


# Construction and Evaluation of Test Items: Part 1


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## Session 2

# Bloom's Taxonomy and Creating Test Items

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At the end of the session participants should be able to

- Explain Bloom's revised taxonomy of learning objectives;
- Use revised Bloom's taxonomy to construct written test items at appropriate level.

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**FOCUS: ASSESSING KNOWLEDGE – COGNITIVE DOMAIN**

**TEST & EXAM**

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## Activity - Mentimeter

- What makes a “good” question?



“Exam questions should test a range of knowledge and skills at [appropriate] level. They should test and reward critical appreciation and the ability to apply what has been learnt rather than the passive reproduction of memorised facts.”

Assessment Code of Practice, (2012)

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## Effective Testing

- To maximize testing, we should aim to integrate all the major components of a course.
- CA - key to creating effective assignments & exams

Teacher's Intention  
- To construct  
- To analyse

Student's Activity  
- To construct  
- To analyse

Exam's Assessment  
- To construct  
- To analyse

Carefully aligned!

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## Linking Assessment to LO

Assessment tasks needs to be thought out before teaching and learning activities.

- To students, assessment defines what is important in the curriculum and they will learn what they think will be assessed.

Teacher Perspective  
Curriculum Learning Outcomes Teaching Activities Assessment

Student Perspective  
Assessment Learning Activities Outcomes

- If assessment tasks mirror the LO as indicated by the downward arrow, then the teaching activities and learner activities are both directed towards the same goal. Hence, constructive alignment.

Biggs 2003

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## Guiding Questions

- What to test?
- How much emphasis on each outcome?
- What type of questions?
- How much time to allocate?
- How to prepare the students?
- Whether to use the textbook or create your own questions?




Undergraduates study with an eye toward the kinds of questions they expect to see on their exams; as a result, instructors need to reinforce the aims of their courses by taking care to construct exams that call for the very kinds of thinking that they most want to encourage.

## Test items

- Assess achievement of learning outcomes
- Measure important aspects of the course (concepts and conceptual relations)
- Accurately reflect the emphasis placed on important aspects of instruction
- Measure an appropriate level of student knowledge
- Vary in levels of difficulty

The basis of all exam questions should be learning outcomes.


- Using Bloom's Taxonomy can help us clarify what we want students to learn.
- Help us tie concepts to the level of questions we should ask.



## Criteria for Quality Test

- Cognitive Complexity
  - focus on appropriate intellectual activity
- Content Quality
  - permit students to demonstrate their knowledge of subject matter
- Meaningfulness
  - worth students' time and they recognize and understand the value
- Language Appropriateness
  - clear and appropriate to the assessment tasks and to students
- Transfer and Generalizability
  - allow valid generalizations about achievement to be made
- Fairness
  - does not give advantage to factors irrelevant to learning
- Reliability
  - consistently trusted to represent what students know

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## Revised Bloom Taxonomy

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## Revised Bloom's Taxonomy (RBT)

(Anderson & Krathwohl, 2001)

- use to describe learning outcomes
  - distinguishes between type of knowledge being learned & type of cognitive process being employed
  - Knowledge Dimension – Kind of Knowledge to be Learned
    - Factual, Conceptual, Procedural, Meta-cognitive
  - Cognitive Process Dimension – Process Used to Learn
    - Remember, Understand, Apply, Analyze, Evaluate, Create
- describes the types of thinking needed to interact with information during an activity



## RBT: Two-Dimensional Taxonomy

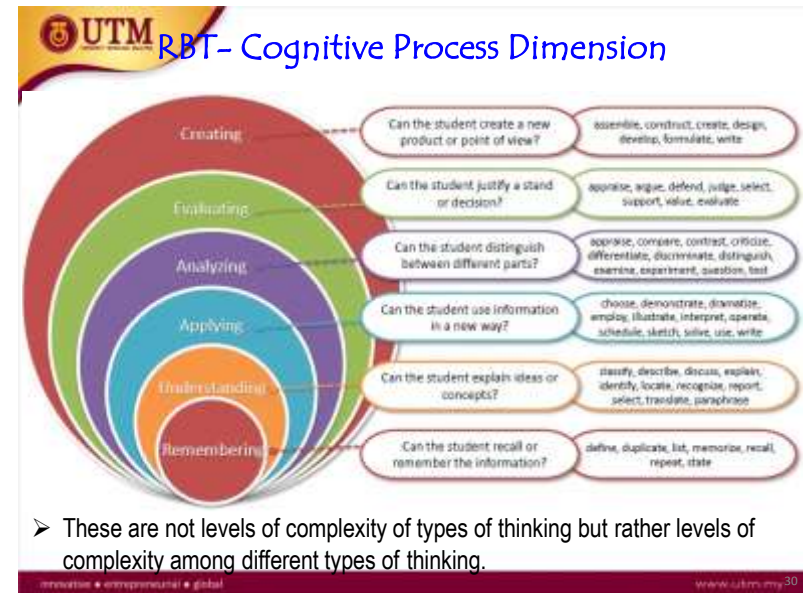
		Cognitive Process					
		remember	understand	apply	analyze	evaluate	create
K n o w l e d g e	Factual						
	Conceptual						
	Procedural						
	Metacognitive						




**Revised Bloom's Taxonomy**

	<i>Remember</i>	<i>Understand</i>	<i>Apply</i>	<i>Analyze</i>	<i>Evaluate</i>	<i>Create</i>
<b>Fact</b>	Remember Facts	Understand Facts	Apply Facts	Analyze using Facts,	Evaluate using Facts,	Create using Facts,
<b>Concept/ Principle</b>	Remember Concepts	Understand Concepts	Apply Concepts	Concepts, Principles and Procedures	Concepts, Principles and Procedures	Concepts, Principles and Procedures
<b>Procedure</b>	Remember Procedures	Understand Procedures	Apply Procedures	Procedures	Procedures	Procedures
<b>Meta-cognitive</b>	Remember Metacog. Strategies	Understand Metacog. Strategies	Apply Metacog. Strategies	Analyze Meta. Strategies	Evaluate Metacog. Strategies	Create Metacog. Strategies
	<i>Knowledge</i>		<i>Skill</i>	<i>Ability</i>		

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➤ These are not levels of complexity of types of thinking but rather levels of complexity among different types of thinking.



## RBT – Knowledge Dimension

CATEGORY	DEFINITION
FACTUAL	The <b>basic elements</b> that students must know to be acquainted with a discipline or solve problems in it.
CONCEPTUAL	The <b>interrelationships among the basic elements</b> within a larger structure that enable them to function together.
PROCEDURAL	<b>How to do something</b> ; methods of inquiry, and criteria for using skills, algorithms, techniques, and methods.
METACOGNITIVE	<b>Knowledge of cognition</b> in general as well as <b>awareness and knowledge of one's own cognition</b>

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## The Knowledge Dimension

The knowledge dimension — major types and subtypes

concrete knowledge → abstract knowledge

factual	conceptual	procedural	metacognitive
knowledge of terminology	knowledge of classifications and categories	knowledge of subject-specific skills and algorithms	strategic knowledge
knowledge of specific details and elements	knowledge of principles and generalizations	knowledge of subject-specific techniques and methods	knowledge about cognitive tasks, including appropriate contextual and conditional knowledge
	knowledge of theories, models, and structures	knowledge of criteria for determining when to use appropriate procedures	self-knowledge

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## The kinds of knowledge that can be tested

- Factual Knowledge
  - Terminology, facts, figures
- Conceptual Knowledge
  - Classification, Principles, Theories, Structures, Frameworks
- Procedural Knowledge
  - Algorithms, Techniques and Methods and Knowing when and how to use them.
- Metacognitive Knowledge
  - Strategy, Overview, Self Knowledge, Knowing how you know

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## Activity – Mentimeter

Categorize each item according to Bloom's taxonomy.

1. Given two opposing theories, design an experiment to compare them.
2. Write short notes on COVID-19 virus.

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## Test Items?

- Consolidation of basic knowledge
- Higher-cognitive skills
- Problem solving skills
- Written communication skills

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## Taxonomy Table

The taxonomy table can be used for a number of purposes including:

- assisting with the creation of questions - type of knowledge & different cognitive skills
- providing a classification system for questions - categorising the questions
- assisting with the construction of question papers - check the balance and complexity
- analyzing question papers - different types of knowledge examined and various cognitive skills assessed
- balancing questions paper - coverage and complexity.

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**Using Taxonomy Table in Planning**

	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual						
Conceptual						
Procedural						
Meta-Cognitive						

- Visual representation of alignment between course activities & outcomes

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**Example - Revised Bloom Taxonomy**

		Cognitive Process					
		remember	understand	apply	analyze	evaluate	create
K n o w l e d g e	Factual	Define the meaning of assessment.			Analyze the major components of CA		
	Conceptual		Associate assessment and CLO				
	Procedural					Assess one's own assessment practice	
	Metacognitive			Apply the strategy of effective assessment in one's own course			

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## How to prepare the students?

“The best way to facilitate the development of higher-level skills is to include high-level tasks in learning objectives, share them with the students in study guides for exams, give illustrations and practice in class and more practice on assignments; and then put the high level questions on the exams.”

- The only way people acquire skills is through practice and feedback.


Felder and Brent (2004)



## Activity

Consider the following questions and decide what kind of knowledge you feel they would test, and the cognitive skills assessed?

- Then map the questions onto the Taxonomy table.
  - 1) Define a “computer database”.
  - 2) Explain three key characteristics of a computer database.
  - 3) Relate each of these characteristics to a database package with which you are familiar.
  - 4) Compare the database facilities of a dedicated database package to those of a general-purpose spreadsheet package.
  - 5) Suggest criteria that could be used to help users decide whether to use a database or spreadsheet package for a specific task.

 **Activity**

- Consider your recent examination questions and decide what kind of knowledge you feel they would test and the cognitive skills assessed?
- Then map the questions onto the Taxonomy table.
- Analyze the coverage of the knowledge/cognitive domain of the paper. What do you notice about its balance?

	remember	understand	apply	analyze	evaluate	create
Factual						
Conceptual						
Procedural						
Metacognitive						

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Thank you