Moving Learning Forward: Academic Measures

March 10, 2022

TeleEDGE: Department of Education Line

Moving Learning Forward Using a System of Assessment

Connecting Learning through a System of Assessment

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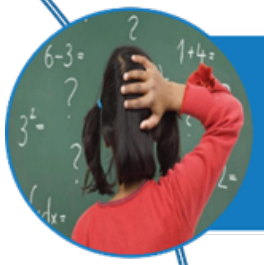
Questions to Consider



How is learning connected through a system of assessment?

How and why should we assess at different levels of complexity?

How can we use rubrics and checklists to move learning forward?

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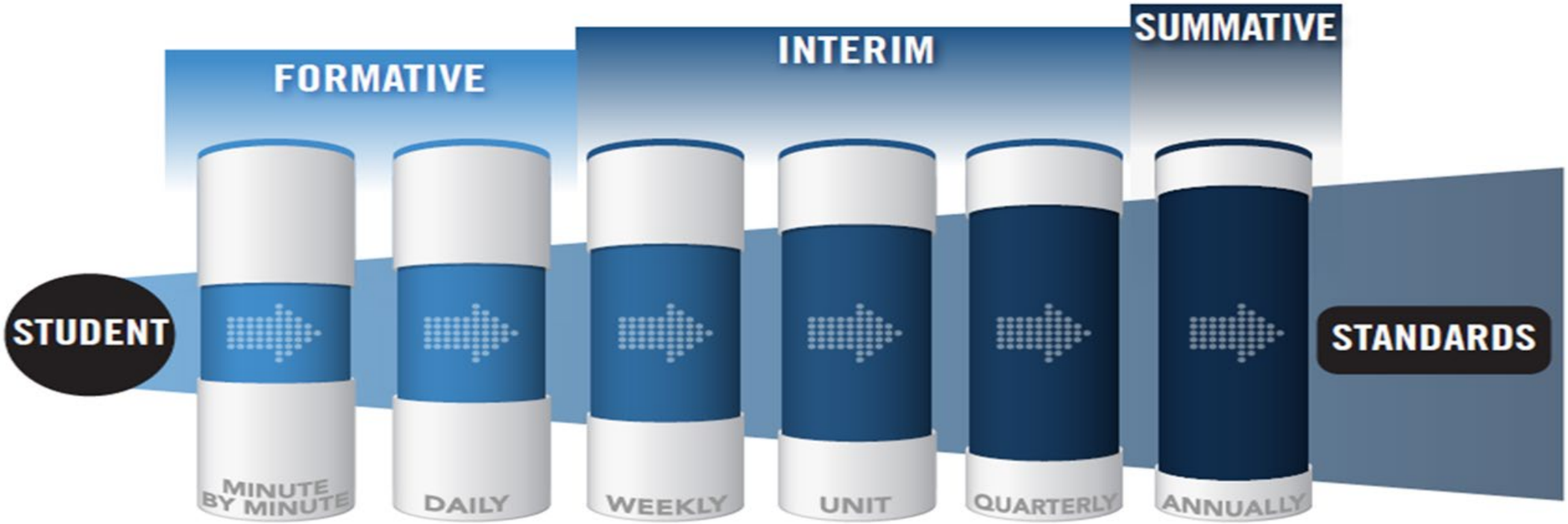
Connecting learning through an assessment system

Oklahoma recognizes that a **robust assessment system** is tied closely to students' learning and teachers' instructional practices. (ESEA Plan, p. 48)



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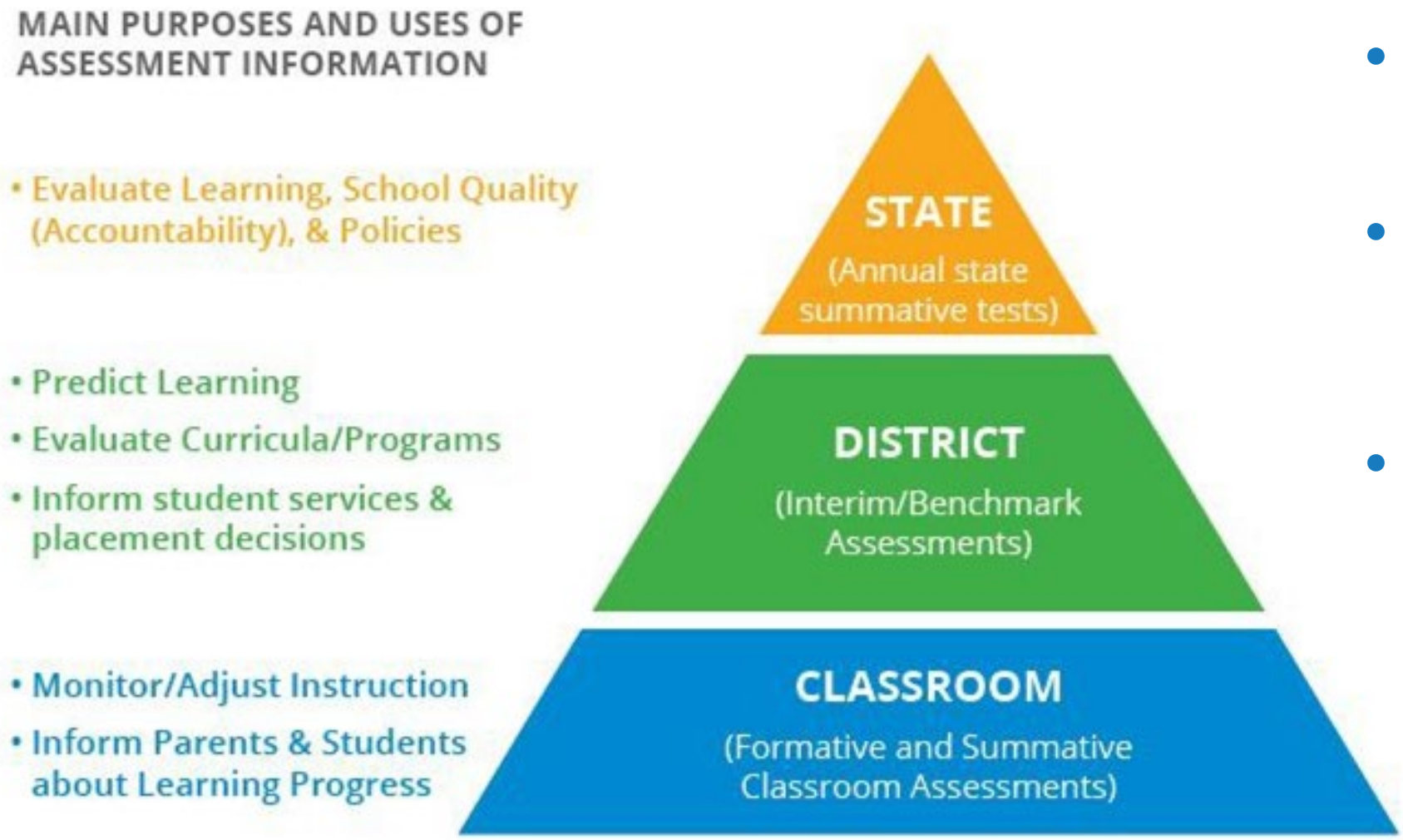
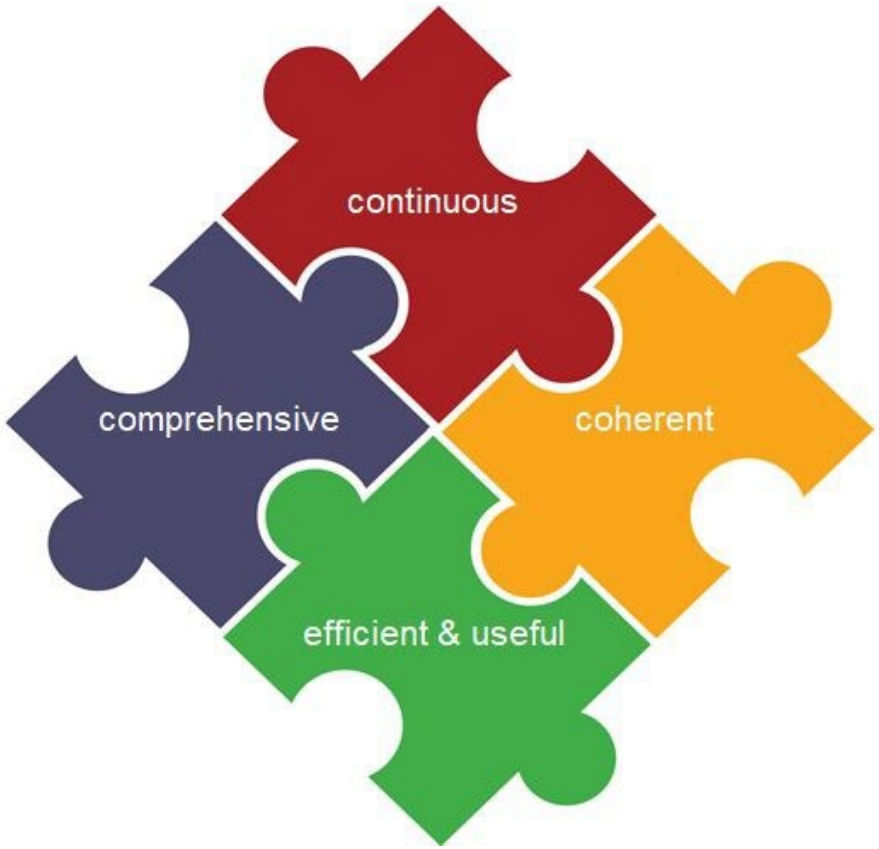
Elements of an assessment system



- There are multiple layers of an assessment system.
- The purposes and uses of assessment information differ at each layer.
- It is important to guard against practices that might have a negative impact on classroom instruction (e.g., teaching to the test, over-testing, narrowing of the curriculum, etc.).

Source: http://www.nciea.org/featured-resources/classroom-assessment

Considerations for connecting assessments in a system to move learning forward



See paper: "Not as Easy as It Sounds: Designing Balanced Assessment Systems"

Comprehensive

- The assessment system allows students to demonstrate their understanding in a variety of ways and reflects the breadth and depth of the state content standards.

Coherent

- The assessment system reflects a systemic educational approach to promote deeper and more meaningful learning for students. Assessments in the system are compatible with the underlying model of learning.

Continuous

- The assessment system continuously documents student progress over time.

Efficient

- Each assessment within the system is non-redundant and used to make educational decisions.

Useful

- The assessment system provides the necessary information to make better decisions in a timely fashion and at the right level of specificity to support intended uses.

Source: http://www.nciea.org/featured-resources/classroom-assessment

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Comprehensive

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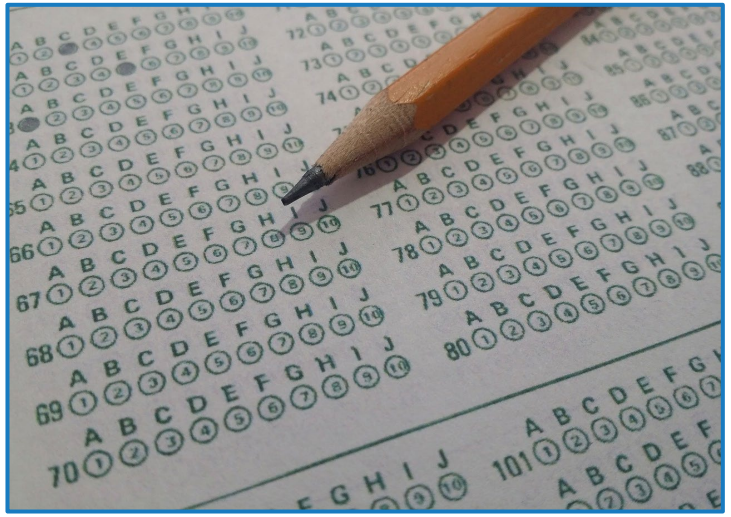

Source: http://www.nciea.org/featured-resources/classroom-assessment

Coherent

The assessment system reflects a systemic educational approach to promote deeper and more meaningful learning for students. Assessments in the system are compatible with the underlying model of learning

Source: http://www.nciea.org/featured-resources/classroom-assessment

Coherent

Assessments and instruction are aligned to the standards. The standards outline grade-level expectations for what students should know and be able to do.

Number & Operations (N)			
Fifth Grade (5)	**Sixth Grade (6)**	**Seventh Grade (7)**	**Pre-Algebra (PA)**
5.N.1 Divide multi-digit numbers and solve real-world and mathematical problems using arithmetic. **5.N.1.1** Estimate solutions to division problems in order to assess the reasonableness of results. **5.N.1.2** Divide multi-digit numbers, by one- and two-digit divisors, using efficient and generalizable procedures, based on knowledge of place value, including standard algorithms. **5.N.1.3** Recognize that quotients can be represented in a variety of ways, including a whole number with a remainder, a fraction or mixed number, or a decimal and consider the context in which a problem is situated to select and interpret the most useful form of the quotient for the solution. **5.N.1.4** Solve real-world and mathematical problems requiring addition, subtraction, multiplication, and division of multi-digit whole numbers. Use various strategies, including the inverse relationships between operations, the use of technology, and the context of the problem to assess the reasonableness of results.	**6.N.1 Read, write, and represent integers and rational numbers expressed as fractions, decimals, percents, and ratios; write positive integers as products of factors; use these representations in real-world and mathematical situations.** **6.N.1.1** Represent integers with counters and on a number line and rational numbers on a number line, recognizing the concepts of opposites, direction, and magnitude; use integers and rational numbers in real-world and mathematical situations, explaining the meaning of 0 in each situation. **6.N.1.2** Compare and order positive rational numbers, represented in various forms, or integers using the symbols <, >, and =. **6.N.1.3** Explain that a percent represents parts "out of 100" and ratios "to 100." **6.N.1.4** Determine equivalencies among fractions, decimals, and percents. Select among these representations to solve problems. **6.N.1.5** Factor whole numbers and express prime and composite numbers as a product of prime factors with exponents. **6.N.1.6** Determine the greatest common	**7.N.1 Read, write, represent, and compare rational numbers, expressed as integers, fractions, and decimals.** **7.N.1.1** Know that every rational number can be written as the ratio of two integers or as a terminating or repeating decimal. **7.N.1.2** Compare and order rational numbers expressed in various forms using the symbols <, >, and =. **7.N.1.3** Recognize and generate equivalent representations of rational numbers, including equivalent fractions. **7.N.2 Calculate with integers and rational numbers, with and without positive integer exponents, to solve real-world and mathematical problems; explain the relationship between absolute value of a rational number and the distance of that number from zero.** **7.N.2.1** Estimate solutions to multiplication and division of integers in order to assess the reasonableness of results. **7.N.2.2** Illustrate multiplication and division of integers using a variety of representations. **7.N.2.3** Solve real-world and	**PA.N.1 Read, write, compare, classify, and represent real numbers and use them to solve problems in various contexts.** **PA.N.1.1** Develop and apply the properties of integer exponents, including $a^0 = 1$ (with $a \neq 0$), to generate equivalent numerical and algebraic expressions. **PA.N.1.2** Express and compare approximations of very large and very small numbers using scientific notation. **PA.N.1.3** Multiply and divide numbers expressed in scientific notation, express the answer in scientific notation. **PA.N.1.4** Classify real numbers as rational or irrational. Explain why the rational number system is closed under addition and multiplication and why the irrational system is not. Explain why the sum of a rational number and an irrational number is irrational; and the product of a non-zero rational number and an irrational number is irrational. **PA.N.1.5** Compare real numbers; locate real numbers on a number line. Identify the square root of a perfect square to 400 or, if it is not a perfect square root, locate it as an irrational number between two consecutive positive integers.

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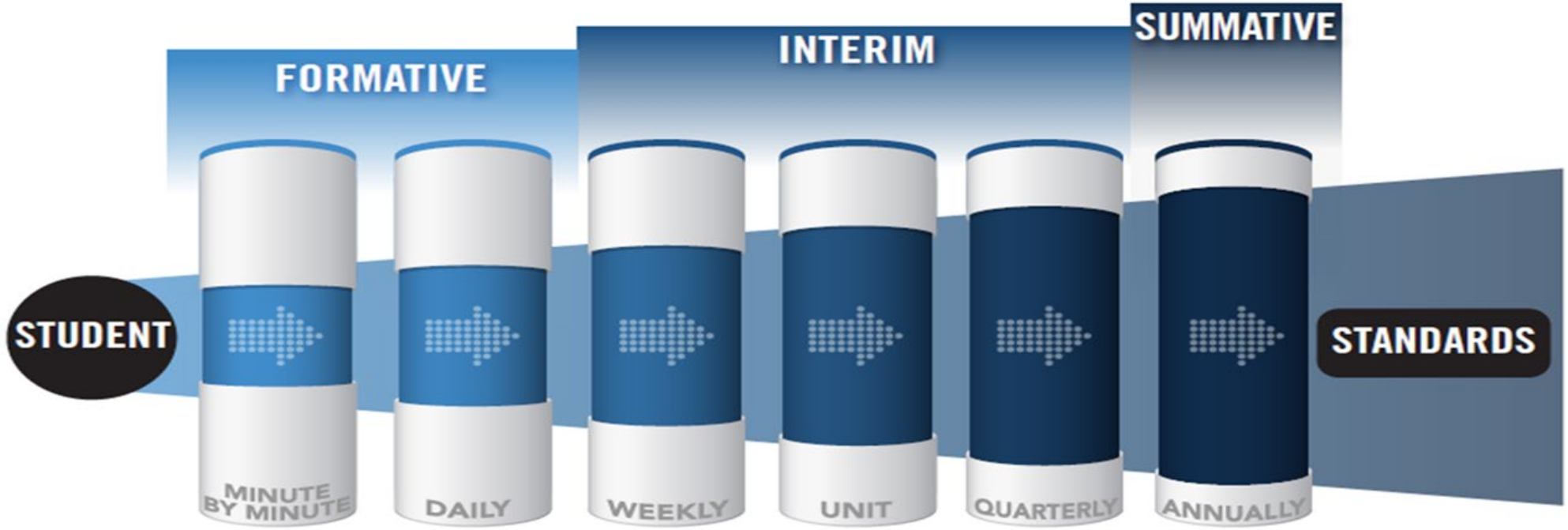
Continuous

Assessments measure student progress on an ongoing basis to provide timely evidence of learning.



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Efficient

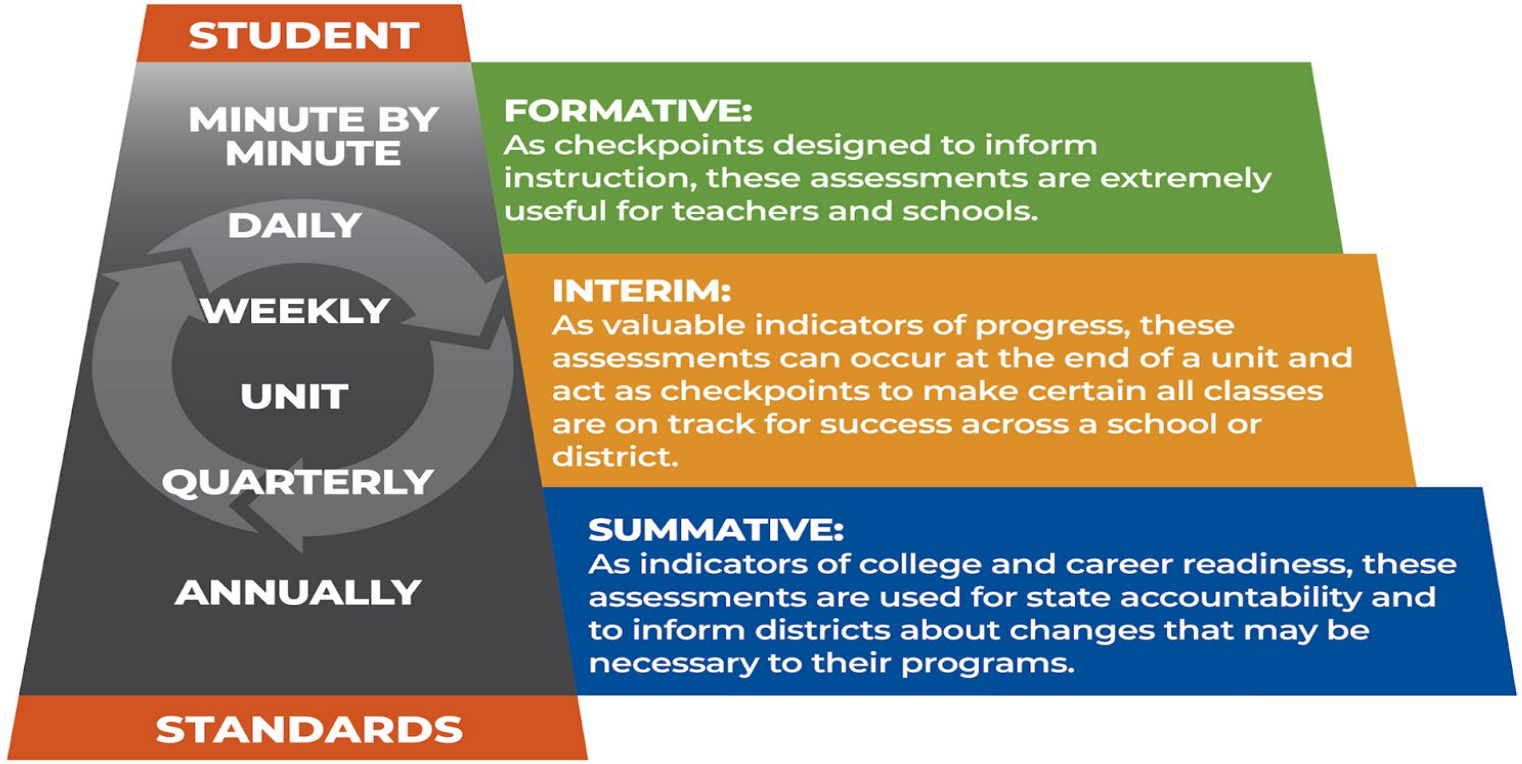
Each assessment within the system is non-redundant and provides timely information and evidence of student learning to make educational decisions.

1. Which assessments are you giving now?
2. Why are you giving this assessment? How is it intended to be used?
3. Is it fulfilling this purpose? How do you know?
4. How does the assessment embody learning goals and what evidence of learning does it provide?
5. To what extent does the information and uses from this assessment overlap with another assessment?

Source: Thompson & Lyons (2017)

Useful

Assessments within the system provide timely information and evidence of what students know and are able to do to inform teaching and learning.



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Alignment and Role of State Assessments

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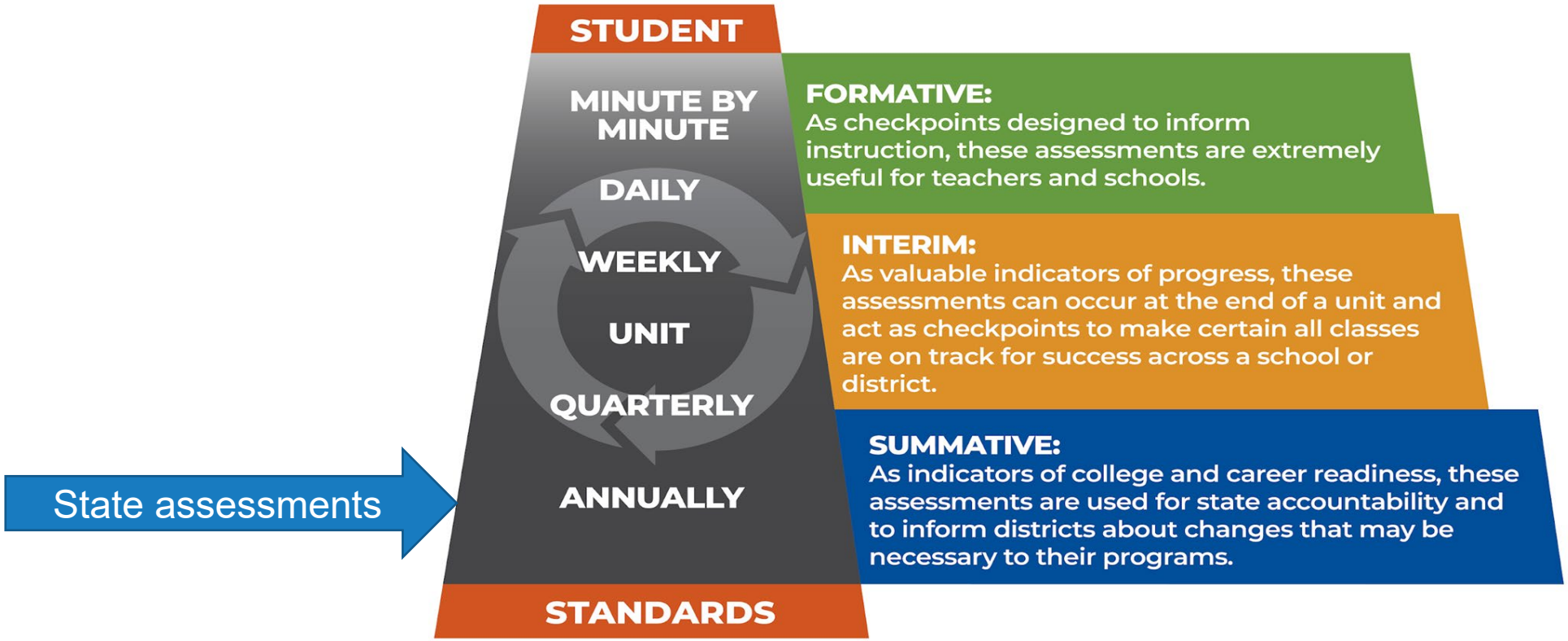
State assessments within a balanced system

State, district, and classroom assessments can work together in a coherent system of assessment . Doing so provides educators with timely information on students' progress and overall achievement each year.



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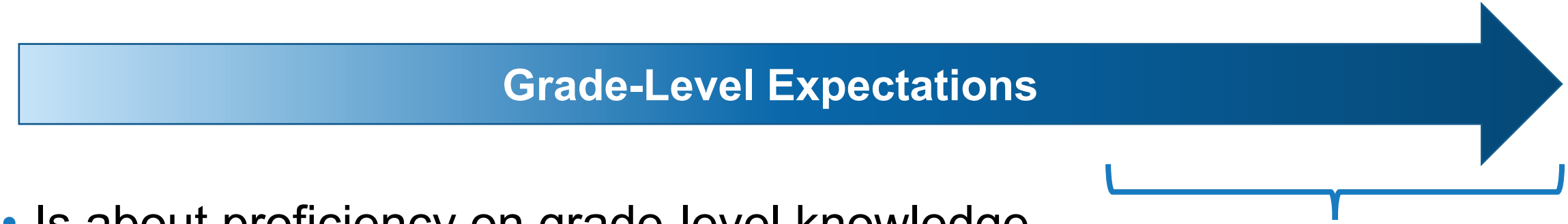
State Summative Assessments in a Typical Year



- Is about proficiency on grade-level knowledge
- Is a single snapshot and does not tell the whole story
- Should be used in conjunction with district and classroom assessments to monitor progress and overall achievement

How far am I from end-of-year expectations?

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State Summative Assessments from SY 2020-2021

- Is still a sound comparison to grade-level expectations
- Tells us the “what” about student performance
- Does not tell us the “why” about student performance
- Helps us understand system-level supports that are necessary to help teachers and students

How much further am I from end-of-year expectations?

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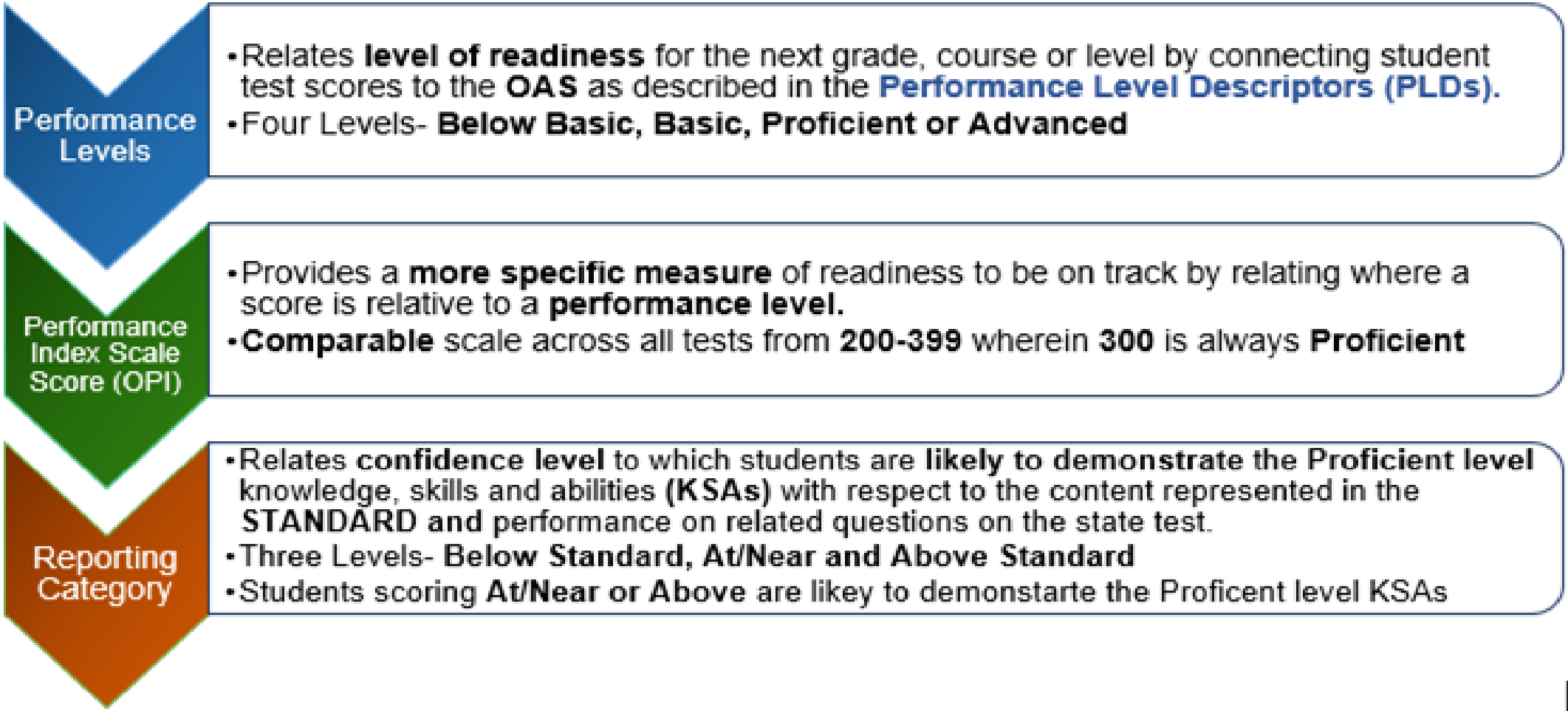
Data from state summative assessments



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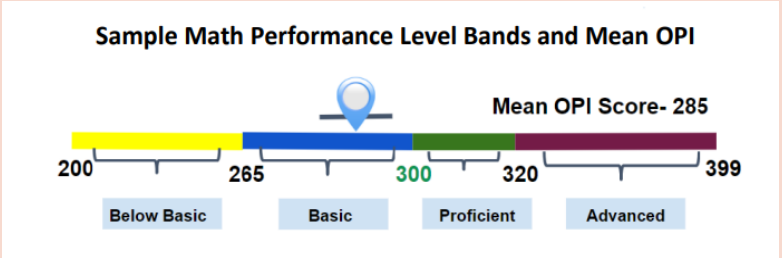
OPIs pinpoint performance within a level to help us measure progress from one year to the next

Grade 5 ELA	Spring	200 – 270	Below Basic
		271 – 299	Basic
		300 – 322	Proficient
		323 – 399	Advanced
Grade 5 Math	Spring	200 – 265	Below Basic
		266 – 299	Basic
		300 – 320	Proficient
		321 – 399	Advanced
Grade 5 Science	Spring	200 – 271	Below Basic
		272 – 299	Basic
		300 – 329	Proficient
		330 – 399	Advanced

Grade 3-8 OSTP Performance Level Lookup Table
Grade 11: ACT/SAT OPI Conversion

Mean OPI scale scores pinpoint overall performance within a performance level.



OPI scores are obtained by converting raw scores onto a common scale to account for differences in question difficulty

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Why scale scores?
Which student showed more mastery?

(1). $1 + 1 =$

(2). $9 + 5 =$

(3). $8.2 + 3.3 =$

(4). $\frac{1}{2} + \frac{1}{3} =$

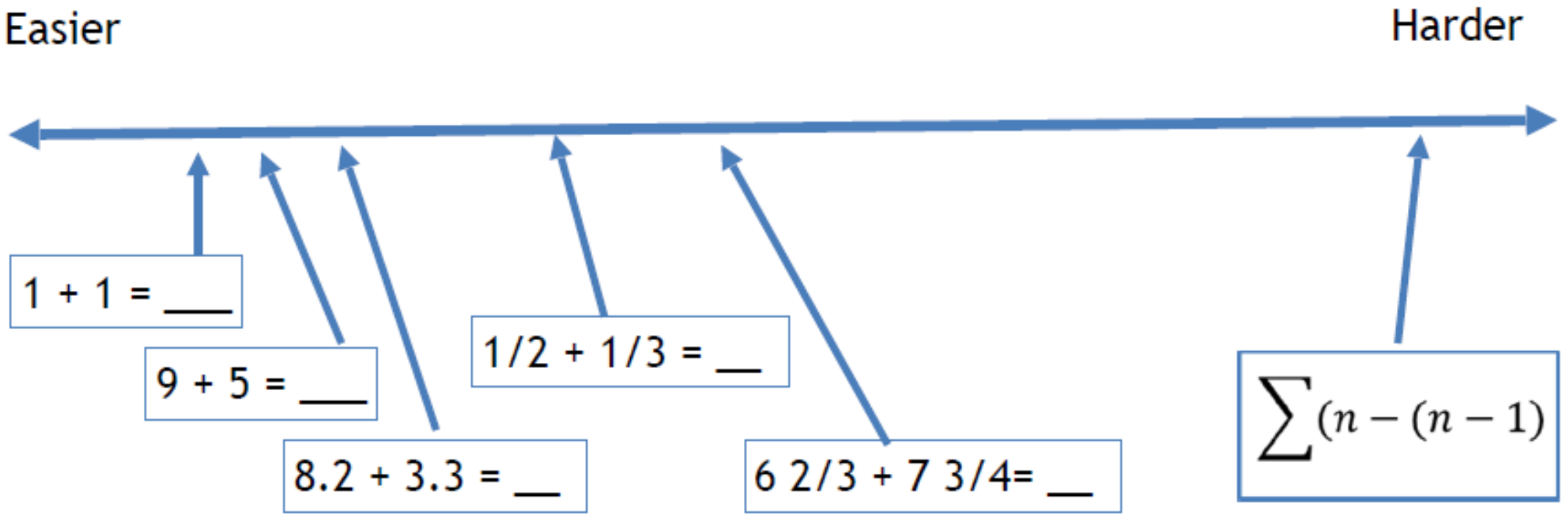
(5). $6\frac{2}{3} + 7\frac{3}{4} =$

(6). $\sum_{n=1}^{100} \left(n - (n-1)\right)^n$

Student A: **4**/6 correct

Student B: **4**/6 correct

It's not about the number correct

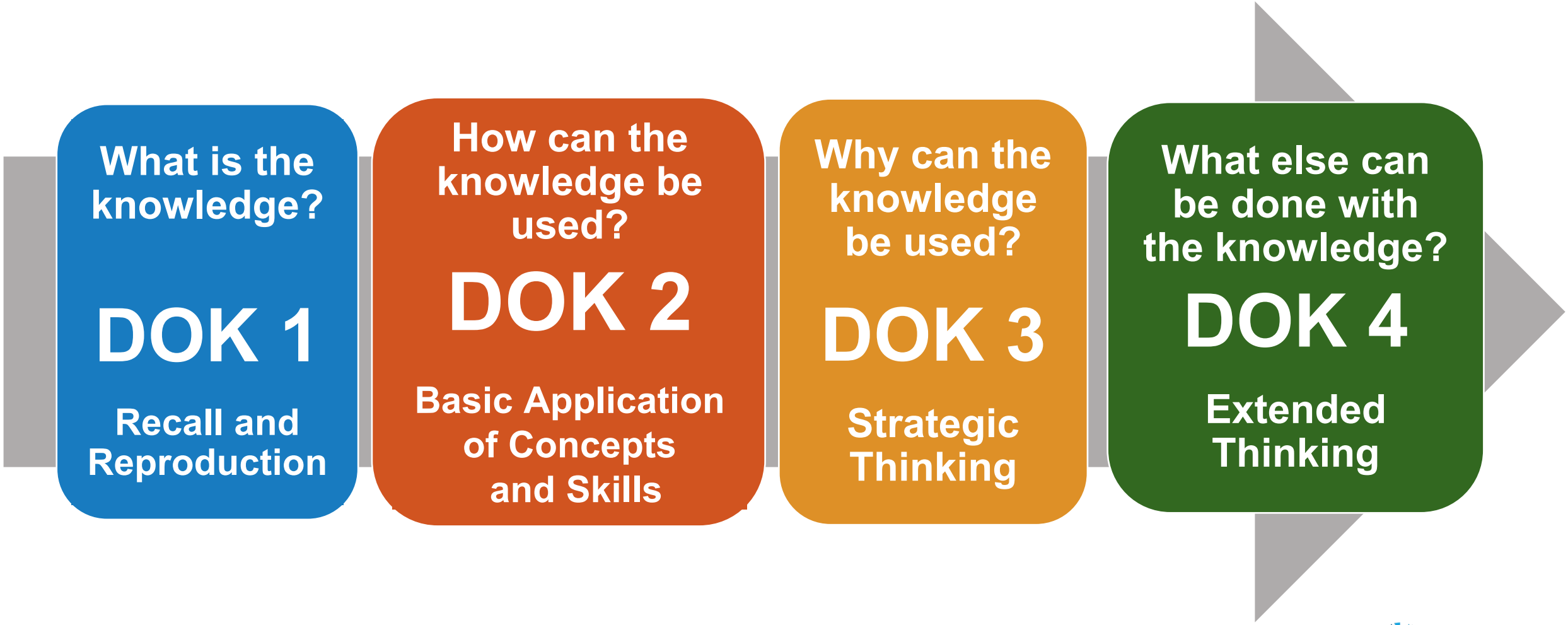


It's about the difficulty and complexity of what the student is being asked to do.

- Difficulty refers to the likelihood that the student will respond correctly.
  - How much effort is needed?(easy or hard)
  - How many people can answer the question correctly?
- Cognitive complexity refers to the mental processes required to meet the task.
  - What kind of thinking, action, or knowledge must be demonstrated? (simple or complex)
  - How many different ways can a question be answered, a problem addressed, or a task accomplished?

Source: Sousa: How the Brain Learns

Depth of Knowledge (DOK) is a way to measure Cognitive Complexity



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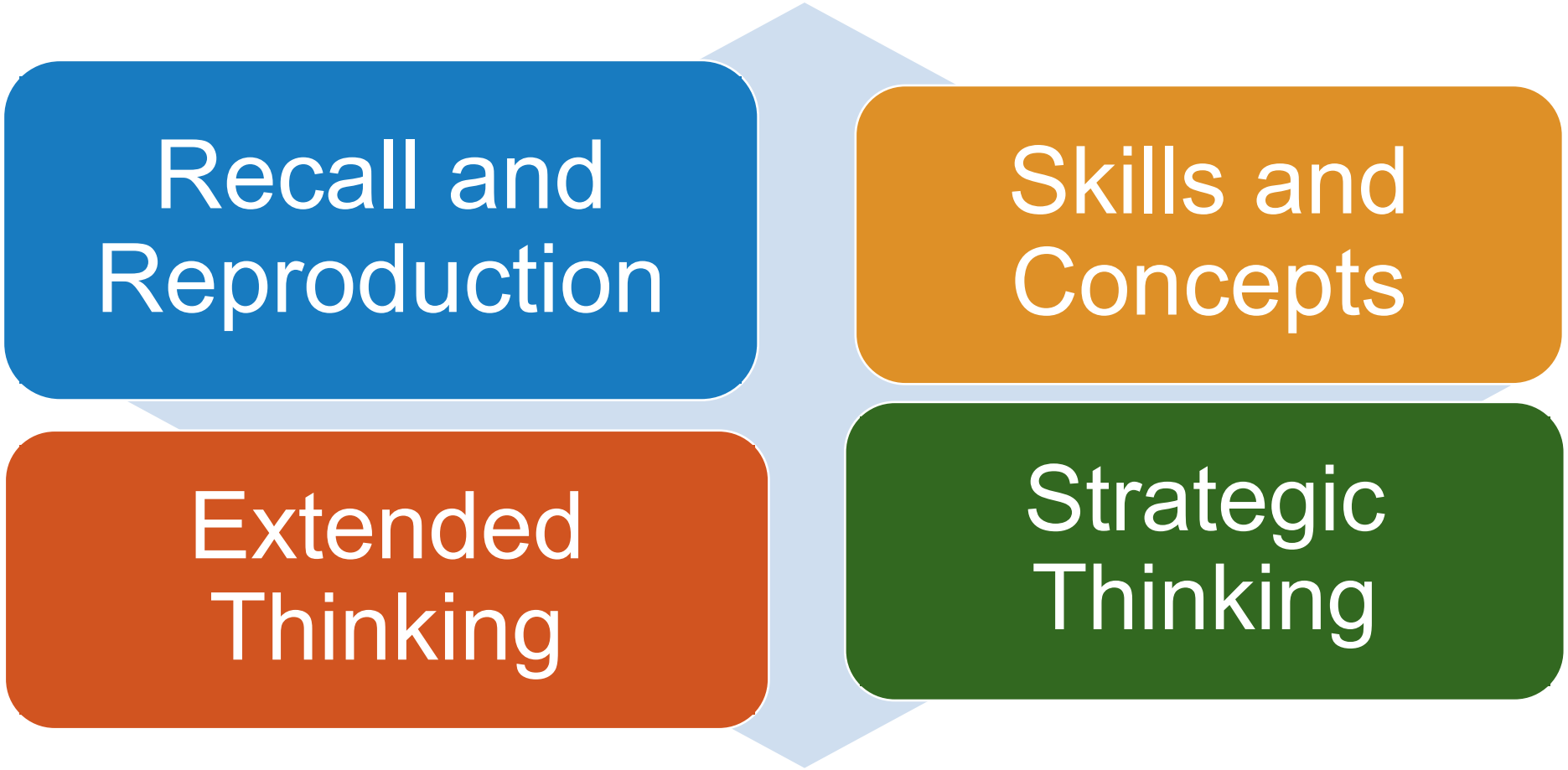
DOK is not sequential



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DOK 1

RECALL AND REPRODUCTION

Recall of information, facts, definitions, and/or a simple algorithm

Following a set of procedures. (like a recipe)

Applying a formula

Performing a clearly defined set of steps.

DOK 2

SKILLS AND CONCEPTS

Requires students to make some decisions about how to approach a problem or activity

Working with problems that have more than one step.

Collecting, classifying, organizing, and comparing data.

Organizing and displaying data in charts, graphs, and tables.

DOK 3

STRATEGIC THINKING

Requires reasoning, planning, using evidence, and a higher level of thinking.

Complexity comes from a higher demand for reasoning, not harder problems.

- Developing a logical argument,
- Making conjectures,
- Justifying responses,
- Solving non-routine problems

DOK on the state summative assessment

Depth-of-Knowledge Assessed by Test Items

The Grade 5 test will approximately reflect the following "depth-of-knowledge (DOK)" distribution of items:

Depth-of-Knowledge	Percent of Items
Level 1—Recall and Reproduction	20–30%
Level 2—Skills and Concepts	65–75%
Level 3—Strategic Thinking	5–15%

DOK Ranges are based on the DOK of the OAS. The standards increase grade-level expectations and rigor, and set expectations for students to be college- and career-ready.

Source: Test and Item Specs: https://sde.ok.gov/assessment-material

Raising the DOK in math

5.N.3: Add and subtract fractions with like and unlike denominators, mixed numbers, and decimals to solve real-world and mathematical problems.

DOK 1

Find the difference.

$$5\frac{1}{2} - 4\frac{2}{3}$$

DOK 2

Using the digits 1 to 9 at most one time each, fill in the boxes to create three different mixed numbers that will make the equation true. You may reuse the same digits for each of the three mixed numbers.

$$5\frac{4}{5} - \square\frac{\square}{\square} = 3\frac{1}{20}$$

Source: https://robertkaplinsky.com/depth-of-knowledge-matrix-5th-grade/

Raising the DOK in math

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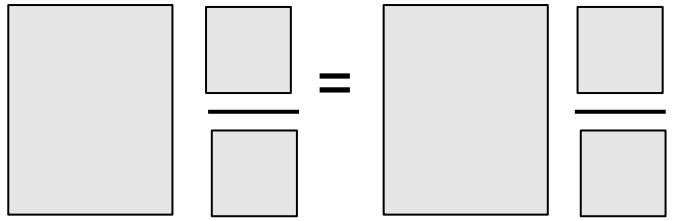
$$5\frac{4}{5} - \square\frac{\square}{\square} = 3\frac{1}{20}$$

DOK 3

Using the digits 1 to 9 at most one time each, fill in the boxes to make the smallest difference.

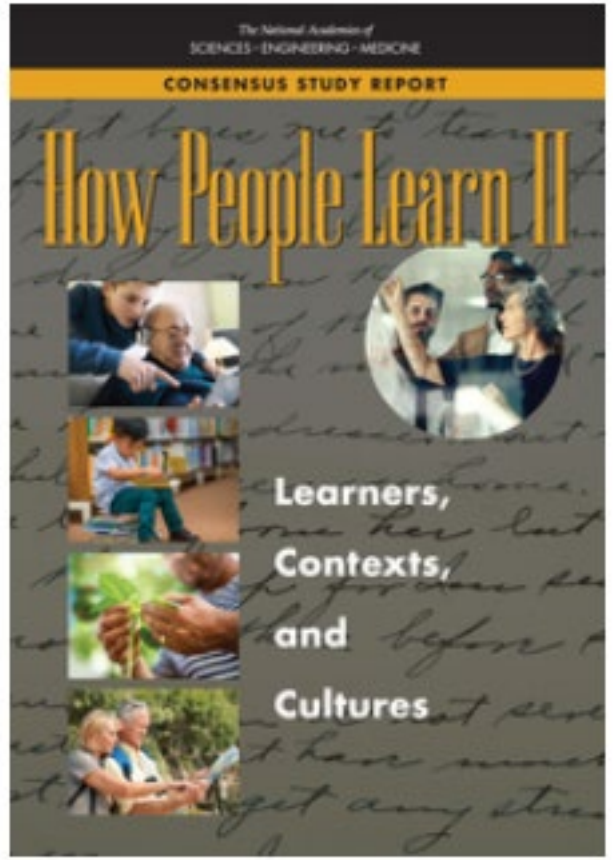


Source: https://robertkaplinsky.com/depth-of-knowledge-matrix-5th-grade/

Assessing at different levels of complexity

- Skills and knowledge must be extended beyond the narrow contexts in which they are initially learned in order for deeper learning to occur.
- It is imperative for the learner to develop a sense of the application of the knowledge (or when the knowledge can be used).
- Transfer most likely occurs when the learner knows and understands the underlying general principles that can be applied to problems in different contexts.
- Conceptual knowledge promotes learning.
- Learners are most successful at learning and will sustain their own learning if they are mindful of themselves as learners and thinkers (i.e., use a metacognitive approach to learning and instruction).

Source: How People Learn II (p.296)



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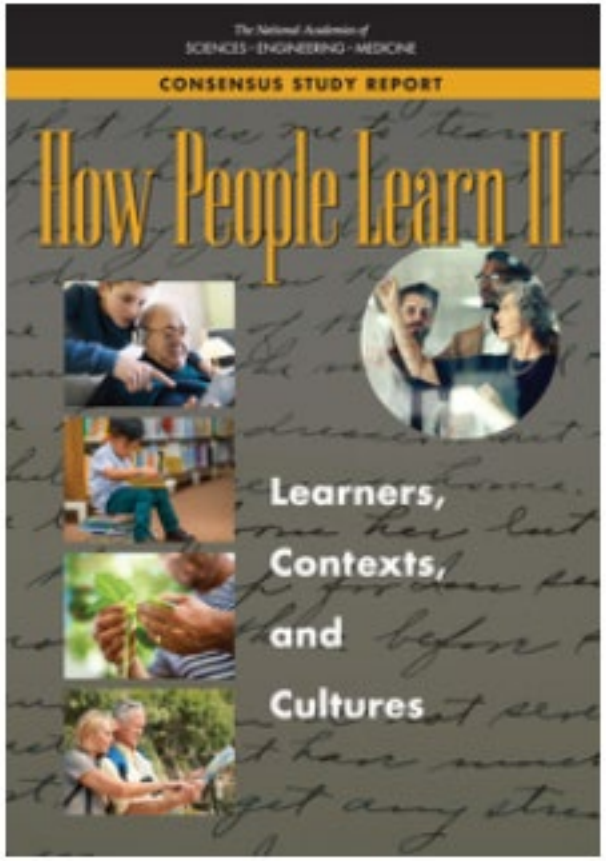
Assessing to move learning forward

- “Assessment can drive the process of learning and motivation in a positive direction by providing feedback that identifies possible improvements and marks progress” (p. 153).
- “Effective formative assessment articulates the learning targets, provides feedback to teachers and students about where they are in relation to those targets, and prompts adjustments to instruction by teachers, as well as changes to learning processes and revision of work products by students” (p.155).

Source: How People Learn II



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Excel Team Case Study

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Math Theory of Improvement

AIM

Students will improve their mathematical reasoning and justification skills (as measured by rubric) each quarter.

DRIVERS

- Student Attitudes and Beliefs
- Student Knowledge and Skills
- Teacher Mindsets and Beliefs
- Teacher Knowledge and Skills

CHANGE IDEAS

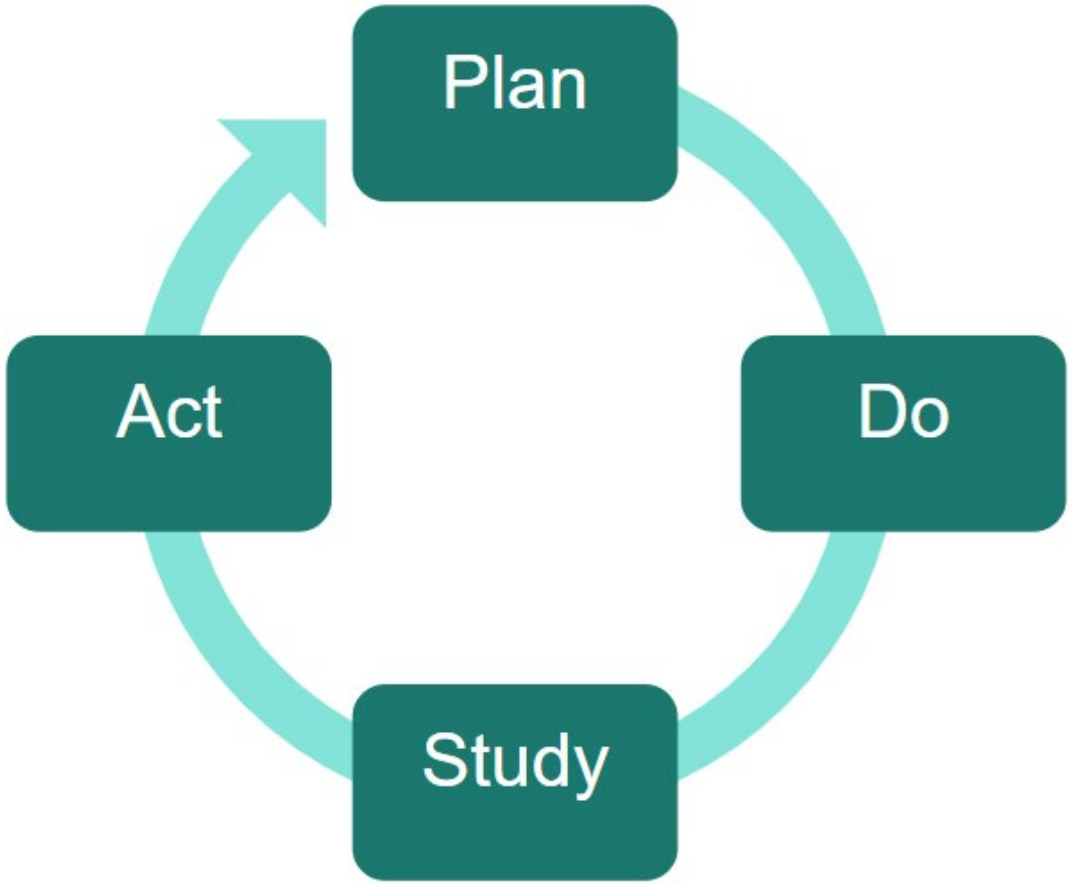
Selecting and Implementing Cognitively Complex Tasks

- Puzzle Problems

Student modeling to communicate understanding

- Selecting and Implementing Open Ended Tasks
- Address Unfinished Learning / Misconceptions / Levels of understanding
- Facilitating discourse and connections

Math Networked Improvement Community



Oklahoma Excel Math Improvement Fellows

Angie Ledgerwood

Oklahoma Connections Academy 4th grade teacher and Excel team member year 1, Fellow years 2 and 3.

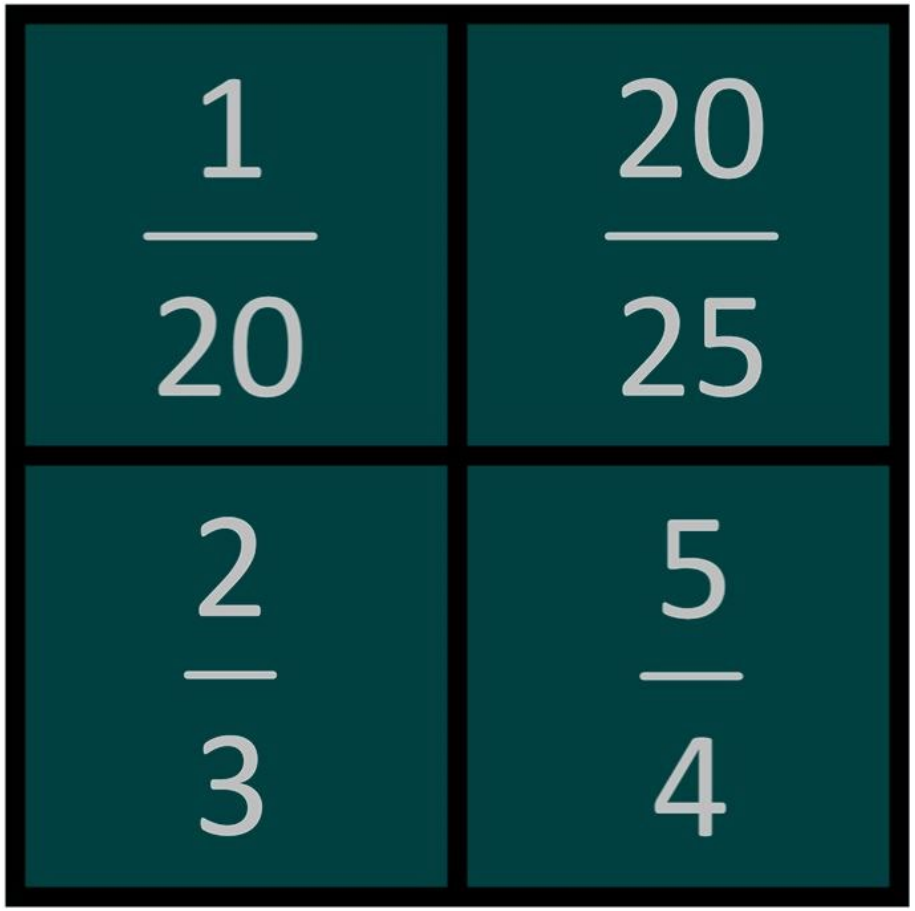
Master teacher and Onboarding Trainer for OKCA. Also a member of First Year Instructional Coaching NIC.

Tim Collier

McAlester High School math teacher during first two years as an improvement fellow.

Currently serving as McAlester Public Schools Secondary Academic Design Coordinator and year three improvement fellow.

Puzzle Problem 32: WODB



Think about what you notice.

Which one doesn't belong? Why? Explain your reason.

Can you find a reason why a different option doesn't belong? Why? Explain your thinking.

Math Briefs & Links

What's the Issue?

Students often enter a mathematics classroom with anxiety due to negative prior experiences with mathematics. As a result, it can be difficult to maintain consistent student engagement in math tasks. When mathematics is taught in a way that allows students to share their own process for solving and argue the viability of their answer, students end up deeply engaged in the material to analyze the task at hand, access background knowledge, synthesize problem-solving strategies, and make inferences about future mathematics concepts and tasks.

As students use their existing and emerging understandings, both conceptually and procedurally, to negotiate new mathematical tasks, they engage in mathematical reasoning that is essential to the ambitious, equitable mathematics learning classroom.

This brief provides considerations for fostering a mathematics classroom that encourages students' mathematical reasoning and the development of students as creative mathematicians.

WHY IT MATTERS TO YOU

- Research shows that students are more likely to **retain mathematics that has its foundation in reasoning and sense-making** than mathematics that is presented as a list of isolated skills.
- Students who are **engaged** in their education not only show **stronger academic achievement**, but have **better social skills** and are **more likely to persist through academic struggles.**
- When students have the **necessary baseline skills** and **abilities** and are **adequately challenged,** they can **demonstrate high levels of focus and enjoyment in their learning.**

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Which One Doesn't Belong

(Champions Brief #14 version 0.2)

Introduction

…y, it is more important than ever to position our students as …mplex ideas to diverse audiences. **Which One Doesn't** …udents to use their reasoning abilities to provide …options or scenarios to choose between. When used as the …matical concepts and ideas, **Which One Doesn't Belong** …matical understanding and the higher order thinking and …tial for student success beyond the classroom.

process and feel more comfortable sharing their thoughts with others.

5. **Give everyone a voice.** While you likely do not have time to let all students share their ideas with the whole class, a turn and talk gives students valuable practice at articulating their mathematical thinking to someone else.
6. **Select a few students to share their ideas with everyone.** When selecting students to share, think about how you can highlight the diversity of thought in your class and help students make connections to the mathematical learning goal.

Considerations

- ➔ There should be **an entry point for every student, regardless of content mastery**. These tasks should have a "low floor and high ceiling" so every student can tackle them from wherever they are in their mathematical understanding.
- ➔ **Discussion protocols** should be in place before using the Would You Rather strategy.

…ed under a Creative Commons Attribution-ShareAlike 4.0 #15 Would You …with attribution. Funded in part by Title II, Part A under the Every Student Succeeds Act (ESSA).
sde.ok.gov/oklahoma-excel/professional-development

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Always, Sometimes, Never

(Champions Brief #21 version 0.3)

Introduction

A teacher's aim is to provide rich math tasks that include a wide range of capacities for our students. **Always, Sometimes, Never** is an engaging and enriching math strategy that allows students to take a stance on a …d justifications. As a formative assessment, **Always,** …isconceptions. When this strategy is used as the basis …nd ideas, it can help connect mathematical …unication skills we know are essential for student success

6. **Plan for student think time.** Allow sufficient time for students to select a response and develop a justification to defend their answer. Students should be able to defend "why" they chose one of the three responses, providing logical examples.
7. **Be intentional on strategies to share out loud.** Anticipate student answers and plan for the flow of discussion before executing the problem. Be intentional in selecting which student responses to highlight during discussion. While it is important to give every student a voice, selecting responses that will guide the class towards the learning goal is the primary objective.

Considerations

- ➔ There should be **an entry point for every student, regardless of content mastery**. These tasks have a "low floor and high ceiling" so every student can tackle them from various levels of mathematical understanding.
- ➔ **Discussion protocols and norms**

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https://sde.ok.gov/oklahoma-excel/professional-development

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Would You Rather

(Champions Brief #15 version 0.2)

Introduction

As we move further into the 21st century, it is more important than ever to position our students as critical …**Would You Rather** is a math strategy …cations when given two real world …r robust discussions about mathematical …ween mathematical understanding and …ential for student success beyond the …

…g at the same conclusion and hear …t mathematical justifications from their …

…**ge students to justify.** Prompt students to …ir justifications to sway the opinion of others …nvince them to change sides. Justifying with a …e can help them better articulate their …matical thinking to others.

…derations

…hould be **an entry point for every** …**t, regardless of content mastery**. These …hould have a "low floor and high ceiling" …y student can tackle them from …er they are in their mathematical …tanding.

…**sion protocols** should be in place before …e Would You Rather strategy. Consider …ols like sentence stems and discussion …s to help build a culture conducive to …tive discussions.

…**n the justifications students are giving** …r answers more than the answer itself. …ts need to internalize that justifying …swers mathematically is just as …ant as producing the correct solution.

…**t all answers as long as they are supported** …**ound reasoning**. Getting students to practice …g their thinking is the most important part, so …epting all true answers is essential in making …

…mmons Attribution-ShareAlike 4.0 #14 Which

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Number Talks

(Champions Brief #19 version 0.3)

Introduction

Number talks were developed for teachers to engage students in mental math tasks that increase sense-making and encourage mathematical discourse. **Number talks** are short and structured strategies that allow students to talk about math with their peers. Students develop a flexible understanding of math through discovering multiple ways to achieve a math solution. Students use the math that is meaningful to them in developing a solution. **Number Talks** are "low floor / high ceiling" tasks that allow multiple entry points for students to grapple with a problem. This strategy fosters deep number sense and helps to create a bridge between mathematical understanding and the higher order thinking and communication skills that are essential for student success beyond the classroom.

Steps for Implementation

1. **Start with a mathematical learning goal.** All instruction should be anchored by what key understanding the student should have at the end of the lesson. The Oklahoma Math Framework Objective Analysis is a helpful resource to ensure your mathematical learning goal is aligned with your grade level standards.
2. **Select the number to discuss**. The number can be a single digit or the solution to a complex grade appropriate math task. It should be mentally solvable and allow different avenues of how to get an answer.
3. **Plan for student responses.** Anticipating student responses will help you prepare to guide students while they justify their answers and identify the ideas to share or highlight during the student discussion.
4. **Plan ahead questions to facilitate the discussion.** Have guiding questions or Math Talk Moves ready to help promote rich student discourse.
5. **Present the problem to the students**. Instruct the students to solve the problem mentally, using whatever strategy works for them. This will allow students multiple entry points to the task and see various ways of thinking.
6. **Allow students time to think**. Providing this time allows students to process and therefore feel more comfortable sharing their thoughts with others.
7. **Give everyone a voice.** While you likely do not have time to let all students share their ideas with the whole class, a turn and talk gives students valuable practice at articulating their mathematical thinking to someone else.
8. **Select a few students to share their ideas with everyone.** When selecting students to share, think about how you can highlight the diversity of thought in your class and help students make connections to the mathematical learning goal.

Considerations

- ➔ The focus is not only on the correct answer, but on **all the possible methods** towards finding the answer and the student explanations of their strategies.
- ➔ Make sure your **learning goal is represented** and you know where students should be in their thinking at the **end** of the

ALSO SEE CHAMPION'S BRIEFS:
#14 Which One Doesn't Belong?
#15 Would You Rather?
#20 Cognitively Complex Math Tasks
#21 Always, Sometimes, Never

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https://sde.ok.gov/oklahoma-excel/professional-development

OKLAHOMA Education

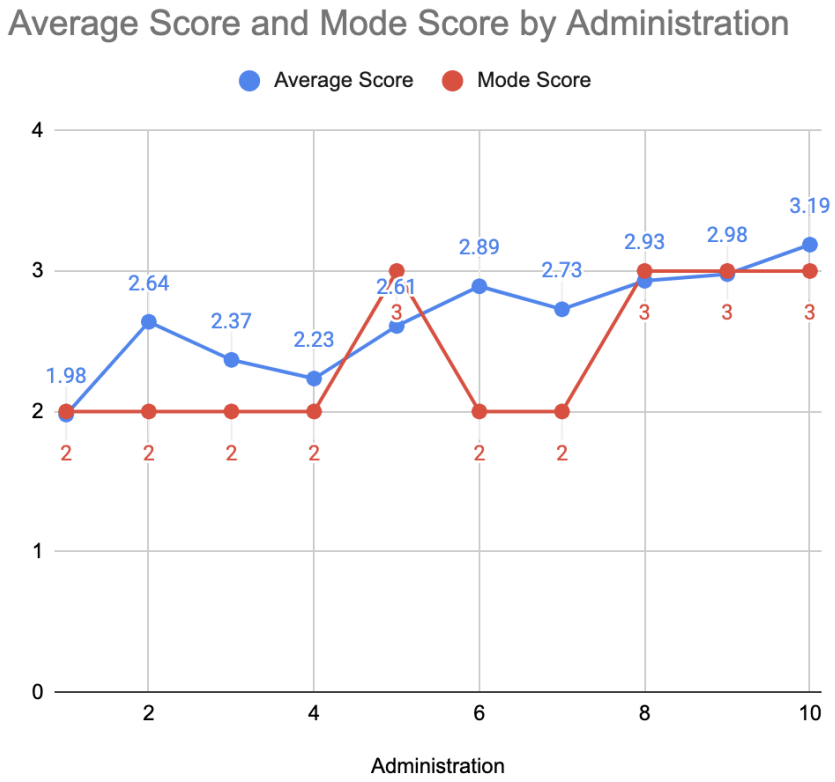
Math Justification and Reasoning Rubric

This rubric allows for a formative assessment of how students are able to explain their mathematical thinking and provide a justification. Justifications evaluated using the rubric can be written or verbal.

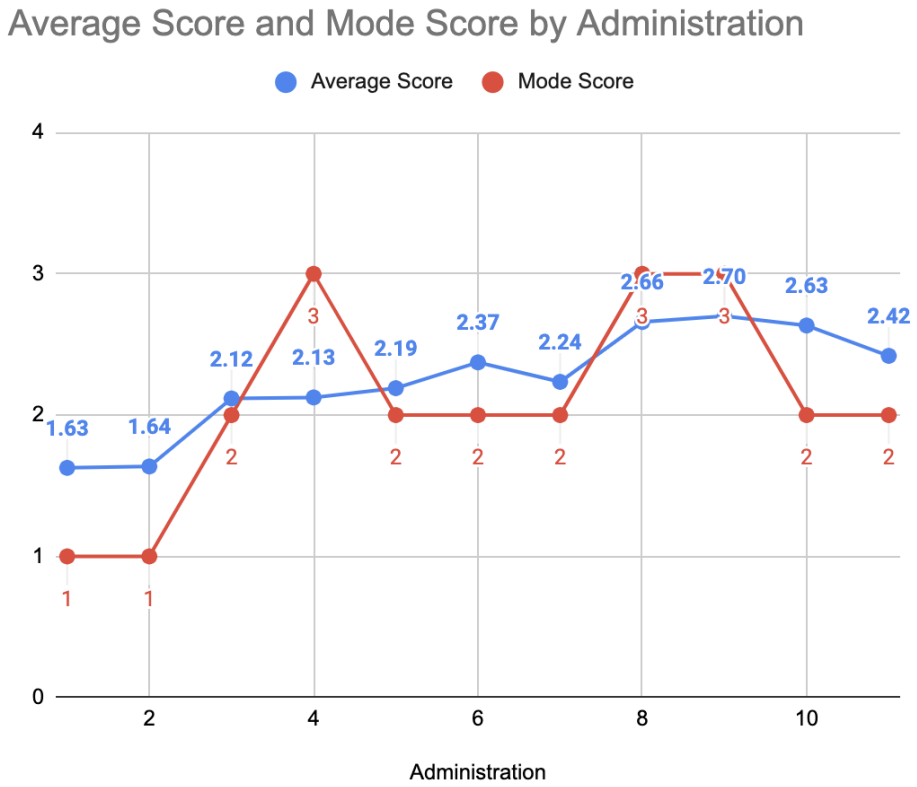
0	1	2	3	4
No attempt was made to justify OR Justification is missing all critical components	Justification is too difficult to understand or is *missing* 3 of the critical components AND The solution may be correct or incorrect	Justification is difficult to understand and/or is *missing* 2 of the critical components AND The solution may be correct or incorrect	Justification is clear and *includes* at least 3 critical components AND The solution may be correct, but may also include minor calculation errors	Justification is detailed and clear and *includes* all 4 critical components AND The solution must be correct
Critical Components of Mathematical Justifications • WHAT they got as the answer • HOW they got to that answer • WHY they chose the strategies or operations they used • WHY their answer is correct				

Justification and Reasoning Data

McAlester 19/20



OKCA 19/20



OKLAHOMA Education

Cognitively Complex Tasks

OKLAHOMA Education

Cognitively Complex Math Tasks

(Champions Brief #20 version 0.4)

Introduction

When students engage in tasks that are cognitively demanding and complex, it helps them make connections between math and real life experiences all while deepening their level of understanding. With proper planning, students will likely find these tasks exciting as they experience the rigor, richness, and flexibility of math. When students are engaged with a cognitively demanding task, they must rely on multiple mental resources, including higher thinking skills and the ability to make connections. It encourages students to do "procedures with connections" and to be "doing math". NCTM and the Mathematics Tasks Framework identifies four Levels of Cognitive Demand that can be used to analyze the complexity of classroom tasks.

Steps for Implementation

1. **Start with a mathematical learning goal.** All instruction should be anchored by which key understandings you need students to walk away with.
2. **Try the task yourself** to evaluate the rigor of the task and identify potential student processes, misconceptions, or roadblocks.
3. **Make your existing tasks more complex** with some simple adjustments such as removing a number or value from a problem, words or labels from a visual, or phrase the question in an open ended format.
4. **Create or locate new tasks** that emphasize having students think, connect, and require considerable cognitive effort.
5. **Take the time to plan the implementation of your appropriate task**. Planning out responses to student misconceptions and thought processes ensure a smoother implementation of the task. Prepare yourself with guiding questions to move their thinking forward and toward the lesson goal. (33)
6. **Task directions** should be clear, concise, and allow for freedom of thought. Ambiguity of "what" to do in a task is an obstacle that can lead to lower student performance.
7. **Curate a classroom culture** where students know what to do if they engage in productive struggle or feel stuck.
8. **Establish classroom discussion norms** before attempting collaboration or discourse so students feel safe and secure in sharing their ideas and thoughts and understand all voices have value.
9. **Plan for appropriate think time** to process and ask questions when giving cognitively demanding tasks. Students should not immediately know the answer and will have to process, question, make a plan, test, and modify thinking, which takes time.

Considerations

- Cognitive complexity is not synonymous with complicated. **Complexity indicates that depth of thinking is required** rather than complicated tasks with multiple steps to be followed.
- Cognitively complex tasks use rigorous thought to **engage students in activities of sustained mental taxation**. Rigor is embedded within a cognitively complex

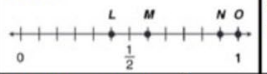
ALSO SEE CHAMPION'S BRIEFS:
#14 Which One Doesn't Belong?
#15 Would You Rather?
#19 Number Talks
#21 Always, Sometimes, Never

Robert Kaplinsky

Depth of Knowledge Matrix – Elementary & Secondary Math

February 4, 2015

Depth of Knowledge Matrix - Elementary & Secondary Math

Topic	Adding Whole Numbers	Money	Fractions on a Number Line	Area and Perimeter	Subtracting Mixed Numbers
CCSS Standard(s)	• 1.NBT.4 • 2.NBT.5	• 2.MD.8	• 3.NF.2	• 3.MD.8 • 4.MD.3	• 5.NF.1
DOK 1 Example	Find the sum. $44 + 27 =$	If you have 2 dimes and 3 pennies, how many cents do you have?	Which point is located at $\frac{7}{12}$ below? 	Find the perimeter of a rectangle that measures 4 units by 8 units.	Find the difference. $5\frac{1}{2} - 4\frac{2}{3} =$
DOK 2 Example	Fill in the boxes below using the whole numbers 1 through 9, no more than one time each, so that you make a true equation. □□ + 53 = □□	Make 47¢ in three different ways with either quarters, dimes, nickels, or pennies.	Label the point where $\frac{3}{4}$ belongs on the number line below. Be as precise as possible. 	List the measurements of three different rectangles that each has a perimeter of 20 units.	Create three different mixed numbers that will make the equation true by using the whole numbers 1 through 9, no more than one time each. You may reuse the same whole numbers for each of the three mixed numbers. $5\frac{4}{5} - \square\frac{\square}{\square} = 3\frac{1}{20}$

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Math Justification and Reasoning Rubric

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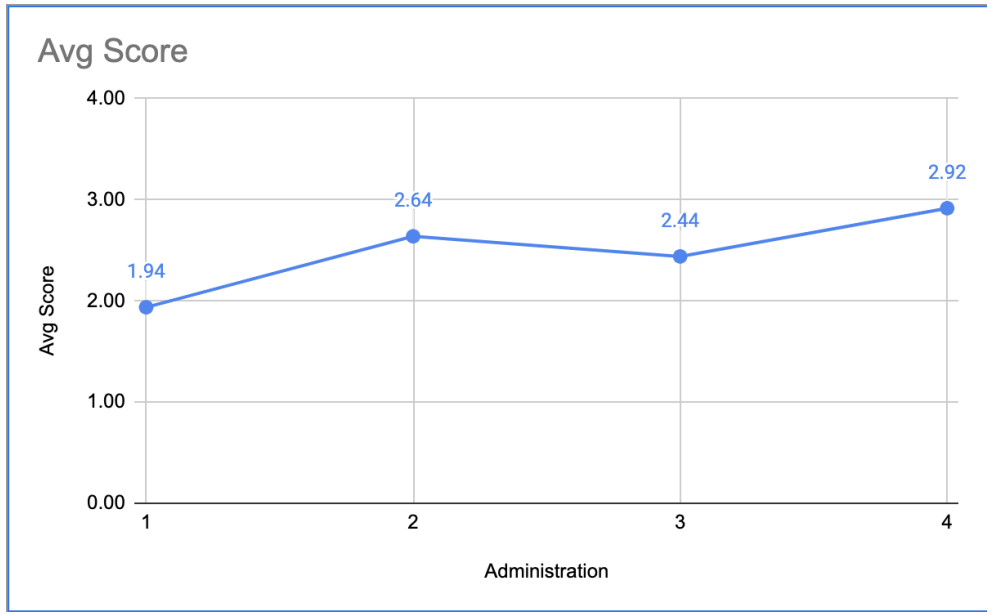
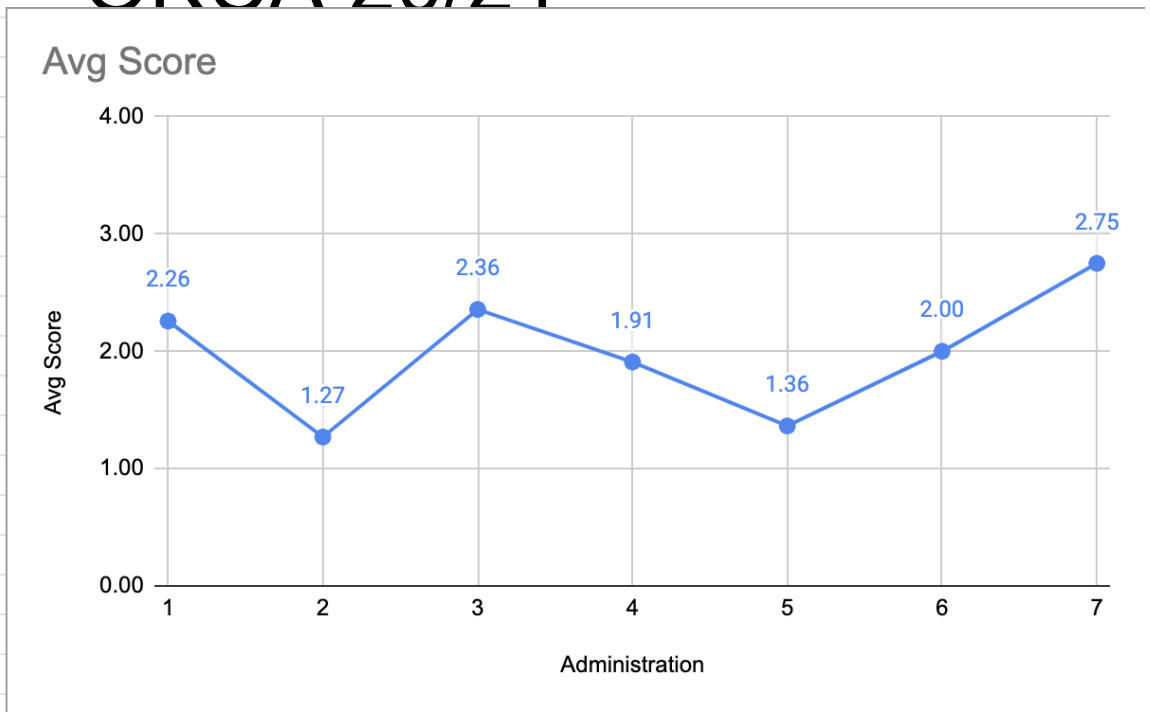
Critical Components of Mathematical Justifications • WHAT they got as the answer • HOW they got to their answer - visual or mathematical representation • HOW they got to their answer - written or verbal explanation • WHY they chose the strategies or operations they used OR WHY their strategy works to solve the problem				

Implementing Cognitively Complex Tasks

McAlester 20/21



OKCA 20/21



*Data interruptions due to Covid

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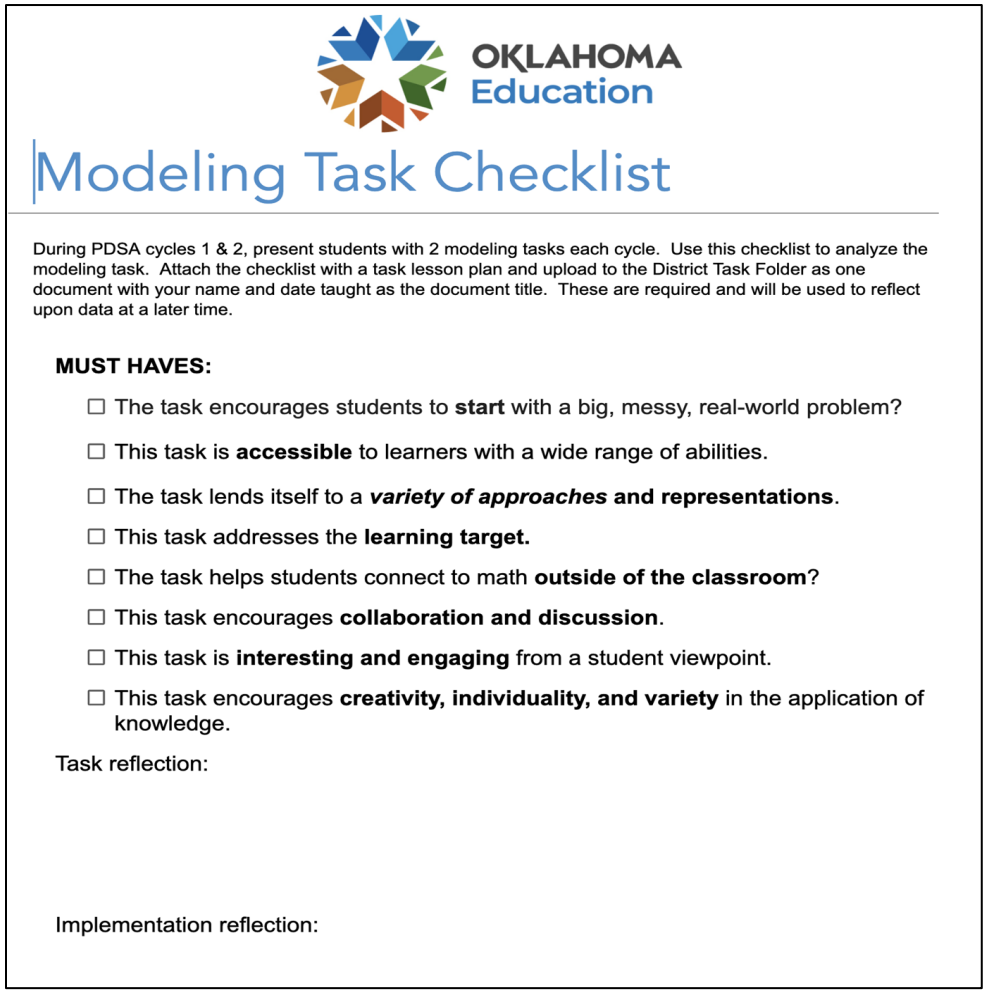
Mathematical Modeling

Once students became familiar with explaining and justifying the reasons for their answers, the NIC moved up to implementing mathematical modeling tasks.

These cognitively complex tasks incorporate:

- low floors/ high ceilings to enter the problem,
- comprehension of the question,
- selecting an appropriate strategy, establishing connections to the work,
- and making sure the solution/model answered the original question.

Choosing appropriate tasks are important



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Modeling Task Checklist

During PDSA cycles 1 & 2, present students with 2 modeling tasks each cycle. Use this checklist to analyze the modeling task. Attach the checklist with a task lesson plan and upload to the District Task Folder as one document with your name and date taught as the document title. These are required and will be used to reflect upon data at a later time.

MUST HAVES:

- ☐ The task encourages students to **start** with a big, messy, real-world problem?
- ☐ This task is **accessible** to learners with a wide range of abilities.
- ☐ The task lends itself to a ***variety of approaches*** **and representations**.
- ☐ This task addresses the **learning target.**
- ☐ The task helps students connect to math **outside of the classroom**?
- ☐ This task encourages **collaboration and discussion**.
- ☐ This task is **interesting and engaging** from a student viewpoint.
- ☐ This task encourages **creativity, individuality, and variety** in the application of knowledge.

Task reflection:

Implementation reflection:

Student Facing Checklist

Before you turn in your math modeling, did you:

- Answer the problem (PS)
- Show an equation (Communicate)
- Use math words to explain (Connect)
- Explain how your answer connects to the problem with words(Connect)
- Show your thinking: use pictures, models, tables, or some that explains how you got your answer (PS & Representation)

Assess the Task- Formative or Summative

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Math Academic Achievement Modeling Rubric (v.2)

Every PDSA cycle, present students with 2 modeling tasks. Use this rubric to analyze their work and upload scores to the district data sheet. Scores will be given for the four components and also the final total score.

	Problem Solving (identify problem, chose strategy, generate solution)	Communication (Evidence)	Connections (Justify/Reason)	Representation (Conclusion)
4 - Expert	An efficient strategy is chosen and progress toward a solution is evaluated, with a reasonable answer.	Formal math language is used to share and clarify ideas. At least two formal math terms or symbolic notations are evident in any combination.	Mathematical connections are used to extend the solution to other mathematics or to a deeper understanding of the mathematics in the task.	An appropriate mathematical representation is constructed to analyze relationships, extend thinking and clarify or interpret phenomenon.
3 - Practitioner	A correct strategy is chosen based on the mathematical situation in the task with a reasonable answer.	Formal math language is used to share and clarify ideas. One formal math term or symbolic notation is evident in any combination.	A mathematical connection is made. Proper contexts are identified that link both the mathematics and the situation in the task.	An appropriate and accurate mathematical representation is constructed and refined to solve problems or portray solutions
2 - Apprentice	A partially correct strategy is chosen, or a correct strategy for solving only part of the task is chosen	An attempt is made to use formal math language. Zero formal math terms or symbolic notation is evident.	A mathematical connection i s attempted but is partially incorrect or lacks contextual relevance.	An attempt is made to construct a mathematical representation to record and communicate problem solving but is not accurate.
1 - Novice	No strategy is chosen, or a strategy is chosen that will not lead to a solution.	No formal mathematical terms or symbolic notations are evident.	NO connections are made or connections are mathematically or contextually irrelevant.	No attempt is made to construct a mathematical representation

Generate a total score as overall Justification and Reasoning Score:
4-6 = Novice, 7-10 = Apprentice, 11-14 = Practitioner (Mastery), 15-16 = Expert
1 2 3 4

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Questions for Tim and Angie

- Can you describe how you use these tasks in your classrooms with students?
- Describe your experience *before Oklahoma Excel* in assessing student thinking.

- What impact has using these tasks and rubrics had on teaching and learning in your classroom?
- What challenges, or limitations, have you encountered with using rubrics to assess student justifications?
- What advice would you give to other teachers who are interested in using complex tasks and rubrics?

Next Echo

- April 14th: 3:30-4:30
- Using Practical Measures to Move Learning Forward