Using Math Simulations to Support Rich Discussions and Investigations around Algebra Readiness

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Goals

What are interactive simulations?

How do simulations support classroom discussion?

Where do I find simulations and teaching resources?
Technology in the classroom
Technology in the classroom
Technology in the classroom
Interactive Simulations…

- Are engaging
- Are dynamic
- Are intuitive
- Link representations
- Connect to the real world
130+ sims for Physics, Chemistry, Math, Biology, Earth Science
K-12 and college
Grant-funded, open (free) educational resource
Translated into 90 languages
Can be run offline
PhET has 19 pure math sims and growing…
How do simulations support discussion?

- Sim
- Activity
- Teacher Facilitation
Sim: Function Builder

http://phet.colorado.edu
Creating an engaging activity
@PhETsims
What did you notice?

• What questions did she ask?
• What techniques did she use?
Sample Student Work

The challenge:

<table>
<thead>
<tr>
<th>Function 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table</td>
</tr>
<tr>
<td>Input (x)</td>
</tr>
<tr>
<td>-3</td>
</tr>
<tr>
<td>-1</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

Recursive Sentence: To find the next output, use the output before and add 2.

Explicit Sentence: To find each output, use the input, add 1, then multiply by 2. Or... To find each output, use the input, multiply by 2, then add 2.
What did you notice?

- What questions did she ask?
- What techniques did she use?
Activity Strategies

- Have clear and meaningful learning goals
- Start with open play
- Avoid explicit instruction
- Leverage affordances of the sim
- Use open, investigative questions and challenge prompts
Supporting student investigation and discussion

Sim

Activity

Teacher Facilitation
Teacher Facilitation Strategies

1. Make learning objectives explicit & meaningful
2. Motivate inquiry through real world connections & questions
3. Promote engagement through exploration, discussion, & sense making
   - Solicit and use student generated ideas to answer questions
   - Observe student discussions, use to seed and further discussions
   - Capitalize on unexpected learning opportunities
4. Connect between representations
5. Connect between simulation and pencil/paper
6. Monitor & measure student learning
Sim: Expression Exchange

tinyurl.com/phetEE

Expression Exchange

Basics

2 + 3

Explore

Variables

Game
Activity: Generating Equivalent Expressions

Flip to pages 6-7 to focus on the activity sheet.

What do you notice about the types of questions being asked? Discuss with people around you.
Lesson: Generating Equivalent Expressions

Look at pages 1-5 to focus on the lesson plan and teacher facilitation

*Note: this lesson aligns specifically with the GoMath curriculum*
Where do I find more simulations and resources?

http://phet.colorado.edu
Where do I find more simulations and resources?

Tips for Using PhET
PhET simulations are very flexible tools that can be used in many ways. Here, you will find videos and resources for learning about effective ways of integrating PhET simulations into your class.

A Brief Introduction to PhET:
An overview of the PhET Simulations (Download Video)

Tips and Resources for Teaching with PhET
- Planning to Use PhET
- Using PhET In Lecture: An Overview
- Interactive Lecture Demonstrations
- Using PhET with Clickers
- Designing PhET Activities for the K12 Classroom
- Facilitating PhET Activities for the K12 Classroom
- Take a Virtual PhET Workshop
Upcoming Sim Topics

Area model multiplication

Equations and inequalities on a balance

Number lines: comparing integers

Number lines: operations with integers
Equality Explorer

2x + 2 = 6