Meaningful Practices to Meet the Needs of Every Learner

It's about the Process

Bridget Dunbar
Supervisor of Secondary Mathematics
St. Mary’s County Public Schools
https://elsdunbar.wordpress.com/
elsdunbar@gmail.com
@BridgetDunbar
Padlet Parking Lot

Parking Lot for #NCTMAnnual 2018
It's about the process

- What was new to you?
- What have you seen/used before?
- What's something you can see yourself trying?
- What questions do you have?

Resources from this presentation.

"Everything I learned about teaching, I learned from teaching students with special needs."
Today’s Goals
(1) WHAT
(2) HOW
(3) WHY
Language
Which One Doesn’t Belong
Which One Doesn’t Belong

What is this useful for?

• Low entry-reduces risk
• Constructing arguments
• Use of precise language
• Discriminating between mathematical objects
Desmos Polygraph Lines
Desmos Polygraph Lines

Hey, students!

Go to student.desmos.com and type in:

VPY PFK
Desmos Polygraph Lines

PICKER  
jasmine

GUESSER  
Bree

4 questions

BREE ASKED
is your slope positive
JASMINE CHOSE
No

BREE ASKED
is it negative?
JASMINE CHOSE
No

BREE ASKED
does your line go through quadrant 2
JASMINE CHOSE
No

BREE ASKED
does it go through quadrant 3
JASMINE CHOSE
No
<table>
<thead>
<tr>
<th>Slope</th>
<th>Positive</th>
<th>Negative</th>
<th>Undefined</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero slope</td>
<td>Quadrant</td>
<td>Proportional</td>
<td>Origin</td>
</tr>
<tr>
<td>Y-intercept</td>
<td>X-intercept</td>
<td>Greater than</td>
<td>Less than</td>
</tr>
</tbody>
</table>
What is the same?

What is different?
Representations
Problem → Answer

The Investigative Process
Cathy Humphreys

A question

STUMPED!

Hmm... conjecturing, questioning

systematic tinkering

proving, explaining

AHA!

tinkering

pattern shifting, observing
Find the co-ordinates of the point where these two lines meet if they are extended.
Find the coordinates of the point where these two lines meet if they are extended.

...
Find the co-ordinates of the point where these two lines meet if they are extended.

$y = mx + c$

1. $y = mx + c$

2. $y = 0.5y + 4$
Find the co-ordinates of the point where these two lines meet if they are extended.

\[ y = -1 + x \]

\[ y = 7 + \frac{1}{2}x \]

\[
\begin{align*}
-1 + x &= 7 + \frac{1}{2}x \\
\frac{1}{2}x &= 8 \\
x &= 16
\end{align*}
\]

\[(16, 15)\]
Students should be able to approach a problem from several points of view and be encouraged to switch among representations until they are able to understand the situation and proceed along a path that will lead them to a solution.

This implies that students view representations as tools that they can use to help them solve problems, rather than as an end in themselves.

Use the representations as tools
Mr. Arimoto lives 29 miles from the airport. Write and solve an equation to find the remaining distance to the airport when Mr. Arimoto has driven 14 miles.
Mr. Arimoto lives 29 miles from the airport. Write and solve an equation to find the remaining distance to the airport when Mr. Arimoto has driven 14 miles.
Mrs. Armstrong's house to the airport is 29 miles. The remaining distance is 29 miles.
There are **25** rows of seating in coach. Write and solve an equation to determine the number of seats in each row.

\[
x \cdot \frac{25}{25} = \frac{150}{25} \times \frac{25}{16} \times \frac{8}{5}
\]
<table>
<thead>
<tr>
<th>WORD PROBLEM</th>
<th>MATH DRAWING</th>
<th>SOLUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the length of a garden hose that is stretched diagonally corner-to-corner across a yard that measures 72 meters long and 60 meters wide? Round to the nearest meter.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. You’re locked out of your house. The only open window is on the second floor, 25 feet above the ground. There are bushes along the edge of the house, so you will need to place the ladder 10 feet from the house. What length ladder do you need to reach the window?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. The diagonal of a TV screen is 26 inches. The screen is 18.8 inches wide. How high is the screen?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Day 41/180: Matching angle of elevation and depression diagrams #teach180
Informal to formal
Find the Mystery Number!

Rules

- You must make both sides of the equals sign the same
- You must use the same number in each box within a question, e.g.

\[
\begin{array}{c}
5 + 5 + 5 + 10 = 5 + 20
\end{array}
\]

A. \[
\begin{array}{c}
\square + \square + \square + 2 = \square + 8
\end{array}
\]

B. \[
\begin{array}{c}
\square + \square + 3 = \square + \square + \square + 2
\end{array}
\]
Be Intentional
Solve for $x$: $3(x + 1) = 15$

\[
3(x + 1) = 15 \\
3x + 3 = 15 \\
3x = 12 \\
x = 4
\]
Flexible Procedural Knowledge

Solution pathways

Make Connections
Which is more efficient? When does it make sense to use the strategy in the middle? The others?


@GailBurrill
<table>
<thead>
<tr>
<th>One variable</th>
<th>Two variable</th>
<th>Two equations in two variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stella has $75 dollars in her savings account. She is going to add $12 each week. How long will it take her to reach $130 in her savings account?</td>
<td>Eli has $80 in his savings account. He is going to add $15 to his account each week. Write the formula that will determine the amount of money in his account based on the number of weeks he has been saving.</td>
<td>Eli has $80 in his savings account. He is going to add $15 to his account each week. Lucas has $35 in his savings account and is going to add $20 to his account each week. When will the boys have the same amount in their savings account?</td>
</tr>
</tbody>
</table>
“I used to think learning math was about doing, doing, doing…

…and now I know it’s about meaningfully doing.”
(1) WHAT
(2) HOW
(3) WHY