Module 3e. Difficulty and Cognitive Complexity

Passport to Great Teaching
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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.

Deeply: What do students need to know 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

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

### 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.