

Mathematical Tasks and Assessment: K-2

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

Number Talk

- $20+20 = 40$, $5+8 = 13$, $40+13 = 53$
- $25+25 = 50$, $50 + 3 = 53$ 28 became $25+3$
- 5 sets of 10... add 3... $50+3 = 53$
 - 5 sets of 10... $25 + 28$... 4 sets of 10, made 1 more 10
- 2 quarters, 3 pennies...
 - 1 quarter = 25, 1 quarter + 3 pennies = 28
 - $25 + 28 = 53$

Tasks with lower-level cognitive demands

- Memorization
 - Reproducing or communicating previously learned knowledge
 - Clear-cut, no ambiguity
 - No connections
- Write the answers:
- $$5 - 2 = \underline{\quad}$$
- $$8 + 7 = \underline{\quad}$$

fluency

- Accuracy
- Flexibility
- efficiency

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 difference between 22 and 8.
- There are 21 children on the playground. Then 17 of them line up. How many are still on the playground?

Find the difference between 22 and some number is 8.
 There are 21 children on the playground. Then some of them line up. If there are 7 left how many lined up?

Tasks with higher-level cognitive demands

- **Procedures w/ connections**
 There are 9 children in the cafeteria. Four of them are eating pizza and the rest of them are eating chicken nuggets. How many students are eating chicken nuggets? Use counters and draw a picture to show your work.

Tasks with higher-level cognitive demands

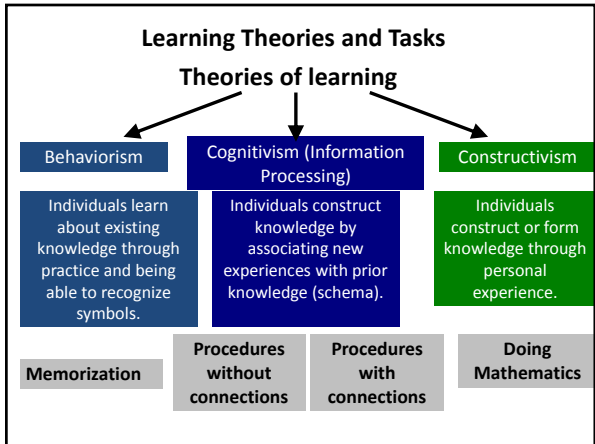
- **Procedures w/ connections**
 Procedures are still used but to develop deeper understanding of mathematical concepts
 Students solve the task in “more than one way”
 Computation, picture, graph
 Require some degree of thinking (cognitive effort)

Bunny Hopping

- A bunny can move either 1 foot or 2 feet each hop. Find different ways that the bunny can travel a total of 10 feet. Use counters and record your work on your paper. Explain how you know that your ways are different.

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



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
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Task Design in the Big Picture

Task Design	Task Set Up	Task Implementation
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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?

Another way to look at tasks...

- EoG items in Grades 3-5 are coded Level 1, 2, and 3
 - In K-2.... That might look like....
- Level 1--- What is the difference between 13 and 8.
- Level 2 – There are 13 cookies in the bag. You take some out. If there are 8 left how many did you take?
- Level 3- There are 13 cookies in the bag. If some are chocolate and some are oatmeal find the various combinations of cookies that there could be.

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...

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