Knowledge, Comprehension, Analysis and Critical Thinking

Products or outcomes are the most common tool used to determine the cognitive abilities of students. The idea behind cognitive learning is what instructors want students to know. This is established through a system of thinking levels, verbs, and behavior that are arranged in a hierarchy from less to more complex. The products are divided into six levels and are based on key words used and questions asked to determine critical thinking skills.

The following levels are used to measure critical thinking skills:

(1) Level 1: Knowledge – is based on previously learned bits of information by recalling facts, terms, concepts, and answers.

(2) Level 2: Comprehension is based on the student’s understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions and stating main ideas.

(3) Level 3: Application is based on the student’s ability to solve problems by applying acquired knowledge, facts, techniques and rules in a different way.

(4) Level 4: Analysis is examining and breaking information into parts by identifying motives and finding evidence to support generalizations.

(5) Level 5: Synthesis is compiling information together in a different way by combining elements in a new pattern or proposing alternative solutions.

(6) Level 6: Evaluation is presenting and defending opinions by making judgments about information, validity of ideas or quality of work based on a set of criteria.

The competency and expected skills demonstrated provides a useful process in which to categorize test questions, since professors will typically ask questions within particular levels. Research has shown that most instructors make tests using questions at the lower levels, yet research also shows that students remember more when they have learned to handle the topic at the higher levels of cognitive learning.
Students can determine the levels of questions that will appear on exams, and the study information using appropriate learning strategies. The following table should be helpful:

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>DEFINITION</th>
<th>KEY VERBS</th>
<th>QUESTIONS</th>
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</table>
| Knowledge | Student recalls or recognizes information, deas, and principles in the approximate form in which they were learned | Who, what, why, when, omit, where, which, choose, find, how, define, label, show, spell, list, match, name, relate, tell, recall, select. | What is…?  
How is …?  
Where is …?  
When did ?  
Recall …?  
Which one ?  
Who …? |
| Comprehension | Student translates, comprehends, or interprets information based on prior learning | Compare, contrast, demonstrate, interpret, explain, extend, illustrate, infer, outline, relate, rephrase, translate, summarize, show, classify. | Classify this  
Compare this  
Rephrase this  
What is the main idea?  
Summarize this |
| Application | Students select, transfers, and used data and principles to complete a problem or task with a minimum of direction | Apply, build, choose, construct, develop, interview, make use of, organize, experiment with, plan, select, solve, utilize, model, identify. | How would you use …?  
What other way would you plan to …?  
What elements would …? |
| Analysis | Students examine and break information into parts by identifying motives or causes. They make inferences and find evidence to support conclusions. | Analyze, categorize, classify, compare, contrast, discover, dissect, divide, examine, inspect, simplify, survey, take part in, test for, distinguish, list, distinction, theme, relationships, function, motive, inference, assumption and conclusion | Why do you think?  
What is the theme?  
How would you classify?  
What is the relationship between?  
What ideas justify …? |
| Synthesis | Students compile information together in a different way by combining elements in a new pattern or proposing alternative solutions. | Build, choose, combine, compile, compose, construct, create, design, develop, estimate, formulate, imagine, invent, make up, originate, plan, predict, propose, solve, solution, suppose, discuss, modify, change, original, improve, adapt, minimize, maximize, delete, theorize, | How would you improve?  
Can you invent…?  
How would you test …?  
Can you predict the outcome if …?  
What facts can you compile? |
<table>
<thead>
<tr>
<th>Synthesis</th>
<th>elaborate, test, improve, happen, change</th>
<th>Can you think of an original way for the?</th>
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<tr>
<td><strong>Evaluation</strong></td>
<td>Students present and defend opinions by making judgements about information, validity of ideas or quality of work based on a set of criteria.</td>
<td>Award, choose, conclude, criticize, decide, defend, determine, dispute, evaluate, judge, justify, measure, compare, mark, rate, recommend, rule on, select, agree, interpret, explain, appraise, prioritize, opinion, support, importance, criteria, prove, disprove, assess, influence, perceive, value, estimate, influence, deduct</td>
</tr>
</tbody>
</table>

**Definition of Term Related to Cognitive Learning –**

**Comprehension** - The act or fact of grasping the meaning, nature, or importance of; understanding. The capacity to include knowledge.

**Understanding** - To perceive and comprehend the nature and significance of; grasp
- To know thoroughly by close contact or long experience with: *That teacher understands children.*
- To grasp or comprehend the meaning intended or expressed by (another): *They have trouble with English, but I can understand them.*
- To comprehend the language, sounds, form, or symbols of:
- To know and be tolerant or sympathetic toward: *I can understand your point of view even though disagree with it.*
- To learn indirectly, as by hearsay: *I understand his departure was unexpected.*
- To infer: *Am I to understand you are staying the night?*
- To accept (something) as an agreed fact: *It is understood that the fee will be 50 dollars.*
- To supply or add (words or a meaning, for example) mentally.

**Apprehension** - To grasp mentally; understand: *a candidate who apprehends the significance of geopolitical issues.*

**Synonyms:** apprehend, comprehend, understand, grasp. These verbs are compared as they denote perception of the nature and significance of something.

*Apprehend* can imply awareness or consciousness that comes through the emotions or senses: "*We should not pretend to understand the world only by the intellect; we apprehend it just as much by feeling*" (Carl Jung).
**Apprehension** also denotes taking in with the mind: “Intelligence is quickness to apprehend” (Alfred North Whitehead).

Both *comprehend* and *understand* stress complete realization and knowledge: “To comprehend is to know a thing as well as that thing can be known” (John Donne). “No one who has not had the responsibility can really understand what it is like to be President” (Harry S. Truman).

To *grasp* is to seize and hold an idea firmly: “We have grasped the mystery of the atom and rejected the Sermon on the Mount” (Omar N. Bradley).

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### How to learn

Educational researchers show that it is the interaction of good instructional practices with students’ strategic learning strategies and skills that results in positive learning outcomes. Yet, many college students do not know what to do to learn the fact and bits of information in all the different content domain areas that they study.

Megacognitive process includes knowledge about oneself as a learner, knowledge about academic tasks, and knowledge about strategies to use in order to accomplish academic tasks. Awareness about oneself as a learner helps students to allocate their personal resources, or the resources that are available in their academic institution, such as group study sessions, tutoring programs, or learning centers.

Increasing student self awareness is required for effective strategy instruction. A survey to promote self awareness of strategies by asking questions such as:

a. How many hours do you spend a week studying for tests?
b. Are you up to date on course assignments and readings?
c. How do you take notes or study while reading the text?
d. How do you take notes in class? Do you review your notes? When? How?

Self reflection is important for self regulation, which means the degree in which students are metacognitively, motivationally, and behaviorally active participants in their own learning.

Seven principles for good practice in undergraduate education. Gamson, 1987

a. encourage contacts between students and the faculty
b. develop reciprocity or cooperative interchange of favors or privileges between students.
c. Emphasize time on task.
d. High expectations
e. Respect diverse talents and ways of learning.
f. Use active learning
g. Give prompt feedback

### Experience of Understanding and Strategic studying

Research survey examined how British students’ understanding was refined and committed to memory during preparation for final examinations. Students differed in terms of the breadth of
their understanding and in the depth or level of understanding, which was a function of the effort put into making connections within the material and with related ideas and experiences.

**Motivation**

Student learning and memory are closely tied to motivation. Students are learning all the time - however the sort of learning for which students are motivated is not always that which contributes to attaining the goals of our courses. Teachers should change their teaching methods from formal instruction to individuals who facilitate learning and understanding.

- Teachers can neither learn for the students nor stop them from learning.
- How are students motivated toward course goals?
  a. increase the value of learning
  b. affect the students’ expectancy that investment in course activities will lead to success in achieving their goals.
- Students are naturally curious. They seek new experiences and learn new things.

- Psychologist identify two general motivational forces:
  Extrinsic motivation – motivation for grades, money, or other rewards that are a consequence of learning.
  Intrinsic motivation - motivation for pleasure, enjoying an activity regardless of the consequences. Curiosity, competency, interest, enjoying problem solving and achievable challenge.

Arousing curiosity – the most successful questions are those that are the most unexpected. The interplay between familiar and novel may be very significant in the development of curiosity.
- novelty is generated by research
- Complexity can also arouse curiosity. Study questions requiring thought produce greater learning form reading.

Competency - students receive pleasure from doing things well. Motivation for learning is increased if students receive feedback that they are improving.
- teachers who support student autonomy help students feel more competent and become more independent.

**Memorizing and Understanding**

- facts and bit of information require memory work.
- definition of terms
- recall is important
- abstract thought will require the arrangement of terms and concepts into sequences that make sense.
- comprehending will mean that you will be able to use and synthesize information. Often it is expected that the concepts will be placed in hierarchical arrangements.
Concrete Learning - memory work – anatomy
Abstract Learning – understanding of facts – physiology: If you are asked to relate force, resistance, and effort to a math-based problem on muscle strength, the principles of physics and the concepts of mathematics would have to be applied. This type of problem-solving and mathematical evaluation is more abstract than the memorization of the name and location of a set of muscles.

**Behavior** - behavior, conduct, deportment. These nouns all pertain to a person's actions as they constitute a means of evaluation by others. Behavior is the most general: time off for good behavior; on their best behavior; guilty of contemptible behavior. Conduct applies to actions considered from the standpoint of morality and ethics: “The fate of unborn millions will now depend . . . on the courage and conduct of this army” (George Washington). “Life, not the parson, teaches conduct” (Oliver Wendell Holmes, Jr.). Deportment more narrowly pertains to actions measured by a prevailing code of social behavior: “[Old Mr. Turveydrop] was not like anything in the world but a model of Deportment” (Charles Dickens).

**Value** – A principle, standard, or quality considered worthwhile or desirable. Increase the value of learning is to link the course to the motives students bring to class – motives that have developed through years of socialization at home and in school. Instructors know that many of their students are taught by their parents to want to do well in school. Thus, students are motivated for achievement is an important factor.

**Beliefs** - belief, credence, credit, faith. The central meaning shared by these nouns is “mental acceptance of the truth, actuality, or validity of something”: a statement unworthy of belief; an idea steadily gaining credence; testimony meriting credit; put no faith in a liar's assertions. Something believed or accepted as true, especially a particular tenet or a body of tenets accepted by a group of persons.

**Summary:** Your beliefs are the core feelings that you hold about yourself and life, and this influences your values. Values are the standard for things, which you consider worthwhile in life, and in turn, they influence your behavior with family and friends as well as in society as a whole. You need to understand and support all three to reach your educational and professional goals. The higher the goal, the more support you will need to succeed.