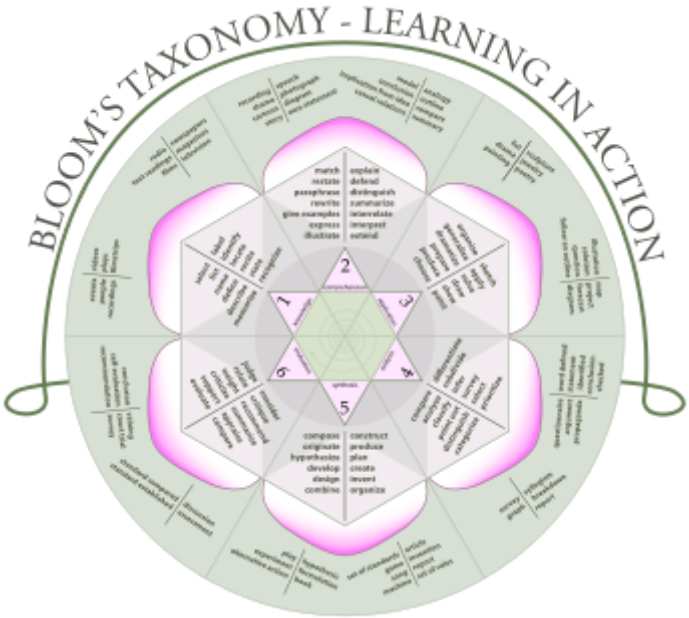
Bloom's taxonomy

Bloom's taxonomy is a set of three hierarchical models used to classify educational learning objectives into levels of complexity and specificity. The three lists cover the learning objectives in cognitive, affective and sensory domains. The cognitive domain list has been the primary focus of most traditional education and is frequently used to structure curriculum learning objectives, assessments and activities.

The models were named after Benjamin Bloom, who chaired the committee of educators that devised the taxonomy. He also edited the first volume of the standard text, *Taxonomy of Educational Objectives: The Classification of Educational Goals*.[1][2]



Bloom's taxonomy (cognitive) according to Bloom's verbs and matching assessment types. The verbs are intended to be feasible and measurable.

Contents

History

The cognitive domain (knowledge-based)
- Knowledge
- Comprehension
- Application
- Analysis
- Synthesis
- Evaluation

The affective domain (emotion-based)
- Receiving
- Responding
- Valuing
- Organizing
- Characterizing

The psychomotor domain (action-based)
- Perception
- Set
- Guided response
- Mechanism
- Complex overt response
- Adaptation
- Origination

Definition of knowledge

Criticism of the taxonomy

Implications

Connections across disciplines

See also

References

Further reading

History

Although named after Bloom, the publication of *Taxonomy of Educational Objectives* followed a series of conferences from 1949 to 1953, which were designed to improve communication between educators on the design of curricula and examinations.[3]

The first volume of the taxonomy, *Handbook I: Cognitive*[1] was published in 1956, and in 1964 the second volume *Handbook II: Affective* was published.[4][5][6][7][8] A revised version of the taxonomy for the cognitive domain was created in 2001.[9]

The cognitive domain (knowledge-based)

In the original version of the taxonomy, the cognitive domain is broken into the following six levels of objectives.[10] In the 2001 revised edition of Bloom's taxonomy, the levels are slightly different: Remember, Understand, Apply, Analyze, Evaluate, Create (rather than Synthesize).[9][11]

Knowledge

Knowledge involves recognizing or remembering facts, terms, basic concepts, or answers without necessarily understanding what they mean. Its characteristics may include:

- Knowledge of specifics—terminology specific facts
- Knowledge of ways and means of dealing with specifics—conventions, trends and sequences, classifications and categories, criteria, methodology
- Knowledge of the universals and abstractions in a field—principles and generalizations, theories and structures

Example: Name three common varieties of apple.

Comprehension

Comprehension involves demonstrating an understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions, and stating the main ideas.

Example: Compare the identifying characteristics of a Golden Delicious apple with a Granny Smith apple.

Application

Application involves using acquired knowledge—solving problems in new situations by applying acquired knowledge, facts, techniques and rules. Learners should be able to use prior knowledge to solve problems, identify connections and relationships and how they apply in new situations.

Example: Would apples prevent scurvy a disease caused by a deficiency in vitamin C?

Analysis

Analysis involves examining and breaking information into component parts, determining how the parts relate to one another, identifying motives or causes, making inferences, and finding evidence to support generalizations. Its characteristics include:

- Analysis of elements
- Analysis of relationships
- Analysis of organization

Example: List four ways of serving foods made with apples and explain which ones have the highest health benefits. Provide references to support your statements.

Synthesis

Synthesis involves building a structure or pattern from diverse elements; it also refers to the act of putting parts together to form a whole. Its characteristics include:

- Production of a unique communication
- Production of a plan, or proposed set of operations
- Derivation of a set of abstract relations

Example: Convert an "unhealthy" recipe for apple pie to a "healthy" recipe by replacing your choice of ingredients. Explain the health benefits of using the ingredients you chose vs. the original ones.

Evaluation

Evaluation involves presenting and defending opinions by making judgments about information, the validity of ideas, or quality of work based on a set of criteria. Its characteristics include:

- Judgments in terms of internal evidence
- Judgments in terms of external criteria

Example: Which kinds of apples are best for baking a pie, and why?

The affective domain (emotion-based)

Skills in the affective domain describe the way people react emotionally and their ability to feel other living things' pain or joy. Affective objectives typically target the awareness and growth in attitudes, emotion, and feelings.

There are five levels in the affective domain moving through the lowest-order processes to the highest.

Receiving

The lowest level; the student passively pays attention. Without this level, no learning can occur. Receiving is about the student's memory and recognition as well.

Responding

The student actively participates in the learning process, not only attends to a stimulus; the student also reacts in some way

Valuing

The student attaches a value to an object, phenomenon, or piece of information. The student associates a value or some values to the knowledge they acquired.

Organizing

The student can put together different values, information, and ideas, and can accommodate them within his/her own schema; the student is comparing, relating and elaborating on what has been learned.

Characterizing

The student at this level tries to build abstract knowledge.

The psychomotor domain (action-based)

Skills in the psychomotor domain describe the ability to physically manipulate a tool or instrument like a hand or a hammer. Psychomotor objectives usually focus on change and/or development in behavior and/or skills.

Bloom and his colleagues never created subcategories for skills in the psychomotor domain, but since then other educators have created their own psychomotor taxonomies.[7] Simpson (1972)[12] proposed the following levels:

Perception

The ability to use sensory cues to guide motor activity. This ranges from sensory stimulation, through cue selection, to translation.

Examples: Detects non-verbal communication cues. Estimate where a ball will land after it is thrown and then moving to the correct location to catch the ball. Adjusts heat of the stove to correct temperature by smell and taste of food. Adjusts the height of the forks on a forklift by comparing where the forks are in relation to the pallet.

Key words: chooses, describes, detects, differentiates, distinguishes, identifies, isolates, relates, selects.

Set

Readiness to act: It includes mental, physical, and emotional sets. These three sets are dispositions that predetermine a person's response to different situations (sometimes called mindsets). This subdivision of psychomotor is closely related with the "responding to phenomena" subdivision of the affective domain.

Examples: Knows and acts upon a sequence of steps in a manufacturing process. Recognizes his or her abilities and limitations. Shows desire to learn a new process (motivation).

Keywords: begins, displays, explains, moves, proceeds, reacts, shows, states, volunteers.

Guided response

The early stages of learning a complex skill that includes imitation and trial and error: Adequacy of performance is achieved by practicing.

Examples: Performs a mathematical equation as demonstrated. Follows instructions to build a model. Responds to hand-signals of the instructor while learning to operate a forklift.

Keywords: copies, traces, follows, react, reproduce, responds.

Mechanism

The intermediate stage in learning a complex skill: Learned responses have become habitual and the movements can be performed with some confidence and proficiency

Examples: Use a personal computer. Repair a leaking tap. Drive a car.

Key words: assembles, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches.

Complex overt response

The skillful performance of motor acts that involve complex movement patterns: Proficiency is indicated by a quick, accurate, and highly coordinated performance, requiring a minimum of energy. This category includes performing without hesitation and automatic performance. For example, players will often utter sounds of satisfaction or expletives as soon as they hit a tennis ball or throw a football because they can tell by the feel of the act what the result will produce.

Examples: Maneuvers a car into a tight parallel parking spot. Operates a computer quickly and accurately. Displays competence while playing the piano.

Key words: assembles, builds, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches. (Note: The key words are the same as in mechanism, but will have adverbs or adjectives that indicate that the performance is quicker, better, more accurate, etc.)

Adaptation

Skills are well developed and the individual can modify movement patterns to fit special requirements.

Examples: Responds effectively to unexpected experiences. Modifies instruction to meet the needs of the learners. Performs a task with a machine that was not originally intended for that purpose (the machine is not damaged and there is no danger in performing the new task).

Key words: adapts, alters, changes, rearranges, reorganizes, revises, varies.

Origination

Creating new movement patterns to fit a particular situation or specific problem: Learning outcomes emphasize creativity based upon highly developed skills.

Examples: Constructs a new set or pattern of movements organized around a novel concept or theory. Develops a new and comprehensive training program. Creates a new gymnastic routine.

Key words: arranges, builds, combines, composes, constructs, creates, designs, initiate, makes, originates.

Definition of knowledge

In the appendix to *Handbook I*, there is a definition of knowledge which serves as the apex for an alternative, summary classification of the educational goals. This is significant as the taxonomy has been called upon significantly in other fields such as knowledge management, potentially out of context. "Knowledge, as defined here, involves the recall of specifics and universals, the recall of methods and processes, or the recall of a pattern, structure, or setting."[13]

The taxonomy is set out as follows:

- 1.00 Knowledge
  - 1.10 Knowledge of specifics
  - 1.11 Knowledge of terminology
  - 1.12 Knowledge of specific facts
  - 1.20 Knowledge of ways and means of dealing with specifics
  - 1.21 Knowledge of conventions
  - 1.22 Knowledge of trends and sequences
  - 1.23 Knowledge of classifications and categories
  - 1.24 Knowledge of criteria
  - 1.25 Knowledge of methodology
  - 1.30 Knowledge of the universals and abstractions in a field
  - 1.31 Knowledge of principles and generalizations
  - 1.32 Knowledge of theories and structures

Criticism of the taxonomy

As Morshead (1965) pointed out on the publication of the second volume, the classification was not a properly constructed taxonomy as it lacked a systemic rationale of construction.

This was subsequently acknowledged in the discussion of the original taxonomy in its 2001 revision,[9] and the taxonomy was reestablished on more systematic lines.

Some critiques of the taxonomy's cognitive domain admit the existence of these six categories but question the existence of a sequential, hierarchical link.[14] Often, educators view the taxonomy as a hierarchy and may mistakenly dismiss the lowest levels as unworthy of teaching.[15][16] The learning of the lower levels enables the building of skills in the higher levels of the taxonomy, and in some fields, the most important skills are in the lower levels (such as identification of species of plants and animals in the field of natural history).[15][16] Instructional scaffolding of higher-level skills from lower-level skills is an application of Vygotskian constructivism.[17][18]

Some consider the three lowest levels as hierarchically ordered, but the three higher levels as parallel.[9] Others say that it is sometimes better to move to Application before introducing concepts, the idea is to create a learning environment where the real world context comes first and the theory second to promote the student's grasp of the phenomenon, concept or event. This thinking would seem to relate to the method of problem-based learning

Furthermore, the distinction between the categories can be seen as artificial since any given cognitive task may entail a number of processes. It could even be argued that any attempt to nicely categorize cognitive processes into clean, cut-and-dried classifications undermines the holistic, highly connective and interrelated nature of cognition.[19] This is a criticism that can be directed at taxonomies of mental processes in general.

Implications

Bloom's taxonomy serves as the backbone of many teaching philosophies, in particular, those that lean more towards skills rather than content.[8][9] These educators view content as a vessel for teaching skills. The emphasis on higher-order thinking inherent in such philosophies is based on the top levels of the taxonomy including analysis, evaluation, synthesis and creation. Bloom's taxonomy can be used as a teaching tool to help balance assessment and evaluative questions in class, assignments and texts to ensur all orders of thinking are exercised in students' learning, including aspects of information searching.[20]

Connections across disciplines

The skill development that takes place at these higher orders of thinking interacts well with a developing global focus on multiple literacies and modalities in learning and the emerging field of integrated disciplines.[21] The ability to interface with and create media would draw upon skills from both higher order thinking skills including analysis, evaluation, and creation and lower order thinking skills which are remembering, comprehending, and application. [22][23] Bloom's taxonomy (and the revised taxonomy) continues to be a source of inspiration for educational philosophy and for developing new teaching strategies.

See also

- DIKW pyramid
- Educational psychology
- Educational technology
- Fluid and crystallized intelligence
- Higher order thinking skills
- *In Over Our Heads*
- Integrative complexity
- Know-how
- Learning cycle
- Learning styles
- Mastery learning

- Metacognition
- Model of hierarchical complexity
- Pedagogy
- Physical education
- Reflective practice
- Rubric (academic)
- Structure of observed learning outcome
- Wisdom

References

1. Bloom, B. S.; Engelhart, M. D.; Furst, E. J.; Hill, W H.; Krathwohl, D. R. (1956). *Taxonomy of educational objectives: The classification of educational goals* Handbook I: Cognitive domain. New York: David McKay Company.
2. Shane, Harold G. (1981). "Significant writings that have influenced the curriculum: 1906-1981". *Phi Delta Kappan*. **62** (5): 311–314.
3. Bloom et al. 1956, p. 4: "The idea for this classification system was formed at an informal meeting of college examiners attending the 1948 American Psychological Association Convention in Boston. At this meeting, interest was expressed in a theoretical framework which could be used to facilitate communication among examiners.
4. Simpson, Elizabeth J. (1966). "The classification of educational objectives: Psychomotor domain". *Illinois Journal of Home Economics*. **10** (4): 110–144.
5. *Harrow, Anita J. (1972). *A taxonomy of the psychomotor domain: A guide for developing behavioral objectives*. New York: David McKay Company
6. *Dave, R. H. (1975). Armstrong, R. J. (ed.). *Developing and writing behavioral objectives* Tucson: Educational Innovators Press.
7. Clark, Donald R. (1999). "Bloom's Taxonomy of Learning Domains" (http://www.nwlink.com/~donclark/hrd/bloom.html). Retrieved 28 Jan 2014.
8. Krathwohl, David R. (2002). "A revision of Bloom's taxonomy: An overview". *Theory Into Practice*. Routledge. **41** (4): 212–218. doi:10.1207/s15430421tip4104_2 (https://doi.org/10.1207%2Fs15430421tip4104_2) ISSN 0040-5841 (https://www.worldcat.org/issn/0040-5841)
9. Anderson, Lorin W.; Krathwohl, David R., eds. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives* Allyn and Bacon. ISBN 978-0-8013-1903-7.
10. Hoy, Anita Woolfolk (2007). *Educational psychology* (10th ed.). Boston: Pearson/Allyn and Bacon. pp. 530–531, 545. ISBN 0205459463. OCLC 68694368 (https://www.worldcat.org/oclc/68694368)
11. Armstrong, Patricia. "Bloom's Taxonomy" (https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/) *Vanderbilt University Center for Teaching*. Vanderbilt University. Retrieved 29 June 2016.
12. Simpson, Elizabeth (1972). "Educational objectives in the psychomotor domain" (https://files.eric.ed.gov/fulltext/ED010368.pdf) (PDF). **3**. Washington, D.C.: Gryphon House: 25–30. Retrieved 3 April 2018.
13. Bloom et al. 1956, p. 201.
14. Paul, R. (1993). *Critical thinking: what every person needs to survive in a rapidly changing world* (3rd ed.). Rohnert Park, California: Sonoma State University Press.
15. Flannery, Maura C. (November 2007). "Observations on biology" (https://www.nabt.org/websites/institution/File/pdfs/american_biology_teacher/2007/069-09-0561.pdf) (PDF). *The American Biology Teacher*. **69** (9): 561–564. doi:10.1662/0002-7685(2007)69[561:OOB]2.0.CO;2 (https://doi.org/10.1662%2F0002-7685%282007%2969%5B561%3AOOB%5D2.0.CO%3B2) "Biology is often referred to as an observational science almost as a slur, with the implication that biologists simply look at the living world without the strong theoretical and mathematic underpinnings of a science like physics. There is the suggestion that observation is easy. Thus biology is viewed as a lightweight science—anyone can do it: just go out and start looking, at birds, at grass, at cells under the microscope. Benjamin Bloom's taxonomy of learning tasks puts observation at the lowest level, with recall of information. This denigration of observation has long bothered me because I see it as often difficult and complex, a skill that needs to be learned and a talent that is much more developed in some".

16. Lawler, Susan (26 February 2016). "Identification of animals and plants is an essential skill set" (https://web.archive.org/web/20161117044125/http://theconversation.com/identification-of-animals-and-plants-is-an-essential-skill-set-55450). The Conversation. Archived from the original (https://theconversation.com/identification-of-animals-and-plants-is-an-essential-skill-set-55450) on 17 November 2016. Retrieved 5 March 2017. "Ironically, the dogma that has been so detrimental to field taxonomy is known as Bloom's taxonomy. University lecturers are told to apply an educational theory developed by Benjamin Bloom, which categorises assessment tasks and learning activities into cognitive domains. In Bloom's taxonomy identifying and naming are at the lowest level of cognitive skills and have been systematically excluded from University degrees because they are considered simplistic."
17. Vygotsky, L. S. (1978). "Chapter 6: Interaction between learning and development". *Mind in society: the development of higher psychological processes*. Cambridge, Massachusetts: Harvard University Press. pp. 79–91.
18. Keene, Judith; Colvin, John; Sissons, Justine (June 2010) [2010]. "Mapping student information literacy activity against Bloom's taxonomy of cognitive skills" (http://jil.lboro.ac.uk/ojs/index.php/JIL/article/view/PRA-V4-I1-2010-1). *Journal of Information Literacy*. **4** (1): 6–21. doi:10.11645/4.1.189 (https://doi.org/10.11645%2F4.1.189). "When supporting students outside the classroom situation, a subject aware advisor should be capable of spotting mistakes in a student's solution and of analysing these mistakes to identify the difficulty that the student is encountering. Such support can be seen as offering scaffolding in a student's 'zone of proximal development' (Vygotsky, 1978) and exemplified by teaching students to analyse a problem through the identification of the key elements and the relationships between these elements".
19. Fadul, J. A. (2009). "Collective Learning: Applying distributed cognition for collective intelligence". *The International Journal of Learning*. **16** (4): 211–220. ISSN 1447-9494 (https://www.worldcat.org/issn/1447-9494)
20. BJ Jansen, D Booth, B Smith (2009) Using the taxonomy of cognitive learning to model online searching (https://faculty.ist.psu.edu/jjansen/academic/pubs/jansen_using_the_taxonomy_of_cognitive_learning_to_model_online_searching.pdf), Information Processing & Management 45 (6), 643-663
21. *Kress, G.; Selander, S. (2012). "Multimodal design, learning and cultures of recognition". *Internet and Higher Education*. **15** (1): 265–268. doi:10.1016/j.iheduc.2011.12.003 (https://doi.org/10.1016%2Fj.iheduc.2011.12.003)
22. *Paul, R.; Elder, L. (2004). *Critical and creative thinking* Dillon Beach, CA: The Foundation for Critical Thinking.
23. *The New London Group (1996). *A pedagogy of multiliteracies: designing social futures* Harvard Educational Review.

Further reading

- Bloom, B. S. (1994). "Reflections on the development and use of the taxonomy". In Rehage, Kenneth J.; Anderson, Lorin W.; Sosniak, Lauren A. (eds.). *Bloom's taxonomy: A forty-year retrospective*. Yearbook of the National Society for the Study of Education. **93**. Chicago: National Society for the Study of Education. ISSN 1744-7984.
- Clark, Donald R. (1999). "Bloom's Taxonomy of Learning Domains". Retrieved 28 Jan 2014.
- Krathwohl, D. R.; Bloom, B. S.; Masia, B. B. (1964). *Taxonomy of educational objectives: The classification of educational goals*. Handbook II: the affective domain. New York: David McKay Company
- Morshead, Richard W. (1965). "On Taxonomy of educational objectives Handbook II: Affective domain". *Studies in Philosophy and Education* **4** (1): 164–170. doi:10.1007/bf00373956
- Orlich, Donald; Harder, Robert; Callahan, Richard; Trevisan, Michael; Brown, Abbie (2004). *Teaching strategies: a guide to effective instruction* (7th ed.). Houghton Mifflin. ISBN 978-0-6182-9999-7.