Responsive Instruction

Module 4

Mathematics Teaching Institute, July 27-31, 2015

Sponsored by Ohio Department of Education

- What mathematical concepts have you found **difficult** for students to learn? Why do you think these concepts are difficult for students to learn? How do you usually address these difficulties?
- What mathematical concepts have you found **easy** for students to learn? Why do you think these concepts are easy for students to learn? How do you usually address these concepts?

What are some questions students ask, or issues you encounter in working with students, that you find challenging to deal with?

An "unfair" coin has a heads side which weighs two and one-half times heavier than the tails side. If you toss this unfair coin 100 times, how many of those times would you expect to see heads? Explain why.

Student: 0% because the heavy side will land due to gravity.

How do you respond to this student?

Student: I don't understand why a negative times a negative is positive.

How do you respond to this student?

Johnny: Why do we invert and multiply when dividing fractions?

If I have $\frac{3}{5} \div \frac{7}{10}$, then I can just do $\frac{3}{5} \div \frac{7}{10} = \frac{6}{10} \div \frac{7}{10} = \frac{6 \div 7}{10 \div 10} = \frac{6 \div 7}{1} = \frac{6}{7}$.

I can do this for any two fractions:

$$\frac{3}{6} \div \frac{7}{9} = \frac{27}{54} \div \frac{42}{54} = \frac{27 \div 42}{54 \div 54} = \frac{27 \div 42}{1} = \frac{27}{42} = \frac{9}{14}$$

Sunny: I don’t understand why Johnny’s method doesn’t work for multiplication of fractions. Why can’t we use a similar procedure for finding the product of fractions?

How do you respond to both of these students?

Defining Concave Polygons

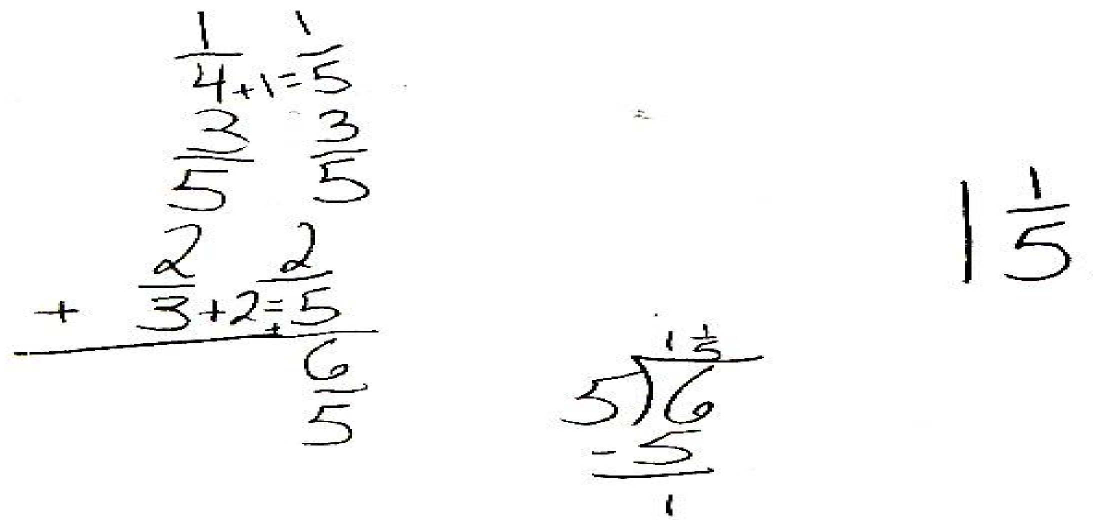
Molly: A polygons is concave if it has at least one angle larger than 180^0.

Steve: A polygon is convex if the line segment connecting any pair of points in its interior falls entirely in the interior of the polygon.

Ellie: A polygon is concave if there is at least one straight line through the polygon that crosses more than two sides.

How do you respond to these students?

Jessica needs to buy rope for a school project. She needs lengths of one-fourth foot, three-fifths foot, and two-thirds foot. How much rope does Jessica need?



The ratio of boys to girls in one class is 4/7. The ratio of the boys to girls in another class is 7/9. what is the ratio of boys to girls when the two groups are joined?

- Group 1: 11/17 since we add the numerators and then we add the denominators.
- Group 2: 36/49 – we cross multiply.
- Group 3: We are just adding fractions so take the common denominator and then add the numerators.

THE OHIO STATE UNIVERSITY

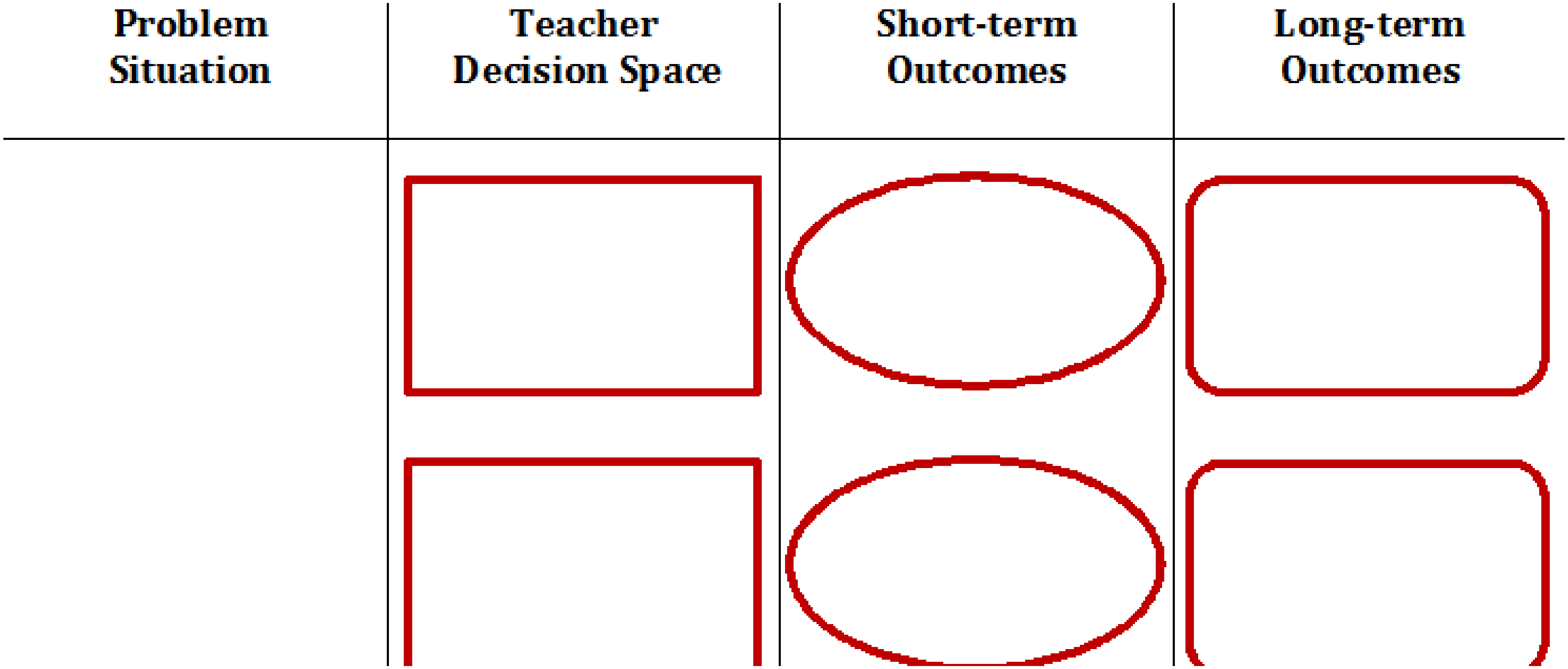
Teacher Decision-Making

Module 4

Mathematics Teaching Institute, July 27-31, 2015

Sponsored by Ohio Department of Education

Teacher Decision-Making Map



Stabilizing

- Anchoring children’s mathematical thinking and mathematical practices
- Assisting the learners to formalize their (intuitive and informal) ideas – *Bridging*
- Motivating *generative* learning
- Providing mathematically important structures for thinking

Stabilizing of the First Order

Associated practices:

- Correcting language
- Correcting methods
- Offering algorithms
- Modeling techniques
- Showing examples

Teacher listens to judge the accuracy of mathematical ideas

Stabilizing of the Second Order

Associated practices:

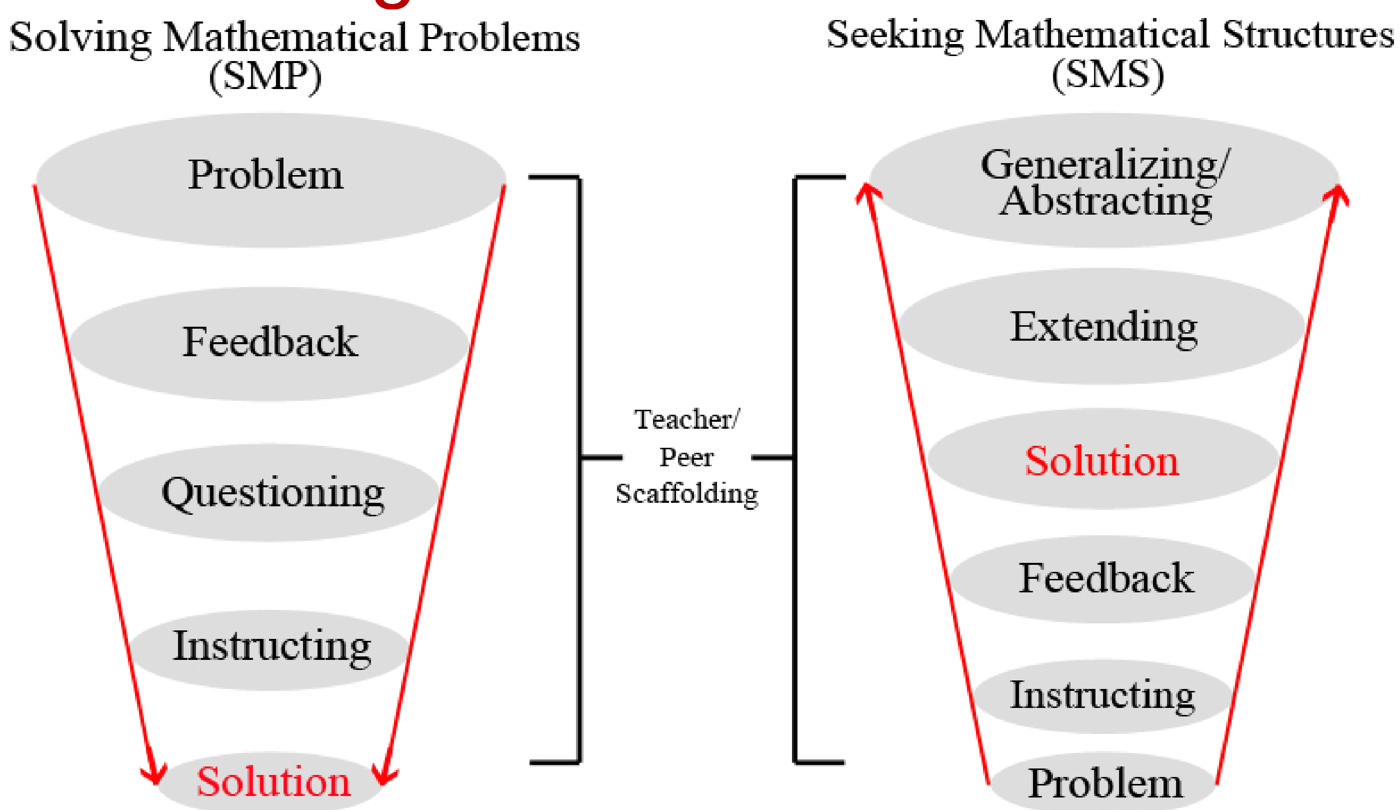
- Re-voicing ideas
- Providing scaffolds
- Suggesting techniques
- Challenging under and over generalizations

Teacher listens to interpret students' ideas and understand what they mean

Stabilizing of the Third Order

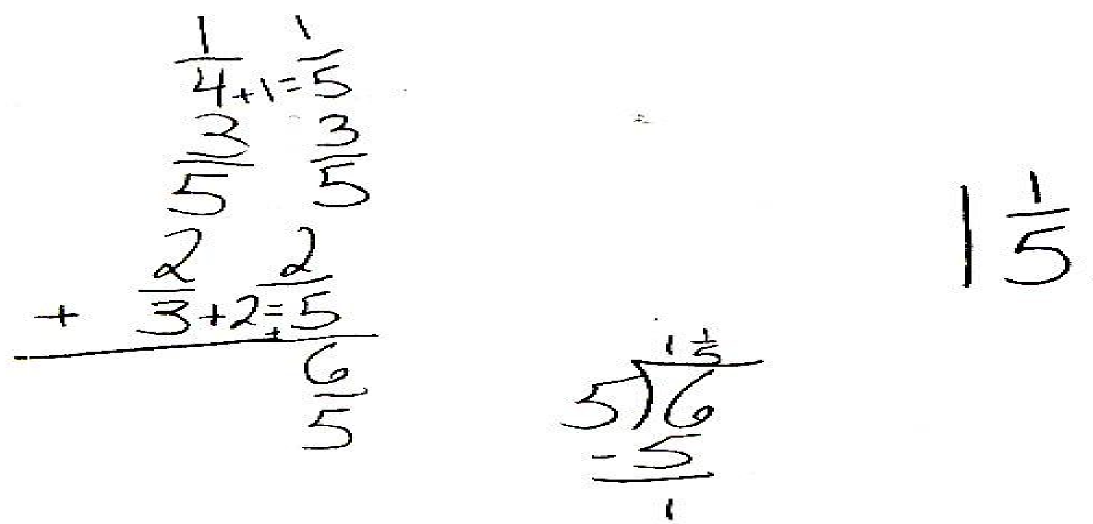
The teacher's feedback is not gauged towards achievement of some absolute truth but constructed in response to the child's milieu system. The teacher's feedback is an attempt to understand the child's way of thinking and expanding it in ways that may have little to do with the knowledge that was intended by the teacher.

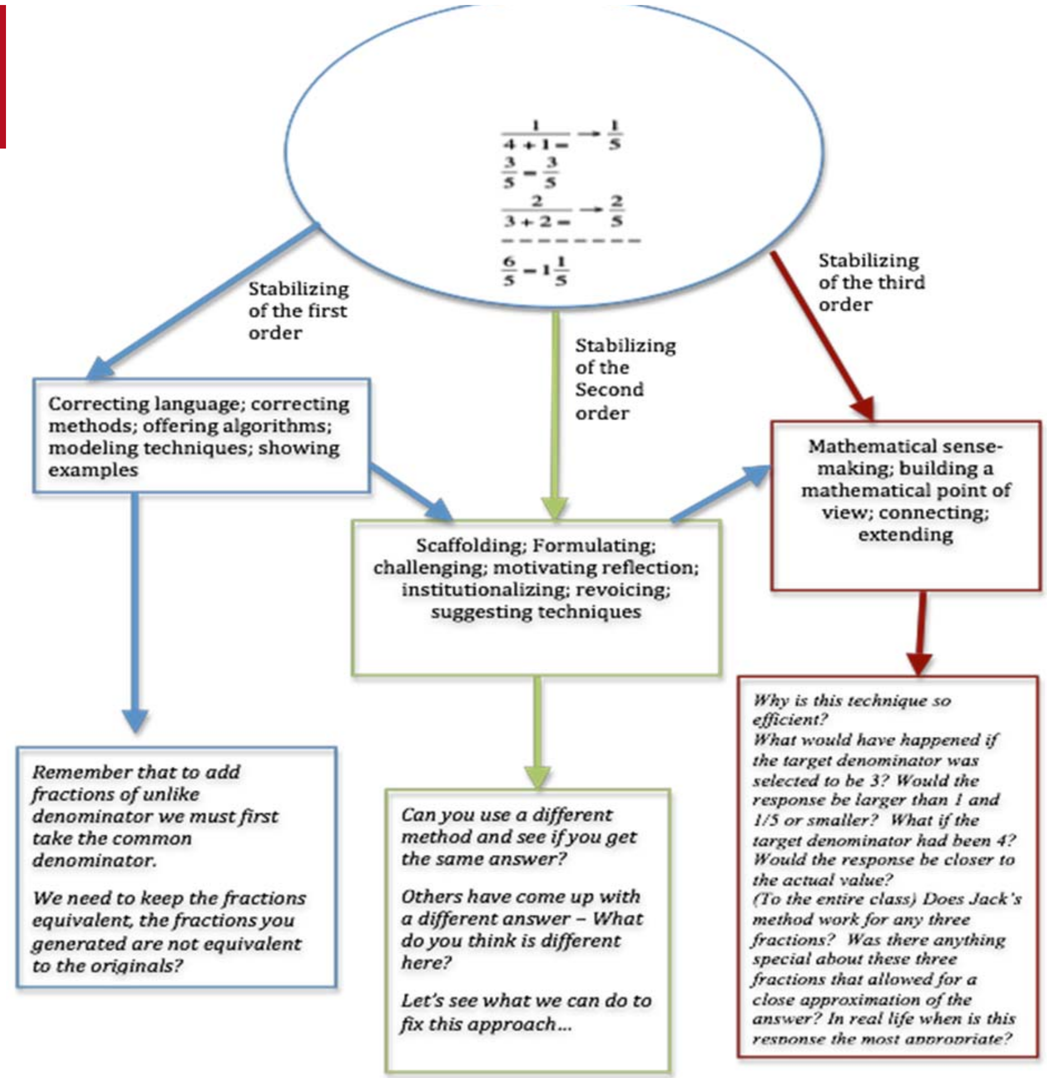
Contrasting Second and Third order Stabilizing



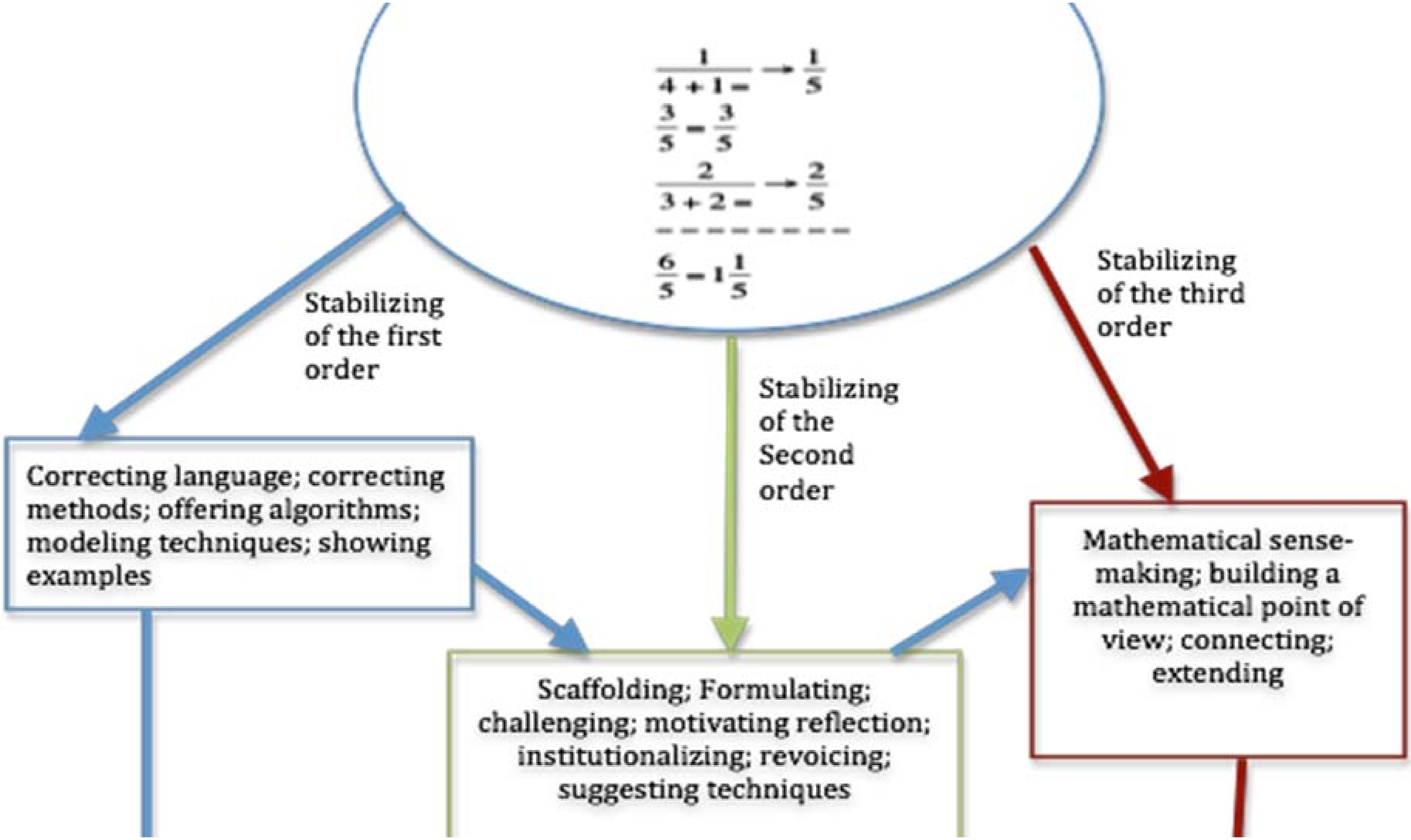
Recall:

Jessica needs to buy rope for a school project. She needs lengths of one-fourth foot, three-fifths foot, and two-thirds foot. How much rope does Jessica need?





$\frac{1}{4+1=} \rightarrow \frac{1}{5}$
$\frac{3}{5} = \frac{3}{5}$
$\frac{2}{3+2=} \rightarrow \frac{2}{5}$
$\frac{6}{5} = 1\frac{1}{5}$
Stabilizing of the first order
Stabilizing of the Second order
Stabilizing of the third order
Correcting language; correcting methods; offering algorithms; modeling techniques; showing examples
Scaffolding; Formulating; challenging; motivating reflection; institutionalizing; revoicing; suggesting techniques
Mathematical sense-making; building a mathematical point of view; connecting; extending
Remember that to add fractions of unlike denominator we must first take the common denominator.
We need to keep the fractions equivalent, the fractions you generated are not equivalent to the originals?
Can you use a different method and see if you get the same answer?
Others have come up with a different answer – What do you think is different here?
Let's see what we can do to fix this approach…
Why is this technique so efficient?
What would have happened if the target denominator was selected to be 3? Would the response be larger than 1 and 1/5 or smaller? What if the target denominator had been 4? Would the response be closer to the actual value?
(To the entire class) Does Jack's method work for any three fractions? Was there anything special about these three fractions that allowed for a close approximation of the answer? In real life when is this response the most appropriate?



Stabilizing of the first order
Stabilizing of the Second order
Stabilizing of the third order
Correcting language; correcting methods; offering algorithms; modeling techniques; showing examples
Scaffolding; Formulating; challenging; motivating reflection; institutionalizing; revoicing; suggesting techniques
Mathematical sense-making; building a mathematical point of view; connecting; extending

Remember that to add fractions of unlike denominator we must first take the common denominator.

We need to keep the fractions equivalent, the fractions you generated are not equivalent to the originals?

Can you use a different method and see if you get the same answer?

Others have come up with a different answer – What do you think is different here?

Let's see what we can do to fix this approach…

Why is this technique so efficient?
What would have happened if the target denominator was selected to be 3? Would the response be larger than 1 and 1/5 or smaller? What if the target denominator had been 4? Would the response be closer to the actual value?
(To the entire class) Does Jack's method work for any three fractions? Was there anything special about these three fractions that allowed for a close approximation of the answer? In real life when is this response the most appropriate?

Let's go back to the problems you identified earlier. In your small group, select two problems and map out how a teacher could go about dealing with those problems. Map out short and long term impact of the different decisions a teacher can make.