Categories of learning outcomes

Knowledge or learning outcomes?

Learning outcomes

- "… are statements of what a learner is expected to know, understand and/or be able to do at the end of a period of learning."[1)]

The most desired outcome of learning is of course knowledge. Yet, if one uses it's more precise definition, one should be aware that it is not the only and not a necessary learning outcome. For example, a learning outcome can be no new knowledge at all, it can be a misinformation, or an unusable belief lacking certainty.

But even the learning outcomes that satisfy the definition of knowledge can still be very different and are often divided into categories or types, which also allow for them to be assessed accordingly.

Bloom's taxonomy of learning outcomes

Bloom's taxonomy of learning outcomes was one of the first and most notable attempts to create a framework for what is expected of students to learn as the result of the instructional process. It was also intended to enable formation of data banks of items assessing same learning outcome which could even be exchanged between universities and lower the labor required for preparing examinations.[2)] Blooms original taxonomy was introduced in 1956[3)], and distinguished between three domains of knowledge (cognitive - mental skills, affective - feelings and attitudes, and psychomotor - physical skills), but developed in details only the cognitive domain as follows:

	Type	Definition
1.	**Knowledge**	Knowledge of specifics (facts and specific terminology), ways and means of dealing with specifics (conventions, trends, sequences, classifications, categories, criteria, methodology), and universals and abstracts in field (principles, generalizations, theories and structures).
2.	**Comprehension**	Translation, interpretation, extrapolation.
3.	**Application**	-
4.	**Analysis**	Analysis of elements, their relationships and organizational principles.
5.	**Synthesis**	Production of a unique communication, plan, proposed set of operations, derivation of a set of abstract relations.
6.	**Evaluation**	Evaluation in terms of internal evidence and judgements in terms of external criteria.

The mentioned six categories represent a hierarchy in which the next type of learning outcomes cannot be achieved unless the current, more simple one is mastered. They were often used to show the breadth (or lack of it) of the assessed learning outcomes, which were often limited just to the first category (knowledge), although other categories like comprehension and analysis are often refereed to as the most important educational outcomes.[4)]

Revised Bloom's taxonomy

Bloom's taxonomy of learning was revised a number of times by other researchers, yet the revision gaining most attention was introduced in 2002[5)], suggesting some improvements to the original taxonomy, especially in the concept of the most simple learning outcome - knowledge. Based on the more recent advancements in the area of cognitive psychology, knowledge is according to the revised taxonomy divided in four types[6)]:

	Type		Definition	Examples	
1.	**Declarative knowledge**	**Factual knowledge**	The knowledge of **facts or the basic elements** students must know to be acquainted with a discipline or solve problems in it.	Knowhedge that a a keyboard is a computer device, that chemical symbol *Au* represents gold, that [knowledge_assessment:learning_outcomes	this color]] is called green, that *7* is the symbol for number 7, knowledge of names of three fastest growing trees, knowledge of the definition of the quadratic formula, knowledge that hte capital of Azerbajdan is Baku, knowledge that the U.S. gained independence in 1776.
2.		**Conceptual knowledge**	Conceptual knowledge reffers to **patterns and interrelationships** among the basic elements within a larger structure that enable them to function together.	Knowledge of categories like cars, dogs or rock music. Knowledge about similarities and patterns in factual knowledge elements, for example forms of business ownership.	
3.	**Procedural knowledge**		How to do something, methods of inquiry, and criteria for using skills, algorithms, techniques, and methods.	Whole-number division algorithm, greedy algorithm, Held–Karp algorithm, interviewing techniques, differential equation solving techniques, gaze heuristic, similarity heuristic.	

	Type	Definition	Examples	
4.	**Metacognitive knowledge**	Knowledge of cognition in general as well as awareness and knowledge of one's own cognition[7].	Knowledge of outlining as a means of capturing the structure of a unit subject matter in a textbook, knowledge of the use of heuristics, knowledge of the types of tests particular teachers administer, knowledge of the cognitive demands of different tasks.	

The taxonomy itself was subjected to some changes. Those changes include the changes in the terminology of the learning outcomes and in adding a second dimension of mentioned knowledge types to the taxonomy. The new taxonomy is therefore two dimensional and consists of four types of knowledge on one axis and six types of cognitive processes (learning outcomes) that can be performed on them[8)9)]:

	Type	Definition	Key processes
1.	**Remember**	Retrieving relevant knowledge from long-term memory.	Recognize, recall.
2.	**Understand**	Determining the meaning of instructional messages, including oral, written, and graphic communication.	Interpret, exemplify, classify, summarize, compare, explain.
3.	**Apply**	Carrying out or using a procedure in a given situation.	Execute, implement.
4.	**Analyze**	Breaking material into its constituent parts and detecting how the parts relate to one another and to an overall structure or purpose.	Differentiate, organize, attribute.
5.	**Evaluate**	Making judgments based on criteria and standards.	Check, criticize.
6.	**Create**	Putting elements together to form a novel, coherent whole or make an original product.	Generate, plan, produce.

1)

Bologna Website cited by Learning outcomes: Common framework – different approaches to evaluation learning outcomes in the Nordic countries. Nordic Quality Assurance Network for Higher Education, 2008.

2) , 4) , 6) , 8)

Krathwohl, David R. A Revision of Bloom's Taxonomy: An Overview. Theory into practice 41, no. 4, Autumn 2002.

3)

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5)

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7)

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9)

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