

Becoming

(transferable learning)

CREATE

Students can put elements together to form a functional whole, create a new product or point of view: **assemble, generate, construct, design, develop, formulate, rearrange, rewrite, organize, devise, propose**

EVALUATE

Students can make judgments and justify decisions: **appraise, argue, defend, judge, select, support, evaluate, debate, measure, select, test, verify**

ANALYZE

Students can distinguish between parts, describe how they relate to each other and to the overall structure: **compare, contrast, criticize, differentiate, discriminate, question, distinguish, experiment**

APPLY

Students can use information in a new way: **demonstrate, dramatize, interpret, solve, use, illustrate, convert, discover, discuss, prepare**

UNDERSTAND

Students can construct meaning from oral, written, and graphic messages: **interpret, exemplify, classify, summarize, infer, compare, explain, paraphrase, discuss**

REMEMBER

Students can recognize and recall relevant knowledge from long-term memory: **define, duplicate, list, memorize, repeat, reproduce**

Doing

(assignments)

Knowing

(content)

Bloom's Revised Taxonomy (Anderson & Krathwohl, 2001)

A Model of Learning Objectives

based on

A Taxonomy for Learning, Teaching, and Assessing:

A Revision of Bloom's Taxonomy of Educational Objectives

Among other modifications, Anderson and Krathwohl's (2001) revision of the original Bloom's taxonomy (Bloom & Krathwohl, 1956) redefines the cognitive domain as the intersection of the Cognitive Process Dimension and the Knowledge Dimension. This document offers a three-dimensional representation of the revised taxonomy of the cognitive domain.

Although the Cognitive Process and Knowledge dimensions are represented as hierarchical steps, the distinctions between categories are not always clear-cut. For example, all procedural knowledge is not necessarily more abstract than all conceptual knowledge; and an objective that involves analyzing or evaluating may require thinking skills that are no less complex than one that involves creating. It is generally understood, nonetheless, that lower order thinking skills are subsumed by, and provide the foundation for higher order thinking skills.

The Knowledge Dimension classifies four types of knowledge that learners may be expected to acquire or construct—ranging from concrete to abstract (Table 1).

Table 1. The Knowledge Dimension – major types and subtypes

concrete knowledge		abstract knowledge	
factual	conceptual	procedural	metacognitive*
knowledge of terminology knowledge of specific details and elements	knowledge of classifications and categories knowledge of principles and generalizations knowledge of theories, models, and structures	knowledge of subject-specific skills and algorithms knowledge of subject-specific techniques and methods knowledge of criteria for determining when to use appropriate procedures	strategic knowledge knowledge about cognitive tasks, including appropriate contextual and conditional knowledge self-knowledge

(Table 1. adapted from Anderson and Krathwohl, 2001, p. 46.)

*Metacognitive knowledge is a special case. In this model, "metacognitive knowledge is knowledge of [one's own] cognition and about oneself in relation to various subject matters ..." (Anderson and Krathwohl, 2001, p. 44).

Example Problem: $2x^2 - x - 1 = 0$

Student: I don't know what I'm doing or how to solve this.

TA: Tell me what you do know.

Scenario 1: Factual Realm (basic elements students must know)

Student's response:

- I can see that there are letters and numbers in a sequence – but that's it.

TA Response

- So, let's go to p. 7 where the text discusses variables.

Scenario 2: Conceptual Realm (interrelationships among basic elements)

Student response:

- Well I've solved it but I keep coming up with two different answers and don't understand why that's possible or what that means.

TA Response:

- Nice job – these kinds of problems do have two solutions. So let's talk about why that is the case.
- Why do you think you might keep coming up with two different possible solutions?

Scenario 3: Procedural Realm (how to do something, methods of inquiry and criteria for using skills, algorithms, techniques, and methods)

Student's response:

- I think I'm supposed to use the quadratic formula to solve this but I don't know how.

TA Response:

- The quadratic formula is definitely one option, what is that formula? Let's work together to figure this out.

Scenario 4: Metacognitive (self-awareness and knowledge of cognition)

Student's response:

- Ok – really I feel like I can solve this problem, but it takes me a long time to do and I am unsure whether I could take these principles and solve a more difficult problem.

TA Response:

- That seems like a great place to be at this point. Why don't I give you a more challenging problem and we can work through it together.
- One option to really make sure you understand is to work from the other direction and actually create a problem. Would you like to work together on doing that?

Scenario 5: Sociodynamic Realm

Student's response:

- I am feeling so overwhelmed I don't even know where to begin.

TA Response:

- I understand. Are you overwhelmed about just this problem, just this class, or something else?

**This is a great place to identify other support resources on campus, including the professor, Q Center and Class Dean

Biology:

An mRNA has the sequence 5'-AUGAAAUCCUAG-3'. What is the template DNA strand for this sequence? What sequence of amino acids does this mRNA encode?

Computer Science:

Write a method that determines whether a String is a palindrome.

Economics:

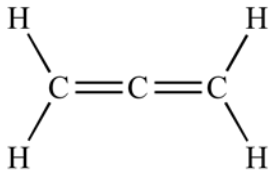
Consider the following events: Scientists reveal that consumption of oranges decreases the risk of diabetes, and at the same time, farmers use a new fertilizer that makes orange trees more productive. Illustrate and explain what effect these changes have on the equilibrium price and quantity of oranges.

Physics:

A canoe has a velocity of 0.4 m/sec southeast relative to the earth. The canoe is on a river flowing 0.5 m/sec east relative to the earth. Find the velocity of the canoe relative to the river.

Chemistry:

The allene molecule has the following Lewis structure:



Must all four hydrogen atoms lie in the same plane? If not, what is the spatial relationship among them? Why?

Math:

Show that the curve $y=6x^3+5x-3$ has no tangent line with slope 4.

Use your disciplinary specific problem to focus your conversation

Student: I don't know what I'm doing or how to solve this.

TA: Tell me what you do know.

Scenario 1: Factual Realm (basic elements students must know)

Student's response:

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TA Response

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Scenario 2: Conceptual Realm (interrelationships among basic elements)

Student response:

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TA Response:

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Scenario 3: Procedural Realm (how to do something, methods of inquiry and criteria for using skills, algorithms, techniques, and methods)

Student's response:

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TA Response:

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Scenario 4: Metacognitive (self-awareness and knowledge of cognition)

Student's response:

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TA Response:

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Scenary 5: Sociodynamic Realm

Student's response:

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TA Response:

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