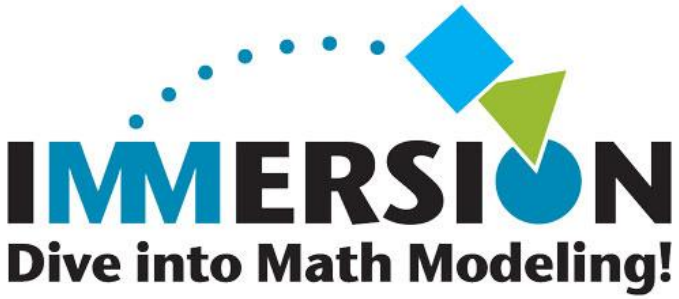

Mathematical Modeling in Elementary Grades: Outreach Activities from the Immersion Program

BETH BURROUGHS (SUBSTITUTING FOR RACHEL LEVY)
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JOINT MATHEMATICS MEETINGS
SIAM MINISYMPOSIUM ON K-8 APPLIED MATHEMATICS OUTREACH ACTIVITIES

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IMMERSION is a research and professional development program investigating mathematical modeling in the elementary grades, funded by NSF STEM-C 1441024

Professional Development

- Three sites, each with 24 participants, led by a partnership between university mathematics faculty and lead teachers from the district.
- Five day summer PD focusing on teachers as mathematical modelers (mornings) and teaching mathematical modeling in elementary grades (afternoons).
- Follow-up fall semester “teacher study groups” were facilitated by university faculty or lead teachers and supported teachers’ enactment of mathematical modeling lessons.
- Classrooms from kindergarten through fifth grade

Professional Development

- Engages teachers as modelers
- Examines the teaching modeling framework
- Supports teachers in implementing modeling with students in grades K-5

A glance at the week

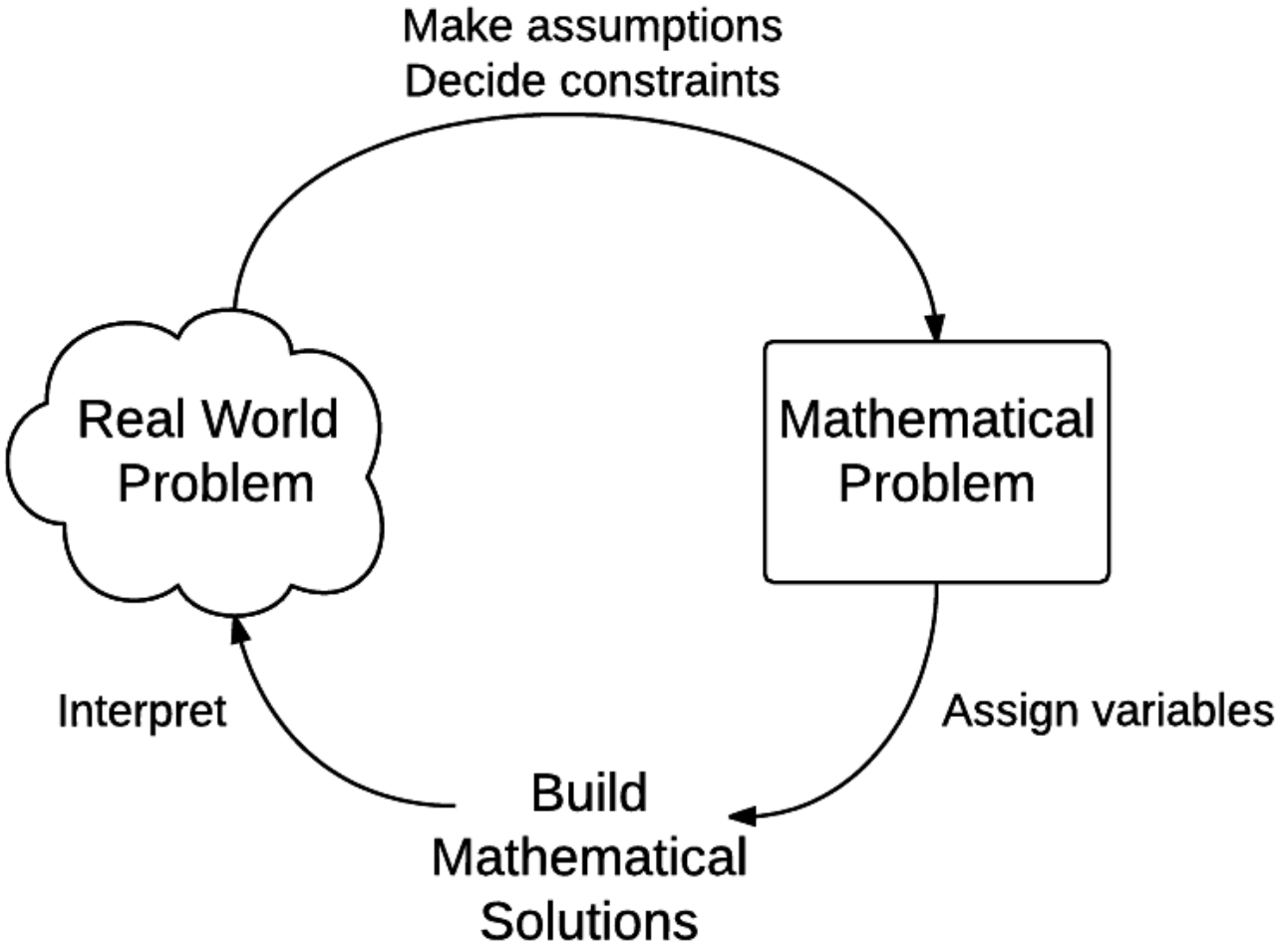
Monday	Tuesday	Wednesday	Thursday	Friday
Open-endedness & Defining Modeling	Mathematical Problem Posing & Developing	Creativity and Choices & Enacting	Revising & Revisiting	Teacher Study Groups & Differentiation

What is modeling?

A *mathematical model* is a representation of a system or scenario that is used to gain qualitative and/or quantitative understanding of some real-world problems and to predict future behavior.

Modeling is the process of creating these models. In elementary classrooms, students use mathematical tools to represent, understand, and solve real world problems.

Mathematical Modeling



Elementary students modeling

When students use their mathematical tools to make a decision, prediction, or solution about a real world situation.

What is special about mathematical modeling in schools?

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Mathematical modeling requires the modeler to make value judgments. The worth of the model is determined by its usefulness in addressing real world situations, not by the teacher or curriculum.

Complex and ambiguous

Mathematical modeling engages students in inquiry, empirical investigations, and complex judgments about how mathematics helps us understand phenomena in the world.

Modeling in schools

Mathematical modeling is an open-ended process.

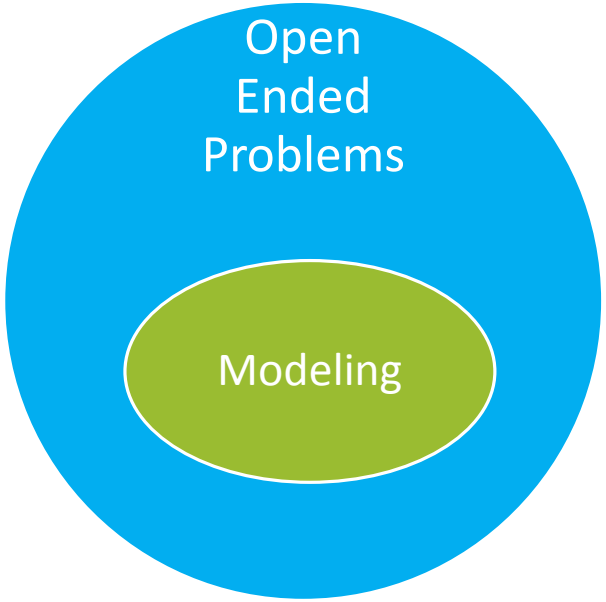
- Open in how the modeler defines the mathematical problem
- Open in the solution method
- Open in the final solution

Opportunities

The **cyclic** nature of modeling, its reliance on **open-ended** problem **posing**, and a focus on problems **without a single** correct answer provide a rich learning environment for students.

Modeling and open-endedness

Not all open-ended problems are modeling problems.



Where is the most important “open”?

We give students more opportunities to use multiple solution strategies than we give them opportunities to define their own mathematical problem.

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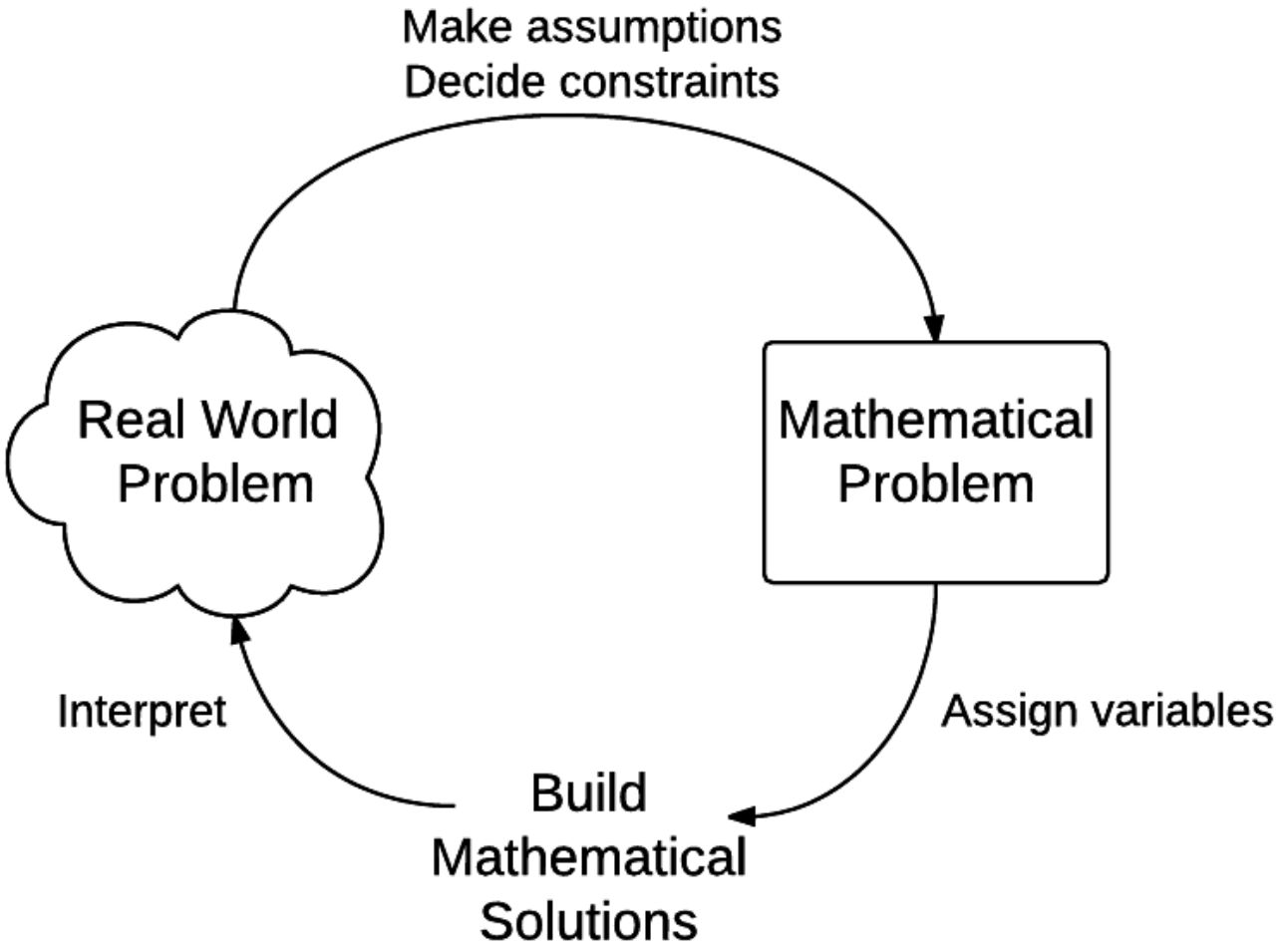
In prioritizing where to spend the time on openness with modeling, I’d choose openness in problem posing, because it’s a characterizing feature in modeling.

Mathematical Modeling in 1st grade



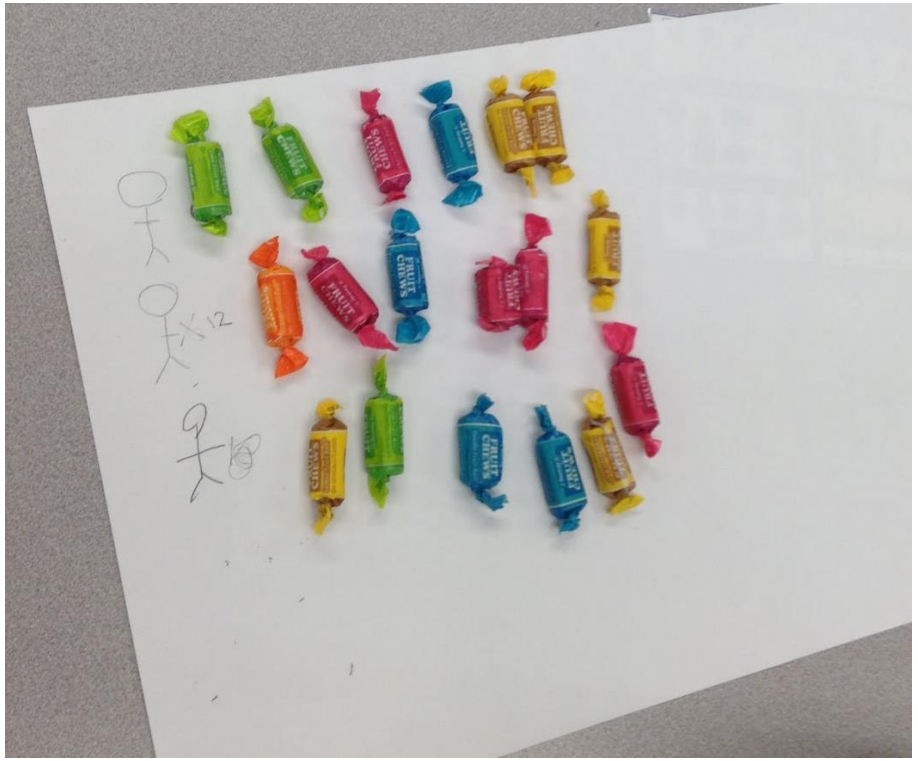
How many bags of candy do we need for our party?

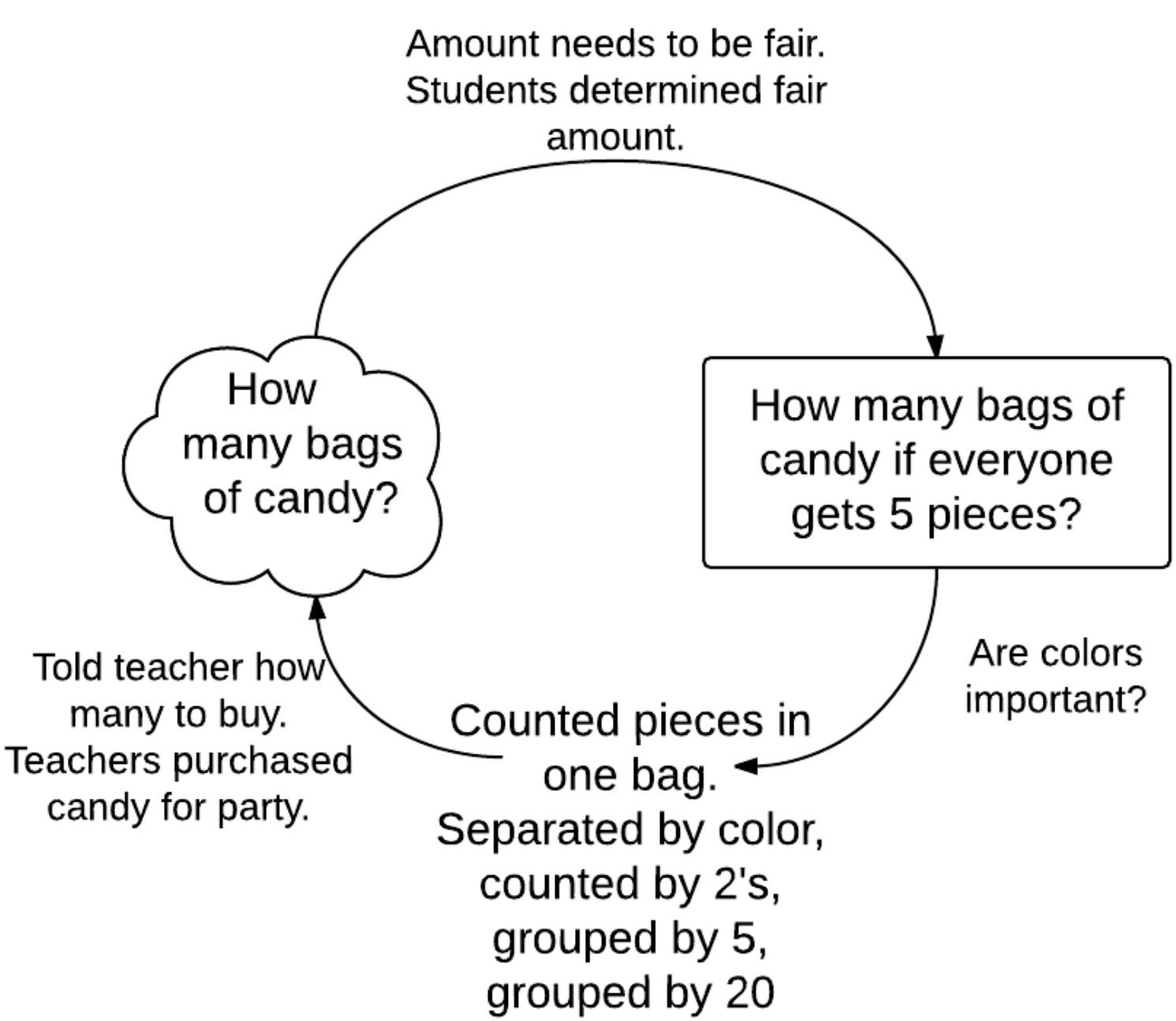
- Question was framed with a story about having candy for trick-or-treaters and need to know how many will be needed for the class.
- Since candy was purchased for trick-or-treaters each group had one bag.
- Teachers chose not to identify fairness as the priority – they posed the question to students as “how many” and let the students determine what was important.

Counting by 2’s

Separate into groups of 20


BOCATS




Amount needs to be fair.
Students determined fair amount.
How many bags of candy?
How many bags of candy if everyone gets 5 pieces?
Are colors important?
Counted pieces in one bag.
Separated by color, counted by 2's, grouped by 5, grouped by 20
Told teacher how many to buy.
Teachers purchased candy for party.

What to do with leftover candy?

5th grade task

What's the best field trip for our class?

The assistant superintendent wanted a way to evaluate all field trip proposals – created a client video asking for a model.

Ways to assess ‘Safe’, ‘Fun’, ‘Educational’ and ‘Affordable’

5 Stars	4 Stars	3 Stars	2 Stars	1 Star
Really fun (a blast)	Fun (really fun)	Kind of fun	Not so fun	Not fun (a rip)
Fun for everyone	Fun for almost everyone	Fun for half the people	Fun for not many	Fun for almost none
Kids are smiling	Most people smiling	Half of the people smiling	Drowsy eyes	No smiles
Interesting	Most people interested	Okay experience	Kind of bad experiences	Nothing to do
Lots of laughing	Talking	Happy	Talking about math	Have to be silent
Lots of movement	Happy	Talking	Standing	Falling asleep
			Listening	Boring
				No movement

Model Validation

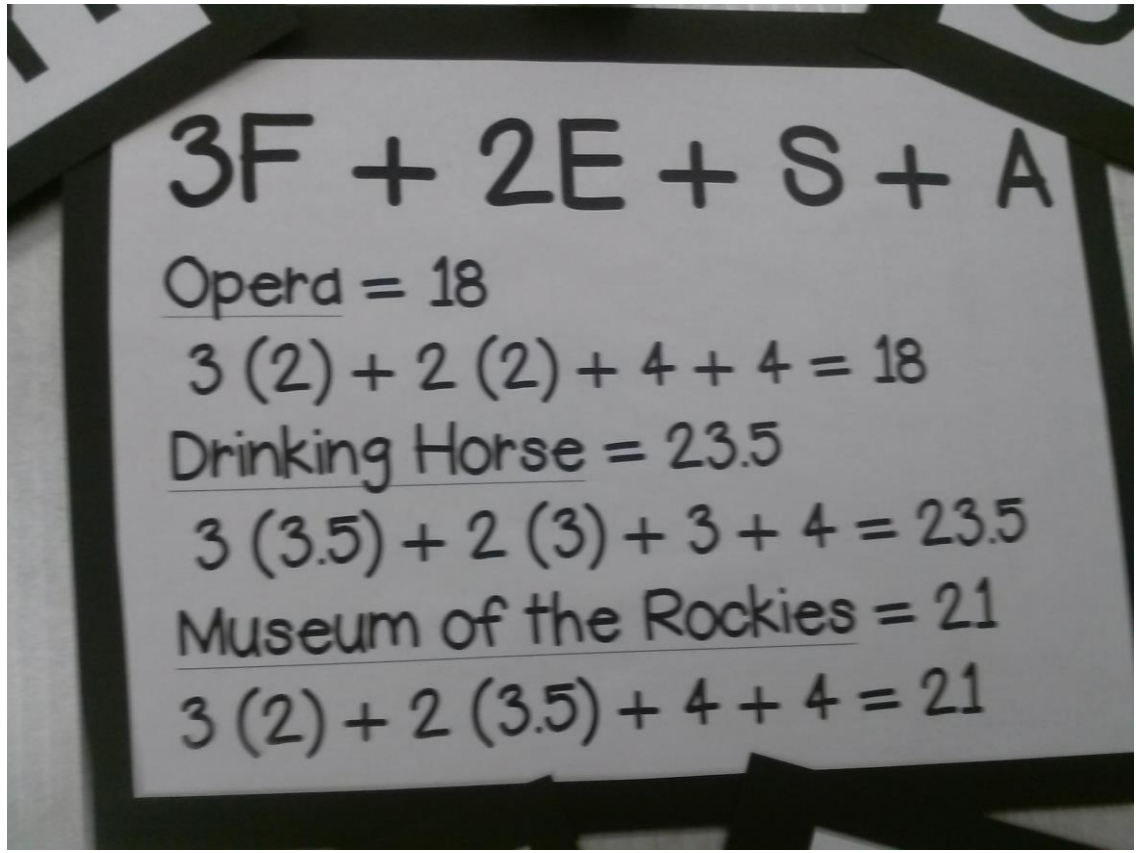
First model:

F + E + S + A

Problem – boring field trips got high scores

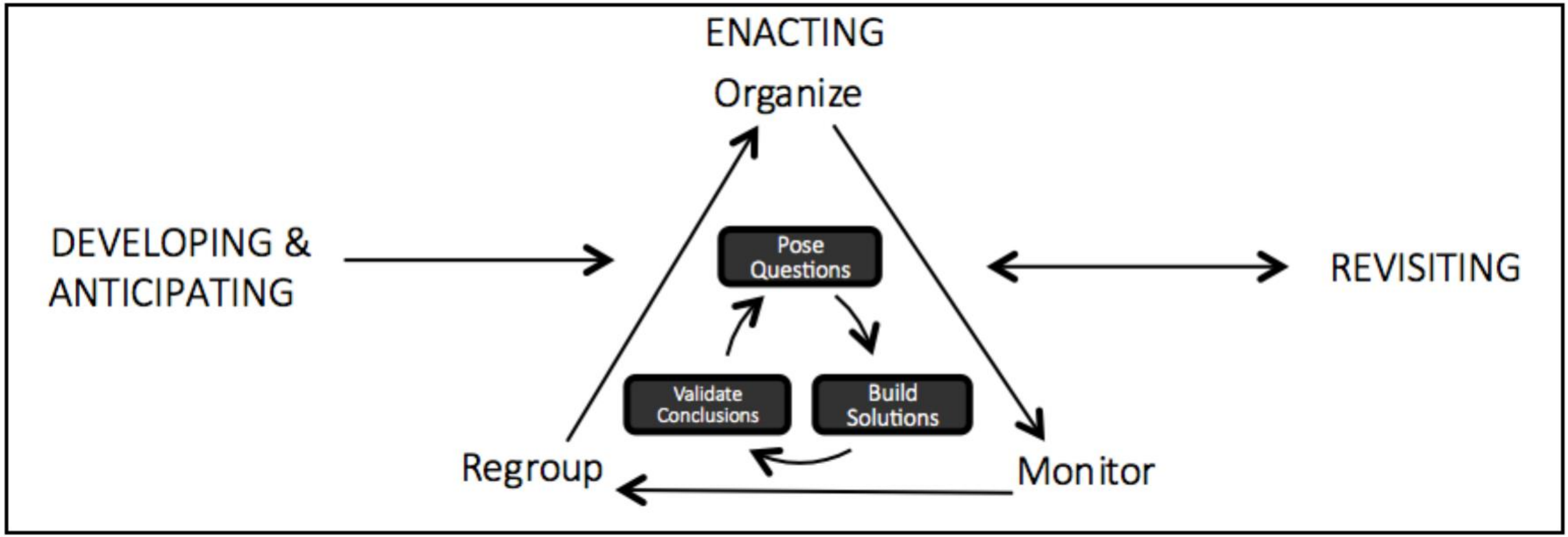
Final model:

3F + 2E + S + A



Our (initial) challenge

How do we, as teacher educators, describe and support teaching practices that give students the best chance of engaging in mathematical modeling?



(Carlson, Wickstrom, Burroughs, & Fulton, 2016)

Modeling is Important and Worthwhile

- Young children can engage in the practice of mathematical modeling.
- Teachers learn and exercise ambitious teaching practices while engaging with students in mathematical modeling.

Carlson, Mary Alice, Wickstrom, Megan H., Burroughs, Elizabeth A., & Fulton, Elizabeth. W. (2016). A Case for Mathematical Modeling in the Elementary Classroom. Annual Perspectives in Mathematics Education (APME) 2016: Mathematical Modeling and Modeling Mathematics (Chapter 11). Reston, Virginia: National Council of Teachers of Mathematics (forthcoming).