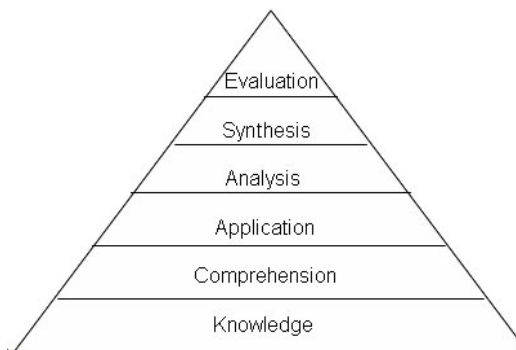


Bloom's Taxonomy and knowledge taxonomy verbs

Although Benjamin Bloom developed his classification of levels of intellectual behavior important in learning, (the now classic Taxonomy of Instructional Objectives) in 1956, research continues to support the value of objectives that involve the understanding and use of knowledge, those that are usually considered the most important goals of education.

In his Taxonomy, Bloom identified three areas in which learning takes place – the cognitive, affective, and psychomotor domains. In the cognitive domain, which deals with the recall or recognition of knowledge and the development of intellectual ability, six major levels are usually identified.

These levels are knowledge, comprehension, application, analysis, synthesis, and evaluation. Each level becomes progressively more complex and builds upon the previous level. So, not only is synthesis a more complex operation than knowledge, but the ability to synthesize depends upon the foundation of knowledge possessed by the learner. By using questions requiring higher-order thinking, teacher questioning moves beyond an assessment tool and becomes a valuable instructional tool as well.



Level	Definition
Knowledge	Remember previously learned information, recognize and recall facts and specifics
Comprehension	Understand the meaning of information, summarize or paraphrase given information
Application	Utilize knowledge in actual situations, use information in a situation different from the original learning context
Analysis	Break down objects or ideas into simpler parts, see how the parts relate and are organized, better understand the organization of the whole and the relationships between the parts
Synthesis	Rearrange component ideas into a new whole, combine elements learned into a new entity
Evaluation	Make judgments based on internal evidence or external criteria, make decisions, judge, or select based on criteria and rationale

Verb List

Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation
arrange, define, match, check, order, choose, find, recall, group, identify, label, list, select, locate, name, recognize, count, draw, find	calculate, discuss, select, convert, restate, solve, classify, give examples, predict, review, describe, explain, identify, generalize	relate, apply, change, choose, compute, demonstrate, discover, illustrate, predict, relate, show, sketch, solve	analyze, calculate, categorize, compare, contrast, differentiate, discriminate, distinguish, examine, experiment, question, test	arrange, collect, compose, construct, create, design, develop, formulate, organize, plan, prepare, propose, set up	appraise, argue, assess, attach, choose compare, defend estimate, judge, predict, rate, select, support, evaluate

Developing Mathematical Thinking with Effective Questions

To help students build confidence and rely on their own understanding, ask...

Why is that true?
 How did you reach that conclusion?
 Does that make sense?
 Can you make a model to show that?

To help students learn to reason mathematically, ask...

Is that true for all cases? Explain.
 Can you think of a counterexample?
 How would you prove that?
 What assumptions are you making?

To check student progress, ask...

Can you explain what you have done so far? What else is there to do?
 Why did you decide to use this method?
 Can you think of another method that might have worked?
 Is there a more efficient strategy?
 What do you notice when...?
 Why did you decide to organize your results like that?
 Do you think this would work with other numbers?
 Have you thought of all the possibilities? How can you be sure?

To help students collectively make sense of mathematics, ask...

What do you think about what _____ said?
 Do you agree? Why or why not?
 Does anyone have the same answer but a different way to explain it?
 Do you understand what _____ is saying?
 Can you convince the rest of us that your answer makes sense?

To encourage conjecturing, ask...

What would happen if...? What if not?
 Do you see a pattern? Can you explain the pattern?
 What are some possibilities here?
 Can you predict the next one? What about the last one?
 What decision do you think he/she should make?

To promote problem solving, ask...

What do you need to find out?
 What information do you have?
 What strategies are you going to use?
 Will you do it mentally? With pencil and paper? Using a number line?
 Will a calculator help?
 What tools will you need?
 What do you think the answer or result will be?

To help when students get stuck, ask...

How would you describe the problem in your own words?

What do you know that is not stated in the problem?

What facts do you have?

How did you tackle similar problems?

Could you try it with simpler numbers? Fewer numbers? Using a number line?

What about putting things in order?

Would it help to create a diagram? Make a table? Draw a picture?

Can you guess and check?

Have you compared your work with anyone else? What did other members of your group try?

To make connections among ideas and applications, ask...

How does this relate to...?

What ideas that we have learned before were useful in solving this problem?

What uses of mathematics did you find in the newspaper last night?

Can you give me an example of...?

To encourage reflection, ask...

How did you get your answer?

Does your answer seem reasonable? Why or why not?

Can you describe your method to us all? Can you explain why it works?

What if you had started with... rather than...?

What if you could only use...?

What have you learned or found out today?

Did you use or learn any new words today? What do they mean? How do you spell them?

What are the key points or big ideas in this lesson?

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