Are You Down with the DOK?

HOW TO LIFT YOUR MATH INSTRUCTION EVERY DAY!

ATOMIC Conference, December 2017

Bryan Kerachsky, Principal
Skinner Road School, Vernon
Bryan.Kerachsky@vernonct.org

Heather Rigatti, Math Coach
Haddam Elementary School
hrigatti@rsd17.org
Participants will:

• correlate DOK to CCSS Mathematical Practices

• consider ways to lift DOK 1 → DOK 2 → DOK 3 through task selection, worksheet adaptation, questioning and discourse

• link to everyday math instruction
Go to Menti.com
Code: 70 46 87

List your responses to these two questions as a word or short phrase:

◦ What do you know about DOK/cognitive rigor?

◦ How do you increase rigor in your math classroom?
What is DOK?

Is it this?
What is DOK?

**DOK-1 – Recall & Reproduction** - Recall a fact, term, principle, concept; perform a routine procedure – measure, calculate, apply rule (e.g., Problems that provide practice - “Doing the drills”)

**DOK-2 - Basic Application of Skills/Concepts** - Use of information, conceptual knowledge, select appropriate procedures for a task, two or more steps with decision points along the way, routine problems applying 2+ concepts, organize/display data, interpret/use simple graphs; categorize data; extend patterns (e.g., Word Problems)

**DOK-3 - Strategic Thinking** - Requires reasoning, developing a plan or sequence of steps to approach problem; requires some decision making and justification; abstract, complex, or non-routine; often more than one possible answer or approach (e.g., Performance Tasks; “playing the game”)

**DOK-4 - Extended Thinking** – Design & conduct an original investigation; requires more time to research, problem solve, and process and collect evidence across multiple conditions (real world); non-routine manipulations, across disciplines/content areas/multiple sources (e.g., Projects)
**What is DOK?**

---


<table>
<thead>
<tr>
<th>Revised Bloom’s Taxonomy</th>
<th>Webb’s DOK Level 1 Recall &amp; Reproduction</th>
<th>Webb’s DOK Level 2 Skills &amp; Concepts</th>
<th>Webb’s DOK Level 3 Strategic Thinking/Reasoning</th>
<th>Webb’s DOK Level 4 Extended Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Remember</strong></td>
<td>Recall, observe, &amp; recognize facts, principles, properties</td>
<td>Recall identify relationships among representations or numbers (e.g., customary and metric systems)</td>
<td>Use concepts to solve non-routine problems</td>
<td>Rotate mathematical or scientific concepts to other contexts, other domains, or other concepts</td>
</tr>
<tr>
<td><strong>Understand</strong></td>
<td>Evaluate an expression on a graph or number on number line</td>
<td>Specify and explain relationships (e.g., non-linear functions)</td>
<td>Explain more than one response is possible</td>
<td>Develop generalizations of the results obtained and the strategies used (form investigation or leadings and apply them to new problem situations</td>
</tr>
<tr>
<td><strong>Apply</strong></td>
<td>Follow simple procedures; execute directions; apply a rule or formula</td>
<td>Select a procedure occurring in the problem</td>
<td>Design investigation for a specific purpose or research question</td>
<td>Select or devise approach among many alternatives to solve a problem</td>
</tr>
<tr>
<td><strong>Analyze</strong></td>
<td>Examine information from a table or graph to answer a question</td>
<td>Identify whether specific information is contained in graphical representations (e.g., table, graph, “chart, diagram)</td>
<td>Examine and develop a logical sequence of steps for solving the problem and report results</td>
<td>Conduct a project that specifies a problem, identifies solution paths, solves the problem, and reports results</td>
</tr>
<tr>
<td><strong>Evaluate</strong></td>
<td>Make judgments based on criteria, criteria, defined or stated</td>
<td>Examine patterns and trends among representations or numbers, or within and between customary and metric measures</td>
<td>Analyze multiple sources of evidence</td>
<td>Gather, analyze, &amp; evaluate information to draw conclusions</td>
</tr>
<tr>
<td><strong>Create</strong></td>
<td>Generate ideas, concepts, or perspectives related to a topic</td>
<td>Create new knowledge or hypotheses based on observations or other knowledge and experience</td>
<td>Analyze and develop a logical sequence of steps for solving the problem and report results</td>
<td>Synthesize information across multiple sources or tasks</td>
</tr>
</tbody>
</table>

---

Use Hess’ Cognitive Rigor Matrix instead
Why does DOK matter?

• complexity matters
• depth of understanding matters
• transfer matters
7 Misconceptions

1. All kids can't do this; or kids don't need scaffolding to get "up" there.
2. Webb’s DOK model is a taxonomy
3. Bloom verbs & levels = Webb DOK
4. DOK is about difficulty.
5. All DOK levels can be assessed with a multiple choice question
6. Higher order thinking = deeper learning
7. Multi-step or longer tasks, multiple texts, or complex texts always means deeper thinking

Hess, K. “How to Go Deep to Meet the New Math Standards” http://media.wix.com/ugd/5e86bd_6db65a2fbb94f384339ae5e5e250510c.pdf
<table>
<thead>
<tr>
<th>Instruction and assessment decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Selected Response</strong></td>
</tr>
<tr>
<td><strong>Constructed Response</strong></td>
</tr>
<tr>
<td><strong>Performance Tasks</strong></td>
</tr>
</tbody>
</table>

### DOK 1: Recall and Reproduction
- **Remember**
  - Recall basic math facts, definitions, rules, terms
- **Understand**
  - Evaluate an expression
  - Locate points on a number line

<table>
<thead>
<tr>
<th>Apply</th>
</tr>
</thead>
</table>

### DOK 2: Skills and Concepts
- **DOK 2**
  - **Skills and Concepts**
  - Explain if-then relationships
  - Summarize steps to solve problem

<table>
<thead>
<tr>
<th>Analyze</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Evaluate</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Create</th>
</tr>
</thead>
</table>

### DOK 3: Reasoning and Thinking
- **Reasoning and Thinking**
  - Explain, generalize or connect ideas using supporting evidence (diagrams, models, calculations)
  - Use concepts to solve non-routine problems and justify solutions

<table>
<thead>
<tr>
<th>Develop a logical argument for conjectures or proof based on one concept or task</th>
</tr>
</thead>
</table>

### DOK 4: Extended Thinking
- **Extended Thinking**
  - Explain how statistics concepts specifically relate to other content domains.
  - Devise an approach among many alternatives to research a novel problem

<table>
<thead>
<tr>
<th>Synthesize across multiple sources/data sets</th>
</tr>
</thead>
</table>

---

Hess, K. “How to Go Deep to Meet the New Math Standards”

[http://media.wix.com/ugd/5e86bd_6db65a22f0c94f338199a0c5a92361af.pdf](http://media.wix.com/ugd/5e86bd_6db65a22f0c94f338199a0c5a92361af.pdf)
Roles of Teacher and Student

TEACHER/FACILITATOR

1. Build conceptual understanding, schemas
2. Probe for reasoning
3. Provide tasks requiring analysis of evidence
4. Strategically scaffold to advance thinking
5. Allow for reflection and “processing” time

STUDENT

1. Conceptual discourse (if-then; alike-different)
2. No canned answers
3. Persevere when challenged; seek alternatives
4. Generate deeper questions
5. Listen, probe, & respectfully challenge others with evidence
Correlation of DOK to Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.
# Math Content Standards & Math Practices

<table>
<thead>
<tr>
<th>Depth + Thinking</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Recall &amp; Reproduction</td>
<td>Skills &amp; Concepts (routine applications)</td>
<td>Strategic Thinking (support with data, equations, models, etc.)</td>
<td>Extended Thinking (across domains)</td>
</tr>
<tr>
<td>Remember</td>
<td>Know math facts, terms</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understand</td>
<td>Attend to precision, evaluate expressions, plot point</td>
<td>Model with mathematics, estimate, predict, observe, explain relationships</td>
<td>Construct viable arguments, geometry proof</td>
<td>Integrate concepts across domains</td>
</tr>
<tr>
<td>Apply</td>
<td>Calculate, measure, make conversions</td>
<td>Make sense of routine problems</td>
<td>Make sense of non-routine problems</td>
<td>Design &amp; conduct a project</td>
</tr>
<tr>
<td>Analyze</td>
<td>Identify a pattern, locate information in table</td>
<td>Use tools strategically, classify, organize data, extend a pattern</td>
<td>Reason abstractly, generalize a pattern</td>
<td>Analyze multiple sources of evidence</td>
</tr>
<tr>
<td>Evaluate</td>
<td></td>
<td>Critique the reasoning of others</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create</td>
<td></td>
<td></td>
<td></td>
<td>Design a complex model</td>
</tr>
</tbody>
</table>

Hess, K. “How to Go Deep to Meet the New Math Standards” [Link](http://media.wix.com/ugd/5e86bd_6db65a2fffc94f438439afe5a85051df.pdf)
Ways to lift
DOK 1 → DOK 2
DOK 2 → DOK 3

in everyday
lessons

How do you increase rigor in your math classroom?
“The Marzano Center Essentials for Achieving Rigor model includes 13 strategies. Considered and implemented as a set, these strategies represent a dramatic shift from traditional classroom pedagogy and align directly with the goals of college and career readiness standards.”
Teacher behavior

INSTEAD OF...

• Spend a lot of time talking during teaching
• Focus on the activity
• Teach explicitly all the time
• Jump in quickly to assist
• Provide yes/no, right/wrong questions and tasks

TRY...

• Let students do the work and the talk
• Focus on the mental processing required for students
• Try an inquiry lesson
• Be less helpful
• Promote stamina and perseverance
Questioning

INSTEAD OF...

• Ask most of the questions
• Move at fast pace
• Provide hints
• Being surprised by student responses

TRY...

• Students generate questions (Question Formulation Technique)
• Provide wait time
• Give non-specific hints and general strategies (link to MPs)
• Anticipate student solutions

QFT based on work of Rothstein/Santana, *Make Just One Change* and the work of the *Right Question Institute*
Questioning: Funneling or Focusing?

• Questions that “funnel” → to one answer or step in the processes

• Questions that “focus” → are more open-ended and lead to discourse; What do you notice? How would you describe...? Where could we start?
# Questioning: Examples

<table>
<thead>
<tr>
<th>Funneling question</th>
<th>Focusing question</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DOK 1 Recall and Reproduction</strong></td>
<td><strong>DOK 2 Application of skills and concepts</strong></td>
</tr>
<tr>
<td>Who? Where? When?</td>
<td>What is the outcome? What can you do? What steps are needed to ___? What do you notice about ___?</td>
</tr>
<tr>
<td><strong>What?</strong></td>
<td></td>
</tr>
<tr>
<td>How? How would you use it? How would you compare ___? How are they alike? Different? How would you classify ___? How would you summarize ___?</td>
<td>How could you develop and use a model? How is ___ related to ___? How do you know? Defend your reasoning with evidence. How would you justify it? How would you test ___?</td>
</tr>
<tr>
<td><strong>Why?</strong></td>
<td></td>
</tr>
</tbody>
</table>


Questioning

Video: Listen to student and teacher talk.

What DOK are the teacher’s questions?
<table>
<thead>
<tr>
<th>QUESTION/STATEMENT</th>
<th>DOK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tell me what you notice here.</td>
<td></td>
</tr>
<tr>
<td>So, which one is greater?</td>
<td></td>
</tr>
<tr>
<td>Why is 66 greater?</td>
<td></td>
</tr>
<tr>
<td>So, what matters? Do the ones matter when we’re looking at this?</td>
<td></td>
</tr>
<tr>
<td>Now you two have to flip again. Who gets all these cards?</td>
<td></td>
</tr>
<tr>
<td>Why? Why is 82 more than 34?</td>
<td></td>
</tr>
</tbody>
</table>
Questioning Activity

<table>
<thead>
<tr>
<th>QUESTION/STATEMENT</th>
<th>DOK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tell me what you notice here.</td>
<td>2</td>
</tr>
<tr>
<td>So, which one is greater?</td>
<td>1</td>
</tr>
<tr>
<td>Why is 66 greater?</td>
<td>3</td>
</tr>
<tr>
<td>So, what matters? Do the ones matter when we’re looking at this?</td>
<td>3</td>
</tr>
<tr>
<td>Now you two have to flip again. Who gets all these cards?</td>
<td>1</td>
</tr>
<tr>
<td>Why? Why is 82 more than 34?</td>
<td>3</td>
</tr>
</tbody>
</table>
Tasks: Task Predicts Performance

“What predicts performance is what students are actually doing... the instructional task is the actual work that students are asked to do during the process of instruction...” ~City, Elmore et al.

Does this look familiar?

Rewriting Addition to Multiplication

Rewrite each addition problem into a multiplication problem.

Ex) $2 + 2 + 2 + 2 + 2$

1) $2 + 2 + 2 + 2 + 2 + 2 + 2$

2) $3 + 3 + 3$

3) $3 + 3 + 3 + 3 + 3 + 3 + 3$

Name: __________________________

Teacher: ________________________

$13.18 + \$40.56 = \$53.74$

$79.36 + \$17.77 = \$97.13$

$11.13 + \$68.69 = \$80.28$

Name ________________ Date ________________

Find the Least Common Multiple of each number pair.

10, 4 ________________ 14, 6 ________________

3, 27 ________________ 25, 5 ________________
Tasks: Modify

**INSTEAD OF...**

- Use worksheets and tasks in original form most of the time
- Use closed tasks
- Focus on small skills
- Look for right/wrong

**TRY...**

- Add a layer, generalize, flip the known/unknown, ask to defend thinking
- Introduce ambiguity by providing incomplete info and inviting student questions
- Link to other domains
- Offer a worked example: Is it correct or not? Explain.
Tasks: Examples

What could > mean?

What do you notice?

What do you think?

What is the reason?

What does this suggest?
Tasks: Re-Sequence

INSTEAD OF...

• Begin concepts with literal, factual knowledge (DOK 1)

TRY...

• Launch with an inquiry or challenging problem (DOK 2 or 3)
• Lead with a visual (photo, video, graph, data) and time to think
• Lead with a worked example (correct or erroneous) and time to make sense of it
Task Activity

• Here’s a task and how we modified it

\[
\begin{array}{ccccc}
605 & +516 & 616 & +831 & 553 & +576 & 625 & +670 & 171 & +608 \\
\hline
\end{array}
\]

\[
\begin{array}{ccccc}
156 & +961 & 575 & +105 & 376 & +949 & 439 & +114 & 123 & +775 \\
\end{array}
\]
Task Activity

• Here’s a task and how we modified it

Look at the comparisons below. Cross out all that are not true.

71 > 17  
40 < 4  
80 > 18

35 < 33  
26 > 16  
64 < 74

Write your own comparisons.

<table>
<thead>
<tr>
<th>True</th>
<th>Not true</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____ &gt; _____</td>
<td>_____ &gt; _____</td>
</tr>
</tbody>
</table>
Task Activity

- You try it!
  - Think of a task you’ve asked your students to work on recently OR Choose a Task (Tasks A-F provided)
  - Work together at your table to lift the DOK
  - How could you revise or reframe the tasks to require a higher level of cognitive demand?
  - Share out, chart it, gallery walk...
Implications for Teachers

• Consider task selection

• Plan for questioning
Implications for Coaches

• Coach into task selection through collaborative planning for authentic rich tasks...

• Coach questioning skills through planning, scripting, tagging to DOK, shifting, whispering in...

• Coach into discourse through video, prompt cards, sentence stems...
Implications for Administrators

- In evaluation - CCT...domain 2 and domain 3
- In standardized testing - SBAC...considers DOK on question stems
- Hess Walk-Through Tool
Reflection

• How can you lift the DOK of your tasks?
• What question stems speak to you? Why?
• What will you go back and quickly implement in your classroom or school?
• What ideas will you share with your colleagues?
• What new questions or thoughts do you have?
References

- Francis, E. (2016) *Now That's a Good Question! How to Promote Cognitive Rigor Through Classroom Questioning*, ASCD


- Open Middle http://www.openmiddle.com/