Standards For Mathematical Practice

Our session will start momentarily. While you are waiting, please do the following:

Enter/edit your profile information by going to:

•Tools - Preferences - My Profile…

•Fill out the info on the "identity" tab and click "OK"

•To view the profile of another use, hover your mouse over his or her name in the participants window

Configure your microphone and speakers by going to:

•Tools – audio – audio setup wizard

Confirm your connection speed by going to:

•Tools – preferences – connection speed

Clearing up confusion:

- This webinar is not about CCGPS content, it is about using the CCGPS Mathematical Practices this year with GPS content.
- For information about how and why CCSS were developed and adopted, watch: common core- teaching channel and this: common core- math- teaching channel
- GPS is taught and tested 2011-12. CCGPS is taught and tested 2012-13.
- I will provide a list of resources at the end of this webinar.

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Welcome!

- Thank you for taking time out of your day to join this discussion.
- You should end the session today with at least 3 takeaways- *something you can do tomorrow, a list of resources, something to think about*.

Think for 30 seconds, then share-

What is learning?

What defines an effective classroom?

How do students become proficient in mathematics?

Answers from classroom teachers

- Learning happens when a student can make connections.
- Learning happens when a student can make sense of mistakes.
- Learning happens when students can think about their thinking.
- An effective classroom is a place where students are doing the work.

Dr. Lewin video can be found at:

http://www.youtube.com/watch?v=7Zc9Nuoe2Ow

Is this learning?

Is this an effective classroom?

Are Dr. Lewin's students becoming proficient in mathematics?

- Attendance in Professor Lewin's classes fell by 40% by the end of the term.
- 10% of Professor Lewin's students failed his Mechanics class.
- 14% of Professor Lewin's students failed his Electricity & Magnetism class.

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Where do we begin in creating a classroom environment which encourages students to take responsibility for their learning and allows them to become proficient in mathematics?

CCGPS Standards for Mathematical Practice

1. Make sense of problems and persevere in solving them 6. Attend to precision	2. Reason abstractly and quantitatively 3. Construct viable arguments and critique the reasoning of others	Reasoning and explaining
	4. Model with mathematics 5. Use appropriate tools strategically	Modeling and using tools
	7. Look for and make use of structure. 8. Look for and express regularity in repeated reasoning.	Seeing structure and generalizing

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Starting now: we can begin using Standards for Mathematical Practice

- "The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important 'processes and proficiencies' with longstanding importance in mathematics education."

  (CCSS, 2010)

- The mathematical practices require a "re –negotiation" of the classroom contract. (Classroom contract is often "sit, take-in, regurgitate")

- 3 Major Shifts:
  - Teachers cannot create learning-only learners can do that.
  - Increased student responsibility- from receptive to active learner
  - Teacher/student relationship shift- from adversarial to collaborative

  Black and Wiliam, 2006

So what does the teacher do?

- Focus on more on learning, less on teaching.
- Ask questions related to the ideas the students are constructing, questions that illuminate the learner's thinking.
- Provoke disequilibrium.
- Allow productive struggle.
- Think differently. Many of us have seen math as something to be learned, practiced, and applied. Now it is understood as interpreting, organizing, inquiring, and constructing meaning using a mathematical lens.

Chew on this for a moment:

"Am I really interested in getting to know what is in *their* heads, or,

do I just want them to know what is in *my* head?"

Ann Shannon, 2011

What Not to Do

- Problem solving Friday
- Enrichment for the few
- Just give the answer
- Isolate content from process

Otherwise, it may lead to this…

Who Wants to be a Millionaire video can be found at:

http://www.youtube.com/watch?v=BbX44YSsQ2I

CCGPS Standards for Mathematical Practice

These are the backbone of the practices.

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1. Make sense of problems and persevere in solving them.
- Mathematically proficient students:
  - start by explaining to themselves the meaning of a problem and looking for entry points to its solution.
  - can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends.
  - check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?"

6. Attend to precision.
- Mathematically proficient students:
  - try to communicate precisely to others.
  - state the meaning of symbols they choose, including using the equal sign consistently and appropriately.
  - are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem.
  - calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context.

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What *teachers* do:

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

- Provide time and facilitate discussion in problem solutions.
- Facilitate discourse in the classroom so that students UNDERSTAND the approaches of others.
- Provide opportunities for students to explain themselves, the meaning of a problem, etc.
- Provide opportunities for students to connect concepts to “their” world.
- Provide students TIME to think and become “patient” problem solvers.
- Facilitate and encourage students to check their answers using different methods (not calculators).
- Provide problems that focus on relationships and are “generalizable”.

6. Attend to precision.

- Facilitate, encourage and expect precision in communication.
- Provide opportunities for students to explain and/or write their reasoning to others.

(Inside Mathematics)

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Word Problems vs Problematic Situations

- **Word problems**: Teachers assign them after they have explained operations, algorithms, or rules, and students are expected to apply these procedures to the problems.
- **Problematic situations**: Used at the beginning- for construction of understanding, generation and exploration of mathematical ideas and strategies, offering multiple entry levels, and supportive of mathematization.

(*Young Mathematicians at Work*, Fosnot, 2002)

Problem #1

What is the length of the hypotenuse of a right triangle with legs that measure 5cm and 12 cm?

(Does this question require students to engage in mathematical practices?)

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Problem #1

Original question:

What is the length of the hypotenuse of a right triangle with legs that measure 5cm and 12 cm?

New question with focus on SMP 1 and SMP 6:

What is the longest stick you can place in a box that has dimensions of 3 cm, 4 cm, and 12 cm?

Reasoning and explaining

2. Reason abstractly and quantitatively.
   - Mathematically proficient students
     - make sense of the quantities and their relationships in problem situations.
     - have the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—
     - have the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved.

3. Construct viable arguments and critique the reasoning of others.
   - Mathematically proficient students
     - understand and use stated assumptions, definitions, and previously established results in constructing arguments.
     - make conjectures and build a logical progression of statements to explore the truth of their conjectures.
     - are able to analyze situations by breaking them into cases, and can recognize and use counterexamples.
     - justify their conclusions, communicate them to others, and respond to the arguments of others.
     - reason inductively about data, making plausible arguments that take into account the context from which the data arose.

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Reasoning and explaining

What *teachers* do:

2. Reason abstractly and quantitatively.

- Provide a range of representations of math problem situations and encourage various solutions.
- Provide opportunities for students to make sense of quantities and their relationships in problem situations.
- Provide problems that require flexible use of properties of operations and objects.
- Emphasize quantitative reasoning which entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, **not just how to compute them and/or rules**; and knowing and flexibly using different properties of operations and objects.

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

- Provide **ALL** students opportunities to understand and use stated assumptions, definitions, and previously established results in constructing arguments.
- Provide ample time for students to make conjectures and build a logical progression of statements to explore the truth of their conjectures.
- Provide opportunities for students to construct arguments and critique arguments of peers.
- Facilitate and guide students in recognizing and using counterexamples.
- Encourage and facilitate students justifying their conclusions, communicating, and responding to the arguments of others.
- Ask useful questions to clarify and/or improve students' arguments.

(Inside Mathematics)

Problem #2

A parallelogram with length 2 cm and width 1.5 cm. What are the new dimensions after undergoing a dilation with a scale factor of 4?

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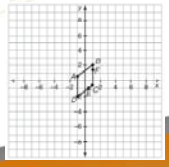
A parallelogram with length 2 cm and width 1.5 cm. What are the new dimensions after undergoing a dilation with a scale factor of 4?

Using the coordinates of the vertices of *ABCD*, determine the ordered pairs of the vertices of *A'B'C'D'*, a dilation of *ABCD* with a scale factor of 4 and its center at the origin. Label the vertices on the grid.



Modeling and using tools

4. Model with mathematics.
   - Mathematically proficient students:
     - can apply the mathematics they know to solve problems arising in everyday life, society and the workplace.
     - can apply what they know and are comfortable making assumptions to simplify a complicated situation, and realize when these assumptions must be changed.
     - are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas.
     - can analyze those relationships mathematically to draw conclusions.
     - routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5. Use appropriate tools strategically.
   - Mathematically proficient students:
     - consider the available tools when solving a mathematical problem.
     - are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations.
     - are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems.
     - are able to use technological tools to explore and deepen their understandings of concepts.

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Modeling and using tools

(what teachers do)

4. Model with mathematics.

- Provide problem situations that apply to everyday life.
- Provide rich tasks that focus on conceptual understanding, relationships, etc.

5. Use appropriate tools strategically.

- Provide a variety of tools and technology for students to explore to deepen their understanding of math concepts.
- Provide problem solving tasks that require students to consider a variety of tools for solving. (Tools might include pencil/paper, concrete models, empty number line, ruler, calculator, etc.)

(Inside Mathematics)

Problem #3

Plot the following points and connect them with a line. (0,0), (1,1), (2,2), (3,2), (4,2), (5,3), (6,4)

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Plot the following points and connect them with a line. (0,0), (1,1), (2,2), (3,2), (4,2), (5,3), (6,4).

Draw a graph for the following story:
A person who walks two blocks at a moderate speed, waits at an intersection for a short time until the "walk" light turns "green," then walks the next block more slowly, and finally runs the final two blocks very rapidly.

Seeing structure and generalizing

7. Look for and make sense of structure.

- Mathematically proficient students:
  - look closely to discern a pattern or structure.
  - can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects.
  - recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems.
  - can step back for an overview and shift perspective.

8. Look for and express regularity in repeated reasoning.

- Mathematically proficient students:
  - notice if calculations are repeated, and look both for general methods and for shortcuts.
  - maintain oversight of the process, while attending to the details.
  - continually evaluate the reasonableness of their immediate results.

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Seeing structure and generalizing

(what teachers do)

7. Look for and make sense of structure.

- Provide opportunities and time for students to explore patterns and relationships to solve problems.
- Provide rich tasks and facilitate pattern seeking and understanding of relationships in numbers rather than following a set of steps and/or procedures.

8. Look for and express regularity in repeated reasoning.

- Provide problem situations that allow students to explore regularity and repeated reasoning.
- Provide rich tasks that encourage students to use repeated reasoning to form generalizations and provide opportunities for students to communicate these generalizations.

(Inside Mathematics)

Problem #4

From a graph you have decided, y = .85x, what is y when x = 35?

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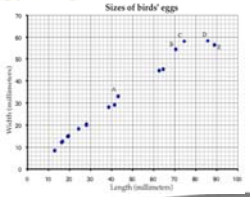
Another sample of similar birds has eggs with a length of 35 millimeters on average. If these birds follow the trend in the scatterplot, about what width would you expect these eggs to be, on average?



Where can we start?

- GaDOE Teaching Guides
- http://public.doe.k12.ga.us/ci_services.aspx?PageReq=CIServMath
- Learning Village
- https://portal.doe.k12.ga.us/LearningVillageLogin.aspx
- List Serve
- join-mathematics-k-5@list.doe.k12.ga.us
- join-mathematics-6-8@list.doe.k12.ga.us
- join-mathematics-9-12@list.doe.k12.ga.us
- join-mathematics-districtsupport@list.doe.k12.ga.us
- join-mathematics-administrators@list.doe.k12.ga.us
- join-mathematics-resa@list.doe.k12.ga.us

- Inside Mathematics
- http://www.insidemathematics.org/
- Teaching Channel
- http://www.teachingchannel.org/videos?categories=topics_common-core

- Arizona
- http://www.ade.az.gov/standards/math/2010MathStandards/
- New York City
- http://schools.nyc.gov/Academics/CommonCoreLibrary/SeeStudentWork/default.htm
- North Carolina
- http://www.ncpublicschools.org/acre/standards/extended/
- Ohio
- http://www.ode.state.oh.us/GD/Templates/Pages/ODE/ODEPrimary.aspx?page=2&TopicRelationID=1704

Connecting the Standards for Mathematical Practice to the Standards for Mathematical Content

- The Standards for Mathematical Content are a balanced combination of procedure and understanding.
- Expectations that begin with the word "understand" are often good opportunities to connect the practices to the content.
- Students who lack understanding of a topic may rely on procedures too heavily.
- Without a flexible base from which to work, students may be less likely to :
  - **consider analogous problems, represent problems coherently**
  - **justify conclusions**
  - **apply the mathematics to practical situations**
  - **use technology mindfully to work with the mathematics**
  - **explain the mathematics accurately to other students**
  - **step back for an overview**
  - **deviate from a known procedure to find a shortcut.**
- *A lack of understanding effectively prevents a student from engaging in the mathematical practices.*

3 things?

- Something to do tomorrow?
- Resources?
- Something to think about?
- 8 SMPs
- Stop "GPS-ing" our students!
- Still hungry? Prezi.com- search for CCGPS- more resources, more food for thought. Enjoy!
- Take the 8 SMPs and become the "Dancing Guy"

Dancing Guy video can be found at:

http://www.youtube.com/watch?v=fW8amMCVAJQ

Contact

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http://prezi.com/as3zivtdozh5/ccgps-standards-for-mathematical-practice/

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