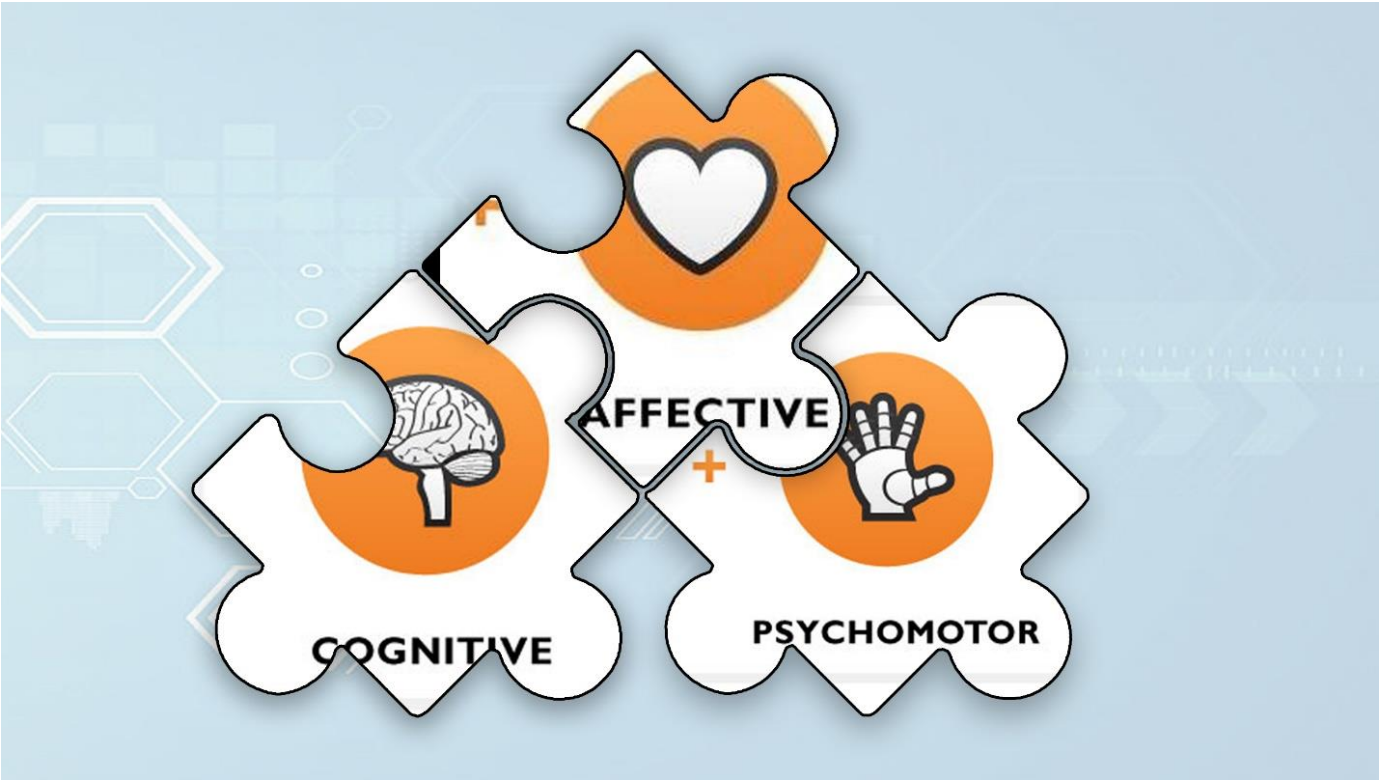
UNIT 2: THREE DOMAINS OF LEARNING



Lesson 3: Three domains of Learning

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LEARNING OBJECTIVES

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- Explore Dave's, Simpson's and Harrow's Taxonomy for Psychomotor Domain

3.1 INTRODUCTION TO THREE DOMAINS OF LEARNING

Every person is involved in learning something all the time. To a lay man, learning may mean reading a passage, memorizing a formula, understanding a process or even listening to a teacher. To educators and teachers, Learning is relatively permanent change in behavior resulting from reinforced practice. When a student can do something after instruction which he could not do before, he is said to have learnt.

According to Berelson and Steiner, learning refers to changes in behavior that result from previous successful behaviour in similar situations. If one is really learning, one's behavior becomes more effective and more adaptive than what it used to be before. Learning can occur in three domains:

- Cognitive
- Affective
- Psychomotor.

Teaching is a catalytic process for bringing about desirable changes in learners. The relation between teaching and learning related to each domain is shown in the following diagram.

The basic idea behind the cognitive domain involves the knowledge and intellectual skills that a student will develop. *The affective domain includes the feelings, emotions and attitudes that learners will develop. The psychomotor domain (physical and Kinesthetic) includes utilizing motor skills and the ability to coordinate them.*

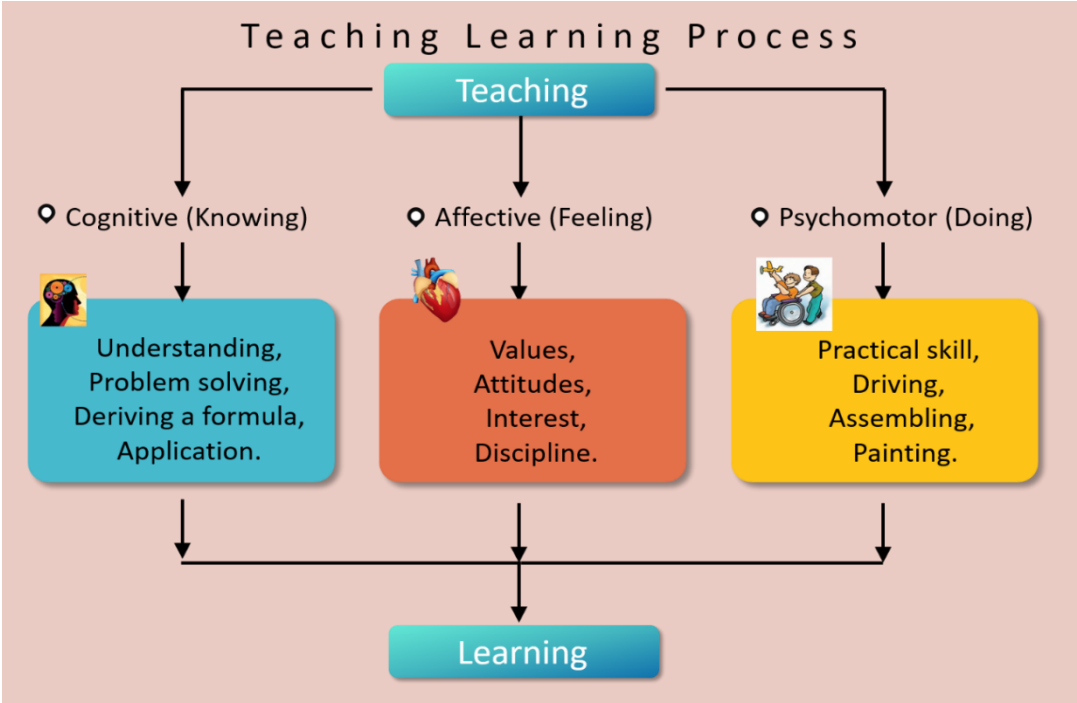

Figure 1: Relationship between teaching and learning

All teachers should know about these domains and use them to construct lessons. Each domain has a taxonomy associated with it. Taxonomy is simply a word for a classification. Domains may be thought of as categories.

Instructional designers, trainers and educators often refer to these three categories as KSA knowledge (cognitive), Skills (psychomotor), and attitudes (affective).

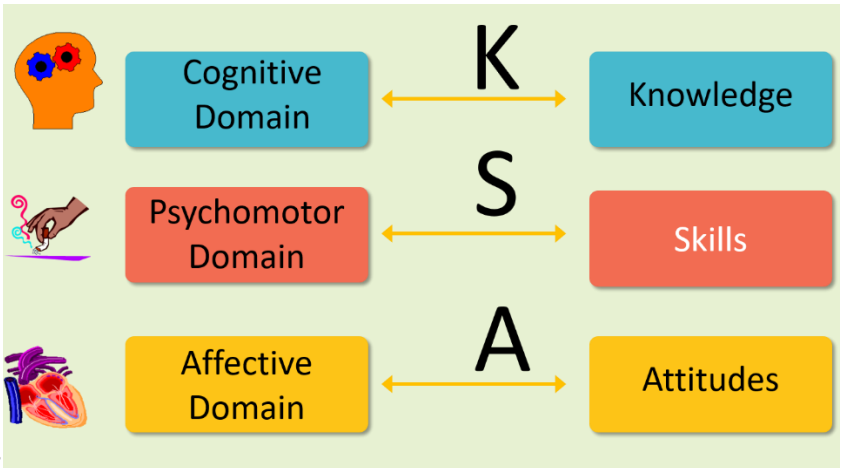

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Figure 2: Three Domains of Learning

3.2 BLOOM'S TAXONOMY OF COGNITIVE DOMAIN

In 1956, Benjamin Bloom with collaborators Max Englehart, Edward Furst, Walter Hill, and David Krathwohl published a framework for categorizing educational goals: *Taxonomy of Educational Objectives*. It is familiarly known as Bloom's Taxonomy. This framework has been applied by generations of school and college teachers in their teaching. It is most often used when designing educational, training and learning processes.

The basic idea behind the cognitive domain involves the knowledge and intellectual skills that a student will develop. There are six categories involved within the cognitive domain, and they are usually considered to be stages of difficulty. Usually, the first category must be mastered before a student can move on to the next one. These categories are knowledge, comprehension, application, analysis, synthesis, and evaluation.

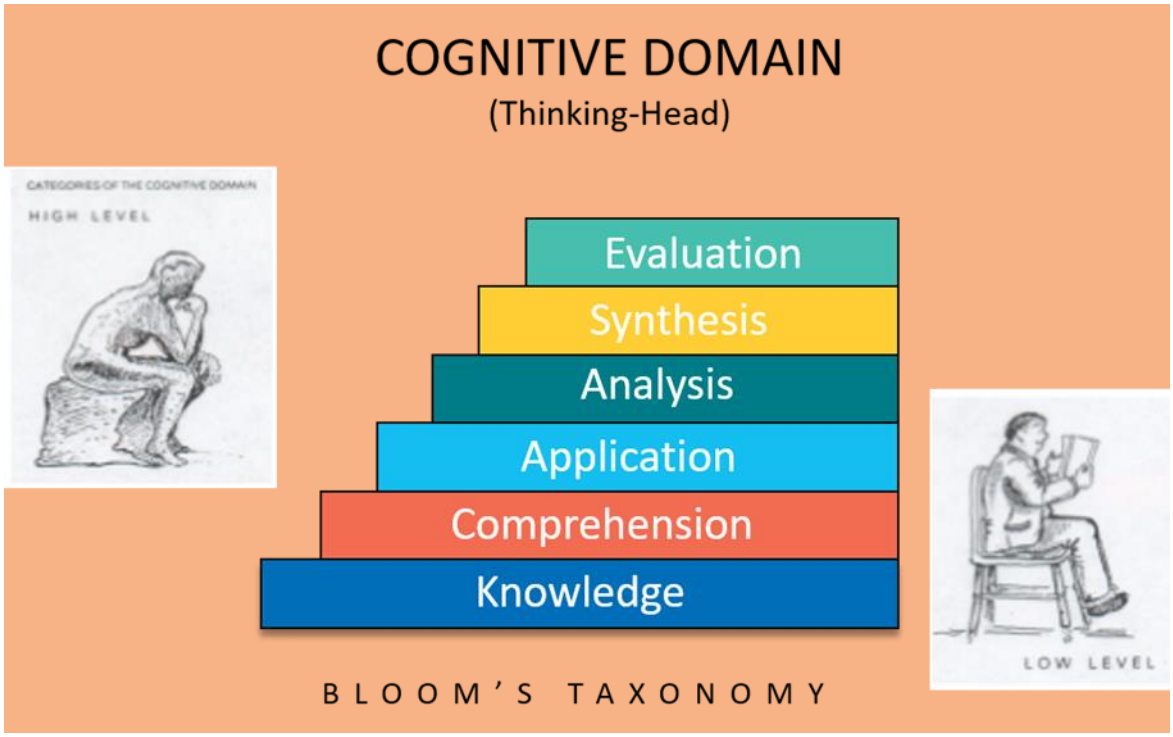

Figure 3: **Bloom's Taxonomy of Educational Objectives (Traditional)**

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

Like any theoretical model, Bloom's Taxonomy has its strengths and weaknesses. Its greatest strength is that it has taken the very important topic of thinking and placed a structure around it that is usable by practitioners. Those teachers who keep a list of question prompts relating to the various levels of Bloom's Taxonomy undoubtedly do a better job of encouraging higher order thinking in their students than those who have no such tool. On the other hand, as anyone who has worked with a group of educators to classify a group of questions and learning activities according to the Taxonomy can attest, there is little consensus about what seemingly self-evident, terms like "analysis," or "evaluation" mean. In addition, so many worthwhile activities, such as authentic problems and projects, cannot be mapped to the Taxonomy, and trying to do that would diminish their potential as learning opportunities.

3.3 REVISED BLOOM'S TAXONOMY OF COGNITIVE DOMAIN

Lorin Anderson, a former student of Bloom, and David Krathwohl revisited the cognitive domain in the mid-nineties and made some changes, with perhaps the three most prominent ones being (Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths, Wittrock, 2000):

- changing the names in the six categories from noun to verb forms

- rearranging them as shown in figure. Making evaluate as the fifth level and taking create to the top level
- creating a processes and levels of knowledge matrix

Figure 4: Revised Bloom's Taxonomy

The Revised Bloom's Taxonomy Action Verbs are given in the Table: 1

Table 1: REVISED Bloom's Taxonomy Action Verbs

I. Remembering	II. Understanding	III. Applying	IV. Analyzing	V. Evaluating	VI. Creating
Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	Demonstrate understanding of facts and ideas by organizing, comparing, interpreting, giving descriptions, and stating main ideas.	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations.	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	Compile information together in a different way by combining elements in a new pattern or proposing new solutions.

define describe duplicate enumerate examine identify label list locate match memorize name observe omit quote read recall recite recognize record repeat reproduce retell select state tabulate tell visualize	ask associate cite classify compare contrast convert describe differentiate discover discuss distinguish estimate explain express extend generalize give examples group identify illustrate indicate infer interpret judge observe order paraphrase predict relate report represent research restate review rewrite select show summarize trace transform translate	act administer apply articulate calculate change chart choose collect complete compute construct determine develop discover dramatize employ establish examine experiment explain illustrate interpret judge manipulate modify operate practice predict prepare produce record relate report schedule simulate sketch solve teach transfer write	advertise analyze appraise calculate categorize classify compare conclude connect contrast correlate criticize deduce devise diagram differentiate discriminate dissect distinguish divide estimate evaluate experiment explain focus illustrate infer order organize plan prioritize select separate subdivide survey test	appraise argue assess choose compare conclude consider convince criticize critique debate decide defend discriminate distinguish editorialize estimate evaluate find errors grade judge justify measure order persuade predict rank rate recommen d reframe score select summarize support test weigh	adapt anticipate assemble collaborate combine compile compose construct create design develop devise express facilitate formulate generalize hypothesize infer integrate intervene invent justify manage modify negotiate originate plan prepare produce propose rearrange reorganize report revise rewrite role-play simulate solve speculate structure test validate write

Adapted from Anderson, L. W., & Krathwohl, D. R. (2001). *A taxonomy for learning, teaching, and assessing*, Abridged Edition. Boston, MA: Allyn and Bacon.

This revised taxonomy attempts to correct some of the problems with the original taxonomy. Unlike the 1956 version, the revised taxonomy differentiates between "*knowing what*," the

content of thinking, and "*knowing how*," the procedures used in solving problems.

The Knowledge Dimension is the "knowing what." It has four categories: factual, conceptual, procedural, and metacognitive. Factual knowledge includes isolated bits of information, such as vocabulary definitions and knowledge about specific details. Conceptual knowledge consists of systems of information, such as classifications and categories. Procedural knowledge includes algorithms, heuristics or rules of thumb, techniques, and methods as well as knowledge about when to use these procedures. Metacognitive knowledge refers to knowledge of thinking processes and information about how to manipulate these processes effectively.

3.3.1 The Knowledge Dimension

Dimension	Definition
Factual Knowledge	The basic elements students must know to be acquainted with a discipline or solve problems in it
Conceptual Knowledge	The interrelationships among the basic elements within a larger structure that enable them to function together
Procedural Knowledge	How to do something, methods of inquiry, and criteria for using skills, algorithms, techniques, and methods
Metacognitive Knowledge	Knowledge of cognition in general as well as awareness and knowledge of one's own cognition

There are four major knowledge types in Knowledge Dimension and the subtypes with Examples are given in the following table.

Major Types and Subtypes of Knowledge Dimension with Examples	
A. Factual Knowledge - The basic elements students must know to be acquainted with a discipline or solve problems in it	
A1. Knowledge of terminology	Technical vocabulary, music symbols
A2. Knowledge of specific details and elements	Major natural resources, reliable sources of information
B. Conceptual knowledge – The interrelationships among the basic elements within the	

larger structure that enable them to function together	
B1. Knowledge of classifications and categories	Periods of geological time, forms of business ownership
B2. Knowledge of principles and generalizations	Pythagorean theorem, law of supply and demand
B3. Knowledge of theories, models and structures	Theory of evolution, structure of Congress
C. Procedural Knowledge-How to do something, methods of inquiry, and criteria for using skills, algorithms, techniques, and methods	
C1. Knowledge of subject-specific skills and algorithm	Skills used in painting with water colors, whole-number division algorithms
C2. Knowledge of subject-specific techniques and Methods	Interviewing techniques, scientific method
C3. Knowledge of criteria for determining when to use appropriate procedures	Criteria used to determine when to apply a procedures involving Newton's second law, Criteria used to judge the feasibility of using a particular method to estimate business costs
D. Metacognitive Knowledge - Knowledge of cognition in general as well as awareness and knowledge of one's own cognition	
D1. Strategic knowledge	Knowledge of outlining as a means of capturing the structure of a unit of subject matter in a text book, knowledge of the use of heuristics
D2. Knowledge about cognitive tasks including appropriate contextual and conditional knowledge	Knowledge of the types of tests particular teachers administer, knowledge of the cognitive demands of different tasks
D3. Self Knowledge	Knowledge that critiquing essays is a personal strength, whereas writing essay is a personal weakness; awareness of one's own knowledge level

.3.3.2 The Cognitive Process Dimension

The Cognitive Process Dimension of the revised Bloom's Taxonomy like the original version

has six skills. They are, from simplest to most complex: remember, understand, apply, analyze, evaluate, and create

1. Remember

Categories & Cognitive Processes	**Alternative** Names	Definition
Remember		Retrieve knowledge from long- term memory
1.1 Recognizing	Identifying	Locating knowledge in long-term memory that is consistent with presented material
1.2 Recalling	Retrieving	Retrieving relevant knowledge from long-term memory

2. Understand

Categories & Cognitive Processes	Alternative Names	Definition
Understand		Construct meaning from instructional messages, including oral, written, and graphic communication
2.1 Interpreting	Clarifying Paraphrasing Representing Translating	Changing from one form of representation to another
2.2 Exemplifying	Illustrating Instantiating	Finding a specific example or illustration of a concept or principle
2.3 Classifying	Categorizing Subsuming	Determining that something belongs to a category
2.4 Summarizing	Abstracting Generalizing	Abstracting a general theme or major point(s)
2.5 Inferring	Concluding Extrapolating Interpolating Predicting	Drawing a logical conclusion from presented information
2.6 Comparing	Contrasting Mapping Matching	Detecting correspondences between two ideas, objects, and the like
2.7 Explaining	Constructing models	Constructing a cause and effect model of a system

3. Apply

Categories & Cognitive Processes	Alternative Names	Definition
Apply		Applying a procedure to a familiar task
3.1 Executing	Carrying out	Applying a procedure to a familiar task
3.2 Implementing	Using	Applying a procedure to an unfamiliar task

4. Analyze

Analyze	Alternative Names	Break material into its constituent parts and determine how the parts relate to one another and to an overall structure or purpose
4.1 Differentiating	Discriminating Distinguishing Focusing Selecting	Distinguishing relevant from irrelevant parts or important from unimportant parts of presented material
4.2 Organizing	Finding coherence Integrating Outlining Parsing Structuring	Determining how elements fit or function within a structure
4.3 Attributing	Deconstructing	Determine a point of view, bias, values, or intent underlying presented material

5. Evaluate

Evaluate	Alternative Names	Make judgments based on criteria and standards
5.1 Checking	Coordinating Detecting Monitoring Testing	Detecting inconsistencies or fallacies within a process or product; determining whether a process or product has internal consistency; detecting the effectiveness of a procedure as it is being implemented
5.2 Critiquing	Judging	Detecting inconsistencies between a product and external criteria; determining whether a

		product has external consistency; detecting the appropriateness of a procedure for a given problem

6. Create

Categories & Cognitive Processes	Alternative Names	Definition
Create		Put elements together to form a coherent or functional whole; reorganize elements into a new pattern or structure
6.1 Generating	Hypothesizing	Coming up with alternative hypotheses based on criteria
6.2 Planning	Designing	Devising a procedure for accomplishing some task
6.3 Producing	Constructing	Inventing a product

According to Revised Bloom's taxonomy, each level of knowledge can correspond to each level of cognitive process, so a student can remember factual or procedural knowledge, understand conceptual or metacognitive knowledge, or analyze metacognitive or factual knowledge. According to Anderson and his colleagues, "Meaningful learning provides students with the knowledge and cognitive processes they need for successful problem solving".

	Cognitive Process					
Knowledge Dimensions	Remember	Understand	Apply	Analyze	Evaluate	Create
Factual						
Conceptual						
Procedural						
Metacognitive						

3.4 KRATHWOHL TAXONOMY FOR AFFECTIVE DOMAIN

Bloom's Taxonomy second domain, the Affective Domain, was detailed by Bloom, Krathwohl and Masia in 1964 (Taxonomy of Educational Objectives: Volume II, The Affective Domain. Bloom, Krathwohl and Masia.) Bloom's theory advocates this structure and sequence for developing attitude - also now commonly expressed in the modern field of personal development as 'beliefs'

Figure 5: Krathwohl's Taxonomy for Affective Domain

Affective learning is demonstrated by behaviours indicating attitudes of awareness, interest, attention, concern, and responsibility, ability to listen and respond in interactions with others, and ability to demonstrate those attitudinal characteristics or values which are appropriate to the test situation and the field of study.

Receiving	Receiving refers to the student's willingness to attend to particular phenomena of stimuli (classroom activities, textbook, music, etc.). Learning outcomes in this area range from the simple awareness that a thing exists to selective attention on the part of the learner. Being aware of or attending to something in the environment
Responding	Responding refers to active participation on the part of the student. At this level he or she not only attends to a particular phenomenon but also reacts to it in some way. Learning outcomes in this area may emphasize acquiescence in responding (reads assigned material), willingness to respond (voluntarily reads beyond assignment), or satisfaction in responding (reads for pleasure or enjoyment). Showing some new behaviours as a result of experience
Valuing	Valuing is concerned with the worth or value a student attaches to a particular object, phenomenon, or behaviour. Showing some definite involvement or commitment Showing some definite involvement or commitment
Organization	Organization is concerned with bringing together different values, resolving conflicts between them, and beginning the building of an internally consistent value system. Integrating a new value into one's general set of values, giving it some ranking among one's general priorities
Characterization by Value	The individual has a value system that has controlled his or her behaviour for a sufficiently long time for him or her to develop a characteristic "life-style." Thus the behaviour is pervasive, consistent, and predictable. Learning outcomes at this level cover a broad range of activities, but the major emphasis is on the fact that the behaviour is typical or characteristic of the student. Acting consistently with the new value

3.5 DAVE TAXONOMY FOR PSYCHOMOTOR DOMAIN

The Psychomotor Domain was ostensibly established to address skills development relating to manual tasks and physical movement, however it also concerns and covers modern day business and social skills such as communications and operation IT equipment, for example telephone and keyboard skills, or public speaking. Dave's Psychomotor Domain is probably the most commonly referenced and used psychomotor domain interpretation. There are other two namely - Simpson's, and Harrow's.

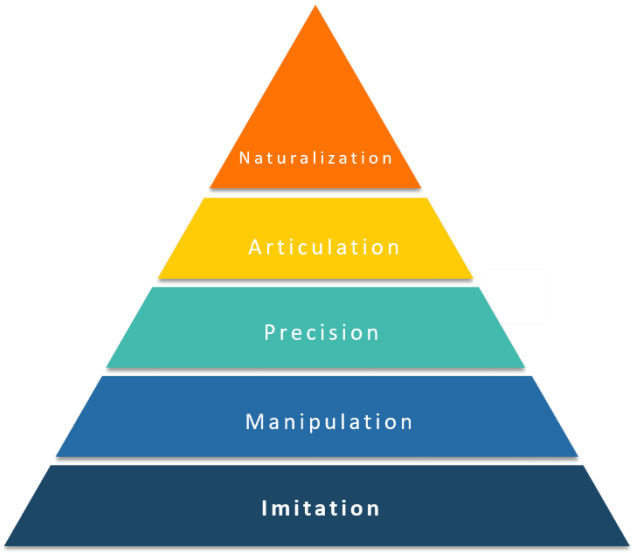

Figure 6: Dave Taxonomy for Psychomotor Domain

Category or 'level'	Behaviour descriptions	Examples of activity or demonstration and evidence to be measured
Imitation	copy action of another; observe and replicate	watch teacher or trainer and repeat action, process or activity
Manipulation	reproduce activity from instruction or memory	carry out task from written or verbal instruction
Precision	execute skill reliably, independent of help	perform a task or activity with expertise and to high quality without assistance or instruction; able to demonstrate an activity to other learners
Articulation	adapt and integrate expertise to satisfy a non-standard objective	relate and combine associated activities to develop methods to meet varying, novel requirements
Naturalization	automated, unconscious mastery of activity and related skills at strategic level	define aim, approach and strategy for use of activities to meet strategic need

Simpson's Taxonomy for Psychomotor Domain

The psychomotor domain (Simpson, 1972) includes physical movement, coordination, and use of the motor-skill areas. Development of these skills requires practice and is measured in terms of speed, precision, distance, procedures, or techniques in execution. Thus,

psychomotor skills range from manual tasks, such as digging a ditch or washing a car, to more complex tasks, such as operating a complex piece of machinery or dancing.

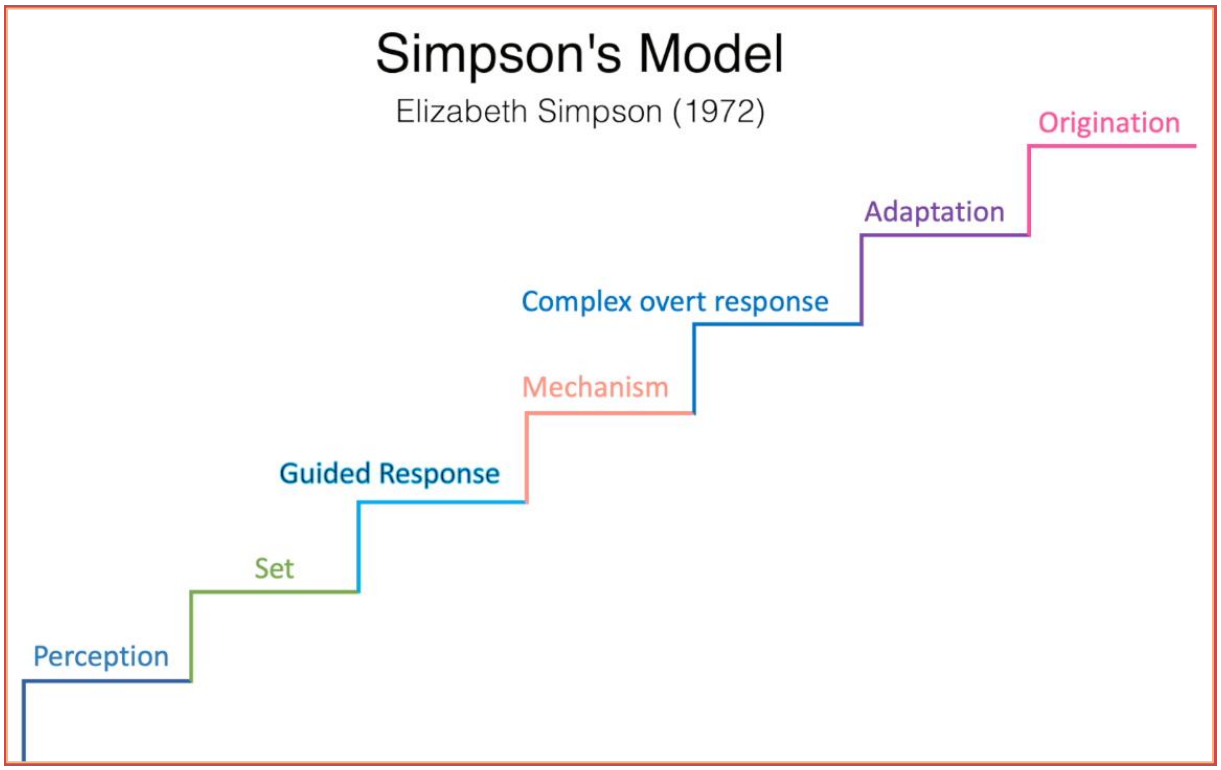

Figure 7: Simpson's Taxonomy for Psychomotor Domain

The seven major categories are listed from the simplest behavior to the most complex:

Category	Example and Key Words (verbs)
Perception (awareness): 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 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).	Examples: Knows and acts upon a sequence of steps in a manufacturing process. Recognize one's abilities and limitations. Shows desire to learn a new process (motivation). NOTE: This subdivision of Psychomotor is closely related with the "Responding to phenomena" subdivision of the Affective domain. Key Words: begins, displays, explains, moves, proceeds, reacts, shows, states, volunteers.
Guided Response: The early stages in 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 hand-signals of instructor while learning to operate a forklift. Key Words: copies, traces, follows, react, reproduce, responds
Mechanism (basic proficiency): This is 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 faucet. Drive a car. Key Words: assembles, calibrates, constructs, dismantles, displays, fastens, fixes, grinds, heats, manipulates, measures, mends, mixes, organizes, sketches.
Complex Overt Response (Expert): 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 are 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 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. Perform a task with a machine that it was not originally intended to do (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 situation or specific problem. Learning outcomes emphasize creativity based upon highly developed skills.	Examples: Constructs a new theory. Develops a new and comprehensive training programming. Creates a new gymnastic routine. Key Words: arranges, builds, combines, composes, constructs, creates, designs, initiate, makes, originates.

Harrow's Taxonomy for Psychomotor Domain

Figure 8: Harrow's Taxonomy for Psychomotor Domain

Category	Example and Key Words (verbs)
Reflex Movements — Reactions that are not learned, such as an involuntary reaction	Examples: instinctive response Key Words: react, respond
Fundamental Movements — Basic movements such as walking or grasping.	Examples: perform a simple task Key Words: grasp an object, throw a ball, walk
Perceptual Abilities — Response to stimuli such as visual, auditory, kinesthetic, or tactile discrimination.	Examples: track a moving object, recognize a pattern Key Words: catch a ball, draw or write
Physical Abilities (fitness) — Stamina that must be developed for further development such as strength and agility.	Examples: gain strength, run a marathon Key Words: agility, endurance, strength
Skilled movements — Advanced learned movements as one would find in sports or acting.	Examples: Using an advanced series of integrated movements, perform a role in a stage play or play in a set of series in a sports game. Key Words: adapt, constructs, creates, modifies
Non discursive communication — Use effective body language, such as gestures and facial expressions.	Examples: Express one's self by using movements and gestures Key Words: arrange, compose, interpretation

Summary:

- ✓ Developing and delivering lessons by teachers are integral in the teaching process. It is important for teachers to ensure that the three domains of learning which include cognitive (thinking), affecting (emotions or feelings) and Psychomotor (Physical or Kinesthetic) to be achieved.
- ✓ Bloom's Taxonomy is a hierarchical ordering of cognitive skills helps teachers teach and student learn. It can be used to create assessment, plan lessons, evaluate the complexity of assignments, design curriculum maps, develop online courses, plan project based learning and also for self-assessment.
- ✓ According to the two main dimension of Revised Bloom's Taxonomy, there are four types of knowledge – factual, conceptual, procedural and metacognitive and the six major cognitive process categories – Remember, Understand, Apply, Analyze, Evaluate and Create.

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1. Anderson, L.W. & Krathwohl, D.R. (2001). A taxonomy for teaching, learning, and assessing: A revision of Bloom's taxonomy of educational objectives. New York, NY: Longman.
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