

# HOW TO ASSESS HIGHER-ORDER THINKING SKILLS IN YOUR CLASSROOM

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- Studies analyzing classroom tests, over many decades, have found that most teacher-made tests require only recall of information (Marso & Pigge, 1993). However, when teachers are surveyed about how often they think they assess application, reasoning, and higher-order thinking, both elementary and secondary teachers claim they assess these cognitive levels quite a bit.
- Teachers who do not specifically plan classroom discussion questions ahead of time to tap particular higher-order thinking skills, but rather ask extemporaneous questions are likely to ask recall questions.
- Transfer: Retention requires that students remember what they have learned, whereas transfer requires students not only to remember but also to make sense of and be able to use what they have learned.
- Critical thinking: Critical thinking is reasonable, reflective thinking that is focused on deciding what to believe or do. It includes reasoning, questioning and investigating, observing and describing, comparing and connecting, finding complexity and exploring viewpoints.
- Most human creations, both inventions of things and inventions of social customs, were conceived to solve some sort of problem.
- Thinking-skills interventions are effective in supporting student improvement in thinking, content area achievement, and motivation.
- Instruction emphasizing reasoning was associated with higher scores on TIMSS and NEP.
- Four Kinds of thinking skills
  - Metacognition – the ability to think about thinking
  - Making inferences
  - Transfer or generalizing ideas across context
  - Synthesizing information.
- Low achieving students were more motivated to do the thoughtful work than the one-word-answer drill work.

## Chapter 1: General Principles for Assessing Higher-Order Thinking

- Constructing an assessment always involves these basic principles:
- Specify clearly and exactly what it is you want to assess
- Design tasks or test items that require students to demonstrate this knowledge or skill
- Decide what you will take as evidence of the degree to which students have shown this knowledge or skill
- Present something for students to think about, usually in the form of introductory text, visuals, scenarios, resource material, or problems of some sort
- Use novel material – material that is new to the student, not covered in class and thus subject to recall
- Distinguish between level of difficulty (easy versus hard) and level of thinking (lower-order thinking or recall versus higher-order thinking) and control for each separately

## Chapter Two: Assessing Analysis, Evaluation, and Creation

- **Assessing Analysis:** TO assess the quality of students' thinking as they break down information into its parts and reason with that information, questions or tasks must ask students to find or describe those parts and figure out how they are related. (e.g. infer main idea from individual points made in a text)
- To assess how students focus on a question, give students a statement of a problem or policy, a political address or cartoon, or an experiment and results. Then ask students what the main issue or problem is. You could also ask what criteria they would use to evaluate the quality, goodness, or truth of the argument or conclusions.
- You need to analyze the content knowledge and reasoning requirements of a question and make sure they match what you intend the question to measure. If a question requires background or content knowledge that is not part of the intended domain, then the question should be revised.
- **Analyze arguments or theses:** To assess how students analyze arguments, give students an argument – text or a speech, for example. Then ask students one of the following:
  - What evidence does the author give that supports the arguments?
  - What evidence does the author give that contradicts the arguments?
  - What assumptions need to hold for the arguments to be valid?
  - Are any parts of the statement irrelevant to the arguments?
  - What is the logical structure of the arguments?
- The best way to avoid confounding your assessment of thinking and writing is to assess the merits of each separately.
- To assess evaluation, you need items or tasks that can assess how students judge the value of materials and methods for their intended purposes. Students can appraise the material against criteria. The criteria can be standard or criteria that the students invent.
- To assess how well students can do evaluation, give them some material and ask them to judge its value for some purpose.
- Task specific rubrics cannot be shared with students before the assessment.
- To assess whether students can “create” in the Bloom’s taxonomy sense means assessing whether they can put unlike things together in a new way, or reorganize existing things to make something new. Present students with a task to do or a problem to solve that includes generating multiple solutions, planning a procedure to accomplish a particular goal, or producing something new. The creation we are discussing here is what the old Bloom’s taxonomy called “synthesis,” and it overlaps with creativity in the broader sense.
- The goal of using a cognitive taxonomy is to help students transfer their knowledge to new situations. The purpose of assessment of analysis, evaluation or creation is to get information about the ways in which students use their knowledge and skills in novel situations.
- An important part of formative feedback on items or tasks requiring analysis, evaluation, or creation should be feedback on the thinking itself. Instead of concentrating solely on whether students have arrived at appropriate literary, historical, scientific, or mathematical conclusions, make sure to coach students on the sounds of their reasoning, their selection of evidence, and the clarity of their explanations. Model sound reasoning, good use of evidence, and clear explanations for students.
- Student self-assessment requires higher-order thinking. To participate in the formative assessment process – Where am I going? Where am I now? What do I need to do to close the gap? – students need to use a combination of analysis, evaluation and creation. They need to understand various aspects of their own work (analysis), evaluate these aspects against criteria (evaluation), and figure out what the next step should be (creating a plan).

### **Chapter Three: Assessing Logic and Reasoning**

- **Deduction:** reasoning from a principle to an instance of the principle.

- Induction involves reasoning from an instance or instances to a principle. Unlike deduction, inductive reasoning is not certain.
- The interpretation of results sections of science lab reports are usually assessments of inductive reasoning.
- Notice that the content rubric (pg 80) talks about the accuracy of facts and details and the completeness of information, both in the context of whether the thesis is clear and logically supported. Thinking cannot be done in the abstract. Students must think about something. Judging the accuracy and relevance of information is part of the reasoning process.
- Build formative assessment opportunities into student work on long-term projects by assessing plans, progress, or partial products. Don't make students wait until the end of a long assignment to get information about how the work is contributing to their learning.
- Reasoning is required for all higher-order thinking. Much is made of cognitive taxonomies and problem solving, but the mental infrastructure students need is less often discussed.

#### **Chapter Four: Assessing Judgment**

- Types of judgments: evaluating the credibility of a source of information, identifying assumptions implicit in that information, and identifying rhetorical and persuasive methods.
- Identifying what is assumed in an argument or text is an important skill. Examining assumptions also helps students judge the soundness of arguments.
- Multiple-choice questions assess whether students can recognize assumptions, constructed-response questions assess whether students can generate the assumption themselves.
- In ELA, students can identify assumptions that characters in novels or short stories make about the world or their situation, motivating their actions.
- Identifying rhetorical tactics is an aspect of literary analysis, but also important to all subject areas.
- Once students have received feedback that helps them see the reasoning that should support a conclusion, in effect the task becomes an assessment of recall for that student. Therefore, after formative assessment, administer another assessment task requiring similar reasoning and see if students can use what they learned to do better on this question.

#### **Chapter Five: Assessing Problem Solving**

- Bransford and Stein: Five-stage IDEAL Problem Solving Strategies
  - I – Identify the problem
  - D – Define and represent the problem
  - E – Explore possible strategies
  - A – Act on the strategies
  - L – Look back and evaluate the effects of your activities
- For problems that require higher-order thinking, the solution strategy is not immediately apparent. Problems that require higher-order thinking are non-routine problems.
- Unstructured problems are more typical of real-life problems. Highly structure problems allow the teacher more control over the content of students' work.
- Students who work on unstructured problems are more successful than students who work on structured (one answer) problems.
- Often, once the problem has been identified, the solution and explanation fall into place. Assess students' explanations specifically for how they conceptualized the problem.
- To assess how students identify what is and is not relevant to a particular problem, present interpretive materials and a problem statement and ask students to identify all the irrelevant information.

- An important “identifying irrelevancies” problem in all disciplines is how to search for information for an assignment. To produce a good paper or project and distinguish relevant from irrelevant information, students need more than a topic. They need a research question, and they need to stay with it long enough to verify findings and draw concepts from the findings. Sometimes students looking up information for a paper or project get distracted by interesting but irrelevant information they run across along the way – or worse, they do not realize the information is irrelevant.
- McClymer and Knowles observed that students without the skill of knowing what is relevant and what is not cope with assignments rather than learning from them. Two of the coping mechanisms involve students’ producing “clumps” or “shapes”. Clumps are clods of information shoveled up without underlying logic or explanation. Students can clump data, reproducing lots of information with little or no thinking; they can clump jargon, using technical language without really understanding it; and they can clump assertions, for example by making thesis statements surrounded by lots of “stuff” that does not really support the thesis.
- Shapes are arguments in the right form but without substance. Some common shapes students employ to mimic critical thinking without actually doing it include borrowing the analysis of another author, analyzing only surface meanings and analyzing a single thread or issue as if it represented the topic.
- Students who clump lack the critical-thinking skills listed here as being able to “focus on a question” and identify irrelevancies”.
- My librarian friend says technology is not the issue teachers should worry about. He says what secondary teachers should do is teach their students how to ask questions and how to judge what information is relevant to answering the question and what is not.
- Describe and evaluate multiple strategies
- Prioritizing the strategies according to criteria that are important for the specific problem (for example, the most efficient, most effective, least expensive, and so on), either before trying them or after trying several of them, and deciding which is the best strategy, is also an important higher-order thinking skill.
- To assess how students describe multiple problem-solving strategies, state a problem and ask students to solve the problem in two or more ways and show their solutions using pictures, diagrams or graphs.
- To assess how students model a problem, state a problem and ask students to draw a diagram or picture showing the problem situation. Assess students on how well they represent the problem rather than on whether the problem is correctly solved.
- Solving a problem backward requires what cognitive psychologists call means-end analysis. Students need to figure out ways to successively reduce the difference between the problem as presented and the desired solution.
- To assess how students solve more open problems backward, present a complex problem situation or a complex, multistep task to complete. Ask students to work backward from the desired outcome to develop a plan or a strategy for completing the task or solving the problem.
- Try to use general problem-solving rubrics, not task-specific ones, so that students internalize as their goal the general strategies of identifying the problem, defining and representing the problem, exploring possible strategies, acting on the strategies, and looking back and evaluating the effects of the strategies. Using the same rubrics over and over again will help the students focus on the qualities described in those rubrics as their goal for successful problem solving.
- Identify a problem to be solved
- Identify irrelevancies
- Describe and evaluate multiple strategies

- Model a problem
- Solve a problem backward

### **Chapter 6: Assessing Creativity and Creative Thinking**

- Creativity is probably the most poorly assessed and least understood higher-order thinking skill.
- Brainstorming is a classic creative activity.
- Whether or not you can grade creativity depends on whether you believe creativity is just the generative, productive act, or if it includes critiquing. If you believe the former, creativity should be assessed and described with feedback. If you believe that creativity comprises both having a new idea and evaluating the value of the new idea, then it is possible to grade an assignment.
- To assess creative thinking, an assessment should do the following:
- Require student production of some new ideas or a new product, or require students to reorganize existing ideas in some new way. Juxtaposing two different content areas or texts is one way to do this.
- Allow for student choice (which itself can be a “creation of an idea”) on matters related to the learning target(s) to be assessed, not on tangential aspects of the assessment like format.
- If graded, evaluate student work against the criteria students were trying to reach, where appropriate, as well as conventional criteria for real work in the discipline.
- Giving students the opportunity to decorate a cover on a paper about the big bang theory of the origin of the universe does not help students develop a creative, generative approach to science. Giving students the opportunity to approach the material in different ways (for example, as if they were a reporter for the science section of Parade magazine, as if they were a high school science teacher, as if they were a NASA administrator, as if they were the parent of a curious child, ) allows students to write very different papers about the big bang and gets creative juices flowing about the topic, not the tangent.
- The most common misconception I have noted in my own work with teachers is saying “creative when they mean artistic or aesthetically pleasing. Another common misconception is to use creativity to mean interesting (to the teacher or reader).
- I hope that these examples will help refocus assessment of creativity that really means something else (neatness, artistry, interest, persuasiveness, and so on) to its true target.

### **Afterword**

- Principles of assessment
- Clearly specify what it is you want to assess
- Design a task or test time that requires students to do precisely that
- Decide how you will interpret and evaluate the results
- Assessing higher-order thinking requires some additional principles
- Use introductory material or allow access to resource material
- Use novel material
- Attend separately to cognitive complexity and difficulty
- Plan assessment criteria at the same time you plan assessment questions or tasks. Use the criteria to focus your feedback, student self-evaluation, or student peer evaluation.
- Thinking is a teachable and learnable skill and should not be reserved for high achievers only. Teachers can expect, teach, and assess thinking skills for all students.