In 1956, Benjamin Bloom wrote *Taxonomy of Educational Objectives: Cognitive Domain*, and his six-level description of thinking has been widely adapted and used in countless contexts ever since. His list of cognitive processes is organized from the most simple, the recall of knowledge, to the most complex, making judgments about the value and worth of an idea.

### Bloom’s Taxonomy of Educational Objectives (Traditional)

<table>
<thead>
<tr>
<th>Skill</th>
<th>Definition</th>
<th>Key Words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Recall information</td>
<td>Identify, describe, name, label, recognize, reproduce, follow</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Understand the meaning, paraphrase a concept</td>
<td>Summarize, convert, defend, paraphrase, interpret, give examples</td>
</tr>
<tr>
<td>Application</td>
<td>Use the information or concept in a new situation</td>
<td>Build, make, construct, model, predict, prepare</td>
</tr>
<tr>
<td>Analysis</td>
<td>Break information or concepts into parts to understand it more fully</td>
<td>Compare/contrast, break down, distinguish, select, separate</td>
</tr>
<tr>
<td>Synthesis</td>
<td>Put ideas together to form something new</td>
<td>Categorize, generalize, reconstruct</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Make judgments about value</td>
<td>Appraise, critique, judge, justify, argue, support</td>
</tr>
</tbody>
</table>

Today’s world is a different place, however, than the one Bloom’s Taxonomy reflected in 1956. Educators have learned a great deal more about how students learn and teachers teach and now recognize that teaching and learning encompasses more than just thinking. It also involves the feelings and beliefs of students and teachers as well as the social and cultural environment of the classroom.

Several cognitive psychologists have worked to make the basic concept of a taxonomy of thinking skills more relevant and accurate. In developing his own taxonomy of educational objectives, Marzano (2000) points out one criticism of Bloom’s Taxonomy. The very structure of the Taxonomy, moving from the simplest level of knowledge to the most difficult level of evaluation, is not supported by research. A hierarchical taxonomy implies that each higher skill is composed of the skills beneath it; comprehension requires knowledge; application requires comprehension and knowledge, and so on. This, according to Marzano, is simply not true of the cognitive processes in Bloom’s Taxonomy.

The originators of the original six thinking processes assumed that complex projects could be labeled as requiring one of the processes more than the others. A task was primarily an “analysis” or an “evaluation” task. This has been proven not to be true which may account for the difficulty that educators have classifying challenging learning activities using the Taxonomy. Anderson (2000) argues that nearly all complex learning activities require the use of several different cognitive skills.

Like any theoretical model, Bloom’s Taxonomy has its strengths and weaknesses. Its greatest strength is that it has taken the very important topic of thinking and placed a structure around it that is usable by practitioners. Those teachers who keep a list of question prompts relating to the various levels of Bloom’s Taxonomy undoubtedly do a better job of encouraging higher-order thinking in their students than those who have no such tool. On the other hand, as anyone who has worked with a group of educators to classify a group of questions and learning activities according to the Taxonomy can attest, there is little consensus about what seemingly self-evident
terms like “analysis,” or “evaluation” mean. In addition, so many worthwhile activities, such as
authentic problems and projects, cannot be mapped to the Taxonomy, and trying to do that would
diminish their potential as learning opportunities.

Revised Bloom’s Taxonomy
In 1999, Dr. Lorin Anderson, a former student of Bloom's, and his colleagues published an
updated version of Bloom’s Taxonomy that takes into account a broader range of factors that
have an impact on teaching and learning. This revised taxonomy attempts to correct some of the
problems with the original taxonomy. Unlike the 1956 version, the revised taxonomy differentiates
between “knowing what,” the content of thinking, and “knowing how,” the procedures used in
solving problems.

The Knowledge Dimension is the “knowing what.” It has four categories: factual, conceptual,
procedural, and metacognitive. Factual knowledge includes isolated bits of information, such as
vocabulary definitions and knowledge about specific details. Conceptual knowledge consists of
systems of information, such as classifications and categories.

Procedural knowledge includes algorithms, heuristics or rules of thumb, techniques, and methods
as well as knowledge about when to use these procedures. Metacognitive knowledge refers to
knowledge of thinking processes and information about how to manipulate these processes
effectively.

The Cognitive Process Dimension of the revised Bloom’s Taxonomy like the original version has
six skills. They are, from simplest to most complex: remember, understand, apply, analyze,
evaluate, and create.

Remembering
Remembering consists of recognizing and recalling relevant information from long-term memory.

Understanding
Understanding is the ability to make your own meaning from educational material such as reading
and teacher explanations. The subskills for this process include interpreting, exemplifying,
classifying, summarizing, inferring, comparing, and explaining.

Applying
The third process, applying, refers to using a learned procedure either in a familiar or new
situation.

Analysis
The next process is analysis, which consists of breaking knowledge down into its parts and
thinking about how the parts relate to its overall structure. Students analyze by differentiating,
organizing, and attributing.

Evaluation
Evaluation, which is at the top of the original taxonomy, is the fifth of the six processes in the
revised version. It includes checking and critiquing.

Creating
Creating, a process not included in the earlier taxonomy, is the highest component of the new
version. This skill involves putting things together to make something new. To accomplish
creating tasks, learners generate, plan, and produce.

According to this taxonomy, each level of knowledge can correspond to each level of cognitive
process, so a student can remember factual or procedural knowledge, understand conceptual or
metacognitive knowledge, or analyze metacognitive or factual knowledge. According to Anderson
and his colleagues, “Meaningful learning provides students with the knowledge and cognitive
processes they need for successful problem solving. The following charts list examples of each skill of the Cognitive and Knowledge Dimensions.

### Cognitive Processes Dimensions

<table>
<thead>
<tr>
<th>Cognitive Processes</th>
<th>Examples</th>
</tr>
</thead>
</table>
| **Remembering**—Produce the right information from memory | Identify frogs in a diagram of different kinds of amphibians.  
• Find an isosceles triangle in your neighborhood.  
• Answer any true-false or multiple-choice questions. |
| **Recognizing** |  
• Identify frogs in a diagram of different kinds of amphibians.  
• Find an isosceles triangle in your neighborhood.  
• Answer any true-false or multiple-choice questions. |
| **Recalling** |  
• Name three 19th-century women English authors.  
• Write the multiplication facts.  
• Reproduce the chemical formula for carbon tetrachloride. |
| **Understanding**—Make meaning from educational materials or experiences |  
• Translate a story problem into an algebraic equation.  
• Draw a diagram of the digestive system.  
• Paraphrase Jawaharlal Nehru's tryst with destiny speech. |
| **Interpreting** |  
• Translate a story problem into an algebraic equation.  
• Draw a diagram of the digestive system.  
• Paraphrase Jawaharlal Nehru's tryst with destiny speech. |
| **Exemplifying** |  
• Draw a parallelogram.  
• Find an example of stream-of-consciousness style of writing.  
• Name a mammal that lives in our area. |
| **Classifying** |  
• Label numbers odd or even.  
• List the events of the Sepoy Mutiny of 1857.  
• Group native animals into their proper species. |
| **Summarizing** |  
• Make up a title for a short passage.  
• List the key points related to capital punishment that the Web site promotes. |
| **Inferring** |  
• Read a passage of dialogue between two characters and make conclusions about their past relationship.  
• Figure out the meaning of an unfamiliar term from the context.  
• Look at a series of numbers and predict what the next number will be. |
| **Comparing** |  
• Explain how the heart is like a pump.  
• Compare Mahatma Gandhi to a present day leader.  
• Use a Venn diagram to demonstrate how two books by Charles Dickens are similar and different. |
| **Explaining** |  
• Draw a diagram explaining how air pressure affects the weather.  
• Provide details that justify why the French Revolution happened when and how it did.  
• Describe how interest rates affect the economy. |
| **Applying**—Use a procedure |  
• Add a column of two-digit numbers.  
• Orally read a passage in a foreign language.  
• Have a student open house discussion. |
| **Executing** |  
• Add a column of two-digit numbers.  
• Orally read a passage in a foreign language.  
• Have a student open house discussion. |
| **Implementing** |  
• Design an experiment to see how plants grow in different kinds of soil.  
• Proofread a piece of writing.  
• Create a budget. |
| **Analyzing**—Break a concept down into its parts and describe how the parts relate to the whole |  
• List the important information in a mathematical word problem and cross out the unimportant information. |
| **Differentiating** |  
• List the important information in a mathematical word problem and cross out the unimportant information. |
<table>
<thead>
<tr>
<th>The Knowledge Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Factual Knowledge—Basic information</strong></td>
</tr>
<tr>
<td>Knowledge of terminology</td>
</tr>
<tr>
<td>Knowledge of specific details and elements</td>
</tr>
<tr>
<td><strong>Conceptual Knowledge—The relationships among pieces of a larger structure that make them function together</strong></td>
</tr>
<tr>
<td>Knowledge of classifications and categories</td>
</tr>
<tr>
<td>Knowledge of principles and generalizations</td>
</tr>
<tr>
<td>Knowledge of theories, models, and structures</td>
</tr>
</tbody>
</table>

**Procedural Knowledge—How to do something**

| Knowledge of subject-specific skills and algorithms | Procedure for solving quadratic equations, mixing colors for oil painting, serving a volleyball |
| Knowledge of subject-specific techniques and methods | Literary criticism, analysis of historical documents, mathematical problem-solving methods |
| Knowledge of criteria for determining when to use appropriate procedures | Methods appropriate for different kinds of experiments, statistical analysis procedures used for different situations, syllabus guidelines for different genres of writing |

**Metacognitive Knowledge—Knowledge of thinking in general and your thinking in particular**

| Strategic knowledge | Ways of memorizing facts, reading comprehension strategies, methods of planning a Web site |
| Knowledge about cognitive tasks, including appropriate contextual and conditional knowledge | Different reading demands of textbooks and novels; thinking ahead when using an electronic database; differences between writing emails and writing business letters |
| Self-knowledge | Need for a diagram or chart to understand complex processes, better comprehension in quiet environments, need to discuss ideas with someone before writing an essay |

**References**


