HOW TO

ASSESS HIGHER-ORDER THINKING SKILLS

IN YOUR CLASSROOM

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What Are Cognitive Taxonomies?

Cognitive taxonomies are organized schemes for classifying instructional learning targets into various levels of complexity. Several different taxonomies have been developed for sorting learning targets.

The *Taxonomy of Educational Objectives, Handbook I: Cognitive Domain* (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956) is the taxonomy many readers may have studied during their teacher education programs. Despite its age, Bloom's taxonomy is still used in many curriculum and teaching materials. The taxonomy classifies cognitive performances into six major headings arranged from simple to complex:

1. **Knowledge** involves the recall of facts and concepts.
2. **Comprehension** involves basic understanding. The classic assessment to see whether students comprehend a concept or story is to ask them to restate it in their own words.
3. **Application** involves using facts and concepts to solve new or novel problems, but they can be problems that are similar to ones students have solved before. Application-level problems usually have one correct answer.
4. **Analysis** involves breaking down information into its parts and then reasoning with that information. There are often many different acceptable responses to analysis-level tasks.
5. **Synthesis** involves putting parts together to form a new whole. Synthesis-level tasks require arranging ideas in a new or original way.
6. **Evaluation** involves judging the value of materials and methods for various purposes. Evaluation-level activities usually ask students to make a claim about the worth of something and explain their reasons.

Anderson and Krathwohl and a group of colleagues published a revision of the Bloom *handbook* in 2001. A major difference between the revised taxonomy and the original is that the 2001 version has two dimensions—Knowledge and Cognitive Process. The Knowledge dimension classifies the kind of knowledge a student deals with: facts, concepts, procedures, or metacognition. The Cognitive Process dimension looks very much like the original Bloom's taxonomy except that the order of the last two categories is reversed. Because the

Knowledge dimension uses the word *knowledge*, the first level of the Cognitive dimension is called "Remember." So we have the following:

1. **Remember** involves recognizing or recalling facts and concepts.

2. **Understand** involves basic comprehension, understood in light of newer theories of learning that emphasize students constructing their own meaning. Processes in this category include interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.

3. **Apply** means to execute or implement a procedure to solve a problem. Application-level problems still usually have one best answer.

4. **Analyze** means to break information into its parts, determining how the parts are related to each other and to the overall whole. Processes include differentiating, organizing, and attributing. Multiple correct responses are still likely in analysis-level tasks.

5. **Evaluate** means judging the value of material and methods for given purposes, based on criteria. Processes include checking and critiquing.

6. **Create** means putting disparate elements together to form a new whole, or reorganizing existing elements to form a new structure. Processes include generating, planning, and producing.

There are other taxonomies. Assessment standards for the Dimensions of Learning model (Marzano, Pickering, & McTighe, 1993) distinguish Declarative Knowledge, Procedural Knowledge, Complex Thinking, Information Processing, Effective Communication, Cooperation, and Habits of Mind. Each of the last five categories includes descriptions of various thinking processes that could be considered higher-order thinking.

More recently, Marzano and Kendall (2007), like Anderson and Krathwohl (2001), have distinguished knowledge from types of thinking. Marzano and Kendall identify three domains of knowledge: Information, Mental Procedures, and Psychomotor Procedures. Their Systems of Thinking form a hierarchy of levels of processing: (1) Retrieval, (2) Comprehension, (3) Analysis, (4) Knowledge Utilization, (5) Metacognition, and (6) Self-System Thinking.

The cognitive demands of many state accountability tests are analyzed with Webb's (2002) Depth of Knowledge levels. Webb uses four levels to classify the