Bloom’s Taxonomy

Overview

In 1956, a committee led by Benjamin Bloom introduced a “cognitive model”. That model has come to be known as, rather than, say, the "Bloom Committee Hierarchy". Cognitive means “mental”, with the Committee’s goal to encourage higher-order thinking in learners by building on lower-level cognitive skills. The model is a hierarchy, listing cognitive levels from Knowledge (the lowest level) through Evaluation (the highest level). Our goal with using the model is the same: to help guide item writers to construct items assessing across cognitive levels, especially above the level of Knowledge – simple recall of facts.

The model is a six-level “cognitive hierarchy” ranging from Knowledge at the lowest level (Level 1), through Evaluation at the highest level (Level 6). The higher the cognitive level of a test item, the more complex the thought / mental processes needed to answer that item. And, for you as item writers, the more of a challenge it is to write items at that level. Answering any test item requires the examinee to use a mental process; the higher the cognitive level of an item, the correspondingly higher level of cognitive (thought) process s/he needs to use to answer it:

Why Our Tests Need Higher-Level Items

In brief, it’s because actuaries do more than just recall learned knowledge. Practice requires critical thinking and problem solving, as well as use of that knowledge at higher-levels of critical thinking. Since a credentialing test must reflect practice requirements to be “valid”, each CAS exam not only must assess the content areas underlying the particular slice of professional actuarial practice that it was developed to assess, that assessment must happen across cognitive levels. Translating the test specifications into a series of items getting at that content, together with assessing that content across cognitive levels, is important psychometrically. It provides evidence that the test is "valid" – that the test really is measuring what we want it to measure, and in the relative/ percentages needed to do the job.
Thus, CAS item writers across test committees are very strongly encouraged to develop items to assess learning objectives / content areas at level above Knowledge (e.g., simple recall). There will always be a place for assessing Knowledge on each of our tests. That's because Knowledge is the basis of practice.

A test comprised of mostly Knowledge items could cause us to question the job-relatedness of that test, and whether an examinee who passed really has mastered the content of whatever is being assessed. Such a test would not be assessing any kind of examinee critical thinking or problem-solving skills. Test items written at more complex levels of thinking (e.g., higher Bloom's levels) requires that examinee have knowledge to apply, evaluate or synthesize, at whatever level the item is written. Those who have not learned the content, they would not have anything to Apply, Synthesize or Evaluate at a higher level.

How many items from each cognitive level are needed to support validity of a particular test? There's no firm answer for any of our exams, only general guidance that every item writer produce as many items as possible which assess critical thinking and problem-solving skills for possible inclusion on each test.

As the chart below shows, there is some overlap of the cognitive levels at the lower and upper ends. Moreover, except for Knowledge and Comprehension, there is no firm dividing line between any of the levels next to each other; a dividing line becomes even more blurred as you go higher in the hierarchy, especially between the top two levels. As the chart below shows, Knowledge and Understanding are basic, lower-level thinking skills; Levels Three through Six require higher-order thinking, with Application (Level Three) in the middle, requiring elements of both lower and higher-level thinking:
Item Writing Gets More Challenging the Higher Up You Go

Items getting at simple recall are the easiest to write, whether multiple-choice or constructed-response, but Knowledge-level items offer the most limited examinee assessment. Similarly, the higher in the hierarchy you're trying to write an item to assess – regardless of the content area you're trying to assess – the harder it is to write an item. But, like item writing itself, constructing items to get at higher-level cognitives tends to get easier with experience and practice; as noted earlier, item writers are encouraged to try to write higher-level items in the interest of our supporting respective Admissions test validity. It's important to note that the particular learning objective or content area doesn't change in a higher-level item. The content for any test to assess is fixed, specified in the test specifications document. Rather, it's the structure and focus of the item which changes to assess that content (learning objective) at a higher level. Note, too, that it's often possible to revise an existing item to assess at a higher level. To do that – to increase the cognitive demand needed to answer the item – I've found that using novel problems or material that expand on the item's relevant information is a good way to approach it.

To help item writers go for higher cognitive level measurements, each of the six Bloom's levels are summarized below, along with general learning objectives found at this level, and some verbs to use to help construct items at each level. (Just using one of the "action verbs" doesn't mean that your item is actually getting at the particular cognitive level, but it's a start.) Examples of items written at different levels is also provided:

**Level One: Knowledge**

Also known as recall, this is the lowest (simplest) lowest level of thought someone needs to answer the item. It only requires the recall of memorized information and facts; all that's needed to answer the question is to recall that information. These types of items assess examinee ability to memorize and to recall terms, facts and details without showing anything more, like if they understand the concept. Since memory alone is needed to answer the question (e.g., "At what temperature Fahrenheit does water freeze?" or "In what year was the Declaration of Independence signed?", the examinee either knows the answer or they don't, but they don't have to do anything more than recall information to correctly answer it. This is the level at which most textbook information is written: providing facts and supporting details, including examples and applications. We want to increase item level to assess that knowledge across our exams so each of our tests is demonstrably valid and job-related.

- **Learning objectives at this level:** Know common terms; know specific facts; know methods and procedures; know basic concepts and principles; define a term, or describe a process. The examinee doesn't have to do anything except describe (recall) the process.

- **Suggested item writing verbs at this level:** Memorize, Define, Identify, Repeat, Recall, State, Write, List and Name.
Level Two: Understanding

To get the item correct, examinees have to comprehend and interpret information, rather than just recall it. Items at this level assess examinee ability to summarize information, in their own words, without necessarily relating it to anything. Can examinees grasp the meaning of material, and go past simple recall of facts to understand the information, or make inferences from what they know?

- *Learning objectives at this level:* Understand facts and principles; interpret verbal material; interpret charts and graphs; estimate the future consequences implied in data; and justify methods and procedures.

- *Suggested item writing verbs at this level:* Distinguish, Explain, Interpret, Predict, Recognize and Summarize.

Level Three: Application

Application items require the examinee to use (apply) or transfer knowledge to a context that's different from the one in which the knowledge was learned. Can examinees apply their knowledge to solve a problem or apply it another (or new) situation? This level requires understanding, interpretation or manipulation of concepts or data to answer the question, such as by interpreting written or quantitative data; extrapolating (e.g., drawing conclusions from) written or numerical data; predicting the continuance of trends or the consequences of a decision (including being able to identify factors and variables which could make predictions inaccurate); and solving problems actuaries encounter at work.

- *Learning objectives at this level:* Apply concepts and principles to new situations; apply laws and theories to practical situations; solve mathematical problems; construct graphs and charts and demonstrate the correct usage of a method or procedure.

- *Suggested item writing verbs:* Apply (obviously . . . ), Compare, Contrast, Construct, Demonstrate, Examine, Predict, Relate and Solve.

Level Four: Analysis

To correctly answer items at this level, examinees have to go beyond knowledge and application to break down material into its component parts, see and describe patterns and relationships among those parts, and subdivide information and show how it's put together (interrelates). Examinees have to understand the relationship between those parts and see patterns they can use to analyze the problem to get the item right, perhaps taking several steps to get there. Or, can they support a conclusion based on available information and assumptions, or integrate several points of view to reach a conclusion or solve a problem.

- *Learning objectives at this level:* Recognize unstated assumptions, recognizes logical fallacies in reasoning, distinguish between facts and inferences, evaluate the relevancy of data, analyze the organizational structure of a work (art, music, writing).

- *Suggested item writing verbs at this level:* Analyze (of course . . . ), Differentiate, Distinguish, Estimate, Explain, Infer, Relate, Research & Separate.
**Level Five: Synthesis**

Synthesis items are at a high level, requiring examinees to use given facts to create new theories or make predictions; the ability to take various pieces of information and form a whole creating a pattern where one didn't exist before. They must create something new by using a combination of ideas from different sources to create something new: Can examinees put parts together or link ideas to form a new whole, pulling in knowledge from multiple subject areas and synthesize this information to reach the proper conclusion?

- *Learning objectives at this level:* Propose a plan for an experiment; integrate learning from different areas into a plan for solving a problem; and formulate a new scheme for classifying objects (or events, or ideas).
- *Suggested item writing verbs at this level:* Arrange, Combine, Compose, Construct, Create, Design, Develop, Formulate, Integrate, Organize, and Propose.

**Level Six: Evaluation**

Items at this top level require examinees to assess information to develop a supported opinion and make value decisions they can support based on specific criteria. In other words, can an examinee come to a conclusion, or show they have the ability to judge the value of material, like a statement or research report, for a given purpose based on evaluative criteria? Examinees have to look at someone else's ideas or principles and judge the worth/value of the work and value of the conclusions. Learning outcomes in this area are highest in the cognitive hierarchy because they contain elements of all the other categories, plus conscious value judgments based on clearly defined criteria; a multiple-choice item cannot be used to assess Synthesis or Evaluation, the two highest cognitive levels.

- *Learning objectives at this level:* Judge the adequacy with which conclusions are supported by data; or judge the value of a work (e.g., report or conclusion) and supporting your view.
- *Suggested item writing verbs at this level:* Assess; Criticize, Critique, Determine, Discriminate Between, Evaluate (obviously), Judge, Justify, Measure, Recommend, Support, and Weigh.