PERSPECTIVES

BLOOM'S TAXONOMY: What's Old Is New Again

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Disclaimer

Original Bloom's in Action: Writing Objectives

Learning objectives, also called instructional objectives, are statements describing what learners will be able to do upon completion of a unit of instruction. They help us decide what learners should learn and how we will determine whether they have learned that content. This brings up an important point: We write these objectives, at least at the outset, to guide the design of the instruction.

Clear objectives guide instructional designers, teachers, and facilitators in choosing appropriate instructional delivery methods and instructional strategies and therefore help learners achieve desired learning outcomes. To ensure that activities and evaluation are valid and properly aligned to instructional goals and content, assessments should be developed from objectives.

Suppose that one objective of a lesson calls for nursing students to determine whether a patient in the emergency room needs immediate care. This requires clinical judgment, so students need practice in interpreting assessment data and predicting outcomes. To assess this objective, questions on the knowledge and comprehension levels may be used to determine whether students can recall the facts needed to make an informed decision. However, the objective cannot be met unless students demonstrate that they can use higher-order thinking skills to make a clinical judgment.

Objectives can also be used to determine whether instruction aligns with educational outcomes or business goals. Suppose that a company invests in training to improve the performance of its service technicians. If the technicians meet only lower-level objectives, their skill is unlikely to improve. They might be able to label every part of every machine without error, but to do their job effectively they must develop the higher-order skills of diagnosing malfunctions and making repairs.

Cognitive Levels

In the original taxonomy, the verbs in learning objectives describe intended behavior—what learners will do to show that they have attained the objective. Learning objectives using verbs from the taxonomy have at least two parts:

- A noun or noun phrase identifying who is to perform the action
- A verb phrase describing the required behavior

For example:

Noun/Noun Phrase	**Verb Phrase**
The *learner*	will *identify* the flammable items.
The *learner*	will *determine* the merits of a proposal to create a new international division to handle international accounts.

In this example, the verb is *identify*. The cognitive skill required is recalling information. So the first example clearly targets Bloom's level 1, knowledge. In the second example, the verb *determine* could be associated with more than one cognitive level. Trainees might analyze whether the benefits of the proposal outweigh its costs. However, they might also be expected to judge whether the proposal is written in a way that meets criteria for communication excellence. The second objective should be revised so that the verb clearly targets either level 4, analysis, or level 6, evaluation.

Much of the power of Bloom's Taxonomy lies in its verbs. The verbs associated with each cognitive level identify what students can do to demonstrate that they have met objectives. The secret of alignment, whether at the lesson or program level, is to choose verbs that correlate instructional goals with content and assessment. Suppose a company develops a program to improve managers' coaching skills. If the instructional objectives are "List the steps in the coaching process" and "Define coaching," the program has a fatal flaw: its objectives are limited to the knowledge level, but its goals include mastery of higher-order skills that participants may not have learned or practiced. If instruction is limited to the knowledge level and participants must use higher-order skills to show mastery, the misalignment between lower-level instruction and higher-level assessment sets learners up to fail.

The lesson here is that it is critical to construct learning objectives at the level that you expect learners to perform.

Tools for Writing Objectives

Because learning objectives are so critical to instruction and assessment, many tools have been created to help writers use the original taxonomy to develop them. The most basic tools are tables that suggest verbs correlated to each level of cognition, such as Table 2 (on page 10) for an example. To use such tables, first identify the cognitive level you want to target; then choose a verb from the key words column and use it to begin your objective.

Table 2:

Bloom's Taxonomy cognitive levels and key words

	Skill	Definition	Verbs
Level 1	Knowledge	Recall information	Identify, describe, name, label, recognize, reproduce, follow
Level 2	Comprehension	Understand the meaning, paraphrase a concept	Summarize, convert, defend, paraphrase, interpret, give examples
Level 3	Application	Use the information or concept in a new situation	Build, make, construct, model, predict, prepare
Level 4	Analysis	Break information or concepts into parts to understand it more fully	Compare/contrast, break down, distinguish, select, separate
Level 5	Synthesis	Put ideas together to form something new	Categorize, generalize, reconstruct
Level 6	Evaluation	Make judgments about value	Appraise, critique, judge, justify, argue, support

Objectives at the knowledge level might ask learners to:

- Define a key term
- List the steps in a process
- Label a diagram

These objectives require learners to find an application for what they have learned:

- Predict the answer to a problem given certain variables
- Select the key concepts to cover in a course unit or training module

Some tools add a third element: an observable behavior that learners perform to show that they have met the objective. The result is a three-part learning objective that specifies who is to meet the objective, what is to be done, and what the result will be.

Who	does what	to accomplish this
The learner	will identify the parts of a Widget2000	by labeling a diagram
The sales representative	will use the jujitsu strategy	to develop counters to at least two anticipated objections

Tools that include this third element often show relationships among cognitive levels and components of the objective graphically. For example, the original taxonomy is often depicted as a staircase (Figure 2 on page 11) because it is a cumulative hierarchy.

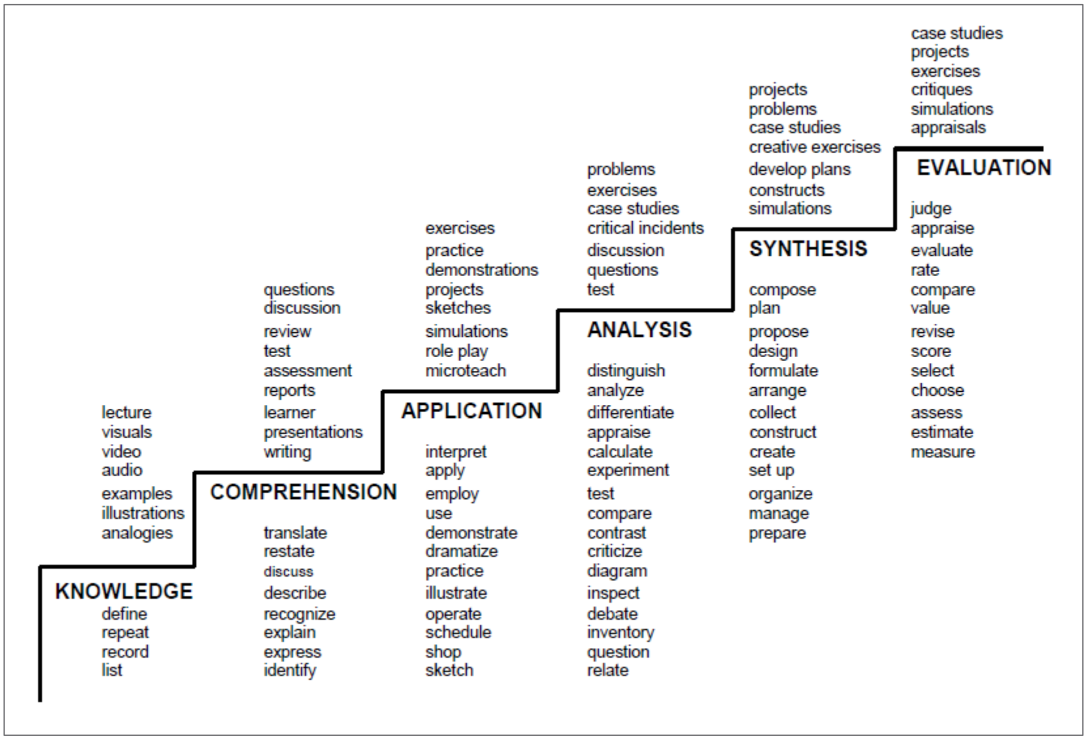
Learners are expected to climb the levels in sequence, and mastery of each step is required before moving to the next, more complex, level.

In Figure 2, the stairs represent the cognitive levels, arranged in ascending sequence. Above each step is a list of suggested activities for that level. Below each step is a list of verbs that might be used to create objectives targeted to that cognitive level.

Figure 2:

Bloom's Taxonomy staircase

(Source: ftp://ftp-fc.sc.egov.usda.gov/NEDC/isd/taxonomy.pdf)



Let's see how the staircase in Figure 2 can be used to create learning objectives.

1) Select the cognitive level of the learning objective.
2) Choose a verb from the list below that step.
3) Connect the verb to an activity above the step.

Sample application learning objective: Learners will demonstrate how to create a ticket for a request for computer support.

Sample evaluation learning objective: Learners will compare three sales call scripts and judge which is most likely to close the sale.

Objectives can be made more specific by basing them on real-world conditions or performance criteria, as shown in Table 3 (on page 12).

Table 3:

Examples of objectives with conditions and performance criteria

(Source: Shank)

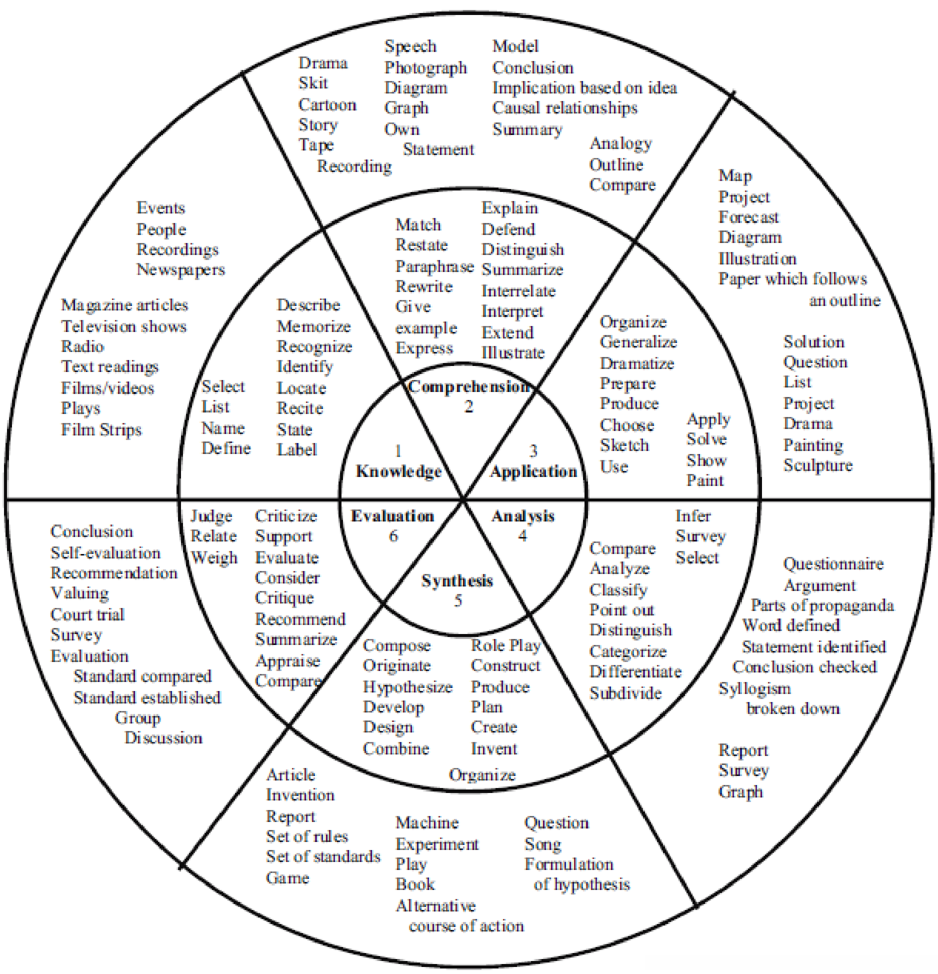
Who	Action	Conditions	Criteria
The student will	assess which window treatment(s) will work best.	given window size, facing, type, and budget	
The customer service rep will	manage client phone complaints		with fewer than 2% escalated to managers

The Bloom's Taxonomy question and task design wheel has a more extensive list of ideas for active learning. The wheel, available from CESA 7, is organized as a series of rings. The inner ring identifies the cognitive level of Bloom's Taxonomy; the middle ring contains action-oriented verbs; and the outer ring lists products and activities that demonstrate mastery.

Figure 3:

Bloom's Taxonomy question and task design wheel

(Source: CESA 7; http://www.cesa7.org/tdc/documents/bloomswheelforactivestudentlearning.pdf)



For an example of how to use Bloom's Taxonomy to differentiate outcomes for basic and advanced courses, see the University of Connecticut's Assessment Primer (http://assessment.uconn.edu/primer/taxonomies1.html). Note that students use higher-order thinking skills in both introductory and advanced courses. The verbs describing cognitive processes do not change; what does change is the amount of critical thinking students are expected to do, which increases as they advance.

Another strategy for writing objectives is to complete a prompt. A critical thinking poster in a Flickr photostream by Enokson (no real name given) illustrates how to use sentence frames to create questions and objectives for each level of Bloom's Taxonomy. For example, a question for the analysis level is "What evidence can you present for ________________?" An objective for the evaluation level is "Prioritize _________________ according to _______________." The poster, which may be freely used by not-for-profit organizations, is available at http://www.flickr.com/photos/vblibrary/4576825411/in/pool-27724923@N00/.

Still more tools, some interactive, are available on Larry Ferlazzo's Websites of the Day blog, which has an entry on "The Best Resources for Helping Teachers Use Bloom's Taxonomy in the Classroom" (http://larryferlazzo.edublogs.org/2009/05/25/the-best-resources-for-helping-teachers-use-blooms-taxonomy-in-the-classroom/).

Original Bloom's in Action: Developing Critical Thinking Questions

Forty years after the original taxonomy was published, Bloom reflected that one reason his work was widely adopted was the need for a systematic approach to educational planning. The taxonomy influenced practitioners to think about objectives, shifting their focus from what teachers did to what was learned. The distinction between higher- and lower-order thinking skills also raised awareness of the need to foster critical thinking. When the original taxonomy was published, as much as 90 percent of classroom time was spend on activities designed to help learners recall facts. Forty years later, Bloom estimated that the percentage of lower-order questions had been reduced to about 70 percent.

The tendency for instructors to ask more lower-order than higher-order questions persists, even though student achievement improves when teachers ask more higher-order questions. For a discussion of the correlation between student achievement and critical thinking questions, see Wenglinsky's 2001 report for the Educational Testing Service, "Teacher Classroom Practices and Student Performance."

The same bias toward lower-order questions is found in teacher-made and standardized tests. One reason is that lower-order questions are easier to write and score. However, testing at higher cognitive levels is both more valid and more efficient, according to Usova. When answering higher-level questions, learners must use knowledge and skills from lower cognitive levels. For example, a question might ask learners to analyze the differences between a company's new defined-contribution plan and the pension plan it replaced. To make the comparison, they must know the definition of each type of plan, understand the purpose of each type, and use this information to categorize the differences.

Not only is testing at higher cognitive levels more efficient, asking too many lower-order questions can actually impede learning. If you ask lower-order questions, the result will be lower-order learning, according to Andre (cited in Bloom's "Reflections"). To encourage higher-level learning, you must ask higher-order questions. Effective higher-order questions are often based on real-world experience, so asking learners to think critically in response to questions based on realistic situations develops their thinking and makes them more likely to use what they have learned. Andre's conclusions have particular relevance for educators who must provide evidence of student achievement and for trainers and instructional designers who must show how their work contributes to organizational goals.

By correlating assessment questions to Bloom's cognitive levels, practitioners and test developers can ensure that their questions promote both retention of knowledge *and* critical thinking. The model test items developed for *The Handbook* are still considered excellent examples of how to construct test questions. The editors of the revised taxonomy believed that they could not improve on the model items in the original.

Criticisms and the Need for Revision

The original taxonomy is still widely used by teachers, instructional designers, researchers, and assessment writers. However, a revised version of the taxonomy was published in 2001 to update the original and provide more guidance for classroom teachers. The editors also addressed some common criticisms of the original:

- The hierarchy lacks internal consistency; this is the most frequent criticism. Some categories overlap, and some skills—such as understanding—can be exercised at many cognitive levels.
- The taxonomy has not been validated by external evidence. Different raters often assign different cognitive levels to the same items, and the hierarchical relationship of the cognitive levels has not been proven.
- The taxonomy is too simplistic in the way it represents thinking and learning. Learning does not always follow a step-by-step progression. Also, the categories at the top level of the hierarchy do not adequately describe higher-order thinking processes.
- The taxonomy is a framework, or set of loosely organized principles, rather than a theory of instruction that can be used to predict how learners will behave.
- The term "lower-level thinking skills" has led educators to devalue the foundational knowledge required for higher-order thinking.
- The original taxonomy was based on the classroom practice and educational psychology of the 1950s.

In 1965, Bloom and one of his chief collaborators responded to calls for a revision by calling a meeting to find ways to make the framework easier for elementary and high school teachers to use. Their first effort to revise the taxonomy failed, explains David Krathwohl in "The Taxonomy: Past, Present, and Future," largely because of the difficulty of constructing one unified theory of learning.

During the 1970s, the use of Bloom's cognitive levels became institutionalized. Recipients of Title I funds used the taxonomy to develop objectives that met the federal government's reporting requirements. As states began standardized testing programs, item development guidelines called for questions that targeted both higher- and lower-order thinking.

In 1983, a National Commission on Excellence in Education warned that widespread deficiencies in critical thinking were making America *A Nation at Risk*, as it titled its report. The Association for Supervision and Curriculum Development met the following year to consider solutions to the problem. One recommendation called for an update to Bloom's Taxonomy. In response, 28 organizations formed a collaborative to revise the original version, but their efforts bore no fruit.

The Revised Version of Bloom's Taxonomy

Among the dozens of alternatives proposed to the original framework, the revision published by Lorin Anderson and his collaborators in 2001, *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*, has gained the widest acceptance. Anderson was a student of Bloom's, and one of his principal collaborators, David Krathwohl, also collaborated on the original taxonomy. They describe their work as an extension of the original framework rather than a replacement.

The original taxonomy was never intended to be definitive. In fact, Bloom expressed concern that people might grant the framework such authority that it would "freeze" thinking about curriculum, assessment, and instruction. He and his collaborators considered the framework a work in progress. In Bloom's ideal world, each field would have its own taxonomy written in the language of its discipline.

So the revision published in 2001 is not a heretical departure from the original *Handbook*, but a continuation of Bloom's work.

The original taxonomy was revised for two reasons:

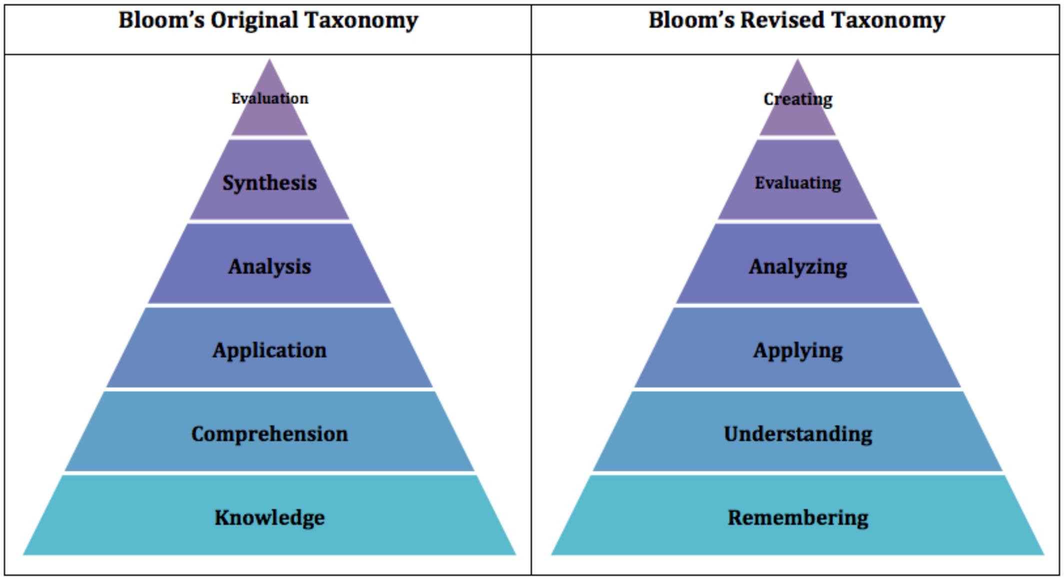
- To refocus attention on the value of the original handbook in developing accountability programs, aligning curriculums, and designing assessments
- To update the original based on new understanding of learning and new methods of instruction

Changes to the Categories

Figure 4 (on page 18) shows the most obvious differences between the 1956 and 2001 versions. In the revised taxonomy, evaluation is no longer the highest level of the pyramid. A new category, creating, claims the peak. This category was originally known as synthesis. Another significant change is that category names are no longer nouns, but verbs. For example, knowledge is now understanding. As a consequence, objectives developed using the revised taxonomy now describe learners' thinking processes rather than behaviors.

Figure 4:

Bloom's original and revised taxonomies



Other differences are more subtle. In the original taxonomy, the most important element was the categories. Six categories were arranged in a hierarchy, and it was assumed that learners must master the lowest level of the hierarchy before they could advance to the next higher level. The revised taxonomy also arranges skills from the most basic to the most complex. However, because skills such as understanding can be exercised on many levels, the developers allowed categories to overlap. For example, understand is technically lower on the hierarchy than apply. However, the skill of explaining is more cognitively complex than executing, even though that skill is associated with a higher category. As a result, "the hierarchy is no longer considered cumulative," according to Krathwohl.

From One to Two Dimensions: Knowledge Levels and Cognitive Processes

While Figure 4 makes it easy to see changes in the six categories, it does not show two important elements of the revised taxonomy: the new version has two dimensions—knowledge and cognitive processes—and the subcategories within each dimension are more extensive and specific. Each element is explained below; for a visual representation of how the elements relate to each other, see Figure 5 (on page 22).

The first dimension, knowledge, now contains four categories of knowledge arranged from the most concrete to the most abstract:

- Factual—knowledge that is basic to an area of study: essential facts, terminology, details, or elements learners must know or be familiar with in order to understand a discipline or solve a problem within a field of study. For example, educational measurement specialists must know the difference between formative and summative assessments.

- Conceptual—knowledge of classifications, principles, generalizations, theories, models, or structures pertinent to a particular disciplinary area. For example, librarians often catalog materials according to the Dewey Decimal System or the Library of Congress classification system.
- Procedural—information or knowledge that helps learners to do something specific within an area of study. It also refers to methods of inquiry, very specific skills, algorithms, techniques, and particular methodologies. This knowledge is often subject- or job-specific. For example, nuclear power plant operators might have to follow emergency shutdown procedures.
- Metacognitive—awareness of one's own thinking and personal growth. This category was added because recent research has given us new understanding of how learners monitor and regulate their own cognitive processes. For example, an instructional designer might recognize that the objectives for a unit do not align with its content. A learner, aware of a tendency toward bias, might consciously choose to research opposing points of view.

The second dimension, cognitive processes (shown in Table 4), organizes 19 cognitive processes along a continuum from the most basic to the most complex. In the revised taxonomy, these cognitive processes are considered more important than the six categories, according to Krathwohl.

Table 4:

The cognitive processes dimension—categories and cognitive processes and alternative names

(Source: Iowa State University Center for Excellence in Learning and Teaching; http://www.celt.iastate.edu/pdfs-docs/teaching/RevisedBloomsHandout.pdf)

lower order thinking skills →					higher order thinking skills
remember	**understand**	**apply**	**analyze**	**evaluate**	**create**
recognizing • identifying recalling • retrieving	interpreting • clarifying • paraphrasing • representing • translating exemplifying • illustrating • instantiating classifying • categorizing • subsuming summarizing • abstracting • generalizing inferring • concluding • extrapolating • interpolating • predicting comparing • contrasting • mapping • matching explaining • constructing models	executing • carrying out implementing • using	differentiating • discriminating • distinguishing • focusing • selecting organizing • finding coherence • integrating • outlining • parsing • structuring attributing • deconstructing	checking • coordinating • detecting • monitoring • testing critiquing • judging	generating • hypothesizing planning • designing producing • constructing

Adapted from Anderson & Krathwohl, 2001.

Revised Bloom's in Action: Writing Two-Dimensional Objectives

The new emphasis on cognitive processes remedies a weakness in the original taxonomy. In the 1956 version, the verbs associated with each cognitive level describe behaviors. However, the same behavior can sometimes be performed at different cognitive levels. For example, an objective might ask learners to list the three most serious sources of pollution in their state. The behavior—writing a series of related items—is the same whether learners are simply recalling information from a source or independently evaluating the most damaging sources of pollution. Adding a second dimension allows objective writers to differentiate between retrieving a list or constructing one.

Two-dimensional learning objectives follow a familiar structure:

Subject	**Verb**	**Object**
Who	does what	to accomplish this

However, two-dimensional objectives allow writers to be more specific about the level of cognitive complexity required by first *choosing a verb associated with a cognitive process* and then *targeting the type of knowledge learners are asked to master*. For example:

Subject	**Cognitive Process**	**Type of Content**
The learner will	remember (*recognize, recall*)	factual
	understand (*interpret, classify, summarize*)	conceptual
	apply (*execute, implement*)	procedural
	analyze (*differentiate, organize, attribute*)	metacognitive
	evaluate (*check, critique*)	
	create (*generate, plan, produce*)	

In the original taxonomy, verbs are associated with six categories of cognitive skills and abilities: knowledge, comprehension, application, analysis, synthesis, and evaluation. Using the revised taxonomy, objective writers can target either a category or one of the 19 cognitive processes. Airasion and Miranda suggest that writers avoid vague terms such as *learn* or *state* by choosing the names of either the categories (bolded in Table 4) or thinking skills (bulleted in Table 4) as verbs when developing objectives. For example, the objective "Learners will state the main point" could be made more precise by replacing *state* with *recall* or *summarize*.

Develop Performance-based Objectives with Bloom's

If you are using either version of Bloom's Taxonomy to write performance objectives, your choice of verbs is critical. Michele Medved of MBM Training identifies three criteria for selecting verbs for performance objectives.

Verbs in performance objectives must:

- Be measurable and observable
- Specify what the learner (not the instructor) does
- Require the learner to apply the learning

Verbs are the most critical element of a performance objective because they identify what the learner must do to meet the objective. Another component of an effective performance objective is the condition under which the learner performs. One way to identify the conditions is to use the knowledge dimension of the revised taxonomy. First, determine how (or in what context) will learners use what they have learned? Then identify the cognitive process learners must use to apply their knowledge. Objectives for any cognitive process can target any of the four categories of knowledge, as shown below.

Table 5:

Job aid using Bloom's to target the knowledge dimension

Type of Knowledge: How will learners use what they learn?	**Cognitive Process:** Remember	**Cognitive Process:** Evaluate
Factual	List the links in the Chain of Survival.	Check whether a performance objective contains all necessary elements.
Conceptual	Recognize the symptoms of a heart attack.	Determine whether a performance objective targets knowledge or skill learners need to do their job.
Procedural	Recall how to give chest compressions for an adult.	Judge whether performance criteria are fair and appropriate.
Metacognitive	Identify situations in which CPR is not the appropriate treatment.	Reflect on how I can write better performance objectives.

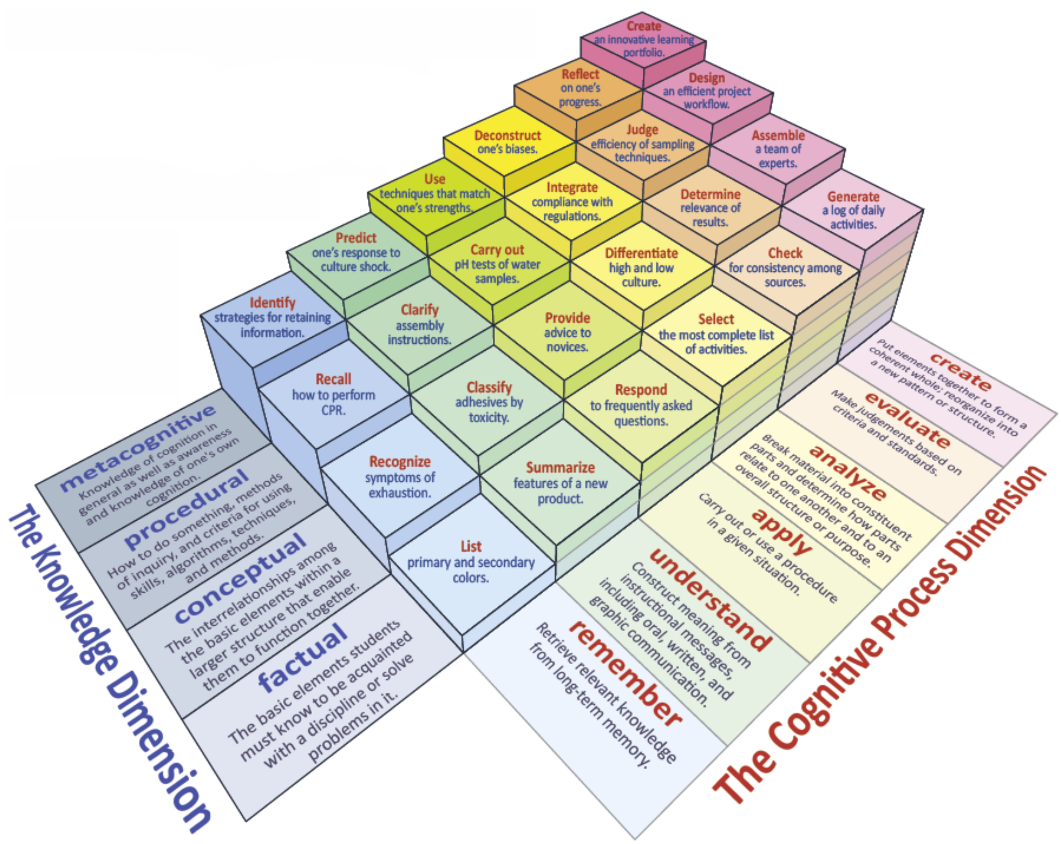
Figure 5 shows how the two dimensions of the revised taxonomy relate to each other and to cognitive complexity. The knowledge dimension, shown on the left in blue, categorizes the types of knowledge beginning with the most basic (factual) on the right to the most complex (metacognitive) on the left. The cognitive process dimension, shown on the right in red, categorizes increasing cognitive complexity from left (remembers) to right (create). The height of each bar illustrates the relative difficulty of objectives written at that level. For example, the procedural objective "Carry out pH tests of water samples" is expected to be more difficult than one asking learners to apply knowledge of water testing and less difficult than one that requires learners to judge whether the test supplies the data required by new regulations.

An interactive version of this model is available from the Iowa State University Center for Excellence in Learning and Teaching (http://www.celt.iastate.edu/teaching/RevisedBlooms1.html).

Figure 5:

Taxonomy for learning, teaching, and assessing: a revision of Bloom's Taxonomy of Educational Objectives

(Source: Iowa State University Center for Excellence in Learning and Teaching; http://www.celt.iastate.edu/pdfs-docs/teaching/RevisedBloomsHandout.pdf)



Rex Heer, Iowa State University Center for Excellence in Learning and Teaching, March 2009.

In "Rote versus Meaningful Learning," Richard Mayer recommends using the revised taxonomy to write objectives across the entire range of cognitive processes. When your goal is to have learners retain what they have learned, write lower-level objectives to target foundational knowledge. When your goal is to have learners build knowledge or apply what they have learned, write objectives that require higher-order cognitive processing. Mayer developed his explanation of how each higher-level cognitive dimension can be used to promote and assess meaningful learning in collaboration with other members of the team that produced the revised taxonomy.

Table 6 shows how an instructional designer might write two-dimensional learning objectives at many levels of the revised taxonomy. Targeting different dimensions allows the designer to assess whether learners have mastered the basics and can apply what they have learned in new situations.

Table 6:

Two-dimensional learning objectives

Cognitive Dimension	Knowledge Dimension	Customer Service Module Objective: How to Handle a Complaint
Remember	Procedural	List the steps in documenting a customer complaint
Understand	Factual	Summarize the customer's complaint
Apply	Conceptual	Provide advice to a new call center employee about how to handle an irate customer
Analyze	Factual	Select the most appropriate way to handle a complaint from a given set of options
Evaluate	Conceptual	Critique the way a customer service representative handled a complaint call
Create	Procedural	Develop a plan to improve customer satisfaction with the way we handle complaints

Try Revised Bloom's Yourself

Directions: The best way to understand the revised taxonomy is to develop your own two-dimensional objectives. Using Figure 5 and Table 6 as models, write objectives for at least two different cognitive levels.

Worksheet 1:

Developing two-dimensional objectives

Cognitive Dimension (remember, understand, apply, analyze, evaluate, create)	**Knowledge Dimension** (choose at least one)	**Objective**
	Factual	
	Conceptual	
	Procedural	
	Metacognitive	
	Factual	
	Conceptual	
	Procedural	
	Metacognitive	
	Factual	
	Conceptual	
	Procedural	
	Metacognitive	
	Factual	
	Conceptual	
	Procedural	
	Metacognitive	

Try Revised Bloom's Yourself: Align Coverage with the Taxonomy Table

Another tool that can be used to analyze the depth and breadth of objectives is the taxonomy table. The example in Table 7 maps the customer service objectives in Table 6 to the knowledge dimensions of each cognitive level. When these objectives are placed into the matrix, it's easy to see that they cover facts, concepts, and procedures. However, no objectives target metacognitive knowledge. That may be a deliberate decision, based on the goals of the unit. On the other hand, the designer may decide the lack of metacognitive objectives is an omission that should be remedied. The taxonomy table may also be used to analyze the degree to which instruction matches assessment and program objectives encourage higher-level thinking, as Anderson explains in his article on curricular alignment.

Table 7:

Example taxonomy table: customer service objectives from Table 6

(Adapted from Krathwohl)

Knowledge Dimension	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual Knowledge		✓		✓		
Conceptual Knowledge			✓		✓	
Procedural Knowledge	✓					✓
Metacognitive Knowledge						

The taxonomy table in this case shows that metacognitive knowledge is missing from the unit but does not show whether the designer of the instruction has designed the instruction appropriately. It is possible, for example, that the designer has used remember objectives in too many places and has not used application objectives where they should have been used. This is only a very high-level look at the objectives.