The Search for a Thinking Classroom
The Search for a SUSTAINABLE Thinking Classroom
The Sustainable Thinking Classroom: Building Student Autonomy
The Sustainable Thinking Classroom: Building Student Autonomy through Student Reflections
The Sustainable Thinking Classroom: Building Student Autonomy through Student Reflections with the Curricular Competencies
My Journey

• WHY?
• Happy Gram
• My first day teaching – a disappointment
  • Students don’t use their brain ... but I guess I didn’t ask them to
• Lessons Learned from not Teaching
• Trying to implement it
Let’s Do

• **Random pairs, vertical surfaces, non-permanent.**
• Together with your partner, figure out what I did in number one. Write down what you think is happening.

1) $2 \times 5 = 6$
2) $4 \times 5 = 7$

Now, apply your understanding to questions three to five.

3) $4 \times 9 = $
4) $6 \times 7 = $
5) $5 \times 5 = $
Let’s Do

• *Random pairs, vertical surfaces, non-permanent.*
• Switch pens with your partner and try these together.

1) $14 \times 14 =$
2) $-4 \times 11 =$
3) $9 \times -1 =$
4) $8 \times \frac{3}{2} =$
5) $\frac{-2}{5} \times \frac{7}{3} =$
Let’s Do

• *Random pairs, vertical surfaces, non-permanent.*
• AGAIN, switch pens with your partner and try these together.

6) \(19 \ast (14 \ast 6) =\)

7) \((8 \ast 6) \ast (4 \ast 5) =\)

8) \((5 \ast -7) \ast (-13 \ast -9) =\)

9) \((\frac{-3}{5} \ast \frac{-2}{3}) \ast (\frac{-2}{5} \ast \frac{7}{3}) =\)

10) \(\left[\frac{-2}{5} \ast (\frac{7}{3} \ast \frac{3}{5})\right] \ast 4 =\)
Let’s Do

• *Random pairs, vertical surfaces, non-permanent.*

\[ a \star b = \frac{a + 2b}{2} \]
What does my class *typically* look like?

• Inquiry question – shared pen

Together with your partner, figure out what I did in number one. Write down what you think is happening. Then apply your understanding to questions two and three.

1) \( \log_4(64) = 3 \)
2) \( \log_4(16) = \)
3) \( \log_4(256) = \)

Challenge
4) \( \log_4(2) = \)

• Applying question – shared or individual pen

Now try applying your knowledge to the following:

1) \( \log_2(8) = \)  
2) \( \log_3(3) = \)  
3) \( \log_4(64) = \)
4) \( \log_9(3) = \)  
5) \( \log_2(128) = \)  
6) \( \log_{64}(8) = \)
7) \( \log_{64}(4) = \)  
8) \( \log_7\left(\frac{1}{7}\right) = \)  
9) \( \log_2\left(\frac{1}{4}\right) = \)
My Journey

• Problems arise in High School – High School students are missing certain skills
• The Thinking Classroom can be awesome – but it has it’s drawbacks
  • What wasn’t working and why?
Essential Skills

• Initiative—starting problems with vigor, reflecting on their work, and going beyond the questions I asked to create something new.

• Resilience—persevering through difficult problems and overcoming setbacks.

• Collaboration—working with others to solve problems, and explaining and justifying mathematical ideas to their peers.

• Responsibility—supporting both their own learning and that of the class as a whole.
Assessment

• Students value what I assess – so I need to assess what I value
• Can I assess these skills?
• Yes/No
• Radical Positive Change
Assessment

• Worth 25% of the final grade
• Every student gets assessed at least 8 times a semester
• Poorly answered self assessments receive zero till filled out properly
Assessment V1

- Just my Essential Skills

### Essential Skills Task:

<table>
<thead>
<tr>
<th>Giving Up</th>
<th>Resilience</th>
<th>Don’t Give Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doing Nothing, Talking to Friends, Wasting Time</td>
<td>Self-Motivation</td>
<td>Make Up your Own Question</td>
</tr>
<tr>
<td>Working Alone</td>
<td>Collaboration</td>
<td>Helping Others</td>
</tr>
<tr>
<td>Distracting</td>
<td>Personal and Social Responsibility</td>
<td>Working Well</td>
</tr>
</tbody>
</table>

Names: ____________ Date: 

__________ Block: 

__________
Assessment V2

- The parents...
- Core Competencies

**Essential Skills Task:**

<table>
<thead>
<tr>
<th>Giving Up</th>
<th>Critical Thinking</th>
<th>Don’t Give Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Talking to Friends, Wasting Time</td>
<td>Creative Thinking</td>
<td>Make Up your Own Question</td>
</tr>
<tr>
<td>Working Alone</td>
<td>Communication</td>
<td>Helping Others</td>
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<td>Distracting</td>
<td>Personal and Social Responsibility</td>
<td>Working Well</td>
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</tbody>
</table>

Names: ____________  Date: ____________  Block: ____________
## Essential Skills Task:
Curricular Competencies Evaluation Rubric

### Resilience / Critical Thinking

<table>
<thead>
<tr>
<th></th>
<th>3 Not Yet Meeting</th>
<th>6 Minimally Meeting</th>
<th>8 Meeting</th>
<th>10 Fully Meeting</th>
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</thead>
<tbody>
<tr>
<td>Reason</td>
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<td>Think Logically</td>
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<td>Estimate</td>
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<td>Model</td>
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<td>Conceptualize</td>
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<tr>
<td>Reflect</td>
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### Initiative / Creative Thinking

<table>
<thead>
<tr>
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<th>3 Not Yet Meeting</th>
<th>6 Minimally Meeting</th>
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<tbody>
<tr>
<td>Create</td>
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<tr>
<td>Extend</td>
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<tr>
<td>Use Tools</td>
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<tr>
<td>Adapt</td>
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<tr>
<td>Reflect &amp; Revise</td>
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### Collaboration / Communication

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<tbody>
<tr>
<td>Teach</td>
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<td>Learn</td>
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<td>Considerate</td>
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<td>Discuss</td>
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<tr>
<td>Explain</td>
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<td>Justify</td>
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</table>

### Integrity / Social Responsibility

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Accommodate</td>
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<tr>
<td>Alternate Perspectives</td>
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<tr>
<td>Make Positive Personal Choices</td>
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<tr>
<td>Positively Influence</td>
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Assessment V16

Instructions

RESILIENCE – Grade yourself on your consistency in showing resilience and critical thinking. Then answer the following questions:

- What math concept, specifically, were you having difficulty with? What was the problem? Show the math.
- How did you overcome this? Show the math.
- Link this experience with 2 competencies (shown on back).
- How can you improve?

Front

... be RESILIENT and THINK CRITICALLY

<table>
<thead>
<tr>
<th>Not Yet Meeting</th>
<th>Limited</th>
<th>Adequate</th>
<th>Capable</th>
<th>Proficient</th>
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</table>

Here is proof that I can be resilient and solve problems with persistence

I can CONSISTENTLY...

Ways I will improve are...

Back

Resilience / Critical Thinking

I show that I:

- start problem solving immediately
- do not give up, overcome setbacks when they occur

My learning (Curricular Competencies):

- Solves problems with persistence; using mistakes as opportunities to advance learning
- Develops thinking strategies to solve problems
- Develops, demonstrates, and applies mathematical understanding through inquiry, problem solving, and play
- Explores, analyzes, and applies mathematical ideas using reasoning, technology, etc
- Demonstrates fluent, flexible, and strategic thinking about mathematical concepts
- Uses visuals to explore and illustrate mathematical concepts and relationships
- Applies flexible and strategic approaches to solve problems
- Represents mathematical ideas in many ways
- Demonstrates Estimating Reasonably
- Models mathematics in situational contexts
- Involves patience and time (PPOL)
Instructions

**INITIATIVE** – Grade yourself on your consistency in showing initiative and creative thinking. Then answer the following questions:

- When finishing a task, what was the question your group **created**? Be specific. Show the math.
- What was the answer?
- What do you **like** about the question?
- To which mathematical idea(s) does it relate?
- Link this experience with 2 **competencies** (shown on back).
- How can you **improve**?

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**Front**

<table>
<thead>
<tr>
<th>... take INITIATIVE and THINK CREATIVELY</th>
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<tbody>
<tr>
<td>Not Yet Moving</td>
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</table>

Here is proof that I can take initiative and create/explore problems with curiosity and wonder

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<table>
<thead>
<tr>
<th>I can CONSISTENTLY</th>
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<tbody>
<tr>
<td>Ways I will improve are...</td>
<td></td>
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</table>

**Back**

**Initiative / Creative Thinking**

I show that I:

- find multiple ways to solve problems
- create new questions when I am done

My learning (Curricular Competencies):

- Involves thinking creatively with curiosity and wonder when exploring problems
- Involves reflecting and creating different methods to solve problems OR creating new problems that connect multiple mathematical concepts to each other
- Uses mathematical concepts to support personal choices and connect to personal interests
Assessment V16

Instructions

COLLABORATION – Grade yourself on your consistency in showing collaboration. Then answer the following questions:

- What did you have trouble with? How did your partner assist you? Be specific and show the math.
- What did your partner have trouble with? How did you assist them? Be specific and show the math.
- Link this experience with 2 competencies (shown on back).
- How can you improve?

Front

...work COLLABORATIVELY and COMMUNICATION

Not Yet Meeting | Limited | Adequate | Capable | Proficient

Here is proof that I can work collaboratively and communicate with my partner

I teach CONSISTENTLY

Ways I will improve are...

Back

Collaboration / Communication

I show that I:
- communicate well with my partner(s)
- offer assistance AND ask for assistance
- teach others and learn from others
- start conversations with my partner: teaching them and learning from them

My learning (Curricular Competencies):
- Communicates mathematical thinking in many ways
- Uses mathematical vocabulary and language to contribute to mathematical discussion - explaining and justifying mathematical ideas in many ways
- Takes risks when offering ideas in group discourse
**Assessment V16**

**Instructions**

INTEGRITY – Grade yourself on your consistency in showing integrity. Then answer the following questions:

- How did your behavior affect the well-being of the **community**?
- Did you have a positive, neutral, or negative disposition?
- Provide an example or two.
- How can you **improve**?

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**Front**

<table>
<thead>
<tr>
<th>/* show INTEGRITY and SUPPORT THE COMMUNITY */</th>
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<tbody>
<tr>
<td>Not Yet Meeting</td>
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<tr>
<td>Here is proof that I can <strong>show integrity and solve problems with a positive disposition</strong></td>
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**Back**

**Integrity / Support the Community**

I show that I:

- act politely to those in the class
- do not disrupt and distract others in the class
- actively look for ways to support the community

My learning (Curricular Competencies):

- Solves problems with positive disposition (attitude)
- Ultimately supports the well-being of the self, the family, the community. Recognizing the consequences of my actions. (FPPOI)
- Is holistic, reflexive, reflective, experiential, and relational (FPPOI)

Ways I will improve are...
Student Work - Resilience

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<tbody>
<tr>
<td><strong>Here is proof that I can be resilient and solve problems with persistence</strong></td>
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<tr>
<td>I had trouble with (-2(3x-4)) = 5 because I thought I had to add the 2 first to get rid of the (+2) but after you showed us we were wrong. I recalled that previously you showed us to divide when faced with something like (-2(3x)) and so me and my partner used this to solve the question. This is evidence of Apple's strategic approaches to solve problems.&quot; and &quot;Demonstrates fluent, flexible, and strategic thinking about mathematical concepts.&quot; because I used my past knowledge to answer the question at hand.</td>
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<tr>
<td>Ways I will improve are...</td>
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<tr>
<td>I can try to solve a problem I am facing with multiple answers instead of being fine with just one and then giving up.</td>
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</table>
Here is proof that I can **be resilient and solve problems with persistence**

I had difficulty with multiplying into the bracket. For the equation $1+10(5x+7)=4$

I thought I was supposed to add the 1+10 first and then multiply 11 by 5x and 7.

How I overcame this was, my partner told me I was incorrect and instead of just giving me the answer, which wouldn't give me an opportunity to learn, she told me to follow the 4 rules we were given. I then realized my mistake and fixed it to be $1+50x+70$. This is evidence of using mathematical understanding and ways I will improve are... using mistakes as opportunities to learn.

practice and review notes.

Beautifully written!
Student Work - Resilience

\[
\begin{align*}
1 + 10(5x + 7) &= 4 \\
1 + 50x + 70 &= 4 \\
71 + 50x &= 4 \\
71x &= 4 - 71 \\
\frac{71x}{50} &= \frac{-67}{50}
\end{align*}
\]
... be RESILIENT and THINK CRITICALLY

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Here is proof that I can **be resilient and solve problems with persistence**

We had trouble with \(-7(v-2) = -5v + 2 (8v + 7)\). When multiplying the \((-7)\) to the \(v^2\) we forgot to change it to an addition sign. (see question 1). After erasing it we did it again and found our mistake. This is evidence of - solved problems with persistence and - involves patience and time.

**Beautifully written!**

Ways I will improve are...

Instead of re-doing it we could've went through the steps.
1) $\theta_1(\theta_2) = -5v + 2(8v+7)$

$-7v - 14 = -5v + 2(8v+7)$ (what we did)

$-7v + 14 = -5v + 2(8v+7)$ (what we should have done)

$-7v + 9 = -5v + 16v + 14$

$-7v + 14 = 11v + 14 + 7v$

$11v - 14 = -14$

$0 = 18v$

$\frac{18v}{18} = \frac{18}{18} v = 0$
Here is proof that I can take initiative and create/explore problems with curiosity and wonder.

My partner and I created this question: \( -12(30x - 7) + 18 = 24(-30x + 12) \). (see question)

The answer was \( x = \frac{7}{6} \). We like to challenge ourselves, so we put in a larger number. We also saw from a nearby group that they added 3 numbers in the brackets so we did that. This relates to adding/subtracting/multiplying in algebra. This is evidence of thinking creatively when exploring problems.

- Involves reflecting and creating different methods to solve problems.

Ways I will improve are...

We could’ve improved by switching question with another group.
2) \(-12(30x - 7 + 18) = 24(-30x + 12)\)
\(-360x + 216 = -720x + 288\)
\(-360x - 132 = -720x + 288\)
\(+720x\)  \(+720x\)
\(-360x + 132 = 288\)
\(+132 +132\)
\(360x = 420\)
\(x = \frac{7}{6}\)

\[\begin{array}{c}
\frac{42}{36} \div \frac{3}{6} = \frac{7}{6}
\end{array}\]
Here is proof that I can **work collaboratively and communicate with my partner**

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I had trouble with \(-12(20x-7+18)=24(-30x+12)\). I did not know how to multiply 24 by -30 so my partner showed me (see question 3).

My partner had trouble with \(-4(-1-2n)-8=-2(1-5n)\). He did not times to get rid of the brackets. Instead, he added/subtracted. So I showed him the correct way (see question 4). This is evidence of communicates mathematical thinking and uses mathematical vocabulary.
3) \[ \frac{12}{x^{30}} \] \[ \frac{00}{360} \]

4) \[ -4(-1-2n)-8=-2(1-5n) \]

5) \[ 6n-8=-1-7n \text{ what he did} \]

6) \[ 4+8n-8=-2+10n \text{ what I showed him} \]
Here is proof that I can **show integrity and solve problems with a positive disposition**

Overall I thought I was quite a positive and helpful person in our class community. I help cut both Harvey and other groups like matters and William who were having trouble with the 2, 3, 4 as well. I solved the questions given to me but I also created new and thought question that challenged my abilities. This is evidence of “solves problems, positive attitude” and ultimately supports the well-being of the self, the family, and the community.

Ways I will improve are…
Thank you

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