

USING BLOOM'S TAXONOMY TO PROMOTE CRITICAL READING AND THINKING

Using Bloom's Taxonomy to Promote Critical Reading & Thinking by Barbara Fowler, Longview Community College

Bloom's Taxonomy divides the way people learn into three domains. One of these is the cognitive domain that emphasizes intellectual outcomes. This domain is divided into categories or levels. The key words used and the type of questions asked may aid in the establishment and encouragement of critical thinking, especially in the higher levels.

Level 1: Knowledge - exhibits previously learned material by recalling facts, terms, basic concepts and answers.

Key words: who, what, why, when, omit, where, which, choose, find, how, define, label, show, spell, list, match, name, relate, tell, recall, select

Questions:

What is . . . ? How is . . . ?
Where is . . . ? When did _____ happen?
How did _____ happen? How would you explain . . . ?
Why did . . . ? How would you describe . . . ?
When did . . . ? Can you recall . . . ?
How would you show . . . ? Can you select . . . ?
Who were the main . . . ? Can you list three . . . ?
Which one . . . ? Who was . . . ?

Level 2: Comprehension - demonstrating understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions and stating main ideas.

Key words: compare, contrast, demonstrate, interpret, explain, extend, illustrate, infer, outline, relate, rephrase, translate, summarize, show, classify

Questions:

How would you classify the type of . . . ?
How would you compare . . . ? contrast . . . ?
Will you state or interpret in your own words . . . ?
How would you rephrase the meaning . . . ?
What facts or ideas show . . . ?
What is the main idea of . . . ?
Which statements support . . . ?
Can you explain what is happening . . . what is meant . . . ?
What can you say about . . . ?
Which is the best answer . . . ?
How would you summarize . . . ?

Level 3: Application - solving problems by applying acquired knowledge, facts, techniques and rules in a different way.

Key words: apply, build, choose, construct, develop, interview, make use of, organize, experiment with, plan, select, solve, utilize, model, identify

Questions:

How would you use . . . ?
What examples can you find to . . . ?

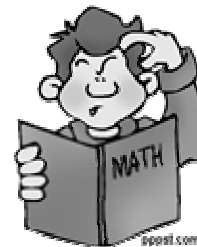
How would you solve _____ using what you have learned . . . ?
How would you organize _____ to show . . . ?
How would you show your understanding of . . . ?
What approach would you use to . . . ?
How would you apply what you learned to develop . . . ?
What other way would you plan to . . . ?
What would result if . . . ?
Can you make use of the facts to . . . ?
What elements would you choose to change . . . ?
What facts would you select to show . . . ?
What questions would you ask in an interview with . . . ?

Level 4: Analysis - examining and breaking information into parts by identifying motives or causes; making inferences and finding evidence to support generalizations.

Key words: 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, conclusion

Questions:

What are the parts or features of . . . ?
How is _____ related to . . . ?
Why do you think . . . ?
What is the theme . . . ?
What motive is there . . . ?
Can you list the parts . . . ?
What inference can you make . . . ?
What conclusions can you draw . . . ?
How would you classify . . . ?
How would you categorize . . . ?
Can you identify the difference parts . . . ?
What evidence can you find . . . ?
What is the relationship between . . . ?
Can you make a distinction between . . . ?
What is the function of . . . ?
What ideas justify . . . ?



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

Key Words: 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, elaborate, test, improve, happen, change

Questions:

What changes would you make to solve . . . ?
How would you improve . . . ?
What would happen if . . . ?
Can you elaborate on the reason . . . ?
Can you propose an alternative . . . ?

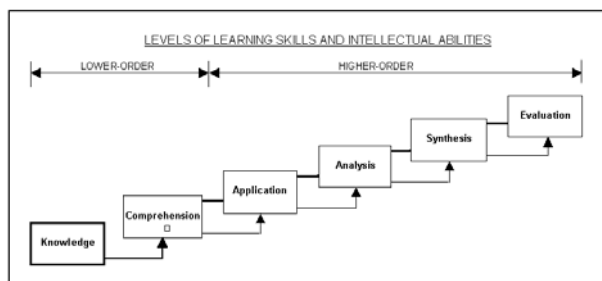
Can you invent . . . ?
 How would you adapt _____ to create a different . . . ?
 How could you change (modify) the plot (plan) . . . ?
 What could be done to minimize (maximize) . . . ?
 What way would you design . . . ?
 What could be combined to improve (change) . . . ?
 Suppose you could _____ what would you do . . . ?
 How would you test . . . ?
 Can you formulate a theory for . . . ?
 Can you predict the outcome if . . . ?
 How would you estimate the results for . . . ?
 What facts can you compile . . . ?
 Can you construct a model that would change . . . ?
 Can you think of an original way for the . . . ?

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

Key Words: 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

Questions:

Do you agree with the actions . . ? with the outcomes.. ?
 What is your opinion of . . . ?
 How would you prove . . . ? disprove . . . ?
 Can you assess the value or importance of . . . ?
 Would it be better if . . . ?
 Why did they (the character) choose . . . ?
 What would you recommend . . . ?
 How would you rate the . . . ?
 What would you cite to defend the actions . . . ?
 How would you evaluate . . . ?
 How could you determine . . . ?
 What choice would you have made . . . ?
 What would you select . . . ?
 How would you prioritize . . . ?
 What judgment would you make about . . . ?
 Based on what you know, how would you explain . . . ?
 What information would you use to support the view ... ?
 How would you justify . . . ?
 What data was used to make the conclusion . . . ?
 Why was it better that . . . ?
 How would you prioritize the facts . . . ?
 How would you compare the ideas . . . ? people . . . ?
 Reference: *Quick Flip Questions for Critical Thinking*, based on Bloom's Taxonomy and developed by Linda G. Barton



Knowledge is defined as the remembering of previously learned information. This may involve the recall of a wide range of material, knowledge of major ideas, or mastery of subject matter. But in general, all that is required in this category of knowledge is the recall of appropriate information. Although memorization is the lowest level of learning outcomes, it represents an important category in teaching and learning of mathematics. Examples of learning objectives at this level are knowing common terms, knowing specific facts, knowing methods and procedures, knowing basic concepts, and knowing principles.

- State the rule of ... [chain rule for differentiation]
- Define ...[an inverse function]
- Explain and use the procedure for ... [finding the roots of a function, finding a derivative of a given function, ...]

Comprehension is defined as the ability to understand information and grasp the meaning of material. This may be shown by translating knowledge into new context, interpreting facts, comparing, contrasting, or predicting consequences. These learning outcomes go one step beyond simple remembering of material and represent the lowest level of *understanding*. Examples of learning objectives at this level are understanding facts and principles, interpreting verbal material, interpreting charts and graphs, translating verbal material to mathematical formulae, estimating the future consequences implied in data, and justifying methods and procedures.

- Summarize the results ...[of the given ISETL code]
- Select the graph that illustrates ...[the data in the given table]
- Explain in your own words ...[properties of tangent function]

Application refers to the ability to use learned material in new situations. This may include solving problems that require recognizing and applying appropriate ideas, concepts, methods, principles, laws, and theories without being told and without any specific or immediate cues. Learning outcomes in this area require a higher level of understanding than those under Comprehension. Examples of learning objectives at this level are applying concepts and principles to new situations, solving mathematical problems, constructing graphs and charts, and demonstrating correct usage of a method or procedure.

- Find (or, calculate) the ...[derivative of the given function using the Chain rule]
- Use the given graph to ...[identify the time period of largest increase in population ...]
- Choose and describe the best method to ...[interpret given data]

Analysis refers to the ability to break down material into components. This may include identification of components, analysis of the relationships between components, recognition of hidden meanings, and/or seeing patterns. Learning outcomes here represent a higher intellectual level than Comprehension and Application because they require an understanding of both the content and the structural form of the material.

- Write a short outline of... [the proof of Fundamental Theorem ...]
- Write a coherent paragraph describing the relationship ...[between the derivative and original function]
- How does ... compare to ... [your new result compare to the result obtained in previous step]

Synthesis refers to the ability to put parts together to form a unique, original product or to form a new whole. This may include generalization from given facts, relating knowledge from several areas, predicting, and drawing conclusions. Learning outcomes in this area stress creative behaviors, with major emphasis on the formulation of new patterns or structures.

- Hypothesize and test ...[Based on the given data, make a hypothesis about the population growth and test your hypothesis]
- Develop a ...[procedure for analyzing and synthesizing given information about the relationship between population growth and a type of bacteria ...]
- Design an experiment for establishing ...[a relationship between ...]

Evaluation is concerned with the critical ability to judge the value of material, as well as to compare and discriminate between ideas. This includes assessing the values of theories or presentations, making choices based on reasoned argument, verifying the value of evidence, and recognizing subjectivity. Learning outcomes in this area are highest in the cognitive hierarchy because they contain elements of all the other categories, plus conscious value judgments based on clearly defined criteria.

- Using ... predict ...[Using information given in this table, predict and justify a trend/formula in growth of population ...]
- Develop a proof ... and justify each step ... [proof of Fundamental Theorem of Algebra]
- Using a definition ...determine ...[of inverse function, determine if the given two functions are inverses of each other]