Leveraging School-Wide/District-Wide Instructional Practices to Improve Student Outcomes in Mathematics

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How would you describe traditional mathematics instruction in the U.S.?

- Algorithm-Driven
- Spiraled
- Mile-Wide/Inch Deep
- Purpose-Disconnected
What’s Common in the Standards?
What’s Common in the Standards?

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<td>Counting and Cardinality</td>
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Introduction to the
6 Shifts for Mathematics (K-12)
Focus: Teachers significantly narrow and deepen the scope of how time and energy is spent in the mathematics classroom. They do so in order to focus deeply on only the concepts that are prioritized in the standards.
Coherence: Teachers carefully connect the learning within and across grades so that students can build new understanding onto foundations built in previous years. Each standard is not a new event, but an extension of previous learning.
Procedural Fluency: Students are expected to have **speed and accuracy** with simple calculations; teachers structure class time and/or homework time for students to memorize, through repetition, core functions such as multiplication tables so that they are more able to understand and manipulate more complex concepts.
6 Pedagogical Shifts for Instruction
(Mathematics)
Instruction and Instructional Materials Should Align w/the Shifts

Deep Conceptual Understanding: Students deeply understand and can operate easily within a mathematics concept before moving on (mastery). Students learn more than a trick to get the answer right because they are able to see mathematics as more than a set of mnemonics or discrete procedures. Students actually learn the math and can write and speak about their understanding using the language of mathematics.
Application: Students are expected to use math and choose the appropriate concept for application even when they are not prompted to do so. Teachers provide opportunities at all grade levels for students to apply mathematics concepts in “real world” situations. Teachers in content areas outside of mathematics, particularly science, ensure that students are using mathematics to make meaning and access content.
6 Pedagogical Shifts for Instruction (Mathematics)

Instruction and Instructional Materials Should Align w/the Shifts

**Dual Intensity:** Students practice and understand. There is more balance between these two phenomenon in the classroom—both occur with intensity. Teachers create practice opportunities for students to participate in “drills” and make use of those skills through extended application of math concepts. The amount of **time and energy spent practicing and understanding** is driven by the specific mathematical concept under study and varies throughout a given school year.
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(Mathematics)
Instruction and Instructional Materials Should Align w/the Shifts

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Introduction to the 8 Standards for Mathematical Practice and 10 Characteristics of Worthwhile Mathematical Tasks (K-12)
Standards for Mathematical Practice (8)

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.
Worthwhile Mathematical Tasks

1. The problem has important useful mathematics embedded in it.

1. The problem requires higher-level thinking and problem solving in it.

1. The problem contributes to the conceptual development of students.

1. The problem creates an opportunity for the teacher to assess what his/her students are learning and where they are experiencing difficulty.

1. The problem can be approached by students in multiple ways using different solution strategies.

2. The problem has various solutions or allows different decisions or positions to be taken or defended.

1. The problem encourages student engagement and discourse.

1. The problem connects to other important mathematical ideas.

1. The problem promotes the skillful use of mathematics.

1. The problem provides an opportunity to practice important skills.
What do the 6 Shifts, 8 Standards for Mathematical Practices, and the 10 Characteristics of Worthwhile Mathematical Tasks Propose?

Instructional Materials must Match the Shifts

What are the implications of the 6 Shifts, 8 Standards for Mathematical Practice and the 10 Characteristics of a Worthwhile Mathematical Task?

- For planning?
- For instruction & instructional materials?
- For assessment?
- For homework?
- For differentiation
- For teacher feedback?
Connection between the Shifts and School-Wide Instructional Practices:

- Curriculum, Instruction, & Assessment

Versus

- Knowledge, Language, & Tools
The process for aligning curriculum with daily instruction and assessment is:

- establishing common **knowledge** of the curriculum (the standards) [what are the standards requiring students to know and be able to do];

- establishing common “absolute” **language** around the standards [including ancillary terms]; and

- identifying common instructional **tools** to make instruction on the standard, standardized.
Domain: Statistics and Probability 7.SP.1
Cluster: Use random sampling to draw inferences about a population.
Standard: Understand that statistics can be used to gain information about a population by examining a sample of the population; generalizations about a population from a sample are valid only if the sample is representative of the population; understand that random sampling tends to produce representative samples and support valid inferences.

Describe the larger population.

Describe a random sample of the larger population.

Statistic(s) about the random sample.

Make a generalization about the larger population from the random sample.

Explain the relationship between generalizations and the representative sample. What makes the generalization a valid inference?

Epiphany Word Bank

Generalization: #Inferring the results from a sample and applying it to the population
Inference: The process of drawing conclusions from data
Population: The whole group from which the sample is taken
Random: Without order, not able to be predicted, happening by chance
Relationship: The way in which two or more concepts are connected
Representative: Small quantity of a larger population
Sample: Election taken from the larger group (the population)
Statistics: The study of data: how to collect, summarize, and present it
Valid: Relevant and logical
Domain: Statistics and Probability 7.SP.2
Cluster: Use random sampling to draw inferences about a population.
Standard: Use data from a random sample to draw inferences about a population with an unknown characteristic of interest; generate multiple samples (or simulated samples) of the same size to gauge the variation in estimates or predictions.

Iden(e)y'afarandom'sample.'

Draw'inferences'about'the'popula(on'with'an'unknown'characteris('of'interest.'"

Generate'a'sample'of'the'same'size.'

Generate'a'sample'of'the'same'size.'

Generate'a'sample'of'the'same'size.'

Interpret'the'vari(ables'mates'or'predictions'in'the'simulated'samples.'

©'Educal'(on'al'Epiphany'""

Epiphany'Word'Bank"

Characteris( a feature belonging to a population
Generate to produce
Inference (the process of drawing conclusions from data
Population (the whole group from which a sample is taken
Random with no border; not able to be predicted; happening by chance
Relation (the way in which two or more concepts are connected
Represent (value in a tally: # represents a population
Sample selection taken from the larger population
Simulate (imitate
Study (how to collect, summarize, and present data
Unknown (not known
Variable (how far each number is spread out)
**Domain: Statistics and Probability 7.SP.3**

Cluster: Draw informal comparative inferences about two populations.

Standard: Informally assess the degree of visual overlap of two numerical data distributions with similar variabilities, measuring the difference between the centers by expressing it as a multiple of a measure of variability.

<table>
<thead>
<tr>
<th>Data 'Set 1:'</th>
<th>Data 'Set 2:'</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display 'numerical data from data set 1' using graphs.</td>
<td>Display 'numerical data from data set 2' using graphs.</td>
</tr>
<tr>
<td>Determine 'the mean' for data set 1.</td>
<td>Determine 'the mean' for data set 2.</td>
</tr>
</tbody>
</table>

Measure 'the difference between the centers' using 'multiple measures of variability.'

Epiphany 'Word Bank'

- Assess & evaluate
- Collection of facts, values & measurements
- Difference result by subtracting one number from another. How much does one number differ from another?
- Measure to find a number that shows the amount of something
- Similar having similarities
- Variability the measure of how spread out the data may be"
Domain: Statistics and Probability 7.SP.4
Cluster: Draw informal comparative inferences about two populations.
Standard: Use measures of center and measures of variability for numerical data from random samples to draw informal comparative inferences about two populations.

<table>
<thead>
<tr>
<th>Populations</th>
<th>Random sample data set 1</th>
<th>Random sample data set 2</th>
<th>Calculate the measure of center and the measure of variability for random sample data set 1</th>
<th>Calculate the measure of center and the measure of variability for random sample data set 2</th>
<th>Determine informal inferences about populations</th>
<th>Determine informal inferences about populations</th>
</tr>
</thead>
</table>

**Epiphany Word Bank**

- Comparing: involving the act of looking at the ways that things are likely different
- Data collection facts, such as values or measurements
- Inference: the process of drawing conclusions from data
- Mean: the average of the numbers
- Measure of Center: the number which summarizes all the values in a set of data
- Measure of Variability: the spread of a set of data
- Population: the whole group from which a sample is taken
- Random: without order, not able to be predicted; happening by chance
- Range: the difference between the lowest and highest values
- Sample: a selection taken from a larger group (the population)
- Standard deviation: how far the numbers fit a pre-determined
Domain: Statistics and Probability 7.SP.5
Cluster: Investigate chance processes and develop, use, and evaluate probability models.
Standard: Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring; larger numbers indicate greater likelihood; a probability near 0 indicates an unlikely event, a probability around ½ indicates an event that is neither unlikely nor likely, and a probability near 1 indicates a likely event.

Describe a chance event.
Calculate the probability of the event occurring.
Describe valid conclusions about the probability of the event.

Epiphany Word Bank

Chance Event: The likelihood that a certain event will occur
Likelihood: The probable chances that a certain event will occur
Probability: The chance an event will occur

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Domain: Statistics and Probability 7.SP.6
Cluster: Investigate chance processes and develop, use, and evaluate probability models.
Standard: Approximate the probability of a chance event by collecting data on the chance process that produces it and observing its long-run relative frequency, and predict the approximate relative frequency given the probability.

Approximate the probability of a chance event.
Approximate the probability of a chance event.
Approximate the probability of a chance event.

Predict the approximate relative frequency.
Predict the approximate relative frequency.
Predict the approximate relative frequency.

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Approximate - not exact, but close enough to be used
Chance Event - the likelihood that a certain event will occur
Chance Process - the likelihood that a certain process will occur
Data - a collection of facts, such as values or measurements
Frequency - how often something happens (usually during a period of time)
Predict - to tell what you think will occur
Probability - the chance an event will occur
Relate - frequency - is the observed number of successful events for a sample of trials
**Domain: Statistics and Probability 7.SP.7.a**

Standard: Investigate chance processes and develop, use, and evaluate probability models.

Cluster: Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events.

| Develop a uniform probability model by assigning equal probability to all outcomes. | Determine probabilities of events using the model. |
| Develop a uniform probability model by assigning equal probability to all outcomes. | Determine probabilities of events using the model. |

**Epiphany Word Bank**

- **Develop**: to create
- **Equal**: to have the same quantity
- **Event**: any of the possible outcomes of an experiment
- **Outcome**: all possible results of a trial or an experiment
- **Model**: to represent or show mathematical ideas and relationships using objects, pictures, graphs, equations, or other methods
- **Probability**: the chance an event will occur
- **Uniform**: identical or consistent
Domain: Statistics and Probability 7.SP.7.b
Cluster: Investigate chance processes and develop, use, and evaluate probability models.
Standard: Develop a probability model (which may not be uniform) by observing frequencies in data generated from a chance process.

Observations from a chance event:

Develop a probability model based on observations from a chance event.

Epiphany Word Bank

- Chance: the possibility that something will happen
- Data: a collection of facts, such as values or measurements
- Develop: to create
- Frequency: how often something happens (usually during a period of time)
- Generate: to produce
- Model: to represent or show mathematical ideas and relationships using objects, pictures, graphs, equations, or other methods
- Probability: the chance an event will occur
Domain: Statistics and Probability 7.SP.8.a
Cluster: Investigate chance processes and develop, use, and evaluate probability models.
Standard: Understand that, just as with simple events, the probability of a compound event is the fraction of outcomes in the sample space for which the compound event occurs.

**Compound Event** - the chance of two or more events happening
**Fraction** - part of a whole
**Outcome** - all possible results of a trial or experiment
**Probability** - the chance that an event will occur
**Sample Space** - an exhaustive list of all the possible outcomes of an experiment
**Simple Event** - the chance of one event happening
Domain: Statistics and Probability 7.SP.8.b
Cluster: Investigate chance processes and develop, use, and evaluate probability models.
Standard: Represent sample spaces for compound events using methods such as organized lists, tables and tree diagrams. For an event described in everyday language (e.g., “rolling double sixes”), identify the outcomes in the sample space which compose the event.

**Compound Event:**

- Identify the outcomes in the sample space representing on using a list:
- Identify the outcomes in the sample space representing on using a table:
- Identify the outcomes in the sample space representing on using a tree diagram:

**Epiphany Word Bank**

- **Compound Event:** the chance of two or more events happening
- **Event:** any of the possible outcomes of an experiment
- **Identify:** to recognize and name
- **List:** a method for organizing data consecutively, typically one below another
- **Outcome:** all possible results of a trial or experiment
- **Sample Space:** an exhaustive list of all the possible outcomes of an experiment
- **Table:** numbers or quantities arranged in rows and columns
- **Tree Diagram:** used to display sample space by using one branch for each possible outcome
<table>
<thead>
<tr>
<th>Given compound event:</th>
<th>Create sample space for compound event. (i.e. list, table and/or tree diagram)</th>
<th>Design a simulation for the compound event.</th>
</tr>
</thead>
</table>

Use the simulation to generate frequencies for the compound event.

Epiphany Word Bank

- **Compound Event** - the chance of two or more events happening
- **Design** - to create
- **Frequency** - how often something happens (usually during a period of time)
- **Generate** - to produce
- **Identify** - to recognize and name
- **Outcome** - all possible results of a trial or experiment
- **Sample Space** - an exhaustive list of all the possible outcomes of an experiment
- **Simulation** - an approximate mathematical model designed to predict the outcome of an event(s)
School-Wide Instructional Practices for Mathematics (K-12)
Practice 1
Practice 1:

An instructional objective (accessible to students, teachers, and observers) linked to the content and a worthwhile mathematical task.
Practice 1 Made Actionable:

1. The problem has important useful mathematics embedded in it.
1. The problem requires higher-level thinking and problem solving in it.
1. The problem contributes to the conceptual development of students.
1. The problem creates an opportunity for the teacher to assess what his/her students are learning and where they are experiencing difficulty.
1. The problem can be approached by students in multiple ways using different solution strategies.
2. The problem has various solutions or allows different decisions or positions to be taken or defended.
1. The problem encourages student engagement and discourse.
1. The problem connects to other important mathematical ideas.
1. The problem promotes the skillful use of mathematics.
1. The problem provides an opportunity to practice important skills.
### School-Wide Instructional Practices for Mathematics

<table>
<thead>
<tr>
<th>Performance-Based Objectives</th>
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<tbody>
<tr>
<td><strong>Geometry:</strong> SWBAT identify triangles, rectangles, and squares IOT decompose a composite figure.</td>
<td><strong>Geometry:</strong> SWBAT use the results of a probability experiment IOT make predictions about the probability of an event occurring.</td>
</tr>
<tr>
<td><strong>Measurement and Data:</strong> SWBAT count by one and five (to 60) and associate the length of each hand with increments of time IOT tell time on an analog clock.</td>
<td><strong>Number and Operations Base Ten:</strong> SWBAT use place value to the millions place IOT compare and order whole numbers from least to greatest and greatest to least.</td>
</tr>
<tr>
<td><strong>Statistics and Probability:</strong> SWBAT analyze data in a given format IOT organize and display data in a line plot or double line graph.</td>
<td><strong>Number Operations – Fractions</strong> SWBAT use knowledge of multiples to find common denominators IOT identify and determine equivalent forms of proper fractions.</td>
</tr>
</tbody>
</table>
School-Wide Instructional Practices
(for Mathematics)

Let’s Practice

With a partner, use your new knowledge of objective writing to compose 1-4 original mathematics objectives (content and a worthwhile mathematical task).
School-Wide Instructional Practices (for Mathematics)

Performance-Based Objectives Worksheet for MATHEMATICS
Educational Epiphany

Components: (Know and Do)

Know: What is the content-related prerequisite skill or knowledge that students must have or know prior to being able to demonstrate mastery of the “in order to” statement in the objective?

Do: What do you expect students to be able to do by the close of the lesson or series of lessons? This is the measurable / quantifiable portion of the objective and is always linked to a worthwhile mathematical task.

<table>
<thead>
<tr>
<th>Practice Opportunity #1</th>
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<th>Practice Opportunity #2</th>
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<th>Practice Opportunity #3</th>
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<th>Practice Opportunity #4</th>
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An instructional objective (accessible to students, teachers, and observers) linked to the content and a worthwhile mathematical task.
School-Wide Instructional Practices for Mathematics (K-12)

Practice 2
Practice 2:

Curriculum-driven opportunities to determine the meaning of general and domain specific words and symbols.

Annotated Objectives

Conceptual Understanding of Academic Language
School-Wide
Instructional Practices
for Mathematics (K-12)
Practice 3
Practice 3:

Lessons characterized by knowledge of student ability and gradual release of responsibility (from teacher dependence to student independence).
Key Questions for Practice 3

1. What is gradual release of responsibility model?

2. What is the purpose of the gradual release of responsibility model? Why is it such an important practice?

3. How many phases are in the gradual release of responsibility model?

4. What are the teacher and student responsibilities relative to each phase of the model?

5. Can/should teachers complete the gradual release cycle in a given period (45 - 120 min) class?

6. What are the major implications for planning, teacher support, and feedback?
Phase 1: Focus Lesson/Teacher Model
[I Do, You Observe]

**Purpose:**

To present students with a ‘perfect’ model of the worthwhile task to be performed by the close of the lesson/series of lesson.

<table>
<thead>
<tr>
<th>Teacher Behaviors</th>
<th>Student Behaviors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model the task to be performed aloud (providing students with an opportunity to develop an understanding of the content and/or through access to his/her thoughts as he/she performs the worthwhile task).</td>
<td>Listen attentively to the teacher think aloud for the purpose of guiding the teacher in the next phase.</td>
</tr>
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<td></td>
<td>Observe the teacher.</td>
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<tr>
<td></td>
<td>Take notes only if necessary to process new learning/information.</td>
</tr>
</tbody>
</table>

**Partner Discussion:**

What are your chief takeaways?  
Are there implications for practice?  
How does this discussion confirm your ideas and practices?
### Phase 2: Guided Instruction [We Do it Together as a Large Group]

**Purpose:**
To allow the teacher an opportunity to formatively assess students’ developing understanding of the content and/or process (as many students as possible/every student is the goal).

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Allow students to model understanding of the content/process.</td>
<td>Model understanding of the content/process for the teacher and peers with a new example.</td>
</tr>
<tr>
<td>Allow students to make mistakes and uses those mistakes to formatively assess students.</td>
<td>Think aloud.</td>
</tr>
<tr>
<td>Provide students with opportunities to construct viable arguments, justify their responses/arguments, and critique the reasoning of others.</td>
<td>Vocalize and justify responses/viable arguments and critique the reasoning of others.</td>
</tr>
</tbody>
</table>

**Partner Discussion:**
What are your chief takeaways?
Are there implications for practice?
How does this discussion confirm your ideas and practices?
Purpose:

(1) To allow peer coaching; (2) to provide the teacher an opportunity to formatively assess students’ developing understanding of the content and/or process; (3) to provide students with tailored assistance; (4) to provide students with feedback and positive reinforcement.

<table>
<thead>
<tr>
<th>Teacher Behaviors</th>
<th>Student Behaviors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulate the classroom.</td>
<td>Equally share the responsibility for demonstrating developing knowledge the content/process with a peer (several practice opportunities).</td>
</tr>
<tr>
<td>Collect and real-time data to assess student acquisition of new knowledge and/or skills.</td>
<td>Think aloud.</td>
</tr>
<tr>
<td>Provide assistance/re-teach (pairs and individuals in a pair) where appropriate.</td>
<td>Vocalize and justify responses/viable arguments and critique a peer’s reasoning.</td>
</tr>
<tr>
<td>Provide students with positive reinforcement.</td>
<td></td>
</tr>
</tbody>
</table>

Partner Discussion:

What are your chief takeaways?
Are there implications for practice?
How does this discussion confirm your ideas and practices?
**Phase 4:**
Independent Practice
[You Do Alone – I Watch]

**Purpose:**
To assess individual students’ ability to demonstrate mastery of the content/process and capacity to transfer that new ability to another learning opportunity and/or discipline with automaticity.

<table>
<thead>
<tr>
<th>Teacher Behaviors</th>
<th>Student Behaviors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circulate the classroom.</td>
<td>Work alone without assistance from the teacher and peers to demonstrate knowledge of the content/process modeled by the teacher, practiced as a large group and practiced with a peer.</td>
</tr>
<tr>
<td>Presented students with a new example/problem and require them to demonstrate individual understanding of the process/content under a time constraint.</td>
<td></td>
</tr>
<tr>
<td>Refrain from providing assistance/reinforcement unless specified in an IEP/504.</td>
<td></td>
</tr>
<tr>
<td>Use real-time data to determine next steps.</td>
<td>Read or sit quietly after finishing.</td>
</tr>
</tbody>
</table>

**Partner Discussion:**

What are your chief takeaways?
Are there implications for practice?
How does this discussion confirm your ideas and practices?
TEACHER RESPONSIBILITY

Focus Lesson

Guided Instruction

Collaborative

“I do it”

“We do it”

“You do it together”

“You do it alone”

STUDENT RESPONSIBILITY

A Model for Success for All Students

School-Wide Instructional Practices
(for Mathematics)

Practice 3:

Observe a **teacher model** the task to be performed provides students with an opportunity to develop an understanding of the process/content through access to the teacher’s thoughts as he/she performs the task. More useful to students when they do not attempt to assist the teacher or take notes.

Participate in **guided practice** opportunity(ies). As a whole group, students lead the teacher through the same process with a new example. The teacher allows students to direct him/her through the process, providing students with an opportunity to model for the teacher their developing understanding of the process/content. The teacher allows students to make mistakes and use those mistakes to formatively assess other students and provide them an opportunity to construct viable arguments and justify them.

Engage in a **cooperative practice** opportunity. When students have shown appropriate levels of process/content acquisition, they are ready for a cooperative practice opportunity. In groups of two, students should be given an opportunity to perform the same task (at least once or twice) with new examples. While students are performing the task(s), it is recommended that the teacher circulates the classroom, using student-talk as formative assessment for the purpose of providing positive feedback or re-teaching where appropriate. If students struggle in the cooperative setting, it might be useful to repeat the teacher model and/or the guided practice phase.

Engage in an **independent practice** opportunity. When students have shown consistent understanding of the process/content in the cooperative setting. It is appropriate to provide students with an independent practice opportunity. In this phase of instruction, students are presented with another new example and are required to demonstrate individual understanding of the process/content. Students may not receive any assistance from the teacher unless such assistance is a function of a student’s Individualized Education Program (IEP).
School-Wide Instructional Practices for Mathematics (K-12)
Practice 4
Practice 4:
The consistent use of manipulatives to teach abstract mathematical concepts.
The consistent use of manipulatives to teach abstract mathematical concepts.

<table>
<thead>
<tr>
<th>Mathematical Concept to be Mastered</th>
<th>Manipulative(s)</th>
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<tbody>
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School-Wide Instructional Practices for Mathematics (K-12)

Practice 5
School-Wide Instructional Practices
(for Mathematics)

Practice 5:

A scope and sequence driven by the connection of new concepts as a logical extension of previously taught/mastered concepts (coherent instruction).

District-Level
Teaming
School-Wide Instructional Practices for Mathematics (K-12)

Practice 6
School-Wide Instructional Practices
(for Mathematics)

Practice 6:

Lesson characterized by a balance of procedural fluency and conceptual understanding (dual intensity).
Practice 6: Lesson characterized by a balance of procedural fluency and conceptual understanding (dual intensity).
School-Wide Instructional Practices for Mathematics (K-12)

Practice 7
Practice 7:

Homework aligned with the requisite concept necessary to demonstrate mastery of the content, concept, process under study.
<table>
<thead>
<tr>
<th>Mathematical Concept to be Mastered</th>
<th>Homework Aligned to Prerequisite Concept(s)</th>
</tr>
</thead>
</table>

**Practice 7:** Homework aligned with the requisite concept necessary to demonstrate mastery of the content, concept, process under study.
School-Wide Instructional Practices for Mathematics (K-12)

Practice 8
School-Wide Instructional Practices
(for Mathematics)

Practice 8:

Multiple opportunities for students to demonstrate behaviors associated with the 8 Standards for Mathematical Practices.
School-Wide Instructional Practices (for Mathematics)

Practice 8:

<table>
<thead>
<tr>
<th>8 Standards for Mathematical Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Make sense of problems and persevere in solving them</td>
</tr>
<tr>
<td>Reason abstractly and quantitatively</td>
</tr>
<tr>
<td>Construct viable arguments and critique the reasoning of others</td>
</tr>
<tr>
<td>Model with mathematics</td>
</tr>
<tr>
<td>Use appropriate tools strategically</td>
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<tr>
<td>Attend to precision</td>
</tr>
<tr>
<td>Look for and make use of structure</td>
</tr>
<tr>
<td>Look for and express regularity in repeated reasoning</td>
</tr>
</tbody>
</table>
School-Wide Instructional Practices for Mathematics (K-12)
Practice 9
School-Wide Instructional Practices
(for Mathematics)

Practice 9:

Teachers’ consistent use of the language of proficient mathematicians (the 8 Standards for Mathematical Practice) throughout the gradual release of responsibility [see matrix].
Summary of Instructional Practices for Mathematics (K-12)
9 Instructional Practices (for Mathematics)

What are the implications of the 6 Shifts?

• For planning?
• For instruction & instructional materials?
• For assessment?
• For homework?
• For differentiation
• For teacher feedback?
Appendix
Analyzing a Worthwhile Mathematical Task

Grade: 5
CCSS: 5.NBT.3

Five swimmers compete in the 50-meter race. The finish time for each swimmer is shown in the video.

23.42
23.35
23.24
23.21
23.18

Explain how the results of the race would change if the race used a clock that rounded to the nearest tenth.
Jared is testing how much weight a box can hold. He plans to put juice bottles into three boxes. He wants each box to have a total weight within the given range.

Drag juice bottles into each box so that the weight is within the given range.

Leave the box empty if the given range is not possible using juice bottles.
What do you need to bring it all together?

- What is the unit of change for improvements in student achievement?
- A lesson progression template (to calibrate expectations and support).
Designing Performance-Based Instruction Aligned with the State Standards for Mathematics

Number of Days Needed to Teach to Mastery:

State Standard under Study:

Performance-Based Objective: [Performance-Based Objectives are composed in the know and do format. The "know" refers to the content whereas the "do" refers to a higher-order thinking skill and/or worthwhile mathematical task].

SWBAT

IOT

Coherence: How is this lesson connected to a previously mastered concept within this unit of study or from a previously taught unit of study?

Manipulatives: What manipulatives will be used throughout the gradual release process to develop and assess students' conceptual understanding of abstract mathematical concept(s)?
Designing Performance-Based Instruction Aligned with the State Standards for Mathematics

General and Domain Specific Vocabulary Words:

List and operationally define key terms and/or symbols that are essential to student mastery of the objective. [Students should be encouraged to use knowledge of Latin and Greek word parts to develop a conceptual understanding of the concept under study].

What strategy(ies)/method(s) will be used to explicitly teach unfamiliar words, phrases, and symbols in the performance-based objective and practice problems?

Teacher Model: The teacher demonstrates what students should know and be able to do while students listen attentively, taking notes where appropriate.

What real-world problems (worthwhile mathematical tasks) will be used by the teacher to model skills/demonstrate application of mathematical concept(s)?

Consider working each problem in advance of instruction to gain firsthand experience with the nuances of each question with attention to your thought processes and probable misconceptions.

Guided Practice: Students are asked to demonstrate developing knowledge of the performance-based objective by demonstrating their knowledge and ability in the large group setting. The teacher uses this opportunity to assess as many students as possible with special attention to struggling learners. If students are unsuccessful at this phase, then students would benefit from another teacher model.

What real-world problems (worthwhile mathematical tasks) will be presented to students in order to provide students with multiple opportunities to apply their knowledge of mathematical concepts through guided practice?

Consider working each problem in advance of instruction to gain firsthand experience with the nuances of each question with attention to your thought processes and probable misconceptions.
Designing Performance-Based Instruction Aligned with the State Standards for Mathematics

How will the teacher know what each student knows and can do during the guided practice opportunity? How will students be assessed through writing and speaking?

Collaborative Practice: Students are asked to work in groups of two to demonstrate developing knowledge of the objective. The teacher uses this opportunity to circulate the room assessing and assisting as many students as possible with special attention to struggling learners. If students are successful in this phase, they are ready for the next step in the gradual release process.

What real-world problems (worthwhile mathematical tasks) will be presented to students in order to provide students with multiple opportunities (with a partner) to apply their knowledge of mathematical concepts?

Consider working each problem in advance of instruction to gain firsthand experience with the nuances of each question with attention to your thought processes and probable misconceptions.

How will the teacher know what each student knows and can do during the collaborative practice opportunity? How can students be assessed through writing and speaking?
Designing Performance-Based Instruction Aligned with the State Standards for Mathematics

Independent Practice: Students are asked to work independently to demonstrate knowledge of the objective. The teacher uses this opportunity to determine what students know and can do without any assistance from the teacher, teacher assistant, or peer. If students are unsuccessful in this phase, then students may benefit from exposure to the general and domain specific vocabulary and/or exposure to a second round of the gradual release process.

What real-world problems (worthwhile mathematical tasks) will be presented to students in order to provide students with multiple opportunities (without any assistance) to apply their knowledge of mathematical concepts?

Consider working each problem in advance of instruction to gain firsthand experience with the nuances of each question with attention to your thought processes and probable misconceptions.

Will students be able to use manipulatives during independent practice to demonstrate mastery of abstract mathematical concepts? If so, which students and why?

Homework for Students Struggling with this Performance-Based Objective:
(Students would benefit from homework aligned with the prerequisite skill necessary to demonstrate mastery of the know and do objective).

Homework for Students Not Struggling with this Performance-Based Objective:
(Non-struggling students would benefit from homework designed to enrich their ability to apply knowledge and skills aligned with the know and do objective).
What is the imperative?

- Alignment of instructional knowledge, language, and tools (curriculum, instruction, and assessment).
  - Graphic Organizers
  - Lesson Progression Template for the Core Content Areas

- High-quality, targeted professional learning
  - Ongoing, rather than Episodic

- School-wide/district-wide calibration walks with key personnel characterized by emphasis on:
  - The Practices
  - Leading with the Truth
  - The Provision of Support/De-emphasis on Evaluation
# Joe's Boiler Repair

1306 Highway 69  
North Overshoe, IA

Bill to: North Overshoe Community School  
315 Learning Drive  
North Overshoe, IA

<table>
<thead>
<tr>
<th>Date</th>
<th>Service</th>
<th>Amount</th>
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<tbody>
<tr>
<td>2/12/03</td>
<td>Fix boiler system.</td>
<td>$250.00</td>
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</table>

**Total Due** $250.00
**Joe's Boiler Repair**  
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North Overshoe, IA  

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<td>Wear and tear on hammer.</td>
<td>$ .85</td>
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**Total Due**  

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<tr>
<td></td>
<td>Knowing where to hit.</td>
<td>$249.15</td>
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</tbody>
</table>

Total Due $250.00
Leveraging School-Wide/District-Wide Instructional Practices to Improve Student Outcomes in Mathematics

Donyall D. Dickey, Ed.D.

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