

Broadening teaching and assessing

Based on Mayer, R.E. (2000) – www.michelvanast.nl

Cognitieve proces	Geassocieerde cognitieve proces (werkwoorden)	Voorbeeld doelstelling	Voorbeeld toetsvraag
Remember Remembering involves retrieving relevant knowledge from long-term memory.	<i>Recognizing</i> (also called identifying) involves locating knowledge in long-term memory that is consistent with presented material.	Identify the major exports of various South American countries.	Which of these is a major export of Colombia? (a) bananas, (b) coffee, (c) silk, (d) tea.
	<i>Recalling</i> (also called retrieving) involves retrieving relevant knowledge from long-term memory.	Recall the poets who authored various poems.	Who wrote The Charge of the Light Brigade?
Understand Students are said to understand when they are able to construct meaning from instructional messages including oral, written, and graphic communications, and material presented during lectures, in books, or on computer monitors.	<i>Interpreting</i> (also called clarifying, paraphrasing, representing, or translating) occurs when a student is able to convert information from one form of representation to another.	Learn to translate number sentences expressed in words into algebraic equations expressed in symbols.	Asking students to write an equation (using B for the number of boys and G for the number of girls) that corresponds to the statement, There are twice as many boys as girls in this class.
	<i>Exemplifying</i> (also called illustrating or instantiating) occurs when a student finds a specific example or instance of a general concept or principle.	Learn to identify various artistic painting styles.	Find a new example of the impressionist style (with new meaning an example not included in the textbook or used in class).
	<i>Classifying</i> (also called categorizing or subsuming) occurs when a student determines that something (e.g., a particular instance or example) belongs to a certain category (e.g., concept or principle).	Learn to classify observed or described cases of mental disorders.	Observe a video of the behavior of a mental patient and then indicate the mental disorder that is being displayed.
	<i>Summarizing</i> (also called abstracting or generalizing) occurs when a student produces a short statement that represents presented information or abstracts a general theme.	Learn to write summaries of events portrayed pictorially.	Watch a videotape about the French Revolution and then write a cohesive summary.

	<i>Inferring</i> (also called <i>concluding</i> , <i>extrapolating</i> , <i>interpolating</i> , or <i>predicting</i>) involves drawing a logical conclusion from presented information.	"Students will be able to infer grammatical principles from examples	A student may be given the articlenoun pairs, "la casa, el muchacho, la senorita, el pero," and asked to formulate a principle for when to use the article <i>la</i> and when to use the article <i>el</i> .
	<i>Comparing</i> (also called contrasting, mapping, or matching) involves detecting similarities and differences between two or more objects, events, icleas, problems, or situations.	Understand historical events by comparing them to faniiliar situations."	How is the American Revolution like a family fight or an argument between friends?"
	<i>Explaining</i> (also called constructing models) occurs when a student mentally constructs and uses a cause-and-effect model of a system or series.	Explain observed phenomena in terms of basic physics laws.	Asking students who have studied Ohm's Law to explain what happens to the rate of the current when a second battery is added to a circuitasking students who have viewed a video on lightning storms to explain how differences in temperature are involved in the formation of lightning.
Apply involves using procedures to perform exercises or solve problems and is closely linked with Procedural Knowledge.	<i>Executing</i> (also called <i>carrying out</i>) occurs when a student applies a procedure to a familiar task.	Learn to divide one whole number by another, both with multiple digits.	A student may be given a worksheet containing 15 whole number division exercises (e.g., 784/15) and asked to find their quotients.
	<i>Implementing</i> (also called <i>using</i>) occurs when a student applies one or more procedures to an unfamiliar task.	Learn to use the most effective, efficient, and affordable method of conducting a research study to address a specific research question.	Give students a research question and have them propose a research study that meets specified criteria of effectiveness, efficiency, and affordability.
Analyze involves breaking material into its constituent parts and determining how the parts are related to each other and to an overall structure.	<i>Differentiating</i> (also called <i>discriminating</i> , <i>selecting</i> , <i>distinguishing</i> , or <i>focusing</i>) occurs when a student discriminates relevant from irrelevant parts or important from unimportant parts of presented material.	Distinguish between relevant and irrelevant numbers in a word problem.	Circle the relevant numbers and cross out the irrelevant numbers in a word problem.

	<i>Organizing</i> (also called <i>finding coherence, integrating, outlining, parsing, or structuring</i>) involves determining how elements fit or function within a structure.	Learn to structure a historical description into evidence for and against a particular explanation.	Prepare an outline showing which facts in a passage on American history support and which facts do not support the conclusion that the American Civil War was caused by differences in the rural and urban composition of the North and the South.
	<i>Attributing</i> (also called <i>deconstructing</i>) occurs when a student is able to determine the point of view, biases, values, or intent underlying presented material.	Learn to determine the point of view of the author of an essay on a controversial topic in terms of his or her theoretical perspective.	Ask students whether a report on Amazon rain forests was written from a pro-environment or pro-business point of view ask a student to determine whether a behaviorist or a cognitive psychologist wrote an essay about human learning.
Evaluate is defined as making judgments based on criteria and standards. The criteria most often used are quality, effectiveness, efficiency, and consistency. They may be determined by the student or given to the student by others. The standards may be either quantitative (i.e., is this a sufficient amount?) or qualitative (i.e., is this good enough?).	<i>Checking</i> (also called <i>coordinating, detecting, monitoring, or testing</i>) occurs when a student detects inconsistencies or fallacies within a process or product, determines whether a process or product has internal consistency, or detects the effectiveness of a procedure as it is being implemented.	Learn to detect inconsistencies within persuasive messages. Learn to determine whether a scientist's conclusion follows from the observed data.	Listen to a television advertisement for a political candidate and point out any logical flaws in the persuasive message. Read a report of a chemistry experiment in order to determine whether the conclusion follows from the results of the experiment.
	<i>Critiquing</i> (also called <i>judging</i>) occurs when a student detects inconsistencies between a product or operation and some external criteria, determines whether a product has external consistency, or judges the appropriateness of a procedure for a given problem.	Learn to evaluate a proposed solution (e.g., eliminate all grading) to a social problem (e.g., how to improve K-12 education) in terms of its likely effectiveness.	

<p>Create involves putting elements together to form a coherent or functional whole; that is, reorganizing elements into a new pattern or structure. Objectives classified as <i>Create</i> involve having students produce an original product.</p>	<p><i>Generating</i> (also called <i>hypothesizing</i>) involves inventing alternative hypotheses based on criteria.</p>	<p>Learn to generate multiple potentially useful solutions for social problems.</p> <p>Generate alternative methods for achieving a particular end result.</p>	<p>Suggest as many ways as possible to assure that everyone has adequate medical insurance.</p> <p>List alternative methods they could use to find which whole numbers yield 60 when multiplied together.</p>
	<p><i>Planning</i> (also called <i>designing</i>) involves devising a method for accomplishing some task.</p>	<p>List the steps needed to solve geometry problems.</p>	<p>Devise a plan for determining the volume of the frustum of a pyramid (a task not previously considered in class).</p>
	<p><i>Producing</i> (also called <i>constructing</i>) involves inventing a product.</p>	<p>Learn to design habitats for certain species and certain purposes.</p>	<p>Design the living quarters of a space station.</p>

Mayer, R.E. (2002). *Rote learning versus meaningful learning*. Theory into practice 41(4) – 226-232
 Revising Bloom's Taxonomy. *Theory Into Practice*, 41(4), Autumn 2002. 212-264 (verkregen op 26 november 2015)