What are “Virtual Manipulatives (VM)”?
Virtual manipulatives are online manipulatives and activities that are modeled after physical manipulatives.

Why VMs?
- Increase the diversity of problems that students are able to think about and solve (Goldenberg, 2000)
- Help students become more aware of mathematical concepts and support the development of abstract representations (Sarama & Clements, 2000)
- Widespread availability (many are free)
- Prevalence of interactive whiteboards, 1-1 classrooms
Using VMs Effectively

- Promote development of conceptual understanding
- Reflection and communication (Hiebert et al., 1997)
- Using and connecting mathematical representations (NCTM, 2014)
- Task Analysis Framework
- Critique and modify/develop instructional task guides

Questions to think about...

1. What is an essential question you would use this activity to explore?
2. Where do you think your students would struggle in this activity?
3. How would your students benefit from engaging in this exploration?
4. Thinking about the essential question, what is one modification you would make so that the exploration better fits the needs of your students?
   - Why would this modification help your students engage in the essential question?

Activity 1

- Go to: [www.explorelearning.com](http://www.explorelearning.com)
- Click on Login/Enroll
- Enter the Username and Password you were given
- Select “Systems of Linear Inequalities”
Working Through an Activity

- Launch the activity
- Complete Activities A & B (C if time allows) as one of your students

Task Analysis Framework

<table>
<thead>
<tr>
<th>Affordances</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>Task primarily requires a technology task with its focus on mathematics.</td>
</tr>
<tr>
<td>A</td>
<td>Task prompts students to recall a mathematical fact, rule, formula, or definition.</td>
</tr>
<tr>
<td>B</td>
<td>Task prompts students to report information from the virtual manipulative or consider mathematical concepts, processes, or relationships in the current display. The student is not expected to provide an explanation.</td>
</tr>
<tr>
<td>C</td>
<td>Task prompts students to explain the mathematical concepts, processes, or relationships in the current display.</td>
</tr>
<tr>
<td>D</td>
<td>Task provides opportunities for students to make predictions and then test their predictions using the virtual manipulative.</td>
</tr>
<tr>
<td>E</td>
<td>Task provides opportunities for students to connect multiple representations of a mathematical concept (e.g., graphical, algebraic, and tabular representations of a relation).</td>
</tr>
<tr>
<td>F</td>
<td>Task provides opportunities to check students’ understanding of mathematical concepts, processes, or relationships. Task may provide feedback to the student based on specific errors.</td>
</tr>
<tr>
<td>G</td>
<td>Task prompts students to go beyond the current display by considering multiple examples to generalize mathematical concepts, processes, or relationships.</td>
</tr>
<tr>
<td>H</td>
<td>Task supports students’ exploration through manipulation of the display that may surprise or challenge students exploring the relationships represented by the activity and to refine their thinking based on themes within the surprises (e.g., addressing a common student misconception).</td>
</tr>
</tbody>
</table>

Critiquing/Modifying an Activity

- Use the Task Analysis Framework (handout) to critique the activity.
  - What “affordances” apply to your activity?
  - What from the activity supports your claim?

- Use the Task Analysis Framework to help you modify your activity
  - Look at the affordances that did not apply.
  - Change prompts/ portions of the activity so that the affordances do apply.

Activity 2 (if time allows)

- Related Rates (AP Calculus)
- Binomial Probabilities Gizmo (AP Stats)
- Fraction Scale (Remedial)
- Ski Slope (Early Algebra)
Parting Thoughts/Questions

Thank you!!

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