Using the CCRS Math Resource Alignment Tool and the Key Shifts

Module 1: The Key Shifts for Mathematics

Pennsylvania Professional Development System

Three key instructional shifts prompted by the CCR standards

Focus: Focus strongly where the CCR standards focus.

Coherence: Design learning around coherent progressions level to level.

Rigor: Pursue conceptual understanding, procedural skill and fluency, and application—all with equal intensity.

Key shift: Focus

Focus: Focus strongly where the CCR standards focus

- By focusing deeply on what is emphasized in the standards, students gain strong foundations.
- Each level includes the major concepts that should be mastered before addressing concepts at the next higher level.
- Each level includes **content from all four strands** (number, algebra, geometry, and data).

Implications for instruction

- Focusing narrows but deepens the scope of content.
- Rather than "a mile wide and an inch deep," focusing results in a "mile deep and an inch wide."
- Focusing opens the door to strengthening understanding of concepts.
- Time spent should include increased emphasis on understanding, reasoning, and explanation.

Key shift: Coherence

Coherence: Designing learning around coherent progressions level to level

Learning progressions are based on how students' mathematical knowledge, skill, and understanding are known to develop over time.

- There are 2 elements of coherence: Coherence **across levels** and coherence that links the topics **within each level**.
- Coherence allows students to build new understanding based upon foundations from their previous study.
- Coherence prevents standards from being a list of isolated topics.

Key shift: Rigor

Rigor: Pursuing Conceptual Understanding, Procedural Skill and Fluency, and Application – with equal intensity

- Students with solid **conceptual understanding** know more than "how to get the answer"; they can generalize and apply concepts from several perspectives.
- When students can perform calculations with speed and accuracy (**fluency**), they are able to access more complex concepts and procedures.
- When students have the ability to use math flexibly, they are then able to **apply** their knowledge to a wide variety of types of problems.

Standards for Mathematical Practice

The **Standards for Mathematical Practice** describe varieties of proficiency that students at all levels need to develop.

- When concepts and skills are connected to the Math Practices, deeper understanding can occur, which allows students to extend them to new situations.
- Emphasis on the Math Practices shifts the focus from just "how to get the answer" to also "learning how to learn."

Research rationale for the Math Practices

- Rely on "processes and proficiencies" with established significance in mathematics education. (National Council of Teachers of Mathematics and National Research Council)
- When connected to content, they deepen understanding, enabling students to extend their thinking to new situations. (ACT National Curriculum Survey)

Developing "habits of mind"

"Mathematical practice lives in the approach to a task, not in the task. Rather than saying 'Here's a problem that exhibits MP.6', we should be saying 'Here's a problem where it's useful to employ MP.6 as a piece of the solution.'"

Education Development Center. (2014). *Three Examples.* Mathematical Practice Institute: Al Cuoco.

Standards for Mathematical Practice

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.

MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

Mathematical Practices are evoked and "practiced" with math tasks that:

- are interesting problems.
- have more than one solution path which may be unpredictable.
- create discussion.
- require cognitive effort.
- connect to the real world.
- relate to grade level CCSS.
- build students' understanding of grade level standards.
- lead students to look back and reflect on answer.
- explicitly ask for justification or explanation.

Stein, M.K., Smith, M.S., Henningsen, M.A., & Silver, E.A. (Bach, J. S. (2009). *Implementing Standards-Based Mathematics Instruction.* New York: Teachers College Press.

An example task: The pencil problem

In the morning, Ms. Wilkins put some pencils for her students in a pencil box. After a while, she found that 1/2 of the pencils were gone. A little later, she found that 1/3 of the pencils that were left from when she checked before were gone. Still later, she found that 1/4 of the pencils that were left the last time she had checked were gone. At that point, there were 15 pencils in the pencil box. No pencils were ever added to the pencil box.

How many pencils did Ms. Wilkins put in the pencil box in the morning?

Solve the problem in as many different ways as you can think of, and explain each solution. Try to relate your different solution methods to each other.

Beckman, S. (2005). *Activity Manual for Mathematics for Elementary Teachers.* New York: Pearson, p. 486.

Which Mathematical Practices might you be seeing?

MP.1 Make sense of problems and persevere in solving them.

MP.2 Reason abstractly and quantitatively.

MP.3 Construct viable arguments and critique the reasoning of others.

MP.4 Model with mathematics.

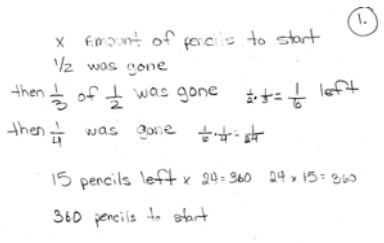
MP.5 Use appropriate tools strategically.

MP.6 Attend to precision.

MP.7 Look for and make use of structure.

MP.8 Look for and express regularity in repeated reasoning.

Student work example



Drawing a diagram – step 1

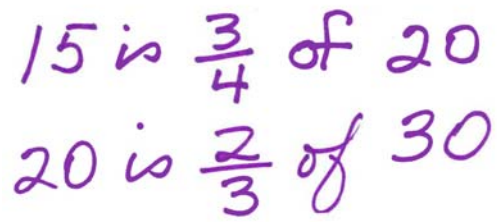
Drawing a diagram – step 2

Drawing a diagram – step 3

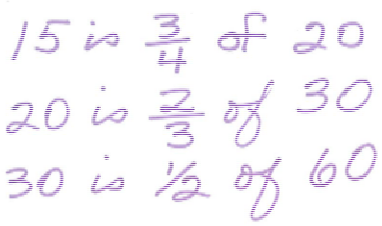
Working backward – step 1

15 is $\frac{3}{4}$ of 20

Working backward – step 2



Working backward – step 3



Mathematical Practices: Impact on curricula

- One or more Standards for Mathematical Practice should be evident in every lesson.
- Students need opportunities to experience *all* of the Standards for Mathematical Practice over the course of a unit or a level of study.
- Prompts may be needed for the teacher to recognize when and what to watch for in students' mathematical thinking.

Congratulations!

You have completed Module 1

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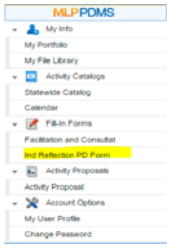
The Key Shifts for Mathematics

The **Individual Reflection Professional Development Form** is available to Division-funded staff to document completion of this on-demand PD activity. Completion of this form is optional.

1. Log into My Learning Plan (www.mylearningplan.com)
2. Click on **Ind Reflection PD Form.**
3. Click on **Fill-in Form.**
4. Complete all fields and click **Save Log Entry.**
5. Click **Submit log entries for approval.**
6. Administrators will be required to approve the form before staff will see the activity listed in their My Learning Plan portfolio.



You have successfully completed this module.
Please download any resources before exiting the lesson.