EVALUATING HIGHER ORDER THINKING SKILLS

Kurt Geisinger
Think of your program/course at the university. Now consider one of the following scenarios:

1. A super brilliant scholar is trying to organize his course of study. What would you say to convince him to take your class?

2. There are organizational changes at the university and some programs or courses might be cut; why not yours?
Activity #1: A 3-minute “Elevator Speech”

Stakes may be high, so a great deal of thought could be a great investment.

Higher Order Thinking Skills – to develop and to assess – is best cultivated and nurtured with time and effort rather than rushed or underestimated.
Whether you are considered a teacher, lecturer, facilitator, professor, or educator, the general expectation is that you will move your students, learners, or trainees from point A to point B or Z and that they will develop more than just the basic skills in the process.

There are many labels for goals beyond basic skills, such as: critical thinking, problem solving, rational thought, complex reasoning, and higher-order thinking.
• Assessment & Reports - grades, scores, marks, proficiency indicators, …

• Differentiating lower-order and higher-order thinking processes in problem solving may be discerned depending on level of reasoning entailed in creating a solution.
  – Reproductive thinking (lower-order)
  – Productive thinking (higher-order)
• Reproductive thinking (lower-order): solution is achievable by applying an algorithm or associated past experiences

• Productive thinking (higher-order): in addition to integration reproductive thought processes, solution involves one or more of the following: reasoning, spontaneous combination of isolated experiences not previously associated, using new evidence or additional information to fill in gaps in a logical sequence, extrapolation, and reinterpretation.
Critical thinking is *disciplined, self directed* and *appropriate* to the domain of thought.

Elements of critical thinking include: clarity, precisions, specificity, accuracy, relevance, consistency, logic, depth completeness, significance, fairness, and adequacy.
**Transfer**: students are able to use their understanding/interpretation of what they remember in a way that indicates “meaningful learning.”

- Learning becomes more meaningful when it can be “transferred” to new or different concepts.
- Learning is reinforced when content or concepts are applied in ways other than how it was first introduced.
**Critical Thinking**: is a type of reasonable, reflective thinking that is aimed at deciding what to believe or what to do.[1]

- Making wise or informed judgments based on prior knowledge
- Producing reasoned or logical critiques
- Consideration of options then deciding what to do
**Problem Solving**: entails evaluating the issue at hand, formulating creative alternative(s) to achieve and communicating effectively.[2]

- The problem should have a goal that can not be reached using simple recall of knowledge, but one that requires processing and strategizing.
“Creativity is putting things together in new ways (conceptually or artistically), observing things others might miss, constructing something novel, using unusual or unconventional imagery that nevertheless works to make and interesting point, an the like.”

Susan Brookhart, 2010
A STARTING POINT

There is no prescriptive format or approach that is set in stone to evaluate Higher-Order Thinking Skills.

Here are some questions one should ask along the way:

- What are Higher-Order Thinking Skills?
- What would Higher-Order Thinking Skills look like in action in your world/framework?
- How do you measure Higher-Order Thinking Skills objectives in your context?
- What are technological implications for Higher-Order Thinking Skills?
- Can you cultivate Higher-Order Thinking Skills and a flexible knowledge base?
- Will you have to adjust your pedagogy?
- What are activities that you currently use that you consider to be higher-order?
- What differentiates these activities from others?
Two of the most popular taxonomies promoted in teacher education programs are Bloom’s Taxonomy (original and revised) and Webb’s Taxonomy.

These taxonomies essentially illustrate hierarchical order of thought processes, which are useful for developing tasks and assessments that stimulate and evaluate learning across levels.
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<tr>
<th>BLOOM’S (Revised)</th>
<th>WEBB’S</th>
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<tr>
<td><strong>1. REMEMBER:</strong> Student remembers or recalls learned information, labels, defines and describes.</td>
<td><strong>1. RECALL:</strong> Student recalls facts, information, procedures or definitions.</td>
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<td><strong>2. UNDERSTAND:</strong> Student comprehends, or interprets information based on prior learning.</td>
<td><strong>2. BASIC APPLICATION OF SKILL/CONCEPT:</strong> Student uses information, conceptual knowledge, and procedures.</td>
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<td><strong>3. APPLY:</strong> Student selects transfers, and uses data and principles to complete a task or problem with minimum direction.</td>
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### Cognition Considerations: Taxonomy – higher order

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<td><strong>4. ANALYSE:</strong> Student is able to utilize information/data to compare &amp; contrast, classify, and explain.</td>
<td><strong>3. STRATEGIC THINKING:</strong> Student uses reasoning and develops a plan or sequence of steps; process has some complexity.</td>
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<td><strong>5. EVALUATE:</strong> Student appraises, convinces, or critiques on a basis of specific standards and criteria.</td>
<td><strong>4. EXTENDED THINKING:</strong> Student conducts an investigation, needs time to think and process multiple conditions of problem or task. <em>Project over time; in-depth synthesis; analysis</em></td>
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<td><strong>6. CREATE:</strong> Student plans, composes, designs, invents, integrates, or combines ideas into a product or a proposal that is new.</td>
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Higher and Lower Order Thinking Skills

- Create
- Evaluate
- Analyze
- Apply
- Understand
- Remember
Activity #2: Verb Wheel

- Remember
- Create
- Understand
- Evaluate
- Apply
- Analyze
SOME EXAMPLES OF HIGHER ORDER VERBS:

- Compare & Contrast
- Construct
- Decide
- Define
- Demonstrate
- Design
- Diagram
- Distinguish
- Estimate
- Evaluate
- Examine
- Identify
- Imagine
- Interpret
- Investigate
- Justify
- Locate
- Measure
- Order
- Plan
- Prioritize
- Rate
- Recommend
The foundation for educational tests is grounded in test standards, learning targets, or objectives for which you will design the test to measure.

Careful selection of the relevant content minimizes the use of items that do not match the constructs of interest and ensure validity of the scores from such items.
What do you hope to ascertain in the evaluation process?

What construct(s) will be assessed?

• Content

• Skill

Which higher order levels are to be assessed?

• Taxonomy / task-level representation

Assessment Strategies:

• Written/Performance tests

• Projects

• Collaboration
Good Practice for Assessing Student Learning

1. The assessment of student learning begins with educational values.

2. Assessment is most effective when it reflects an understanding of learning as multidimensional, integrated, and revealed in performance over time.

3. Assessment works best when the programs it seeks to improve have clear, explicitly stated purposes.

4. Assessment requires attention to outcomes but also and equally to the experiences that lead to those outcomes.
5. Assessment works best when it is ongoing and not episodic.

6. Assessment fosters wider improvement when representatives from across the educational community are involved.

7. Assessment makes a difference when it begins with issues of its use and illuminates questions that people really care about.

8. Assessment is most likely to lead to improvement when it is part of a larger set of conditions that promote change.

9. Through assessment, educators meet responsibilities to students and to the public.
Manage cognitive complexity and difficulty separately

– Difficulty (easy-hard) is a different concept/construct from cognitive complexity (recall versus higher order thinking)

– “The misconception that recall is “easy” and higher-order thinking is “difficult” leads to bad results.” p.29

– Higher-order thinking can be assessed for all learners.

– Both recall and thinking tasks can range from easy to hard in difficulty.¹
• What is the mental task at hand for each item?
  – Recall
  – Reasoning
  – Questioning & Investigating
  – Observing & Describing
  – Comparing & Connecting
  – Finding Complexity
  – Exploring Viewpoints

• Match the item expectations with the language style used
Cognitive-affective Theory of Learning with Media (CTLM) focuses on the following ideas:

– that humans process information differently depending on which modality is being accessed

– that a person’s working memory has limited capacity but their long-term memory has unlimited capacity

– with enough practice certain schemas become automated.
Assessment Principles

- Stimulus
- Novel material
- Rubric/evidence

Cognitive Complexity

- Select
- Compose
- Perform

Blueprint

Content/Construct

Style

- Applying
- Creating
- Analyzing
- Evaluating

Difficulty level

easy
difficult
Metacognitive awareness pertains to how well you know how you think and process information, which in turn would influence the skills and strategies you use to learn – consciously or subconsciously.
Higher Order Considerations

- Curricular Implications
  - Formative vs Summative
  - High / Low Stakes decisions
  - Testing environment
  - Resources
- Achievement and Ability
  - Application
  - Evaluation
  - Synthesis / Creation

  ➢ Clearly define the construct(s) intended to be measured so that its components are all assessed to the extent possible.

  ➢ Considerations for item types or assessment strategies
    - Written Assessments
    - Personalize tasks to students life experiences
    - Collaborate on group worthy tasks
    - Authentic, meaningful, and relevant projects

  ➢ Feedback (from within and beyond the class)

  ➢ Mini Angoff – Judgement Exercise
Curricular Implications

- What is the main purpose of the exam in relation to the curricula?
  - End of program or exit criteria
  - End of semester
  - End of unit
- Clarify:
  - Who will write, administer, and score the test?
  - What decisions will be made using the results (high/low stakes)?
  - When will the test be administered? (timing & frequency)
  - Where will the test be administered? (environment and resources)
  - Why focus on various levels of learning?
  - How will the scores be reported to the students?
• Are you testing just because it is an academic tradition, or is it your intent to gather data that will impact a decision or influence subsequent behavior.

• What kinds of decisions will be made using the scores of this exam?
  – Administrative (admission / promotion / exit)
  – Curricular (program evaluation)
  – Faculty (comparison / appraisal)
  – Student (grade, promotion, exit requirement)

• Clarify:
  – Who
  – What
  – When
  – Where
  – Why
  – How
“Blueprints ensure that your assessment and the information about student achievement that comes from it have the emphasis you intend.” Brookhart (2010)

• Advanced planning will help you to ensure a balance of content and thinking for your assessments that reflect course content and goals.

• Blueprints for assessments can help you to enrich educational delivery with the element of standardization and consistency.

• Similarly, you are encouraged to use blueprint-style approach for criteria for feedback or scoring rubrics.

• When writing actual assessment items or tasks, blueprints simplify the process and adherence to a blueprint helps to maintain fidelity and balance of content (providing evidence/argument for construct validity).
• Learner Outcomes [physical or mental]
  – *Achievement* involves knowledge and skills – learned in short term
  – *Ability* is evident in performance and application – learned over time

• Content
  – What content areas need to be covered in the exam?
  – Are the various content areas scaffolded through the curriculum?
  – What aspects require greater weight/value/representation?

• Time
  – How much time is allotted for the exam?
  – Is the examination speeded?
• **Knowledge** is more than information stored or memorized. There are many dimensions to the assessment of knowledge. Knowledge is important in building foundation for higher level thinking but testing exclusively in this domain will not establish the full range or capacity or extent to which a subject area was learned.

• **Skills** are complex acts that require knowledge and generally involves some degree of practice to achieve mastery.

• **Ability**, physical or mental (e.g. critical thinking, creativity), involves a very complex relationship with knowledge and skills as well. These typically take a long time to develop or train, and in some aspects it may be influenced by natural talent.
What areas need to be covered?

- **Facts**: knowledge, information, data that is generally accepted / not disputed and held to be true in the field.
- **Concepts**: categories of ideas, objects, and / or events that share a common set of defining traits.
- **Principles**:
  - Cause and effect
  - Relationship between two or more concepts
  - Laws of probability
  - Axioms
- **Procedures**: whether simple or complex, there is a sequence or sequences of acts (mental and /or physical) that leads up to the result.
Plan Items or Tasks

When writing a test item or task use these three principles:

1. Present introductory material or allow access to resource material that gives students something to think about
2. Use novel material or perspective when possible
3. Attend separately to cognitive complexity and difficulty

Thereafter assume the test taker’s perspective with respect to what kind of thinking is required to respond to the item.

The response should match both the content and thinking skills requirement of your assessment plan.
Plan ahead & be clear and specific

General Principles

• What do you want to assess?

• What kinds of tasks / item responses will generate relevant evidence? Make sure the items are construct relevant, that they are tapping into what you intended the assess.

• Can you operationalize a rubric to differentiate levels of difficulty/mastery?
For higher-order thinking skills, clearly defined tasks and rubrics become the most useful tools. Since responses may look different or tasks produce different results, especially when students are expected to “create,” it is imperative that expectations are expressed and students get the opportunity to clarify earlier on rather than at the end.
Critical thinking requires a level of higher order thought process that uses judgement, prudence and wisdom to reflect on the issue or content at hand and:

- question value,
- assess context or mitigating information,
- decide based on reason and evidence what to accept as truth or what to do.
“Creative thinking is brainstorming or putting together of new ideas, and then critical thinking takes over and evaluates how successful the new ideas are.” Brookhart, 2010 p 125

– Creative thinking is generative or productive.
– Critical thinking is evaluative.
– Both creative and critical thinking are essential parts of good thinking and often overlap in tasks, projects, assignments, and assessments.
• Creativity is putting things together in new ways
  – This concept is certainly not limited to arts, aesthetics, or entertainment.
  – Products of creativity could be an ideological concept or a physical product. However, creative thinking does not have to result in a product.

• Do not trivialize the word *creativity* in a rubric.
Assessing creative thinking is important across all subject areas.

- Require students to produce new ideas or a new product, or to reorganize existing ideas in a new way.
- Student generated ideas should be central to matters related to learning target(s) to be assessed, not on tangential aspects of the assessment like format.
- If the product is graded, evaluate student work against a clearly pre-established criteria (a rubric or real work in the discipline)
Using technology to promote higher order thinking skills.

– Relevance to subject matter
– Current
– Collaboration beyond the classroom
– Expressed content expectations and rubrics help to differentiate quality work from tech-savvy glitz
Activity #3

Digital media can be a very useful tool in assessing “products” of higher order thinking skills, because it gives you the opportunity to review, reassess, have multiple assessors (internal / external) and also collect evidence toward students achievement or course validation.

Design one activity that would be relevant to your course in which you or your students would use digital media to prompt or demonstrate higher order thinking.
Activity #3

Examples:
One Minute-One Point
Much like the “Elevator Speech” scenario, ask students to create presentations of concepts or suggested solutions for specific topics. In this activity students **analyze** the information, **evaluate** what critical information must be incorporated into the one minute summary or explanation, and **create** a digital media presentation.

Photo/Image/Video prompts
Students are presented with a number of photos, images, or a video prompt and the task to analyze the situation (or problem), establish critical points, then design viable solutions or compose plausible outcomes.