

Learning Taxonomy

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Psychologists often define learning as a relatively permanent or semi-permanent change in behaviour, which is accomplished by the learner for a purpose. Everyone learns from birth; even before being born, learning takes place from the womb. Students come to institutions for learning. Besides the purpose of learning, students get enrolled in academic programs to become worthy citizens in a society. Taxonomy, in general, describes the classification and categories of something by levels. This term is widely used in biology for categorizing the species by groups and layers. Learners have different learning behaviours and patterns that the teachers wish to utilise for better learning. A Taxonomy of learning also describes its levels.

1. Learning Taxonomy

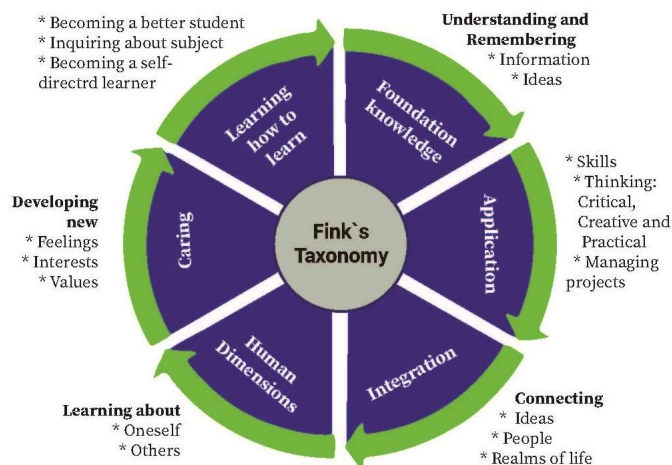
Learning taxonomy is a classification or way of describing different kinds of learning behaviours and characteristics that the students are to develop. A taxonomy is used for identifying different stages of learning development and thus provides a useful tool in distinguishing the appropriateness of particular learning outcomes for a program. The three learning taxonomies described here are:

- (a) Bloom's Taxonomy (1956) adapted by Anderson et al. (2001)
- (b) SOLO Taxonomy (1982) and
- (c) Fink's Taxonomy (2003).

Among these three, the most widely used one is the Bloom's Taxonomy. Before going to the details of it, other two taxonomies are described below with major characteristics.

2. Fink's Taxonomy, 2003

Dr. L. Dee Fink, Director of the Instructional Development Program of the University of Oklahoma formulated Fink's Taxonomy in 2003 as the latest learning taxonomy so far. This can be considered as the abridged simple version of the taxonomy of Bloom and Anderson. Fink's taxonomy, The Taxonomy of Significant Learning⁹ in Fink's terminology, has six cyclic phases. These are (i) Foundational knowledge, (ii) Application, (iii) Integration, (iv) Human Dimension, (5) Caring and (6) Learning How to Learn. Figure 2 describes the characteristics of the phases.



Adapted from Universtiy College Dublin in light of Fink's Model

Figure 2: Six cyclic phases of Fink's Taxonomy

Fink's taxonomy combines three learning domains of cognitive, physical and emotional activities. Every piece of learning finishes by completing a cycle and repeats the same for further learning on a new topic or next level knowledge of the previous topic.

3. SOLO Taxonomy, 1982

SOLO is the abbreviation of Structure of the Observed Learning Outcome. Australian educational psychologist John Biggs and his associate Kevin Collis first formulated the SOLO Taxonomy in 1982¹⁰. This is a layered stage of different structures called (i) Prestructural, (ii) Unistructural, (iii) Multistructural, (iv) Relational and (v) Extended Abstract. Figure 3 shows the steps of the structures.

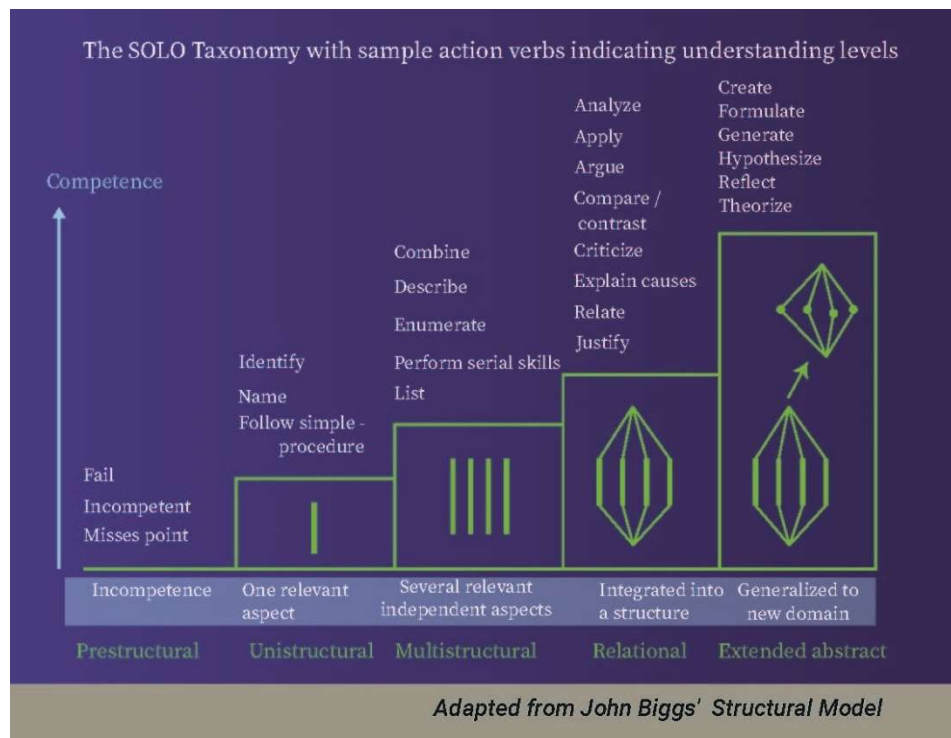


Figure 3: Five levels of structures in the SOLO Taxonomy

Prestructural: Students may have some incomplete, unrelated and somewhat wrong knowledge on the subject topic of interest.

Unistructural: One single aspect of the topic is to be introduced that usually helps build the foundation or is sometimes significant to proceed.

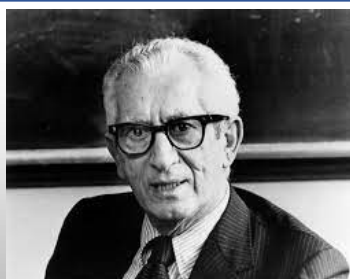
Multistructural: Several aspects of the topic are discussed without interconnections among the aspects. All these are relevant to the topic and necessary to gain the expected knowledge.

Relational: All aspects are now connected to make an integrated knowledge of the subject topic. At this stage, students grab the full picture as expected.

Extended Abstract: Generalisation of the knowledge is created that can describe other similar topics in life. Alternatively, other similar real-life events can be described with the knowledge gained.

The same structural levels are also used in SOLO Taxonomy for evaluating students' performances. Assessing the previous knowledge of the students on a topic is at the prestructural level. One certain aspect of the knowledge is evaluated in the unistructural level and so on.

I humbly request that readers who are reading about learning taxonomy for the first time read back Fink's Taxonomy and SOLO Taxonomy again after completing reading Bloom's Taxonomy described here in this book.



Benjamin S. Bloom (1913-1999): An American educational psychologist born in Pennsylvania who graduated in Psychology from Penn State and earned Ph.D. from the University of Chicago. He joined his *alma mater*, the University of Chicago, in 1940 and was later appointed as Charles Swift Distinguished Service Professor in 1970. He developed educational learning taxonomy in 1956 for the first time and continued with its development throughout the 60s and 70s along with his associates and students. Even long after his death, at the beginning of this century, a number of educationists and psychologists improved different areas of the taxonomy. However, with all developments and modifications, it is still popularly known as Bloom's Taxonomy. The whole learning design suggested in the OBE has been grounded on Bloom's Taxonomy.

4. Bloom's Taxonomy, 1956 & 2001

OBE endorses three learning domains in Bloom's Taxonomy: Cognitive, Psychomotor and Affective. Expected competencies, such as, *knowledge*, *skill* and *attitude* coincide with the learning domains respectively. Learning achievements are classified by these three domains; each with a number of levels. This chapter describes the structure, which is popularly known as Bloom's Taxonomy. Teachers need to make a learning plan for the students so that they can achieve the expected outcomes under all three learning domains: Cognitive, Psychomotor and Affective. After attaining the OBE-guided teaching-learning, every student shall be evaluated on their performance at different domains by various levels. Teachers prepare the course outline and lesson plans in a pre-defined way so that the students' performances are measurable according to the levels of learning domains after their teaching-learning activities. The levels of accomplishment in different domains may not be the same. But, as per OBE, every student needs to achieve a satisfactory level in every learning domain. For example, it is not accepted that a student accomplishes the highest level in the Cognitive domain but failed to achieve a satisfactory level in the Psychomotor or Affective domain. In such cases, the student needs to retake the course or continue studying the same until achieving satisfactory levels in all learning domains. Preparations of the course outline and lesson plan under the curriculum design activities are described in Chapter 6 of this book.

Bloom's Taxonomy

(Cognitive Domain)

Lorin Anderson &
David Krathwohl (2001)

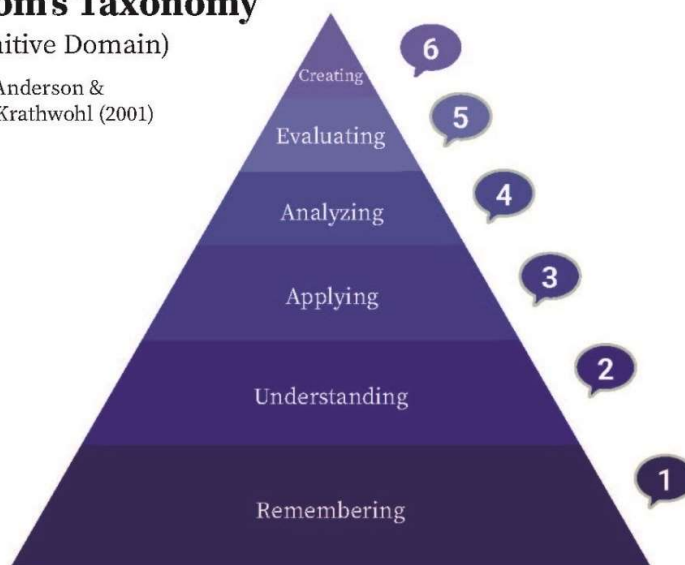


Figure 4: The six layers of the Cognitive Domain in the Bloom's Taxonomy

4.1. Cognitive Domain

Cognitive Domain is all about the knowledge base of the learner. It is concerned with brain functions. By cognitive learning, a student makes relatively permanent changes in the brain as a result of which the student shows changed behaviour. Knowing some facts, comprehending some theory, using previous knowledge for solving a problem, analysing and evaluating a real-life event or creating something new are examples of activities of the cognitive domain. The original cognitive domain levels, first formulated by Professor Bloom himself in 1956, were (1) Knowledge, (2) Comprehension, (3) Application, (4) Analysis, (5) Synthesis and (6) Evaluation¹². The latest formation of the levels, as shown in Figure 4, was developed by Professor Bloom's student Lorin Anderson and associate David Krathwohl in 2001^{13, 14}. The major change in it was the use of noun form to the corresponding action verbs for each level and the interchange in level-5 and level-6. The latter, as shown in Figure 4, is well accepted worldwide where Remembering is the lowest and Creating is the highest level of cognitive attainments of a learner. In the bottom-up direction, every next level always contains the previous level of expertise. Brief descriptions of the cognitive domain levels are stated below.

1. Remembering: With the expertise of the Remembering level, a student can recall some fact or information from memory. Some example activities are: reciting a poem, quoting a law, stating a theory, telling the price of products as a shopkeeper, *etc.* Action verbs of this level are: State, Define, List, Identify, Recognize, Recall, *etc.*

2. Understanding: With the Understanding level, in the cognitive domain, a student can describe the inner meaning or interpretation of a fact. With this level expertise, a student can elaborate on a fact in their own words. For example, describing a chart, rephrasing a paragraph, making a summary of a story, drawing a diagram of a concept, *etc.* Action verbs of this level are: Summarize, Rewrite, Illustrate, Describe, Explain, Interpret, *etc.*

3. Applying: With the capability of Applying level, a student can use the knowledge for solving a real-life problem. The knowledge base of a fact or theory can be successfully applied in real-life to make a solution plan. Some example activities are: finding the area of a land, estimating the expenses of a project, checking the profitability of a business, making a diet plan for a diabetes patient, *etc.* Action verbs of this level are: Estimate, Compute, Construct, Demonstrate, Solve, Prove, *etc.*

4. Analyzing: With the proficiency of Analyzing level, a student can critically analyze a real-life problem in connection with his/her own knowledge base. With this level of expertise, a complex problem can be critically separated into parts by known facts and theories. For example, real-life situations can be finding a cause of an unprecedented happening, analyzing a real-life problem, predicting the economic impact of an earthquake, distinguishing a present event from a similar event in past, *etc.* Action verbs of this level are: Analyze, Distinguish, Predict, Investigate, Criticize, Appraise, *etc.*

5. Evaluating: With the expertise of the Evaluating level, a student can compare two events by critically analyzing their relevant parameters and performing necessary calculations. This level of knowledge helps assess one situation with all probable pros and cons by finally making a decisive comment on the situation. Some example activities are: choosing the right financing option for a business, evaluating a national event, comparing the health systems of two countries, justifying a survey report *etc.* Action verbs of this level are: Justify, Evaluate, Compare, Defend, Review, Examine, *etc.*

6. Creating: With Creating capability, the highest level in the cognitive domain, a student can make a new idea or give a new direction for a solution. This level of knowledge expertise helps build a new structure or pattern. Some example activities are: designing a building, writing a poem, making a business proposal, creating a software application for health online, *etc.* Action verbs of this level are: Create, Synthesize, Develop, Generate, Build, Produce, *etc.*

Bloom's Taxonomy (Psychomotor Domain)

Dave R.H. (1970)

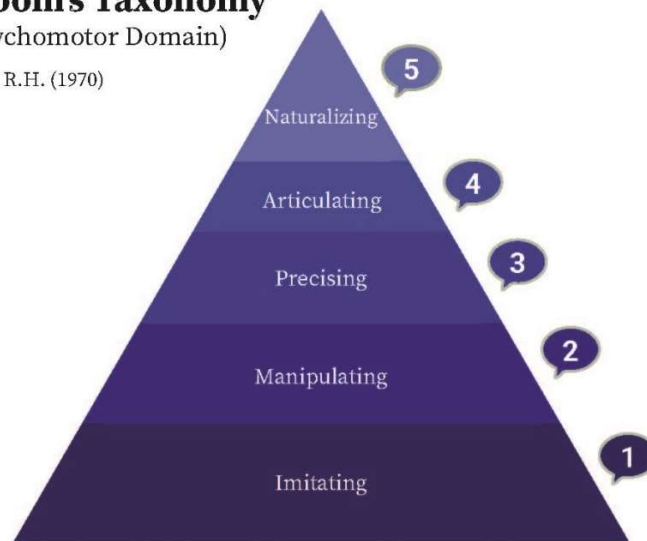


Figure 5: The five layers of the Psycho-motor domain in the Bloom's Taxonomy

4.2. Psychomotor Domain

The hands-on skills of the students are the learning objective in the Psychomotor Domain. It is connected to 'do' by which students show a physical skill of doing something practically what they have learned. The traditional 'motor' skill is extended beyond a combination of physical activities and mental thoughts. In Figure 5, the levels of the Psychomotor Domain are shown from Dave R. H. who was a student of Benjamin Bloom. Dave's 1970 version¹⁵, an advancement of another earlier version published in 1967, is presented here because of its simplicity and easy-to-understand approach.

Dave's 5 levels in the psychomotor domain are briefly described below.

1. Imitating: With this imitation level of skill a student copies the action of another by observing and replicating. While doing some physical activities students follow the teacher or trainer to learn. Action verbs of this level are: Copy, Follow, Replicate, Repeat, *etc.*

2. Manipulating: With this manipulation level of skill, a student reproduces an action from memory or guided by an instruction. A student does something by prior knowledge or by following a written/verbal instruction. Action verbs of this level are: Build, Perform, Execute, Implement, *etc.*

3. Precising: With this 'do-precise' level of skill a student reliably executes an action independent of any support. A student does something by previous experience without any instruction support or guidance. The accomplished students can also demonstrate the activity to others. Action verbs of this level are: Demonstrate, Complete, Show, Calibrate, *etc.*

4. Articulating: With this articulation level of skill a student adapts and integrates expertise to satisfy a non-standard objective of action. A student can relate and combine associated activities to novel requirements. Action verbs of this level are: Construct, Coordinate, Develop, Modify, *etc.*

5. Naturalizing: With this naturalization level of skill a student shows automated, unconscious mastery of the activity and related skills at a strategic level. Students can define an aim, approach and strategy for the use of activities to meet strategic needs. Action verbs of this level are: Design, Specify, Manage, Invent, *etc.*

Other two versions of the Psychomotor Domain levels are formulated by Harrow A. (1972) and Elizabeth Simpson (1972). Simpson's version of the same is also quite popular in which the seven levels are (1) Perception, (2) Set, (3) Guided Response, (4) Mechanism, (5) Complex or Overt Response, (6) Adaptation and (7) Origination. Interestingly, under a U.S. Government project grant and done at the University of Illinois, Simpson herself originally showed 5 layers of the psycho-motor domain in 1965 (shown in Figure 6).

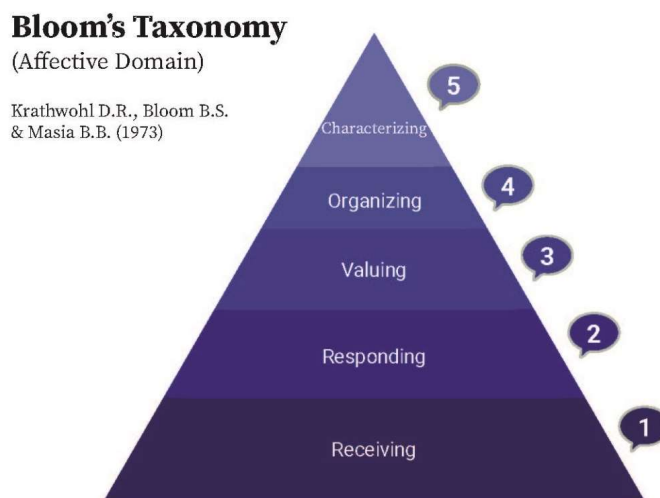


Figure 6: The five layers of the Affective domain in the Bloom's Taxonomy

4.3. Affective Domain

Learning with the Affective domain gives qualities of feeling and building the learner's attitude. For a sustainable society, we need to make sure that our graduates are knowledgeable, skilled and have an appropriate attitude at the same time. They need to know about the chemical reactions in an explosive; they need to have the hands-on skill of making an explosive by mixing necessary reagents; and they also must be able to decide when, where and why the explosive can be used. This is – perhaps a little harsh one - an example of chemistry or chemical engineering education. Let us have another example from a driving school. As expected in the OBE perspective, a learner will gather all theoretical knowledge required for driving, will gain driving skills by doing so physically, and also will build an appropriate attitude so that the driver will not drink or fall asleep while driving. In both of these cases, the latter learning comes with different levels of the Affective Domain.

There are five levels in the domain given by Krathwohl, Bloom and Masia in 1973. The earlier version of the same was published in 1964. There are little and subtle differences between every two consecutive levels in the affective domain. Brief descriptions of the affective domain levels have been stated below.

1. Receiving: With this receive level of attitude a student shows willingness to listen or get involved. The student listens to the teacher, wants to experience, or takes an interest in participation. Action verbs of this level are Listen, Attend, Discuss, Follow, Read etc.

2. Responding: With this response level of attitude a student reacts and participates actively. The student participates in a group activity, takes part in a debate or shows spontaneous interest in an action or subject. Action verbs of this level are: Interpret, Clarify, Contribute, Present, Perform, etc.

3. Valuing: With this value level of attitude a student attaches own values and expresses personal opinions. The student decides a worth or relevance of ideas; accepts or rejects, and then commits to an action. Action verbs of this level are: Argue, Refute, Confront, Justify, Criticize, etc.

4. Organizing: With this conceptualise-value level of attitude a student reconciles internal conflicts in own emotional setup and develops a new value system. The student qualifies and quantifies personal views; declares personal position with reasons; recognises own beliefs. Action verbs of this level are: Develop, Formulate, Modify, Reconcile, Compare, *etc.*

5. Characterizing: With this internalize-value level of attitude a student adopts self-belief system and the philosophy. The student is self-reliant and behaves consistently with the personal value set and own belief system. Action verbs of this level are: Act, Display, Influence, Solve, Practice, *etc.*

Sketch 1 depicts the stories of different layers in the psychomotor domain. These are the five layers of expertise in learning under the psychomotor domain: (1) following to do something in physics lab class as the teacher does with electricity and sound experiment, (2) doing some chemical experiment by the learner following a written instruction, (3) riding a remote control car and showing some extra personal skills, (4) being a student instructing/helping a peer in a dance class for a certain move, and (5) perfect brushing of teeth in the drowsy morning mood right after awaking from bed.



Sketch 1: Five layers of learning in the Psychomotor Domain