Facilitating Successful Math Problem Solving in the Dual Immersion Classroom
Success Criteria

- I can explain the steps in a problem solving lesson and the modifications for DI.
- I can explain the importance of self-regulation and purposeful struggle in problem solving in a DI class.
- I can identify resources to use in my classroom in the next few weeks.
Clear View Data

- Population
  - 40% low SED
  - 25% English Learners
  - 13% Student with disabilities
  - 69% Hispanic

- Observed Data from DI
  - Increase in conversation skills across content areas.
  - Increase in academic vocabulary for mathematics.
  - Increase in teacher confidence!

CAASPP Data for Problem Solving

<table>
<thead>
<tr>
<th>Grade</th>
<th>15/16</th>
<th>17/18</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>76%</td>
<td>87%</td>
</tr>
<tr>
<td>4</td>
<td>75%</td>
<td>88%</td>
</tr>
<tr>
<td>5</td>
<td>68%</td>
<td>79%</td>
</tr>
<tr>
<td>6</td>
<td>68%</td>
<td>87%</td>
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</table>
What’s the big deal with problem solving in DI anyway?

Myths:

- “Do what your grade level does in English, but just do it in Spanish, like a Google Translate version of problem solving.”
- “All DI kids are good at math because it just transfers so easily.”
- “If a student is struggling with both Spanish and Math, just do problem solving in English.”

Expectations:

- “Mathematical understanding (content) and procedural skill (mathematical practices) are equally important, and both are assessable using mathematical tasks of sufficient richness” ([http://www.corestandards.org/Math/](http://www.corestandards.org/Math/)).
- "Having curriculum and materials in both languages is an absolute necessity so that students have the opportunity to develop a full range of proficiency, both linguistic and cultural, in both languages" (Guiding Principles).
- "Language and language objectives should be incorporated into curriculum planning and that oral and written language and literacy should be developed across the curriculum to ensure that students can learn the academic language associated with the content and build knowledge across the curriculum" (Guiding Principles).
# Rubric for Math Problem Solving

Rubrics on pages 1-6 & Samples on pages 7-10

<table>
<thead>
<tr>
<th>Performance</th>
<th>Expert – 4</th>
<th>Practitioner - 3</th>
<th>Apprentice - 2</th>
<th>Novice – 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Understand the Problem</td>
<td>- I read the problem carefully</td>
<td>- I read the problem carefully</td>
<td>- I was able to complete two or three of the four steps.</td>
<td>- I was able to complete less than two of the four steps.</td>
</tr>
<tr>
<td>(Problem Solving)</td>
<td>- I identified the important information</td>
<td>- I identified the important information</td>
<td>- I read the problem carefully</td>
<td>- I identified the important information</td>
</tr>
<tr>
<td></td>
<td>- I created a target statement in my own words</td>
<td>- I created a target statement in my own words</td>
<td>- I identified the important information</td>
<td>- I created a target statement in my own words</td>
</tr>
<tr>
<td></td>
<td>- I selected an efficient strategy</td>
<td>- I selected a strategy</td>
<td>- I created a target statement in my own words</td>
<td>- I selected a strategy</td>
</tr>
<tr>
<td></td>
<td>- I may be able to make a connection</td>
<td></td>
<td>- I selected a strategy</td>
<td>- I selected a strategy</td>
</tr>
<tr>
<td></td>
<td>to previous problems that have already been</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>given.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Show my Strategy</td>
<td>- I showed my plan and my solution</td>
<td>- I showed my plan and my solution path using</td>
<td>- I showed some of my work using</td>
<td>- I didn’t show any work and/or it doesn’t make</td>
</tr>
<tr>
<td>(Representation)</td>
<td>using:</td>
<td>- words,</td>
<td>- words</td>
<td>sense</td>
</tr>
<tr>
<td></td>
<td>- Words</td>
<td>- numbers</td>
<td>- numbers</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Numbers</td>
<td>- pictures</td>
<td>- pictures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Pictures</td>
<td>- and/or symbols</td>
<td>- and/or symbols</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- and/or symbols</td>
<td>- in a way that would be easy for someone else to</td>
<td>- in a way that someone could understand most of my thinking</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- in a way that would be easy for someone else</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>to understand.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explain my Thinking</td>
<td>- I explained:</td>
<td>- what I knew</td>
<td>- what I knew</td>
<td>- I can’t explain what I did</td>
</tr>
<tr>
<td>(Communication)</td>
<td>- what I knew</td>
<td>- how I solved the problem</td>
<td>- how I solved the problem</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- how I solved the problem</td>
<td>- why my solution makes sense</td>
<td>- why my solution makes sense</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- why my solution makes sense</td>
<td>- using precise math language and symbols.</td>
<td>- using some math language and symbols.</td>
<td></td>
</tr>
<tr>
<td>Check My Work (Reasoning</td>
<td>- My solution makes sense</td>
<td>- My solution makes sense</td>
<td>- My solution makes sense</td>
<td>- I don’t know if my solution makes sense.</td>
</tr>
<tr>
<td>and Proof)</td>
<td>- I proved it with multiple strategies.</td>
<td>- I have shown proof.</td>
<td>- I do not know how to prove it.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- I have shown proof.</td>
<td></td>
<td></td>
<td></td>
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</table>
Learning Behaviors: 
Self-Regulation & Purposeful Struggle

- Self-Regulation: Students use strategies to monitor their own comprehension. This includes self-verbalization/self-questioning with a .64 effect size (1.5 years growth) and self-reported grades/student expectations with a 1.44 effect size (4 years growth). (Hattie, Fisher & Frey, *Visible Learning for Mathematics*, 2017)

- Purposeful Struggle: "Perseverance or continuing forward irrespective of struggle or difficulty... Struggle can be positive and can be fostered in students with good teacher support and the right classroom norms and expectations" (Pasquale, 2015).
### Process of Problem Solving

Process is, on average, five days of instruction over one to two weeks. Can be differentiated by grade-level to allow for focus in one area (p. 11 in the resource packet).

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Problem Solving Steps In Action

1. **Success Criteria**
2. **Read**
3. **Wonder/Notice**
4. **Target Statement**
5. **Apply Strategies to Solve**
6. **Explain**
7. **Reflect on Success Criteria**

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**Counting Chicken Wings**

At Annie’s Home-Cooked Chicken Wings Restaurant, chicken wings are served by the bucket. The Biggest Bucket O’ Wings is really big! Let’s figure out how many wings are in it.

If they’re removed two at a time, one wing will be left. If they’re removed three at a time, two wings will remain. If they’re removed four, five, or six at a time, then three, four, and five wings, respectively, will remain. If they’re taken out seven at a time, no wings will be left over.

What’s the smallest possible number of wings that could be in the bucket? How do you know?
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Success Criteria (Step 1)

Self-Regulation: Determine and take ownership of goals.
Purposeful Struggle: Set personalized challenges.

- What is it?
  - Success criteria answers the question: What actions and/or behaviors do I need to demonstrate by the end of this lesson to be successful?

- What does it look like in a lesson?
  - Based on a rubric, standard, language, vocabulary or discussion skill
  - Teacher or student determined

- Modifications for DI:
  - Focus on language, vocabulary & collaborative discussion (see page 13 in the resource packet)
Success Criteria in Grade 3
I Notice/I Wonder/I Know (Step 2 & 3)

Self-Regulation: Monitor own understanding.
Purposeful Struggle: Grapple with and adjust initial understandings & draw conclusions.

» What is it?
  » Students read and annotate the problem taking notes on what they notice, wonder, and know.

» What does it look like in a lesson?
  » Independently and/or collaboratively
  » Process language in multiple formats to support processing (reading, writing, speaking, listening, sketching, labeling, etc.)
  » Building on each other

» Modifications for DI:
  » Noticing and wondering extends to language, punctuation, grammar, and vocabulary (See page 14 in the resource packet)
  » Covering the number to understand the context
  » Focusing either on notice or wonder
I Notice/I Wonder in Grade 4
Target Statement (Step 4)

Self-Regulation: Determine a goal for the specific problem.
Purposeful Struggle: Focus the scope of the problem.

▸ What is it?
  ▸ A sentence frame that reflects the question(s) from the problem solving and narrows the type of answer.

▸ What does it look like in a lesson?
  ▸ Teacher and/or student created
  ▸ Use of annotations to narrow scope of the problem

▸ Modifications for DI:
  ▸ Sentence frames
  ▸ Refer to language annotations
  ▸ Use original problem for key terms
Emi tiene 14 cubos azules y 3 cubos rojos. Lalo tiene un tren con 16 cubos verdes y 4 cubos cafés. ¿Quién tiene más cubos? Compara usando el vocabulario más que, menos que, o igual a que.

Determina el número de segundos que pasarán antes de que tú y tu hermana estén abajo otra vez.

A. Si la rueda de la fortuna grande hace una revolución en 60 segundos y la rueda de la fortuna pequeña hace una revolución en 20 segundos.

El número de Segundos que pasan hasta que están las dos niñas abajo otra vez es 60. El grande va hacer una revolución y el pequeño va hacer tres revoluciones.
Collaborative Conversations (Step 6)

Self-Regulation: Monitor understanding with others.
Purposeful Struggle: Share and listen to ideas to accept, combine or refute.

► What is it?
  ► In diverse groupings (whole group, partners, triads, etc.) students explain their problem solving and their thinking.

► What does it look like in a lesson?
  ► May not be about the correct answer, but the process and the thinking
  ► Based on a class culture of risk-taking

► Modifications for DI:
  ▶ Questions, prompts and cues (see page 15 in the resource packet).
  ▶ Sentence frames (see pages 16-17 in the resource packet).
  ▶ Use annotations
Collaborative Conversations in Grade 2
Collaborative Conversations in Grade 6
Success Criteria Reflection & Goal Setting (Step 7)

**Self-Regulation:** Evaluate progress toward goals based on data.

**Purposeful Struggle:** Determine next steps for personalized challenges.

- **What is it?**
  - A way for students to measure their own growth toward the success criteria or overall problem solving goals.

- **What does it look like in a lesson?**
  - Use rubric and/or success criteria
  - Where am I now? Where am I going? (see pages 18-19 in the resource packet)

- **Modifications for DI:**
  - Sentence frames
  - Use success criteria based on language and discussion
Self-Reflection: Exit Tickets & Goal Setting in Grade 3 & 4

Mi meta para este semestre es mostrar mis estrategias usando modelos, especialmente con fracciones.

¿Qué modelo usaste? ¿Cómo fue este modelo efectivo para ayudarte a entender el problema? Apoya tu respuesta con números y operaciones.

La línea numérica me ayudó para entender el problema mejor. La operación de restar me ayudó a resolver el problema.

La próxima vez que resolvamos problemas, ¿qué te gustaría seguir practicando?

La operación de dividir es una operación que me puede ayudar resolver problemas porque es como restar. En el siguiente problema me gustaría usar la división y la resta como una operación.
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Additional Resources

- Planning Template & Sample (20-21)
- Map of our 3-year PD journey (22)
- Professional Readings & Resources (23)
Questions?

Please fill out and submit the evaluation form on page 24.

Thank You!
Contact

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Margaret Cannon: margaret.cannon@cvesd.org