Module 3e. Difficulty and Cognitive Complexity

Passport to Great Teaching

Timothy S. Brophy

Item Difficulty

As you develop any assessment item, you make a **prediction** based upon your knowledge of student performance at a given course or skill level

The prediction is based on the percentage of students that you estimate are **likely to respond correctly**

Identification of Predicted Item Difficulty
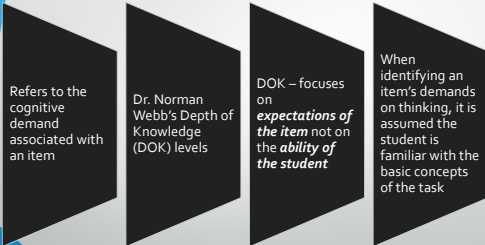
Easy – MORE than 70% get the item correct

Average – Between 40% and 70% get it correct

Challenging (hard) - FEWER than 40% get it correct

What happens after a test item is administered?

- Item Difficulty refers **to the actual percentage of students** who chose the correct answer

Cognitive Complexity

Refers to the cognitive demand associated with an item	Dr. Norman Webb's Depth of Knowledge (DOK) levels	DOK – focuses on *expectations of the item* not on the *ability of the student*	When identifying an item's demands on thinking, it is assumed the student is familiar with the basic concepts of the task

Webb's Depth of Knowledge (DOK)

The *Depth of Knowledge* is the degree of depth or complexity of knowledge standards and assessments require; this criterion is met if the assessment is as demanding cognitively as the expectations standards are set for students

The DOK levels are *Recall* (**Level 1**), *Skill* or *Concept* (**Level 2**), *Strategic Thinking* (**Level 3**) and *Extended Thinking* (**Level 4**).

Of course to accurately evaluate the DOK level, each level needs to be defined and examples given of types of student behaviors.

DOK

DOK implies the interaction of how deeply a student needs to understand the content with different ways of responding and interacting with the content

The level of a DOK item is determined by the task (*defined by complex thinking and reasoning skills*), not the level or ability of the student.

Verbs alone do not determine the DOK's level of an assessment task; the focus is on how deeply students need to know content for a given response

Categories of Cognitive Complexity

LOW Complexity

May require a student to solve a one-step problem

MODERATE Complexity

May require multiple steps

HIGH Complexity

May require a student to analyze and synthesize information

Item Complexity

- Distinctions in item complexity ensure that items assess *the depth of student knowledge for the standard/benchmark*
- **Intent** of the item
- Classify items by **highest** level of complexity demanded by the item
- **Ultimate determination** - overall cognitive demand placed on the student
- You **should evaluate your items** and combine levels of complexity in your assessments

Low Complexity

Rely heavily on recall and recognition

Items specify what the student is to do

- Recall a particular fact, date, title of a work, identify a word

Moderate Complexity

Moderate-complexity items involve more flexible thinking than low-complexity items.

The cognitive demand is greater. Item responses require more than one step, and ordinarily involve reading a passage and identifying a genre, style, or other appropriate component.

The student is expected to reason informally and to bring together skill and knowledge from more than one area of knowledge to answer the question.

High Complexity

High-complexity items make heavy demands on student thinking.

Students must engage in more abstract reasoning, planning, analysis, judgment, and creative thought.

Items require that the student complete multiple cognitive tasks simultaneously, and analyze, synthesize, or create to obtain a response.

Complexity Chart: Examples

- This chart presents some of the primary characteristics of activities evoked by items at each cognitive complexity level.

Examples of Activities Across Cognitive Complexity Levels		
Low Complexity	**Moderate Complexity**	**High Complexity**
➢ Complete a one-step task.	➢ Complete a task requiring multiple steps.	➢ Complete real-world discipline-specific tasks involving multiple steps and multiple choices.
➢ Recall or recognize a fact, title of a work, or a well-known person.	➢ Analyze a work involving multiple transformations of a component/element or reasoning.	➢ Describe how different representations of a work can be used for different purposes.
➢ Identify appropriate symbols or vocabulary words.	➢ Retrieve information from a work, photograph, or other media presentation and apply it to solve a problem.	➢ Complete an on-demand performance (appropriate to expected skill-level).
➢ Write a symbol or a vocabulary word.	➢ Compare works for similarities and differences in selected components.	➢ Analyze similarities and differences between multiple works, performances, and/or concepts.
➢ Recognize, determine, or perform an equivalent representation of an existing work.	➢ Extend an artistic pattern, such as improvising responses to given prompts.	➢ Use accepted forms to create new works.
➢ Retrieve information from a work, photograph, or other media presentation.	➢ Explain steps of a process.	➢ Create an original work within specific, skill-level appropriate parameters.
	➢ Complete a routine process, given specific parameters.	➢ Present a work or excerpt in more than one way.
	➢ Represent findings in more than one way.	➢ Provide a well-reasoned explanation and/or justification for choices.
		➢ Describe, compare, and contrast works or performances. Analyze or produce a deductive argument.

Resources for this Module

Checklist for Selected Response items

List of item stem templates

Pause to Think about Cognitive Complexity

- Examine some of your existing test items for their cognitive complexity. Describe the cognitive complexity – low, moderate, high - of these items and your rationale for this classification.