Analyzing & Increasing Webb's Depth of Knowledge

Objectives

- Analyze existing DOK levels
- Increase DOK levels

Resources

- Francis’ DOK Charts
- Kaplinsky’s Gr. 4 & 5 Matrices
- Hess’ Cognitive Rigor Matrix
- Project BUMP UP’s 3-Step Leveling Up
Overview of Webb’s DOK

Webb’s Depth of Knowledge (Webb, 1997)
Related to number of connections of concepts and ideas a student needs to make
Other factors that influence the cognitive demands of performance
Context: What are students expected to do?

Are students expected to
- Acquire knowledge (DOK-1)?
- Apply knowledge (DOK-2)?
- Analyze knowledge (DOK-3)?
- Augment knowledge (DOK-4)?

(Davis, 2017)

DOK at a Glance

One correct answer?
- DOK 1 – Know it (can find it) or not
- DOK 2
  - More than one concept
  - If/then; cause/effect

More than one correct answer requiring evidence?
- DOK 3 –
  - Interpret
  - Supporting evidence
  - Reasoning (how and why)
- DOK 4
  - DOK 3
  - Additional sources
  - Initiate and complete project

(Hess, n.d.)
By complexity, not difficulty

- Difficulty varies by
  - Student
  - Over time

- Complexity
  - Related to content/context more than verb
  - More complex reasoning

(Kaplinsky, 2015)

Turn & Talk: Why 1, 2, 3?

1. What fraction is best represented by point $P$ on this number line?

2. IDENTIFY A FRACTION ON A NUMBER LINE
   Directions: Label the point where $3/4$ belongs on the number line. Be as exact as possible.

3. PLACING FRACTIONS ON A NUMBER LINE
   Directions: Using the whole numbers 0-9 as numerators and denominators, create 5 fractions and correctly place them all on a number line.

(Kaplinsky, 2014)
Which DOK (1, 2, or 3)?

(Kaplinsky, 2014)

Resource #1

Francis’ Charts
- DOK Analysis Chart
- Teacher and Students do... chart
### Francis' DOK Analysis Chart (2022)

<table>
<thead>
<tr>
<th>Level</th>
<th>What is the DOK level?</th>
<th>What is the cognitive demand?</th>
<th>What is the demand of the task students must complete?</th>
<th>What is the demand of the mental processing students must perform?</th>
<th>What is the demand of the response students must provide?</th>
<th>What is the demand of the goal and expectation for students?</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOK 1 (recall)</td>
<td>Low</td>
<td>Just the facts; Just do it</td>
<td>Recall information; Recall how to</td>
<td>Answer correctly</td>
<td>Answer it</td>
<td>Go for it</td>
</tr>
<tr>
<td>DOK 2 (skill or concept)</td>
<td>Moderate</td>
<td>Show and share or summarize; Comprehend and communicate; Specify and explain; Give examples and non-examples</td>
<td>Apply knowledge, concepts, or skills; Use information and basic reasoning</td>
<td>Establish and explain with examples</td>
<td>Use it to explain</td>
<td></td>
</tr>
<tr>
<td>DOK 3 (strategic thinking)</td>
<td>High</td>
<td>Delve deeply; Inquire and investigate; Critical thinking; Problem solving; Creative thinking; Defend, justify, or refute with evidence; Connect, confirm, conclude, consider or critique</td>
<td>Think strategically; Use complex reasoning supported by evidence</td>
<td>Examine and explain with evidence</td>
<td>Use it to prove it</td>
<td></td>
</tr>
<tr>
<td>DOK 4 (extended thinking)</td>
<td>Extensive</td>
<td>Go deep within a subject area; Go among texts and topics; Go across the curriculum; Go beyond the curriculum</td>
<td>Use extended reasoning supported by expertise; Think extensively</td>
<td>Explore and explain with examples and evidence (over an extended period)</td>
<td>Go for it</td>
<td></td>
</tr>
</tbody>
</table>

### Francis' DOK: Teacher and student do . . . (Abridged from Francis, 2022)

<table>
<thead>
<tr>
<th>DOK 1</th>
<th>DOK 2</th>
<th>DOK 3</th>
<th>DOK 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>Student</td>
<td>Teacher</td>
<td>Student</td>
</tr>
<tr>
<td>Directs and leads</td>
<td>Listens and observes</td>
<td>Assigns and grades</td>
<td>Participates actively</td>
</tr>
<tr>
<td>Instructional steps</td>
<td>Monitoring specific information and procedures</td>
<td>Observes and accounts for student performance</td>
<td>Chooses, shares, stimulates</td>
</tr>
<tr>
<td>Provides details, facts, or specifics</td>
<td>Provides details, facts, or specifics</td>
<td>Provides details, facts, or specifics</td>
<td>Provides details, facts, or specifics</td>
</tr>
<tr>
<td>Provides guidance, instructions, steps</td>
<td>Provides guidance, instructions, steps</td>
<td>Provides guidance, instructions, steps</td>
<td>Provides guidance, instructions, steps</td>
</tr>
<tr>
<td>Focuses questions on current knowledge and skills understanding</td>
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<td>Focuses questions on current knowledge and skills understanding</td>
</tr>
<tr>
<td>Focuses for most of the experience</td>
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</tr>
</tbody>
</table>

For DOK 1 (recall), students must provide very specific details, facts, or responses, results, or examples to demonstrate knowledge and basic reasoning. Teachers lead the learning and students respond to the teacher's instructions. The goal is for students to recall information accurately and quickly.

For DOK 2 (skill or concept), students must provide more detailed responses, results, or examples and engage in deeper thinking to apply knowledge, concepts, or skills. Teachers monitor student progress and provide feedback. The goal is for students to perform tasks and demonstrate understanding.

For DOK 3 (strategic thinking), students must provide complex responses, results, or examples and engage in strategic thinking to think critically and analytically. Teachers prompt extensive thinking and provide feedback on students' thinking. The goal is for students to connect ideas and evidence across diverse contexts and unique situations.

For DOK 4 (extended thinking), students must provide comprehensive responses, results, or examples and engage in extended thinking to think deeply and reflectively. Teachers encourage students to connect knowledge across the curriculum, beyond the classroom, or unique ways. The goal is for students to extend their thinking and reflect on their learning.
Resource #2

Hess’ Cognitive Rigor Matrix
- Bloom’s x Webb’s organizational matrix
- Math examples
### Math Content Standards & Math Practices

<table>
<thead>
<tr>
<th>Depth + Thinking</th>
<th>Level 1 Recall &amp; Reproduction</th>
<th>Level 2 Skills &amp; Concepts</th>
<th>Level 3 Strategic Thinking/Reasoning</th>
<th>Level 4 Extended Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Remember</strong></td>
<td>What is slope?</td>
<td>Explain how you solved this problem.</td>
<td>Construct an argument to show equivalence using area, set, and linear models.</td>
<td>Design an extension project.</td>
</tr>
<tr>
<td><strong>Understand</strong></td>
<td>Read, write, and represent these fractions</td>
<td>Make and explain your estimates.</td>
<td>Use tables and graphs to show your solution.</td>
<td>Use technology and other tools to conduct investigations.</td>
</tr>
<tr>
<td><strong>Apply</strong></td>
<td>Convert this fraction to a decimal.</td>
<td>Add these fractions.</td>
<td>Use these data to graph your solution.</td>
<td>Interpret what's happening in the event.</td>
</tr>
<tr>
<td><strong>Analyze</strong></td>
<td>What kind of graph or model is this?</td>
<td>Which data point shows _____?</td>
<td>Which graph shows how the data would be displayed?</td>
<td>Justify your interpretation using what you know about slope.</td>
</tr>
<tr>
<td><strong>Evaluate</strong></td>
<td>Which team is the best? (opinion without supporting evidence)</td>
<td>How would you explain these _____?</td>
<td>Which team is the best?</td>
<td>Explain why your explanation supports your opinion.</td>
</tr>
<tr>
<td><strong>Create</strong></td>
<td>Create a card game using fractions.</td>
<td>Create a scenario explained by the data display.</td>
<td>Design a project.</td>
<td>Create an acceptable model.</td>
</tr>
</tbody>
</table>

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**Hess, n.d.**
## The CR Matrix Lesson Plan Template

<table>
<thead>
<tr>
<th>Depth of Thinking</th>
<th>Level 1 - Recall &amp; Reproduction</th>
<th>Level 2 - Skills &amp; Concepts</th>
<th>Level 3 - Strategic Thinking - Reasoning</th>
<th>Level 4 - Extended Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Remember</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>Apply</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluate</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Create</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Resource #3

**Kaplinsky Matrices**

- Gr. 4 and Gr. 5 Math DOK Examples
## Depth of Knowledge Matrix — Fifth Grade Math

<table>
<thead>
<tr>
<th>Task</th>
<th>Core Standard</th>
<th>Description</th>
<th>Multi-Digit Multiplication</th>
<th>Multiplying Decimals</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOK 1</td>
<td>Example 1</td>
<td>Evaluate the expression. ( 56 = (8 - 1) ).</td>
<td>( 7 \times 4 \times 3 )</td>
<td>Find the product. ( 37 \times 45 ).</td>
</tr>
<tr>
<td>DOK 2</td>
<td>Example 2</td>
<td>Using the digits 0 through 9, at most one time each, place a digit in each box to create two true statements. Write the value of each digit. ( 5 \times 7 = (4 \times 3) ).</td>
<td>Using the digits 0 to 9 at most one time each, place a digit in each box to create two different dividends that are equivalent when rounded to the nearest hundredths. ( 32.4 \times 5 ).</td>
<td>Using the digits 1 to 9 at most one time each, place a digit in each box to create a true equation. ( 12.3 \times 4 = 49 ).</td>
</tr>
<tr>
<td>DOK 3</td>
<td>Example 3</td>
<td>Using the digits 0 through 9, at most one time each, place a digit in each box to create the greatest possible value. ( 50 = (8 - 1) ).</td>
<td>Using the digits 0 to 9 at most one time each, place a digit in each box to create two different dividends that are equivalent when rounded to the nearest tenths and have the greatest possible value. ( 32.4 \times 5 ).</td>
<td>Using the digits 1 to 9 at most one time each, place a digit in each box to create a true equation with the greatest possible product. ( 12.3 \times 4 = 59 ).</td>
</tr>
</tbody>
</table>

Kaplinsky’s Gr. 4 and 5 Math Matrices

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### Resource #4

**Project BUMP UP’s Leveling Up DOK**

3-Step Approach
Steps for Leveling-up DOK

1. Analyze
   • What is being asked of the students?
   • What is the DOK level?

2. Determine
   • Where do we see a similar concept in future standards?
   • Where can we provide fewer supports?
   • What other questions can we ask about this problem?

3. Construct
   • Select from the standards and/or additional questions created.
   • Rewrite the problem to remove supports and insert updated elements.

4. Re-Evaluate
   Now that you have leveled-up the question, re-evaluate what students are being asked to do at the new DOK level.
Steps for Leveling-up DOK

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   • Select from the standards and/or additional questions created.
   • Rewrite the problem to remove supports and insert updated elements.

4. Re-Evaluate
   Now that you have leveled-up the question, re-evaluate what students are being asked to do at the new DOK level.
Currently, what is this question asking the student to do?

- Compare fractions

Myra read 45 pages of her 100-page book. Her sister read ½ of a 10-page book. Who read a greater fraction of her book, Myra or her sister? Show your work.

*Hint: One fraction has a denominator of 100. The other fraction has a denominator of 10.*

Currently, what is the DOK of this problem?

- DOK 2: Converting the fractions to those with similar denominators and then comparing the two fractions.

Myra read 45 pages of her 100-page book. Her sister read ½ of a 10-page book. Who read a greater fraction of her book, Myra or her sister? Show your work.

*Hint: One fraction has a denominator of 100. The other fraction has a denominator of 10.*
Looking Ahead: When will we see a similar concept like this in the future?

- Mixed fractions
- Conversions to decimals

Myra read 45 pages of her 100-page book. Her sister read \( \frac{1}{2} \) of a 10-page book. Who read a greater fraction of her book, Myra or her sister? Show your work.

**Hint:** One fraction has a denominator of 100. The other fraction has a denominator of 10.

Where can we provide fewer supports for students?

- Eliminate the hint

Myra read 45 pages of her 100-page book. Her sister read \( \frac{1}{2} \) of a 10-page book. Who read a greater fraction of her book, Myra or her sister? Show your work.

**Hint:** One fraction has a denominator of 100. The other fraction has a denominator of 10.
What **other questions can we ask** about this problem?

- Show two ways to answer the question, “Who read the greater fraction of her book, Myra or her sister?”
- How many pages would one sister have to read to equal the fraction the other sister read?
- Justify which sister read a greater portion of her book with evidence.
- Change the numbers for more complexity (e.g., 73 pages out of 192-page book and 1/8 of a 212-page book.

How can we implement these questions? (Building the new problem)

**New Problem**


- Who read a greater fraction of her book, Myra or her sister? Provide evidence for your answer.

The sister who read less wants to catch up and read the same fraction as the other sister.

- How many more pages would the sister need to read to catch up? Explain your answer in two ways.
Now, what is this question asking the student to do?

(This should be the same as the original question/task.)

• Compare fractions

Now, what is the DOK of this problem?

(DOK should increase & look at Bloom’s Taxonomy)

• DOK 3
  • Explain their thinking
  • Another way to approach the problem
  • Compare answers
  • Analyze their responses.
References


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Thank you!