Choosing a good example
Hypothetical learning trajectory
Using formula for area of triangle

\[ A = \frac{(b \times h)}{2} \]

What examples should students see in order to really learn about the use of this formula?
Using formula for area of triangle
Using formula for area of triangle
Using formula for area of triangle
Using formula for area of triangle
Here are the properties Craig and I have worked on.

Typical or routine examples

Variation examples

Non-routine examples

Non-example
Here are the properties Craig and I have worked on.

Typical or routine examples allow the learner to become familiar with key features.

Variation examples highlight a key feature.

Non-routine examples deepen insight and prevent an over-reliance on superficial aspects.

Non-example (looks relevant but isn’t). The absence of key features makes that feature explicit.

What do you think?
Two schools of thought

Chinese

European
Two schools of thought: Chinese

“In contrast with “contextualization problems”, variation problems in the interest of facilitating connection concepts and methods play important roles in the eastern curriculum.”

Xuhua Su (Year) *The structures, goals and pedagogies of “variation problems” in the topic of addition and subtraction of 0 – 9 in Chinese textbooks and reference books*

Mun Yee Lai (Year) *Teaching with Procedural Variation: A Chinese Way of Promoting Deep Understanding of Mathematics*
Two schools of thought: Chinese

Xuhua Su (Year) *The structures, goals and pedagogies of “variation problems” in the topic of addition and subtraction of 0 – 9 in Chinese textbooks and reference books*
“Our conclusions...are that control of dimensions of variation and ranges of change is a powerful design strategy for producing exercises that encourage learners to engage with mathematical structure, to generalize and to conceptualize even when doing apparently mundane questions”

Two schools of thought: The West

“Our conclusions...are that control of dimensions of variation and ranges of change is a powerful design strategy for producing exercises that encourage learners to engage with mathematical structure, to generalize and to conceptualize even when doing apparently mundane questions”

Two schools of thought: The West

<table>
<thead>
<tr>
<th>Simplify these:</th>
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<tbody>
<tr>
<td>6/10</td>
<td>18/20</td>
<td>6/8</td>
<td>14/16</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Now simplify these:</th>
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<tbody>
<tr>
<td>15/25</td>
<td>45/50</td>
<td>15/20</td>
<td>35/40</td>
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</tbody>
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Compare the answers

Over to you

Addition of fractions
Expanding quadratics
Finding the length of the opposite of a right angle triangle.
Examples of mastery at KS3?

“Angles on parallel lines”

- How many hours?
- Headline objectives for each lesson?
Examples of mastery at KS3?

“Angles on parallel lines”

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 min</td>
<td>Assess prior knowledge of angles.</td>
</tr>
<tr>
<td>10 min</td>
<td>Give terms, diagrams, facts etc. of allied, alternate and corresponding angles.</td>
</tr>
<tr>
<td>20 min</td>
<td>Practice of finding missing angles (easy).</td>
</tr>
<tr>
<td></td>
<td>Lots of practice of finding missing angle problems (complex) using combinations of facts.</td>
</tr>
</tbody>
</table>
Deconstructing Teacher-Centeredness and Student-Centeredness Dichotomy: A Case Study of a Shanghai Mathematics Lesson
Rongjin Huang Frederick K. S. Leung (2005)
Corresponding angles

- same side of the transversal line *and*
- the corresponding side of the other lines
Corresponding angles
Where are another pair of corresponding angles?
Corresponding angles
Where are a pair of corresponding angles in each diagram?
Corresponding angles
Add line b and identify the angle 5 on lines b and t that corresponds with angle 4.
Corresponding angles
Add line b and identify the angle 5 on lines b and t that corresponds with angle 4.

Draw line b so that angles 4 and 5 are equal.
Corresponding angles
State a pair of corresponding angles?
Corresponding angles
Where are a pair of corresponding angles in each diagram?
Corresponding angles
Sketch a diagram where angles 1 and 2 are corresponding but not equal and angles 2 and 3 are vertically opposite.

Now construct a diagram where angles 1 and 2 are corresponding and equal and 2 and 3 are vertically opposite.
Looking at textbook page, which questions can we answer?

Mastery of parallel lines
Mastery of parallel lines

What do you think?