

# Depth of Knowledge

- Depth of knowledge can vary on a number of dimensions, including
  - level of cognitive complexity of information students should be expected to know,
  - how well they should be able to transfer this knowledge to different contexts,
  - how well they should be able to form generalizations, and
  - how much prerequisite knowledge they must have in order to grasp ideas.

Source: Webb (1997).



Indiana Department of Education  
SUPPORTING STUDENT SUCCESS

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- The depth of knowledge required by an expectation or in an assessment is related to
  - the number of connections of concepts and ideas a student needs to make in order to produce a response,
  - the level of reasoning, and
  - the use of other self-monitoring processes.

Source: Webb (1997).



# Depth of Knowledge vs. Bloom's Taxonomy

Level 1 (Recall)	Knowledge
	Comprehension
Level 2 (Skill/Concept)	Application
Level 3 (Strategic Thinking)	Analysis
Level 4 (Extended Thinking)	Synthesis
	Evaluation

Adapted from Wyoming School Health and Physical Education Network (2002)



# Depth of Knowledge Level I (Recall)

- Recall of information such as a fact, definition, term, or a simple procedure
- Performing a simple algorithm or applying a formula.
  - A one-step, well-defined, and straight algorithmic procedure should be included at this lowest level.
- Other key words that signify a Level I include “identify,” “recall,” “recognize,” “use,” and “measure.”
- Verbs such as “describe” and “explain” could be classified at different levels depending on what is to be described and explained.

Source: Webb (1999).



# Algebra I DOK Level I

## Example Items

- What is the slope of the graph of  $y = 3x - 2$ ?
- Simplify  $(2x^2 + 5x - 1) + (x^2 + 8)$ .



# Depth of Knowledge Level 2 (Skill/Concept)

- The engagement of some mental processing beyond an habitual response
- Requires students to make some decisions as to how to approach the problem or activity
- Keywords that generally distinguish a Level 2 item include “classify,” “organize,” “estimate,” “make observations,” “collect and display data,” and “compare data.”
  - These actions imply more than one step.

Source: Webb (1999).



# Algebra I DOK Level 2

## Example Items

- Solve  $-3x + 5 = \frac{1}{2}(14x + 6)$ .
- Solve the system of equations below.
$$3x - 2y = -7$$
$$-3x + y = 11$$
- Megan bought 7 charms for \$31.50. Each charm costs the same amount of money. Write an inequality that can be used to find the maximum amount of charms Megan can buy with \$75. What is the maximum amount of charms Megan can buy with \$75?
- Graph  $y = x^2 + 4x + 1$ .



# Depth of Knowledge Level 3 (Strategic Thinking)

- Requires reasoning, planning, using evidence, and a higher level of thinking than the previous two levels.
- Cognitive demands are complex and abstract.
- An activity that has more than one possible answer and requires students to justify the response they give would most likely be a Level 3.

Source: Webb (1999).



# Algebra I DOK Level 3

## Example Items

- Consider the statement: “For any rational number  $n$ ,  $n$  squared is always greater than  $n$ .” Give a value of  $n$  that is a counterexample to the given statement.
- The height of a certain insect, in feet, that jumps straight up into the air is modeled by the equation  $h = -16t^2 + vt$ , where  $t$  is the time in seconds after the insect jumps, and  $v$  is the initial upward velocity of the insect.  
Write an equation that can be used to find the height  $h$  of this insect, in feet, after  $t$  seconds if the insect’s initial upward velocity is 4 feet per second.  
How many seconds will it take for the insect to hit the ground after it jumps?



# Depth of Knowledge Level 4 (Extended Thinking)

- Requires complex reasoning, planning, developing, and thinking, most likely over an extended period of time.
- The cognitive demands of the task should be high and the work should be very complex.
- Students should be required to make several connections—relate ideas *within* the content area or *among* content areas—and have to select one approach among many alternatives on how the situation should be solved, in order to be at this highest level.

Source: Webb (1999).



# Suggestions for the Classroom

- Assign the right amount of “routine” homework with 1 to 2 high level questions
- When practicing a skill in class, post high level questions on the chalkboard
- Problem of the Week (POW)
  - Resources: Textbooks, Test Generators, Dept. Meetings, Internet, etc.
- Have students explain how to solve POWs and other high level questions

