinical Examination (OSCE)
   - Objective Structured Practical Examination (OSPE)

3. **Assessment of "Does":**
   - Mini Clinical Evaluation Exercise (Mini-CEX)
   - Direct Observation of Procedural Skills (DOPS)
   - 360-degree feedback and peer evaluation
   - Logbooks and portfolios
   - Workplace-based assessments (WPBA)

Each tool has strengths and limitations, and effective assessment strategies often combine multiple methods to capture the full spectrum of competence.

Blueprinting: A Systematic Approach

A critical innovation in assessment planning is the use of blueprints. A blueprint is a detailed plan that ensures comprehensive coverage of curriculum objectives while aligning assessment methods with learning outcomes. By assigning weightage to topics based on their importance and prevalence in practice, blueprints help maintain fairness and transparency. They also guide examiners in constructing balanced question papers and practical assessments that reflect real-world relevance.

To prepare a blueprint, educators follow systematic steps:

- Define the scope and purpose of the assessment.
- Decide on weightage for different content areas and domains of learning, guided by relevance to health impact and disease prevalence.

- Finalize the total number of items and weightage distribution.
- Develop a table of test specifications that maps topics to domains and assessment methods.
- Construct assessments that align with the blueprint

Current Scenario in Medical Education

In today's rapidly evolving healthcare environment, assessment must keep pace with advances in knowledge, technology, and pedagogy.

Traditional assessment methods, though valuable, are increasingly supplemented with competency-based evaluations, workplace-based

assessments, and reflective tools such as portfolios. These approaches emphasize not just knowledge but also professional behavior,

communication, teamwork, and lifelong learning skills—attributes essential for modern medical practice.

Conclusion

Assessment is more than a grading exercise; it is a central pillar of medical education that shapes what and how students learn.

By balancing formative and summative approaches, employing diverse tools, and adhering to principles of validity, reliability, feasibility, and fairness, educators can create assessments that truly drive learning.

Essay Questions and Short Answers Questions

Essay Questions : EQs are questions that require extended written responses. It requires the student to give in writing, in his / her own words, a relatively extended response to the problem presented. Thus, it reveals information regarding the student's mental process. These questions evaluate the cognitive domain. They measure a student's ability not only to recall knowledge, but also to use appropriate expressions to record it and further his ability to analyze, synthesize and apply the knowledge to solve the problems presented.

Advantages of EQ

1. Assess higher order or critical thinking
2. Brings out learner's reasoning capacity
3. Allows free and effective expression (open question) i:e tests students ability to express
4. Tests ability to analyse, synthesize, organize and channelize the thought process into meaningful text
5. It minimizes guess-work-in answering.

Disadvantages of EQ

1. Range of application of knowledge is limited to topic.
2. Questions lack objectivity
3. Sets a time constraint on the student
4. Important error in long essay is- Halo/ Antihalo effects.
5. Due to literary ability & handwriting of the student examiner bias may occur.
6. Expression of knowledge in written words may have no relevance to possession of knowledge. It gives advantage to students with better command of language over those with better knowledge recall only
7. Validity and objectivity is limited.

CRITERIA OF EQ

1 .**VALIDITY:** The degree to which the question will measure what it is intended to measure.

2. **RELIABILITY**: The consistency with which the question is answered or evaluated.

3. **OBJECTIVITY**: The degree of agreement between different examiners over

i. The interpretation of the question, and ii. The answer contents.

4 . **FEASIBILITY:** With relevance to time, environment and curriculum.

5. **GRADIBILITY:** Scoring possibility.

6 .**IMPORTANCE:** Does it measure a worthwhile applied knowledge

Steps to Frame EQs:

1. **Identify higher-order learning outcomes** – e.g :ability to analyze, integrate, apply knowledge.
2. **Choose the type of essay question:**
    - **Extended response (unstructured)/traditional:** Broad, student has freedom within the subject context to determine the nature and scope of answer.
        - *Example:* Discuss the universal immunization programme.
    - **Restricted response (structured):** Provides guidelines on what to include.
        - *Example:* Write an essay on protein-energy malnutrition covering

          (a) causes, (b) classification, (c) diagnosis, and (d) management.

- **Modified Essay Question (MEQ):** Problem-solving based on a case vignette.
    - *Example*: A child presents with fever and rash. Answer sequential questions on diagnosis and management.

3. **Use clear task verbs** – *discuss, analyze, explain, justify, compare, evaluate.*
4. **Avoid overlap or ambiguity** – Specify scope so that answers are comparable.
5. **Ensure balance** – Don't focus only on recall; test higher cognitive levels.
6. **Provide marking scheme/model answer** – Define key points expected to improve objectivity

Evaluation of long question

1. Use a point system of scoring based upon those elements that are expected to appear.
2. Mark the papers anonymously to conceal the student identity.
3. When two or more teachers correct the same test, they should agree on the scoring procedure before and correct the papers separately.
4. Score the answers of the entire student to one question, before going on the scoring of another question- to avoid halo effect

SHORT ANSWER QUESTIONS (SAQS)

SAQs are questions that require students to write brief responses, usually a few sentences or points. The questions are framed to be precise. They cover a larger subject area. In contrast to MCQs, guessing choosing from ready-made answers is avoided . These questions help to examine the knowledge, recall, simple calculation, these questions are a means of measuring student's factual knowledge or understanding.

Types of SAQS

1. **Completion Type** : Questions are in the form of incomplete sentence and the students are required to fill in the gaps to complete them. The questions may be : fill in the blank, or Labelling a diagram etc.

Example : Delivery before .. .. week gestation is called preterm delivery. (Numerical)

2. **Unique answer Type** : The questions are framed in a way that they have a single word answer. They primarily test the ability of interpretation of data.

Example: What is the drug of choice for acute attack of angina pectoris.

3. **Open Ended Short Answer Questions** : They are similar to unique answer questions and are mostly in the form of definitions and require single phrase answer.

Examples: 1. Deline chemotherapy

2. What is bradycardia? Enlist two causes of bradycardia.

Merits of SAQS

1. They test the knowledge and application of facts and principles besides the skill of interpretation of data and comprehension of information.
2. They are less time consuming and can cover a large subject area.
3. They are easy to frame.
4. Possibility of guessing is reduced as compared to MCQ tests.
5. Easier to mark than essay questions, usually involve a structured marking sheet.

Demerits of SAQS

1. They are not suitable for testing complex learning outcome
2. They require longer time to answer than MCQs
3. The scoring requires instructors and has to be done manually only
4. Test the lower to middle part of cognitive domain.

Steps to Formulate SAQs in Medical Education:

1. **Define the objective clearly** – Identify what knowledge, concept, or skill you want to assess (e.g., recall, comprehension, application). Identify the topics and learning outcomes that one wants to be assessed, knowledge, comprehension, application, analysis etc.
2. **Write the stem** : Choose the style. Use clear, simple language, stem of question should be concise.
3. **Keep the question specific and focused** – Avoid vague or overly broad wording.
    - ❌ *Write notes on immunization.*
    - ✅ *List any three components of the Universal Immunization Programme (UIP).*
4. **Use directive words** – e.g., *define, list, name, state, classify, differentiate, enumerate, explain briefly.*
5. **Avoid ambiguity** – Ensure only one correct, concise answer is expected.
6. **Ensure coverage of curriculum** – Frame SAQs from different topics to test breadth.
7. **Prepare a structured marksheet:** Allocate marks or part marks for acceptable answers. Be prepared to consider other equally acceptable answers. Set appropriate marks – Usually 2–5 marks, depending on depth.

How to Frame Good MCQs

1. Introduction

If you've ever faced an exam filled with confusing multiple-choice questions (MCQs), you know how discouraging it can be. A poorly designed question not only frustrates students but also fails to reflect what they actually know. As teachers, our responsibility is more than just assessing knowledge—we must give students a fair chance to demonstrate their understanding and application of concepts.

A **well-framed MCQ** can do exactly that. It can check recall of key facts, but more importantly, it can evaluate whether learners can apply knowledge to real-life clinical situations. Conversely, a poorly written MCQ may mislead, confuse, and unfairly penalize even the brightest student. Learning to write good MCQs is, therefore, an essential skill for every medical teacher.

2. What Makes a Good MCQ?

Think of a good MCQ as a carefully crafted clinical case:

- It tests what you intended to teach.
- It is clear, fair, and free of unnecessary tricks.
- It provides meaningful information about your students—distinguishing between those who have memorized facts and those who can apply knowledge in problem-solving.

A good MCQ is not a guessing game; it is a learning tool.

3. Anatomy of an MCQ

Every MCQ has three essential components, much like the skeleton of a body:

1. **Stem** – the main story, clinical scenario, or problem presented.
2. **Lead-in** – the actual question posed (e.g., *"Which of the following is the most likely diagnosis?"*).
3. **Options** – one correct or best answer (the key) along with other plausible but incorrect alternatives (the distractors).

When these three parts are aligned and well written, the MCQ becomes a valid assessment tool.

4. Choosing the Right Type of MCQ

The type of MCQ you choose depends on the learning objective:

- **Recall-based:** Checks memory of facts (useful for basic definitions, formulas, or names).
- **Application-based:** Tests whether students can apply knowledge to a clinical or problem-based scenario.
- **Case-based:** Encourages clinical reasoning and decision-making; ideal for integrating basic sciences with clinical practice.

5. How to Frame an MCQ – Step by Step

Step 1: Start with a learning objective.
☞ Example: *"Students should know the metabolic defect in Alkaptonuria."*

Step 2: Decide the cognitive level.

- *Recall: "Which enzyme is deficient in Alkaptonuria?"*
- *Application: "A child presents with black urine on standing. Which enzyme defect is most likely?"*

Step 3: Write a clear and concise stem.
Avoid unnecessary details or irrelevant background information.

Step 4: Frame a focused lead-in question.
Instead of asking *"Which of the following is correct?"*, ask *"Which enzyme deficiency is most likely?"*

Step 5: Design plausible distractors.
Every option should make sense. Distractors should challenge students to think, not allow them to dismiss options immediately.

6. Common Pitfalls to Avoid

- **Vague or overly long stems** that distract rather than guide.
- **Grammatical clues** (e.g., "an enzyme" → only one option starts with a vowel).
- **Unequal option length** (the correct answer should not stand out as the longest).
- Using **"all of the above"** or **"none of the above"**, which reduces discrimination value.
- **Double negatives** in stems, which confuse rather than test knowledge.

7. Examples

❌ **Poor Question**
Alkaptonuria is due to:
a) Lack of oxygen
b) Lack of exercise
c) Deficiency of homogentisic acid oxidase
d) Vitamin deficiency

☞ *Problem:* Stem is vague, and distractors are irrelevant.

☑ **Improved Question**
A 12-year-old boy passes urine that turns black on standing. Which enzyme deficiency is responsible?

a) Phenylalanine hydroxylase
b) Homogentisic acid oxidase ☑
c) Fumarylacetoacetate hydrolase
d) Tyrosinase

☞ *Strengths:* Clinical scenario, focused lead-in, all options plausible.

8. Beyond Writing: Testing Your Questions

Good teachers don't stop at writing questions—they also evaluate how well their questions perform. **Item analysis** after an exam helps refine MCQs and improve their effectiveness.

- **Difficulty Index (Facility Value):** Tells you how easy or difficult a question was. Ideally, 40–60% of students should answer correctly.
- **Discrimination Index:** Measures whether the question distinguishes strong students from weaker ones. A high discrimination index is desirable.
- **Distractor Efficiency:** Evaluates whether incorrect options were chosen by at least some students (a distractor never chosen is ineffective).

This process ensures that your MCQs are not only well written but also valid and reliable.

9. Conclusion

MCQs are far more than just exam fillers. When carefully designed, they can test memory, application, and reasoning simultaneously. The key lies in aligning them with learning objectives, writing clear stems and focused lead-ins, and constructing realistic distractors.

Ultimately, good MCQs serve a dual purpose: they **assess students fairly** and also **guide teachers to reflect on their teaching effectiveness**. By mastering the art of MCQ writing, medical educators can create assessments that truly enhance learning

Small Group Discussions

Small Group Discussion (SGD) technique is a structured, learner-centered teaching–learning method where a limited number of students (not more than 30) work together under the guidance of a facilitator to discuss a topic, solve a problem, or analyze a case. It is widely used in competency-based medical education because it encourages active participation, critical thinking, communication, collaborative learning, problem solving and leadership.

Key Features of Small Group Discussion (SGD):

- **Group size:** Small group size to ensure everyone can participate.
- **Facilitator role:** The teacher is a *guide* or *moderator*, not a lecturer.
- **Student role:** Learners actively engage, brainstorm, share perspectives, debate, and reason out solutions.
- **Focus:** Development of higher-order thinking (analysis, synthesis, evaluation)
- **Resources:** Usually a case scenario, problem statement, article, topic or guiding questions.

Steps in Conducting SGD:

1. **Planning & Preparation:**
   - Facilitator sets clear objectives and designs discussion triggers (cases, questions, problems). Arranges resources in terms of human resources and infrastructure.
2. **Introduction:**
   - Facilitator explains the purpose, rules, and process. Some ground rules may be formed in initial classes of the batch.
3. **Discussion:**
   - Students participate in discussions
   - Facilitator ensures balanced participation and keeps the group on track.
4. **Summarization:**
   - Group or facilitator summarizes key learning points.
5. **Reflection:**
   - Learners reflect on the process and outcomes. This can be also used for formative assessment.

Advantages of Small Group Discussion:

- **Effective communication**: Encourages active listening, sharing ideas, persuasion, and presentation skills.
- **Teamwork**: Builds collaboration, cooperation, and interpersonal understanding.
- **Self-directed learning**: Students take responsibility for preparing, exploring, and contributing.
- **Critical thinking**: Promotes questioning, reviewing, analyzing, and giving constructive feedback.
- **Knowledge application**: Allows students to apply concepts to case scenarios, problem-solving, and real-life contexts.

What can go wrong in SGD and how to avoid it?

- **Teacher dominates (lecture mode)** → Use guiding questions instead of mini-lectures.
- **Low student participation** → Use icebreakers, assign roles (facilitator, note-taker, presenter).
- **Lack of preparation** → Share expectations and resources in advance; assess preparation.
- **Dominant student(s)** → Politely redirect, establish ground rules for equal participation.
- **Students expect ready-made answers** → Encourage inquiry, emphasize process over product.

What are the challenges in its implementation?

- Requires **more resources** than lectures (time, faculty, rooms, smaller groups).
- Faculty need to **prepare lesson plans, case material, and learning tasks**.
- Infrastructure must support **interactive settings** (movable chairs, breakout spaces).
- Designing appropriate **assessment methods** can be complex.

What makes an SGD Great?

- Safe, warm, and non-threatening environment.
- Cooperative learning rather than competitive.
- Active participation from all students.
- Enjoyable and engaging learning tasks.
- Continuous evaluation and reflection.
- Student preparedness before sessions.

Some Techniques for Group Discussion

- Group Round – Everyone contributes one point in turn.
- Buzz Groups – Short, quick discussions in pairs/small groups before sharing with the class.
- Think-Pair-Share – Individual reflection → Pair discussion → Share with group.
- Brainstorming – Free-flow generation of ideas without judgment.
- Snowball Groups – Start with pairs, then merge into larger groups gradually.
- Fishbowl – Small group discusses while others observe; observers later join in.
- Crossover Groups / Jigsaw – Each subgroup explores part of a topic and teaches it to others.

Formative Assessment in SGD

- Interaction with peers and teachers
- Asking questions
- Ability to discuss and draw conclusions
- Non-argumentative and respectful behavior
- Volunteering for presentations/ reporting
- Reading beyond textbooks
- Punctuality

Done through:

- Observation Checklists
- Peer Assessments
- Self-assessment

Group Round

- Each participant has a brief time (20 seconds–1 minute) to contribute in turn.
- Order can be:
    - Sequential round the group, or
    - More dynamic—each person chooses the next speaker.
- This method encourages equal participation and keeps energy levels high.

Figure 8: Group Discussion

Buzz groups

With larger groups a break is often needed:

- To provide a stimulating change in the locus of attention
- For you to gain some idea of what the students know
- For the students to check their own understanding.

During a discussion, student could be asked to turn to their neighbor to discuss for a few minutes any difficulties in understanding, to answer a prepared question. This will bring a sense of participation and some lively feedback. Buzz groups enable students to express difficulties they would have been unwilling to reveal to the whole class.

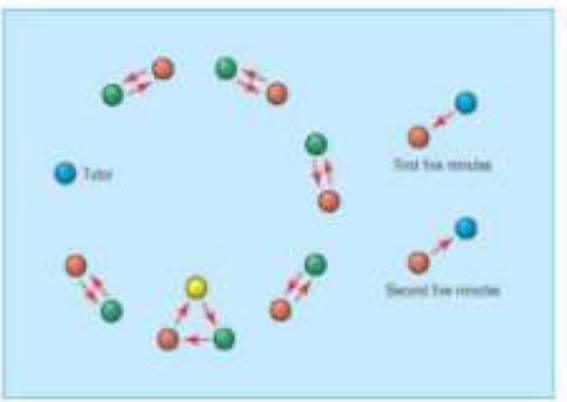

Figure 9: Buzz Group

Snowball groups

Snowball groups (or pyramids) are an extension of buzz groups. Pairs join up to form fours, then fours to eights. These groups of eight report back to the whole group. This developing pattern of group interaction can ensure

comprehensive participation, especially when it starts with individuals writing down their ideas before sharing them. To avoid students becoming bored with repeated discussion of the same points, it is a good idea to use increasingly sophisticated tasks as the groups gets larger.

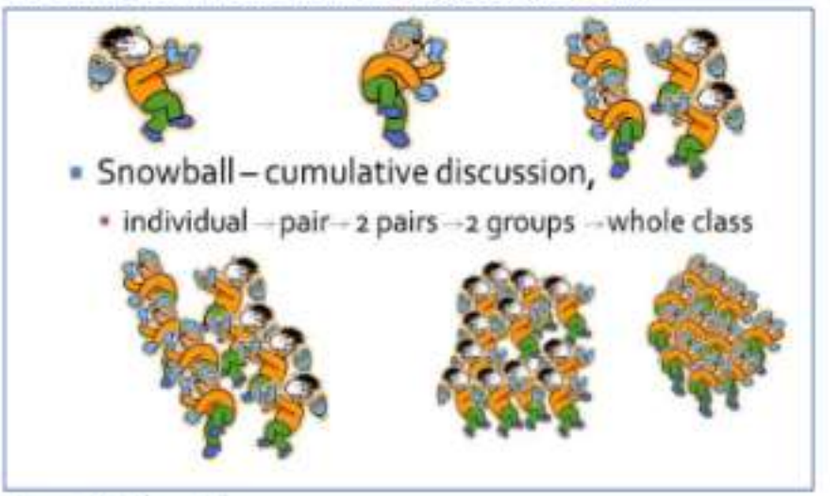

Figure 10: Snowball

Fishbowls

The usual fishbowl configuration has an inner group discussing an issue or topic while the outer group listens, looking for themes, patterns, or soundness of argument or uses a group behavior checklist to give feedback to the group on its functioning. The roles may then be reversed.

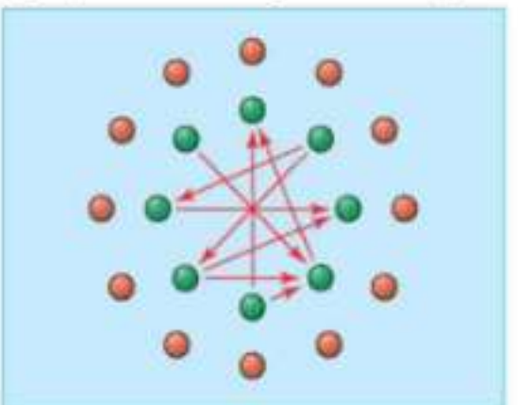

Figure 11: Fish Bowl

Think-Pair-Share (TPS)

It is a collaborative learning strategy in which students work together to solve a problem or answer a question about an assigned reading.

- Step 1: Think individually about a question or problem.
- Step 2: Pair with a partner to discuss ideas.
- Step 3: Share with the larger group.
- Benefits: Maximizes participation, sharpens comprehension, builds confidence.

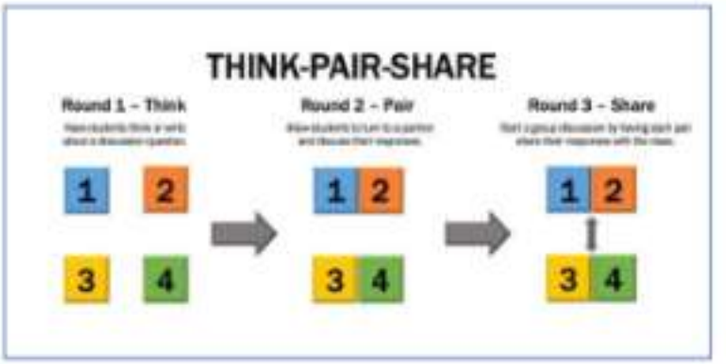

Figure 12: Think - Pair - Share

Jigsaw Puzzle/ Crossover

The jigsaw technique is a method of organizing classroom activity that makes students dependent on each other to succeed. It breaks classes into groups and breaks assignments into pieces that the group assembles to complete the (jigsaw) puzzle.

- Class is divided into **home groups**, and the task into **subtopics**.
- Each member studies one subtopic individually.
- Students then meet in **expert groups** (same topic) to deepen understanding.
- Finally, members return to their **home group** and teach their peers.

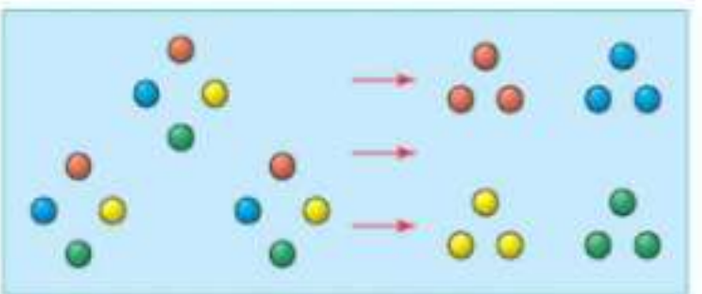

Figure 13: Jigsaw Puzzle

Brainstorming

Brainstorming is a group problem-solving method that involves the spontaneous contribution of creative ideas and solutions. This technique requires intensive, freewheeling discussion in which every member of the group is encouraged to think aloud and suggest as many ideas as possible based on their diverse knowledge.

During brainstorming sessions, participants should avoid criticizing or rewarding ideas in order to explore new possibilities and break down incorrect answers. Once the brainstorming session is over, the evaluation session (which includes analysis and discussion of the aired ideas) begins, and solutions can be crafted using conventional means.

Figure 14: Brainstorming

Large Group Teaching Methods

1. Introduction

Teaching large groups presents unique challenges and opportunities. This chapter explores diverse strategies to enhance engagement, promote active learning, and adapt teaching methods to varied learner needs.

2. Lecture-Based Methods

- Traditional & Interactive Lectures
- Didactic Lectures: Structured delivery of content, ideal for foundational knowledge.
- Interactive Lectures: Incorporate questions, prompts, and pauses to stimulate thinking.
- Guest Lectures: Bring in experts to provide specialized insights and variety.

Tip: Use storytelling and real-life examples to make lectures more relatable.

3. Multimedia & Tech-Enhanced Methods

- Leveraging Technology
- Slide Presentations: Visual aids to reinforce key concepts.
- Video Demonstrations: Useful for showing complex procedures or simulations.
- Live Polling Tools: Engage learners in real-time (e.g., Kahoot, Slido).
- Virtual Classrooms: Platforms like Zoom or MS Teams support remote learning.

Tip: Ensure tech tools are accessible and easy to use for all participants.

4. Discussion-Based Methods

- Promoting Peer Engagement
- Think-Pair-Share: Encourages quick collaboration and idea exchange.
- Panel Discussions: Present multiple perspectives on a topic.
- Debates: Foster critical thinking and structured argumentation.

Tip: Set clear guidelines to maintain respectful and productive discussions.

5. Case-Based & Problem-Based Learning

- Scenario-Driven Teaching
- Case Presentations: Use real-world examples to contextualize learning.
- Problem-Based Scenarios: Present open-ended challenges for group resolution.
- Clinical Vignettes: Short, focused cases for decision-making practice.

Tip: Encourage learners to justify their reasoning and explore alternatives.

6. Assessment-Driven Methods

- Reinforcing Learning
- MCQ Quizzes: Quick checks for understanding.
- Audience Response Systems: Provide instant feedback and track progress.

- Formative Assessments: Continuous evaluation to guide instruction.

  Tip: Use assessments to identify gaps and tailor future sessions.

7. Hybrid & Flipped Approaches

- Blending Formats
- Flipped Classroom: Learners review content before class, allowing in-session application.
- Blended Learning: Combines online and face-to-face instruction.
- Modular Teaching: Breaks content into manageable, focused blocks.

  Tip: Provide clear instructions and accessible materials for pre-class preparation.

8. Choosing the Right Method

- Matching Strategy to Context
- Consider the following when selecting a teaching method:
  - Group size and composition
  - Learning objectives
  - Available resources
  - Desired engagement level

Self-Directed Learning (SDL)

What is Self-Directed Learning?

Self-Directed Learning (SDL) is a process in which learners take the initiative to identify their learning needs, set goals, select resources, choose appropriate strategies, and evaluate their learning outcomes. It emphasizes **transfer of control** from the teacher to the learner, thereby fostering responsibility, independence, and lifelong learning habits.

Why Self-Directed Learning (SDL)?

SDL is an **integral part of the medical curriculum** and is aligned with the goals of the Indian Medical Graduate (IMG), who is expected to function as:

- **Clinician** – providing patient-centred care.
- **Leader and Member** – contributing to the healthcare system.
- **Communicator** – effectively engaging with patients, peers, and society.
- **Lifelong Learner** – continuously upgrading knowledge and skills.
- **Professional** – demonstrating ethical practice.

SDL is the cornerstone of nurturing the lifelong learner role.

Theoretical Basis of SDL

Learning theories that support SDL include:

- **Cognitivism**
  Learners acquire, store, and retrieve information using cognitive tools. SDL helps them "learn how to learn," while teachers act as facilitators rather than information providers.
- **Constructivism**
  Learners actively construct knowledge by connecting new information to prior experiences.
- **Experiential Learning (Kolb's Cycle)**
  Learners move through the cycle of experience, reflection, conceptualization, and experimentation during SDL activities.

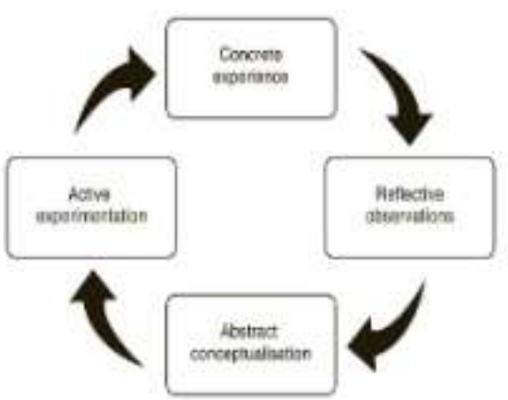

Figure 15:Kolb's Experiential Learning Cycle

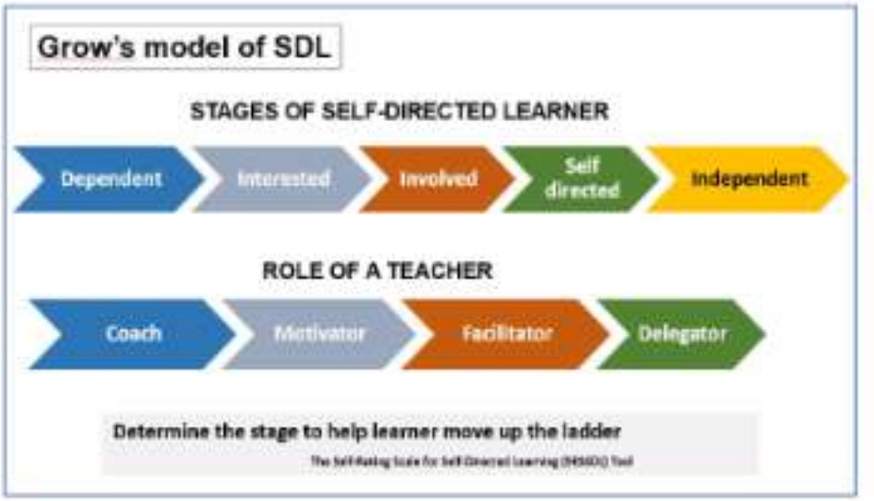

Figure 16:Grow's Model

Role of teacher

In SDL, the teacher's role evolves from being a **knowledge provider to a facilitator and mentor.**

The teacher:

- Guides students in identifying learning objectives.
- Provides access to appropriate resources.
- Monitors learner progress and provides feedback.
- Helps develop critical appraisal skills.
- Encourages reflective practice.

Steps in SDL

A structured SDL activity generally follows these steps:

1. **Identifying the Learning Need** – students recognize gaps in knowledge.
2. **Setting Goals** – defining clear, achievable learning objectives.
3. **Searching for Resources** – accessing books, articles, digital tools, peer collaboration, and mentors.
4. **Learning Activities** – self-study, group discussions, simulation-based practice, workshops, etc.
5. **Synthesizing & Applying Knowledge** – presentations, peer teaching, or clinical application.
6. **Assessment & Reflection** – evaluating outcomes and reflecting on learning strategies.

Designing an SDL Session – A Prototype

- **Initial Session** – Orientation and identification of learning objectives.
- **Intervening Period (Crucial Gap)** – Learners independently engage with resources and activities.
- **Follow-up Session** – Group presentations, discussions, clarification, and teacher feedback.

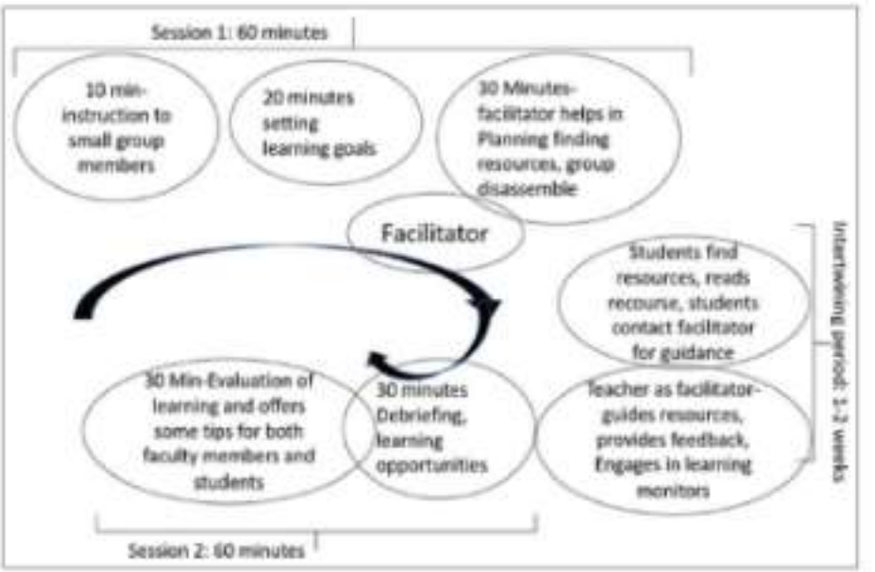

Figure 17: Design of SDL Session

Resources for SDL

Traditional Resources

- Books, journals, and articles
- Films, art, and design
- Workshops and seminars
- Mentorship and collaboration

Digital Tools

- Online quizzes, tests, and interactive games
- Peer-sharing platforms (WhatsApp, Telegram, forums)
- Simulation labs and virtual patients
- Smart technologies: e-boards, scanners, smartphones, smart watches

These tools enrich the learner's experience, making SDL more engaging and effective.

Assessment & Evaluation of SDL

Assessment in SDL can be both **formative** and **summative**, focusing not only on content knowledge but also on process.

Methods include:

- Self-assessment and peer assessment
- Reflective logs or learning portfolios
- Presentations and group discussions
- Objective tests (MCQs, SAQs)
- Direct observation of skills in simulation/clinical settings

ASSESSMENT METHODS IN SELF-DIRECTED LEARNING

Dimension	Assessment Methods
Knowledge / Understanding	- MCQs / Quizzes, Short Answer Questions (SAQs) - Tutorials, Case-based discussions
Skills / Performance	- Project work / Assignments, Presentations, Seminars - OSPE (Objective Structured Practical Exam) - Simulated patients / Skills labs
Learning Process (SDL Skills & Attitudes)	- Reflective writing (learning journals), Portfolios (paper / e-portfolios) - Logbooks
Self- & Peer-Assessment	- Self-assessment rubrics - Peer feedback and evaluation of group work
Digital / E-Learning Tools	- LMS usage tracking, Online quizzes/games - Multimedia/video submissions with feedback

Challenges in Conducting SDL

1. **Student Motivation** – some learners may resist taking responsibility.
2. **Faculty Preparedness** – requires training and mindset change for teachers.
3. **Resource Constraints** – limited access to digital tools or simulation facilities.
4. **Curriculum Overload** – time constraints in an already packed schedule.
5. **Assessment Difficulties** – evaluating SDL fairly and objectively can be complex.

Overcoming these challenges through:-

- Faculty training
- Student orientation
- Careful planning
- Digital tools
- Strong institutional support

Promoting SDL in Students

- Early orientation about SDL and its benefits.
- Creating a supportive environment with access to resources.
- Encouraging collaborative and peer-based learning.
- Integrating SDL activities gradually into the curriculum.
- Providing timely feedback and recognition of efforts.

Conclusion

Self-Directed Learning is an essential component of medical education that empowers learners to become independent, reflective, and lifelong learners. By embracing SDL, teachers and students together contribute to producing competent and future-ready medical graduates.

Figure 18: The Three Pillar Model of Self-directedness

THE THREE PILLAR MODEL OF SELF- DIRECTEDNESS

The fundamental concept of the three pillar structure is that the learner will need each of these pillars in place if they are to successfully become self- directed. If one (or two) is missing they are unlikely to develop a self- directed approach to their learning.

Figure 19: Self-directed learning cycle

Innovations in Medical Education

Introduction

Medical education has traditionally relied on lectures, bedside teaching, and apprenticeship models. While these remain valuable, the rapid evolution of healthcare, technology, and learner needs demands innovative approaches. The Competency-Based Medical Education (CBME) model adopted in India (2019) emphasizes not just knowledge, but also skills, attitudes, communication, ethics, and lifelong learning. Thus, teaching–learning strategies must shift from teacher-centered to learner-centered, passive to active, and knowledge-transfer to competency-development.

Drivers of Innovation in Medical Education

- Competency-Based Education (CBE/CBME): Focuses on outcomes and demonstrable competencies.
- Learner Profile: Today's students are digital natives who expect interactive, visual, and technology-driven learning.
- Healthcare Needs: Modern healthcare requires not only clinical expertise but also teamwork, communication, professionalism, and adaptability.
- Technological Advances: Simulation labs, e-learning, AI, and telemedicine demand new pedagogical approaches.

Innovative Teaching–Learning Methods

- Flipped & Blended Classrooms: Pre-class digital learning with in-class active engagement.
- Simulation-Based Medical Education (SBME): Mannequins, standardized patients, AR/VR for safe practice.
- Case-Based & Problem-Based Learning (CBL/PBL): Real cases drive integration and reasoning.
- Team-Based Learning (TBL): Structured group learning with readiness tests and application exercises.
- Technology-Enhanced Learning: LMS, gamification, AR/VR, AI-driven personalized learning.
- Early Clinical & Community Exposure: Introduced from Year 1 to build empathy and clinical relevance.
- Interprofessional Education (IPE): Collaborative learning with nursing, pharmacy, and allied health.

Innovations in Assessment

- Workplace-Based Assessments (Mini-CEX, DOPS).
- Objective Structured Clinical Examination (OSCE).
- Portfolios & Reflective Writing for self-directed learning.
- 360° Feedback from peers, faculty, and patients.
- Online assessments with instant feedback.

Challenges in Implementation

- Faculty resistance to new methods.
- Limited infrastructure for simulation and e-learning.
- Time constraints in already packed curriculum.
- Need for sustained institutional support and faculty training.

Future Directions

- Integration of AI, VR/AR, and adaptive learning platforms.
- Balanced hybrid of bedside teaching with modern methods.
- Ongoing faculty training in pedagogy.
- Evidence-based research in medical education innovations.

Conclusion

Innovations in teaching–learning are about enriching—not replacing—traditional methods. A hybrid approach that combines bedside teaching with simulation, cases, technology, and reflective practice will prepare the next generation of competent and compassionate physicians.