Understanding Cognitive Complexity
Learning Targets

- Develop the ability to align both instruction and assessment to the levels of cognitive rigor suggested by the standards:
  - Identify the level of cognitive rigor required by a given standard
  - Create assessment items at any/all levels of cognitive rigor
  - Map an instructional path that moves students from a starting point to the required level of cognitive rigor
Future of Education

Why do we need to increase the rigor in our instruction and assessment?
Life in the 21st Century

“"The **good** news is that most schools have improved. The **bad** news is that our world has been changing at a much faster pace than our schools.”

*Dr. Willard R. Daggett*
"I created the term rigor and relevance. Relevance makes rigor possible. The problem is that what is relevant to one child is not relevant to the next child, which is why the third R -- which is relationships -- is so important. Educators need to know why their students are struggling. What conditions are causing that? In order to do that they need to change how they teach. It's important for educators to know their students. Educators need to know what is interesting to them, whether it is football, baseball or the arts. Those are the ways to engage students."

Education Week
Rigor, Relevance & Relationships: An Interview with Bill Daggett
By Peter DeWitt on January 4, 2012 2:42 PM
Lessons from Dan Meyer

“Impatience with irresolution”

“Patience Problem Solving” – MP1 – Persevere in solving problems

“Math serves the conversation, the conversation doesn’t serve the math?”

“Be less helpful”

“Students need to be involved in the formulation of the problem.”
Assessment

How can we use assessment as a tool to ensure that our students are ready to compete in the 21st century workplace?
High-Quality Assessment

Cognitive Complexity • Alignment • Reliability • Bias

Purpose
Why are you giving this assessment?
Brainstorm several reasons for giving an assessment.
Assessments for Student Growth

Need to assess priority targets (essential skills)
Must align all items to standards
Need to allow for stretch (low-high ability)
Need to be valid & reliable
2 Learning Priorities
Identify Learning Priorities

Longevity

Leverage

Levels

• The knowledge and skills important today, tomorrow, and in the future.
• Example: Reading comprehension
• The knowledge and skills used in more than one content area at a specific grade level (horizontal).
• Example: Creating and analyzing charts and graphs
• The knowledge and skills key to success in subsequent grade levels or courses (vertical).
• Example: Strong understanding of fractions to prepare for work with rational numbers
Learning Priorities

- Introduced early
- Reinforced often
- Multiple opportunities for learning
Understanding Student Expectations

Grades 3-11
ELA & Math

Science
Grades 5 & 8
HS Physical Science & Biology

Social Studies
Grades 4 & 6
HS American History & Government

Other Subjects

PARCC
Evidence Tables
Performance Level Descriptors PLD

Ohio
Test Specifications

Ohio
Content Standards
Anchor Standards – College & Career Readiness
Alignment

Do my instruction and assessments align in content and skill to the standards?
Alignment

What do I want my students to know and be able to do?

Content  Skills
K.G2: Correctly name shapes regardless of their orientations or overall size. (CCSS)

• Show me the triangles.
• Show me the pentagons.
• Show me the cylinders.
LS 5.2: Food webs can be used to identify the relationships among producers, consumers and decomposers in an ecosystem. (ONLS)

3. Which of the choices below describes the roles of the four organisms in the correct order from left to right?

A. consumer, consumer, decomposer, producer
B. decomposer, consumer, consumer, producer
C. producer, consumer, consumer, decomposer
Analyse the causes and consequences of major political, economic, and social developments of the 1930s with emphasis on the Dust Bowl. (OACS)

Which of the following areas was most associated with “the Dust Bowls” of the 1930s?

- a. Area marked A
- b. Area marked B
- c. Area marked C
- d. Areas marked by D and E
Depth of Knowledge

To what level do students need to demonstrate their understanding of the content?
Webb’s Depth of Knowledge
Preparing for the “Cognitive Demands” of Ohio’s Next Generation Assessments

- Ohio’s New Learning Standards call for a higher level of cognitive complexity than previous assessments could measure
DoK Level 1

Routine Thinking

Recall and Reproduction

Describe  Measure
Define  Calculate
Locate  Memorize

Jen Jones (2013); helloliteracy.blogspot.com
DoK 1 Question Stems

Can you recall______?
When did _____ happen?
Who was _____?
What is_____?
Can you select_____?
How would you write___?
Who discovered___?
What is the formula for___?
Can you identify___?
Level 1 Questions

Name the parts of a cell.

Based on the U.S. Constitution, which development would cause a state to gain representation in the House of Representatives?

We need DoK level 1 questions . . . .
What we don’t need is JUST DoK level 1 questions.
DoK Level 2

Conceptual Thinking

Basic Application and Reasoning

Classify   Categorize
Summarize  Graph
Infer      Interpret

Jen Jones (2013); helloliteracy.blogspot.com
DoK 2 Question Stems

Can you explain how _____ affected _____?
How would you apply what you learned to develop _____?
How would you compare _____? Contrast_____
How would you classify_____?
What can you say about_____?
How would you summarize_____?
How would you estimate___?
How could you organize___?
What do you notice about___?
Level 2 Questions

Write a paragraph summarizing the main ideas of the text.

Nora is running a race that is 26.2 miles. She is running at a speed of 8 miles per hour. She has completed $\frac{3}{4}$ of the race. How much longer will it take Nora to finish the race?
DoK Level 3

Strategic Thinking

Higher Level Application

Discuss
Investigate
Critique
Revise
Assess
Argue/Justify

* Usually more than one right answer

Jen Jones (2013); helloliteracy.blogspot.com
DoK 3 Question Stems

How is _____ related to _____?
What conclusions can you draw _____?
How would you adapt _____ to create a different _____?
How would you test _____?
Can you predict the outcome if _____?
What is the best answer? Why?
What conclusion can be drawn from these three texts?
What is your interpretation of this text? Support your rationale.
What facts would you select to support _____?
Level 3 Questions

1. Is toothpaste a solid or a liquid? Conduct the following experiment, collect and analyze the data, analyze, make a claim, and support your claim with evidence.

2. Evaluate an experimental study, how data was gathered and what analysis was used. Draw conclusions based on graphical and numerical summaries. Write a report to support or refute the appropriateness of the data.
DoK Level 4

Extended Thinking

Real World Application

Synthesize        Create
Design           Plan
Develop          Propose

* Usually over an extended period of time

Jen Jones (2013); helloliteracy.blogspot.com
DoK 4 Question Stems

• Write a thesis, drawing conclusions from multiple sources.
• Design and conduct an experiment. Gather information to develop alternative explanations for the results of an experiment.
• Write a research paper on a topic.
• Apply information from one text to another text to develop a persuasive argument.
Level 4 Questions

- *Is a democracy always democratic?*
  - Given what you know about the history of American Indians in Ohio and the United States, write an essay explaining the extent to which you believe American Indians were adequately included in the democratic process. Be sure to cite specific examples in your essay.

  - Should a teacher allow kindergarteners to play alone on the playground?

Essential for Project Based Learning Tasks
Hess’ Cognitive Rigor Matrix

Bloom’s Taxonomy

- Create
- Evaluate
- Analyze
- Apply
- Understand
- Remember

Webb’s Depth of Knowledge

- DOK 1: Recall and Reproduction
- DOK 2: Basic Application of Skills and Concepts
- DOK 3: Strategic Thinking
- DOK 4: Extended Thinking

Battelle for Kids
Bringing clarity to school improvement
<table>
<thead>
<tr>
<th>Bloom’s Revised Taxonomy of Cognitive Process Dimensions</th>
<th>Webb’s Depth-of-Knowledge (DOK) Levels</th>
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<tbody>
<tr>
<td><strong>Remember</strong></td>
<td><strong>Level 1 Recall &amp; Reproduction</strong></td>
</tr>
<tr>
<td>Retrieve knowledge from long-term memory, recognize, recall, locate, identify</td>
<td>Recall, recognize, or locate basic facts, ideas, principles</td>
</tr>
<tr>
<td><strong>Understand</strong></td>
<td><strong>Level 2 Skills &amp; Concepts</strong></td>
</tr>
<tr>
<td>Construct meaning, clarity, paraphrase, represent, translate, illustrate, give examples, classify, categorize, summarize, generalize, infer a logical conclusion (such as from examples given), predict, compare/contrast, match like ideas, explain, construct models</td>
<td>Specify and explain relationships, give non-examples/examples, make and record observations, analyze/organize ideas/data, summarize results, concepts, ideas</td>
</tr>
<tr>
<td><strong>Apply</strong></td>
<td><strong>Level 3 Strategic Thinking/Reasoning</strong></td>
</tr>
<tr>
<td>Carry out or use a procedure in a given situation, carry out (apply to a familiar task), or use (apply to an unfamiliar task)</td>
<td>Select a procedure according to task needed and perform it, solve a one-step problem, calculate, measure, apply a rule, apply an algorithm or formula, represent in words or diagrams, use models to represent concepts</td>
</tr>
<tr>
<td><strong>Analyze</strong></td>
<td><strong>Level 4 Extended Thinking</strong></td>
</tr>
<tr>
<td>Break into constituent parts, determine how parts relate, differentiate between relevant/irrelevant, distinguish, focus, select, organize, outline, find coherence, deconstruct (e.g., for bias or point of view)</td>
<td>Use concepts to solve non-routine problems, design investigation for a specific purpose or research question, conduct a designed investigation, apply concepts to solve non-routine problems, use reasoning, planning, and evidence, reverse final draft for meaning or progression of ideas, illustrate how multiple themes (historical, geographic, social) may be interrelated</td>
</tr>
<tr>
<td><strong>Evaluate</strong></td>
<td></td>
</tr>
<tr>
<td>Make judgments based on criteria, check, detect inconsistencies or fallacies, judge, critique</td>
<td>Cite evidence and develop a logical argument for concepts, describe, compare, and contrast, verification methods, verify reasonableness of results, justify conclusions made</td>
</tr>
<tr>
<td><strong>Create</strong></td>
<td></td>
</tr>
<tr>
<td>Reorganize elements into new patterns/structures, generate, hypothesize, design, plan, construct, produce</td>
<td>Generate conjectures or hypotheses based on observations or prior knowledge, synthesize information within one source or text, formulate an original problem, given a situation, develop a complex model for a given situation</td>
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5 2009 © Hess, Carlock, Jones, & Walkup. This article is currently pending publication. Permission to reproduce is given when authorship is fully cited.
K.G2: Correctly name shapes regardless of their orientations or overall size. (CCSS)

- Ask student to point to a shape.
- Ask student to name the shape.
- Ask student to point to all of the shapes identified.
LS 5.2: Food webs can be used to identify the relationships among producers, consumers and decomposers in an ecosystem. (ONLS)

Explain your reasoning.

If these organisms were arranged in a food pyramid, which organism would have the least amount of total energy available?

A. coyote  
B. insect  
C. lizard  
D. shrub

Explain your reasoning.
Analyze the causes and consequences of major political, economic and social developments of the 1930’s with emphasis on the Dust Bowl. (OACS)

Using information from the documents provided and your knowledge of United States history and government, write an essay to answer the following question:

What were the political, social and economic costs and benefits of the Dust Bowl and the United States government response to it?

Work in subject/grade band groups to examine standards and assessment items to determine DoK level.
The bottom line.....

Students need to able to demonstrate original thought, and not just reproduce what they’ve been told....

Don’t assume students know how to do this!
- Model it
- Provide opportunities for practice
Next Steps
Delve deeper into your standards

Discuss learning priorities and depth of knowledge

Determine what EVIDENCE is needed to demonstrate student learning

Develop assessments that provide evidence and instructional plans to guide students to mastery
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<td>ohio-department-of-education</td>
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