Mathematical Tasks and Assessment: Grades 3-5

- How do you believe students best learn mathematics concepts?
- What makes a math problem/activity good?

Number Talk… 213, 3 operations, no 2s or 3s

- 4 x 50 + 19 – 6 = 213
- 213 = 150 + 50 + 7 + 6
- 1,065 / 5 x 1 + 0
- 1 x 400 – 191 + 4
- 1 x 1 / 1 + (1… 212 times)

- 182, can't use the number 8…. Grade 3
- 875, no addition, no 8s
- 1 and ¼, no halves, 2 operations

Count around the class

- Rigor
  - Stopping in middle… what would 25 say without numbers in between
  - Mental computation
- Support
  - Record on screen as we go, look at pattern
  - Small groups
    - Smaller than the whole class
  - Hundreds chart for visual
  - Strategy…. + 20, -2 idea
  - Change what we skip count by…

Tasks with lower-level cognitive demands

- Memorization

  Reproducing or communicating previously learned knowledge

  Clear-cut, no ambiguity

  No connections

  Write the products:

  6 x 5 = ___

  4 x 9= ___

fluently

- Accuracy
- Flexibility
- efficiency

- 135 x 9
- 135 x 10 – 135
- 100 x 9 + 30 x 9 + 5 x 9
- 130 x 9 + 5 x 9

Tasks with lower-level cognitive demands

- Procedures w/ out connections
  - Algorithms and computational problems
  - Clear-cut, little ambiguity about the process
  - Focus on correct answer, not understanding

  - Find the product of 13 and 11.
  - There are 12 students in a group. If there are 14 groups how many students are there?

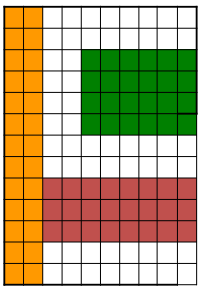
Tasks with higher-level cognitive demands

Draw a rectangle with an area of 24 square units. What are the dimensions of your rectangle? What other rectangles could you draw with the same area?

Tasks with higher-level cognitive demands

- Procedures w/ connections
  - Draw a rectangle with an area of 24 square units. What are the dimensions of your rectangle? What other rectangles could you draw with the same area?

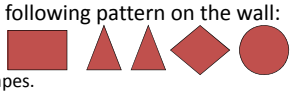
  - 24 x 1…. 50
  - 12 x 2… 28
  - 8 x 3…. 22
  - 6 x 4 … 20



Tasks with higher-level cognitive demands

- Procedures w/ connections
  - Procedures are still used but to develop deeper understanding of mathematical concepts
  - Students solve the task in “more than one way”
    - Computation, picture, graph
  - Require some degree of thinking (cognitive effort)

- You want to paint the following pattern on the wall:



- You have room for 30 shapes.
  - How many times can you paint the pattern?
  - What will the last shape be?
  - Write a number sentence to explain how you figured this out.
  - Explain in words how you figured this out.
- *Now Answer the above questions if you have room for 33 shapes. 112 shapes.*

Tasks with higher-level cognitive demands

- Doing Mathematics
  - Require students to analyze the task
  - Require students to apply relevant knowledge
  - Require students to explain their thinking and/or their rationale for how they solved the problem

Learning Theories and Tasks

Theories of learning

Behaviorism	Cognitivism (Information Processing)	Constructivism
Individuals learn about existing knowledge through practice and being able to recognize symbols.	Individuals construct knowledge by associating new experiences with prior knowledge (schema).	Individuals construct or form knowledge through personal experience.
Memorization	**Procedures without connections**	**Procedures with connections**	**Doing Mathematics**

Let's look at what these look like…

- Subtracting within 100 using various strategies (Grade 2)
- Dividing a unit fraction by a whole number (Grade 5)

- Write 1 task for each…
  - Memorization
  - Procedure w/ out connections
  - Procedures w/ connections- more than one way
  - Doing Mathematics- explanation

Task Design in the Big Picture

Task Design- Curricular materials, textbooks, teacher-made	Task Set Up- teachers' launching of the task, resources, materials	Task Implementation- students' work, teacher assistance, wrap-up

Task Design in the Big Picture

Task Design	Task Set Up	Task Implementation

What research says…..

- Teachers have a desire to pose challenging tasks
- Teachers tend to implement tasks that require materials- manipulatives, technology, etc. without the appropriate resources
- Teachers tend to decrease the demand of tasks during the set up or "launch"– they start by posing simple tasks that they intend to gradually make more difficult
- Teachers tend to decrease the demand of tasks during implementation- "students struggle and get frustrated", "tasks take too long", "it's easier to tell answers and move on."

Supporting Problem Solving

- How do we build students' capacity to solve problems?
- What are the biggest barriers to making students effective "problem solvers?"
- How can we best support teachers?

A little closer to home…

- EoG items, Level 1, 2, and 3
  - Depth of knowledge (DoK)
- Level 1--- What is the product of 2/3 and 3/4?
- Level 2 – There is ¾ of a pound of jelly beans in the bag. Miguel divides the jelly beans equally among 3 bags. He keeps 2 bags. How many pounds of jelly beans does he have?
- Level 3-- There is ¾ of a pound of jelly beans in the bag. Miguel divides the jelly beans equally among 3 bags. He keeps 1 bag. How many pounds of jelly beans did he give away?

What the levels mean…

- What are the implications for….

  a) how many students "pass" the test?

  b) growth for a student from one year to the next?

Tasks on a Daily Basis

- Does your district/school have a mathematics curriculum?
- What types of tasks are in the curriculum?
- Where in lessons/units do tasks with a high-cognitive demand appear?
- Do any of these matter?

Math curriculum…

- Recent research, state-wide from 257 Grade 3-5 teachers in NC
- Even with district curriculum of various types, all teachers supplement
  - 27% with various internet-based resources
  - 26% with teacher-created resources
  - 8% with NCDPI resources
  - 8% with district-compiled or created resources
  - 7% Teachers Pay Teachers
- What does this mean?

Tasks → Lesson Plan

- If tasks with high cognitive demand are left for the end of a lesson what might happen?
- If tasks with high cognitive demand are put at the start of a lesson what might happen?

5E, indirect instruction model

- Engage- opening activity/number talk
- Explore- 1 or 2 tasks… get out of the way
- Explain- discussion of explore… follow up task with guided practice
- Elaborate/extend- small groups, games, worksheets, follow up

Examples on NCDPI Math wiki

- NCDPI Math wiki
- Elementary
- Grade level
- Instructional resources

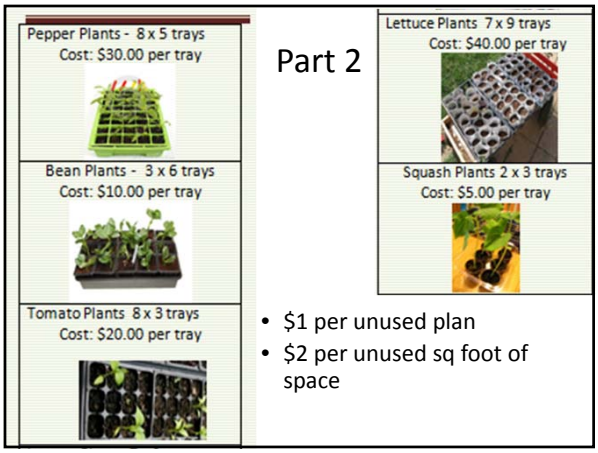
Extended Performance Tasks

- Tasks that feel more like projects
- Elementarymathematics.org
  - Assessment tab
  - Performance tasks
- Let's check one out…

Part 1

- Your garden is 26 feet by 8 feet.
- **Part A:** Design the layout of your garden by partitioning the area into 3-5 different sized rectangular sections.
- Label the dimensions of each section of the garden.
- Calculate the total area of each section and label it on the diagram above. Show your work below.
- What is the total area of your garden? Make sure to show how you solved this.

Part 2



- $1 per unused plan
- $2 per unused sq foot of space

Parts 3 and 4

- You have $150 total budget
- Are you within your budget?
- How much do you have left?
- Letter to Lowe's

Questions and contact info

- Drew.polly@uncc.edu
- http://elemath.pbworks.com
- Math add-on license for elementary mathematics
- UNC Charlotte- 100% online, no meetings
- ECU, Chapel Hill, UNC-W- 100% online, online class every 2 weeks