

Ramping Up the Critical Thinking in YOUR Classroom!

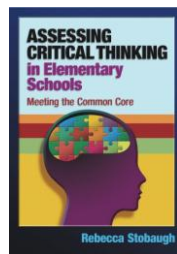
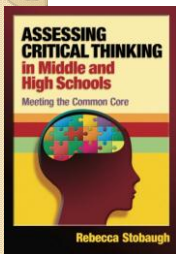
July 31
8:15-10:45

Presenter:
Dr. Rebecca Stobaugh



- Previous principal and teacher

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Assistant Professor

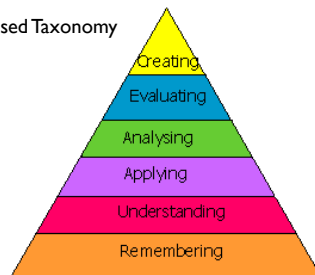


Learning Goals

- Identify various thinking levels and classify assessments used in their class on these levels.
- Design multiple choice and extended response items at top 3 levels of Bloom's taxonomy.
- Design performance assessments at the top 3 levels of Bloom's taxonomy.

Cognitive Complexity

Bloom's Revised Taxonomy



Importance of Higher Level Thinking

- To develop students' critical thinking skills necessary for mastering state and national assessments
- Most importantly, to prepare them to survive in the 21st century as problem solvers.
- Problem-solving skills can increase thinking, content area achievement, and motivation (Higgins, et al., 2005).

Remember



Remember Level Cognitive Processes

1. Recognizing
2. Recalling

Remember



Recognizing

- Retrieving relevant knowledge from long-term memory that is identical or extremely similar to present information
- Example:
 - True or False: The U.S. Constitution was written in 1776.

Remember



Recalling

- Retrieving relevant knowledge from long-term memory when given a prompt to do so
 - Searches long-term memory for a piece of information and brings that piece of information to working memory where it can be processed (retrieving)
 - Typically a question and looking for the answer.
- Example:
 - Taught major exports of Kentucky.

Test item: What is a major export of Kentucky?

Remembering

- Problem with using these types of questions:
 - Teachers tend to overuse it. Most questions in classroom discussions and tests are in the knowledge category.
 - Much of what is memorized is forgotten.
 - Only assesses a shallow understanding of an area.
 - State standards are not written at this level. They expect higher levels of thinking

(Cooper, 2006)

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The line of demarcation in the 6 cognitive categories

Remember = rote learning

All others = meaningful learning(transfer)

Rote learning requires students to remember what they learned. Transfer requires students to remember but also make sense of what they have learned.

Understand



- Purpose: Promote retention and transfer of information
 - Largest category of transfer-based educational objectives
- Requires the construction of meaning from instructional messages (oral, written, & graphic communication)
- Builds connections between the "new" tasks and their prior knowledge
- More cognitive processes are associated with this category than any other category
- Most represented in state standards
- Critical for all further learning

Understand



Understanding level cognitive processes

1. Interpreting
2. Exemplifying
3. Classifying
4. Summarizing
5. Inferring
6. Comparing
7. Explaining

Understand



Interpreting: Convert information from one representation to another

- Example: convert words into picture form
 - Paraphrase
 - Draw pictorial representations
- Must be new examples
 - If task is similar to instruction then it would be Remembering

Understand



Exemplifying: Giving a specific example or instance of a general concept or principle

- Identifying the defining feature of a general concept or principle
- Selecting or producing a specific example that is not encountered during instruction
- Example:
 - Taught artistic styles; then ask students to identify the painting represented by that period.
 - Taught about play genres; when given brief sketches of 4 plays, the students can identify which is a romantic comedy

Understand



Classifying: Recognizing that something's belongs to a certain category (e.g., concept or principle)

- Classifying begins with a specific instance or example and requires the student to find a general concept or principal
 - Exemplifying begins with a general concepts and requires students to find a specific instances or examples
- Example:
 - Students given pictures of prehistoric animals and then group animals based on common characteristics
 - Sorting task: Students given instances and must determine which ones belong in a specified category and which ones do not

Understand



Summarizing: Suggests a single statement that represents presented information or abstract a general theme

- Example:
 - Write a short summary of a event portrayed pictorially
 - After reading, write a summary of events
 - Select a title that best fits a passage

Understand



Inferring: Finding a pattern within a series of examples or instances

- Abstracting a concept or principle that accounts for a set of examples or instances by noticing relationships among them
- When given a set or series of examples, finding a concept or principal that accounts for them
- Example:
 - If x is 1, then y is 0; if $x = 2$ then $y = 3$; if x is 3 then $y = 8$
 - Analogy tasks: National is to president as state is to _____.

Understand



Comparing: Detecting similarities and differences between 2 or more objects, events, ideas, problems, or situations

- Show how each part of one object, idea, problem or situation corresponds to each part of another
- Example:
 - How is the American Revolution like a family fight?
 - Compare structurally similar math word problems.

Understand



Explaining: Constructing and using a cause-and-effect model of a system

- Example:
 - After reading & discussing the American Revolution, students construct a cause-and-effect chain of events that explains why the war occurred
 - After studying Ohm's law, student explain what happens to the rate of the current when the second battery is added to a circuit.
- Assess student's ability to explain including reasoning, troubleshooting, redesigning and predicting
 - Reasoning: Why does air enter the bicycle tire pump when you pull up on the handle?
 - Troubleshooting: Suppose you pull up or press down on a the handle of a bicycle time pump several times but no air comes out. What's wrong?
 - Redesigning: How could you improve a bicycle time pump so that is would be more efficient?
 - Predicting: What would happen in you increased the diameter of the cylinder in a bicycle tire pump?



Apply



Using procedures to perform exercises or solve problems

Linked with procedural knowledge

Student applies a fairly routine approach to a problem

Apply



Apply Level Cognitive processes:

1. Executing
2. Implementing

Apply



Executing: Routinely carries out a procedures when confronted with a familiar task
Follow a sequence of steps that are generally followed in a fixed order

When performed correctly the end result is a predetermined answer

Example:

Divide two whole numbers

Calculate density when given mass & volume
(density = mass/volume)

Apply



Implementing: Student selects and uses a procedures to perform an unfamiliar task

Does not know immediately the available procedures to use

There is no single, fixed answer expected when the procedure is applied correctly

Example:

Determine the procedures need to solve the problem and solve the problem using the selected procedure



Analyze



- Breaking material into its constituent parts and determine how the parts are related to one another and to an overall structure
 - Determine relevant or important pieces of a messages
 - Ways in which the pieces of a message are organized
 - Underlying purpose of the message
- Extension to Understanding or prelude to Evaluating or Creating

Analyze



Analyze Level Cognitive processes:

1. Differentiating
2. Organizing
3. Attributing

Analyze



- Differentiating:** Distinguishing the parts of a whole structure in terms of their relevance or importance
- Discriminate relevant from irrelevant information and then attend to relevant or important information
 - Example:
 - Differentiating apples and oranges in the context of fruit
 - Internal seeds are relevant but color and shape are irrelevant
 - In Comparing all relevant factors considered (i.e., seeds, color, and shape)
 - After reading research paper, identify key points
 - Identify relevant and irrelevant numbers in a word problem

Analyze



- Organizing:** Identifying the elements of communication or situation and recognizing how they fit together into a coherent structure
- Student building systematic and coherent connection among pieces of presenting information
 - Occurs in conjunction with differentiating
 - Student first identified relevant or important elements and then determines the overall structure within which the element fit
 - Examples:
 - Create an outline of facts that support or don't support a conclusion that the Civil War was caused by differences in rural and urban composition
 - Analyze research reports in term of 4 sections (hypothesis, method, data, and conclusion). As an assessment, asked to produce an outline of presented research report
 - In selected response, select which of 4 alternatives graphic hierarchies best corresponds to the organization of a presented passage

Analyze



Attributing: Ascertain the point of view, biases, values, or intentions underlying communication

- Deconstruction to determine the intention of the author of the presented material
- Extension belong Understanding to infer the intention or point of view underlying the presented material
- Example:
 - After reading passage about the American Civil War, determine whether the author takes the perspective of the North or the South
 - Determine motives for a series of actions by characters
 - Analyze a report to determine if a report on rain forests is pro-environment or pro-business



Evaluate



- Making judgments based on criteria and standards
 - Criteria: Quality, effectiveness, efficiency, and consistency
 - Quantitative (Is this enough?) or qualitative (Is this good enough or of sufficiently quality?)
 - Not just a decision of whether 2 objects are similar or different
 - Must have a judgment based on criteria

Evaluate



Evaluate Level Cognitive Processes:

1. Checking
2. Critiquing

Evaluate



Checking: Testing for internal inconsistencies or fallacies in an operation oral product

- Testing whether or not a conclusion follows from its premises; whether data support or disconfirm a hypothesis, or whether presented material contains parts that contradict one another
- Students can examine products given to the students or created by students themselves
- Example:
 - Detecting inconsistencies in persuasive messages
 - Watch campaign advertisement and point out any logical flaws in the persuasive message
 - Determine if a scientific conclusion follows from the observed data

Evaluate



Critiquing: Judging a product or operation based on externally imposed criteria and standards

- Noting positive and negative features of a product and then makes a judgment based on at least partly on those features
- Core of critical thinking
- Example:
 - Judging the merits of a particular solution to the problem of acid rain of its likely effectiveness and its associated costs
 - Judging the merits of a product or operation based on specified or student-determined criteria and standards
 - Evaluating the reasonableness of a hypotheses
 - Judging which of 2 alternative methods is a more effective and efficient way of solving a given problem



Create



- Pulling elements together to form a coherent or functional whole
- Students make a new product
 - May be original and unique but not always
 - Synthesize material into a whole by assembling previously taught material into a organized presentation
- Student must draw upon elements from many sources and put them together into a novel structure or pattern relative to his or her own prior knowledge
- Student's product is more and different than the student's beginning materials

Create



Create Level Cognitive Processes:

1. Generating
2. Planning
3. Producing

Create



- Generating:** Representing the problem and arriving at alternatives or hypotheses that meet certain criteria
- Generate different solutions or hypothesizing
 - Transcends the boundaries of prior knowledge and existing theories (divergent thinking)
 - Core of what can be called creative thinking
 - Understanding requires classifying & inferring but mostly convergent
 - Example: Students are given a description of a problem and must produce an alternative solution
 - Suggest as many ways as you can to assure that everyone has adequate medical insurance
 - Assessment based on criteria (i.e., reasonableness of alternatives, practicality)
 - Generate hypotheses to explain observed phenomena
 - Write as many hypotheses to explain strawberries growing to extraordinary size based on criteria for judging quality responses
 - Generate alternative methods for achievement of a particular result
 - Identify alternative methods could you use to find what whole numbers yield 60 when multiplied together
 - Assessment format: constructed response with alternatives or hypotheses
 - Might list all the possible consequences of an action
 - Might list all the uses for an objective

Create



- Planning:** Devising a solution method that meets a problem's criteria
- Developing a plan for solving the problem
 - Does not involve carrying out the steps to create the actual solution for a given problem
 - Might establish subgoals or break task into subtasks to be performed when solving the problem
 - Planning is often carried out when students construct a product
 - Examples:
 - Plan research papers on given historical topics
 - Submit an outline including steps needed to conduct the research
 - Design studies to test various hypotheses
 - Plan a way of determining which of the 3 factors determines the rate of oscillation of a pendulum
 - Lay out the steps needed to solve geometry problems
 - Devises a plan for determining the volume of a frustum of a pyramid (a task not previously considered in class)
 - Assessment: Students turn in worked-out solution, describe solution plans, or select solution plan for a given problem

Create



- Producing:** Carrying out a plan for solving a given problem that meets certain specifications
- Student given functional description of a goals and must create a product that satisfies the description
 - Must carry out solution plan
 - Example:
 - Producing novel and useful products that meet certain requirements
 - Write papers pertaining to particular historical periods that meet specific standards of scholarship
 - Write a short story that takes place during the American Revolution
 - Design habitats for certain species and certain purposes
 - Design the living quarters of a space station
 - Design the set for a student production of Driving Miss Daisy
 - Always criteria of evaluation student performance relative to the objective



Misconceptions

- Once a higher level thinking question is reviewed the item is a Remembering level for future testing purposes.
- Simply plunking a high level verb like "synthesize" doesn't mean it is automatically a higher level test item.
- "Hard" questions could be on a low thinking level.
 - "What is the capital of South Africa?" might be a hard question for some, but this question is on the Remembering level.

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Misconceptions

- Classifying tasks is typically based on **thinking about the content**, not technology or artistic skills.
 - "Designing a PowerPoint on Washington's presidency" is a low level task. Though the use of technology may be on an Applying level, focus on how deeply they are thinking about the **CONTENT**.
- Students can be taught to think.
- Thinking is not just reserved for advanced students.

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State tests

- If instruction is at a higher level than it is assessed on the state tests, then no doubt students will be able to perform lower level tasks.
 - Always practice harder in class than the test requires; just like in basketball, coaches run multiple drills so basketball players will be well prepared for the game.

Basketball



Practice HARD

7/27/2013

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