# Every Student Deserves Teachers of Mathematical Modeling

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6th-8th WORKSHOP

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9:45 -11:00 AM

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# A Quality Math Task

| | |
|---|---|
| **Aligns to the mathematics I am teaching.** | • It's in the curriculum.<br>• It is where we are in the scope/sequence. |
| **Encourages students to use representations.** | • Uses various representations<br>• Doesn't dictate representations necessarily |
| **Provides students with an opportunity to communicate their reasoning.** | • Asks them to justify their reasoning and strategies |
| **Has multiple entry points.** | • There are different ways to access, represent, begin, or solve the problem. |
| **Allows for different strategies for finding solutions.** | • There is more than one way to complete the task. |
| **Makes connections between mathematical concepts, between concepts, and procedures, and between application and procedures.** | • Helps students see/show connections and make meaning. |
| **Prompts cognitive effort.** | • Thinking/processing is needed. |
| **Is problem-based, relevant, authentic, or interesting.** | • Students connect with the context though it's not necessarily real-world. |

Bay-Williams, J.M. & Van de Walle, J.A. (2010); Lanin, J., Chval, K., Jones, D., and Dougherty, B. (2014); NCTM (2014); SanGiovanni & Novak (2016); SanGiovanni, Katt, & Dykema (2020)

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*Which three of these descriptors do you find the be most important? Why?*

# Norms for Mathematical Modeling

1. **There are many ways to see and do any problem.**
2. **We justify and defend our ideas using mathematics.**
3. **Take risks and be generous with your thinking.**
4. **Use teamwork to investigate problems.**

Source: *Becoming a Teacher of Mathematical Modeling, Grades 6-12*, p.38 (NCTM, 2021)

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# Toward Mathematical Modeling

A newspaper says that you can save A LOT of water every year if you turn off the water while brushing your teeth.

How much water can our class save in one day if we all turn off the water while brushing our teeth? How much water can we save in one week?

Create a model to support your argument.

Source: *Water Conservation Task*, p.2 (M2C3, 2018)

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# Connection to the Standards for Mathematical Practice

MP1: Make sense of problems and persevere in solving them

MP2: Reason abstractly and quantitatively

MP3: Construct viable arguments and critique the reasoning of others

MP4: Model with mathematics

MP5: Use appropriate tools strategically

MP6: Attend to precision

MP7: Look for and make use of structure

MP8: Look for and express regularity in repeated reasoning

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# Big Ideas in Mathematical Modeling

1. Modeling begins and ends outside the mathematical world.
2. Modeling deals with situations that are open and complex.
3. Modelers exercise judgment when investigating problems. These judgments stem from a set of values that may or may not be fully articulated, but are always present.
4. Modelers decide when a solution is good enough.

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Source: *Becoming a Teacher of Mathematical Modeling, Grades 6-12*, p.4 (NCTM, 2021)

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# Student & Teacher Actions During Mathematical Modeling

| Modeling Competency | Teachers Are… | Students Are… |
|---|---|---|
| Pose Mathematical Problems | | |
| Represent & Explore Situations | | |
| Interpret & Revise Solutions | | |

Source: *Becoming a Teacher of Mathematical Modeling, Grades 6-12*, p.18 (NCTM, 2021)

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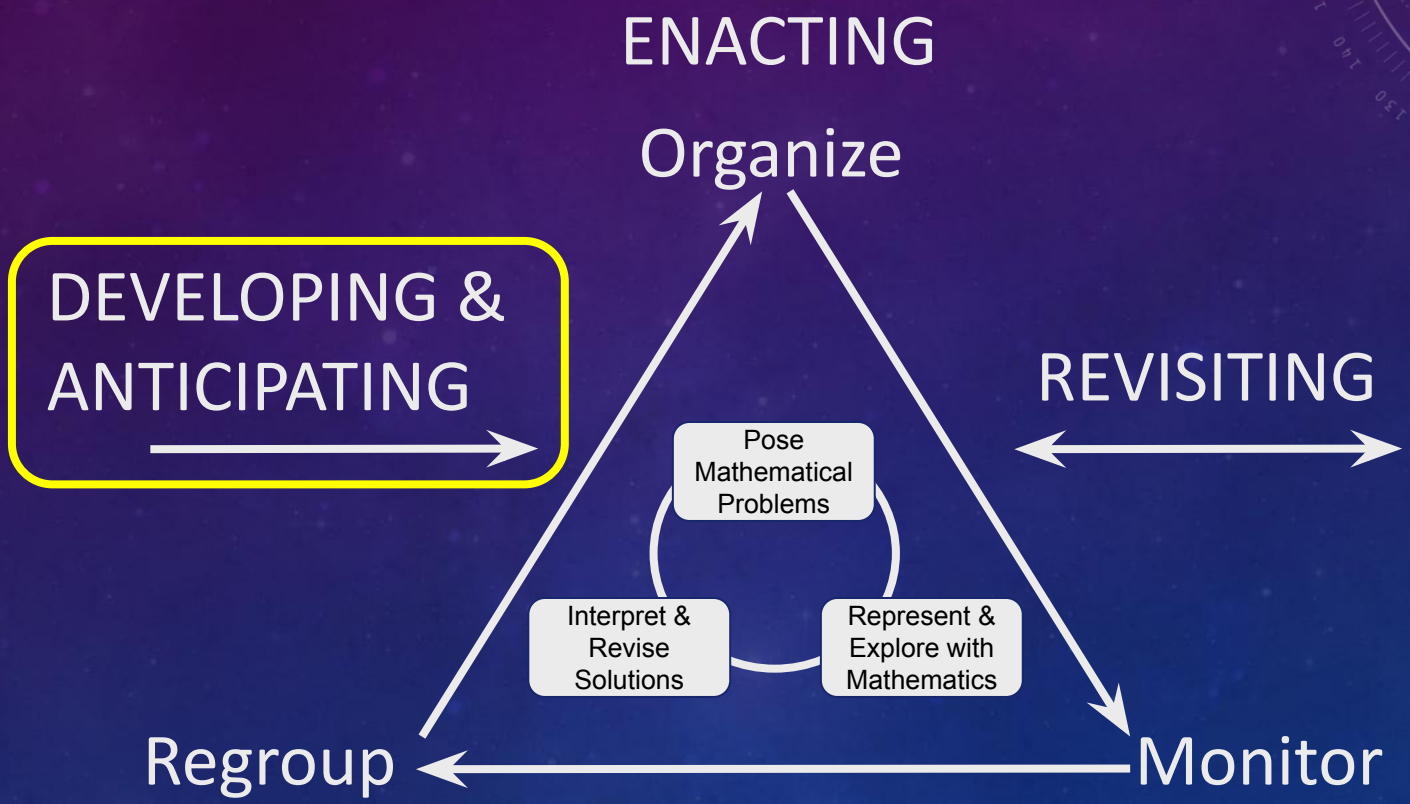
# A Framework for Teaching Mathematical Modeling




Source: *Becoming a Teacher of Mathematical Modeling, Grades 6-12*, p.42 (NCTM, 2021)

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# Pose Mathematical Problems

**Teachers…**

- share a problematic or interesting situation with students
- elicit students' ideas and questions about the situation
- make public record of student questions
- ask questions to support students in noticing the mathematics embedded in the situation

Source: *Becoming a Teacher of Mathematical Modeling, Grades 6-12*, p.18 (NCTM, 2021)

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# Mathematical Modeling

The humane society plans to produce a new social media campaign to encourage spaying and neutering.

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https://pixabay.com//?utm_source=link-attribution&utm_medium=referral&utm_campaign=image&utm_content=435452

Supermarket Shopping Empty - Free photo on Pixabay

# A Framework for Teaching Mathematical Modeling

DEVELOPING & ANTICIPATING →

How does the situation connect to your content standards?

How will you ask questions that support students' noticing of the mathematics in the situation?

Source: *Becoming a Teacher of Mathematical Modeling, Grades 6-12*, p.42 (NCTM, 2021)

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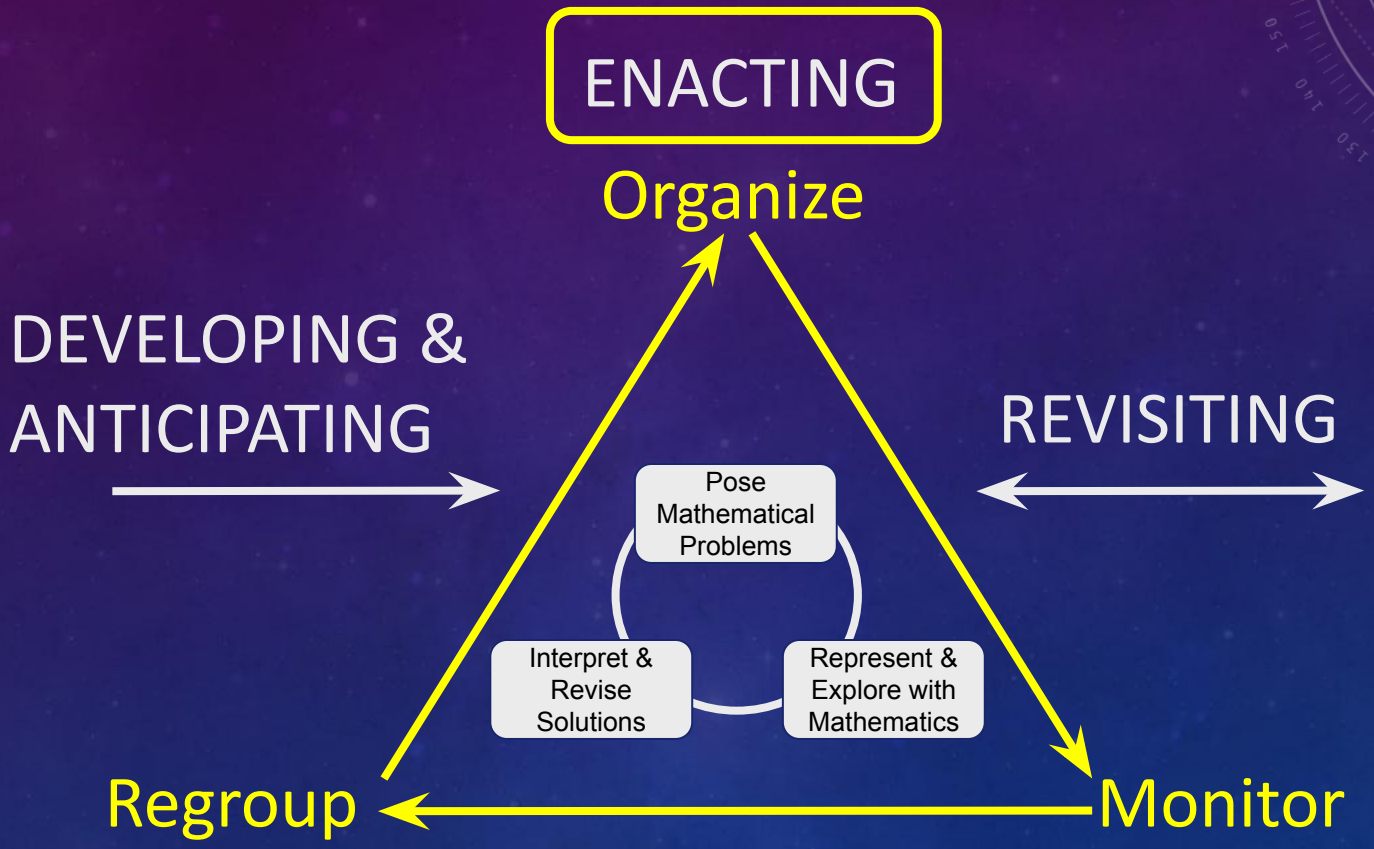


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# Represent & Explore Situations

**Teachers…**

- anticipate what mathematical strategies students might use and what resources students may need to pursue those strategies
- ask students to explain and justify the representations and strategies they are using
- facilitate opportunities for students to share their developing solutions with the class
- provide scaffolding & support when students encounter new or challenging mathematics

Source: *Becoming a Teacher of Mathematical Modeling, Grades 6-12*, p.18 (NCTM, 2021)

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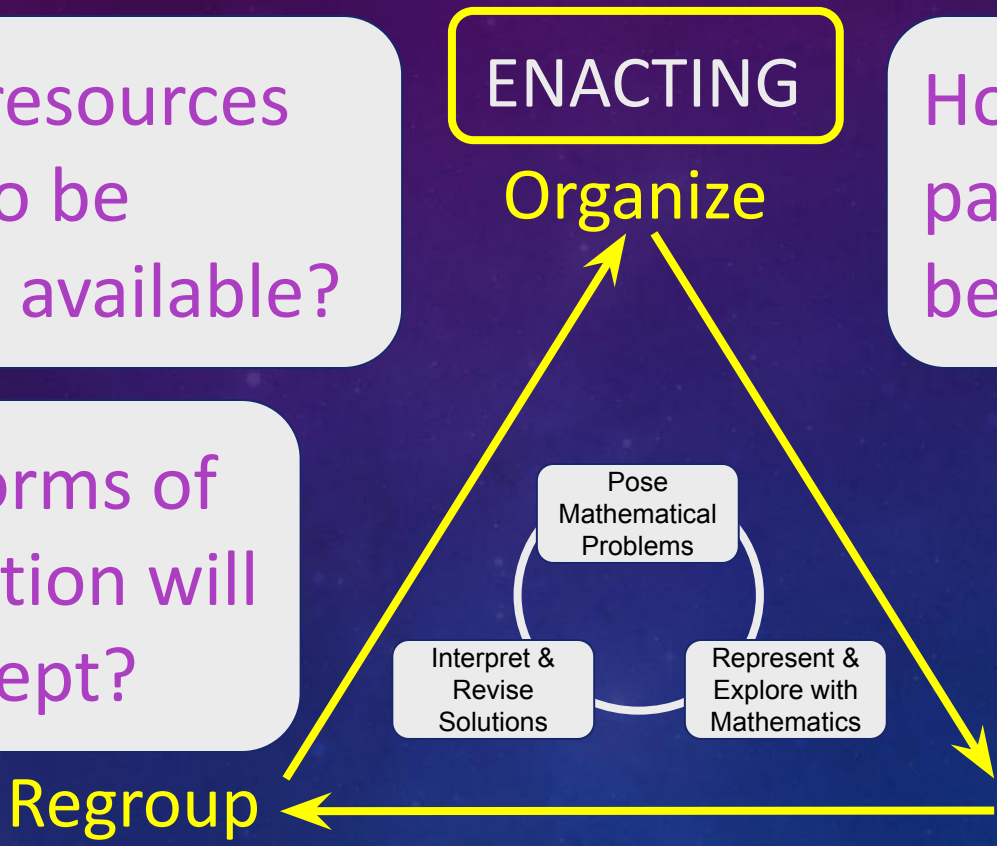
# A Framework for Teaching Mathematical Modeling

What resources need to be readily available?

How & when will partial solutions be shared?

What forms of justification will you accept?

How will you scaffold & support?

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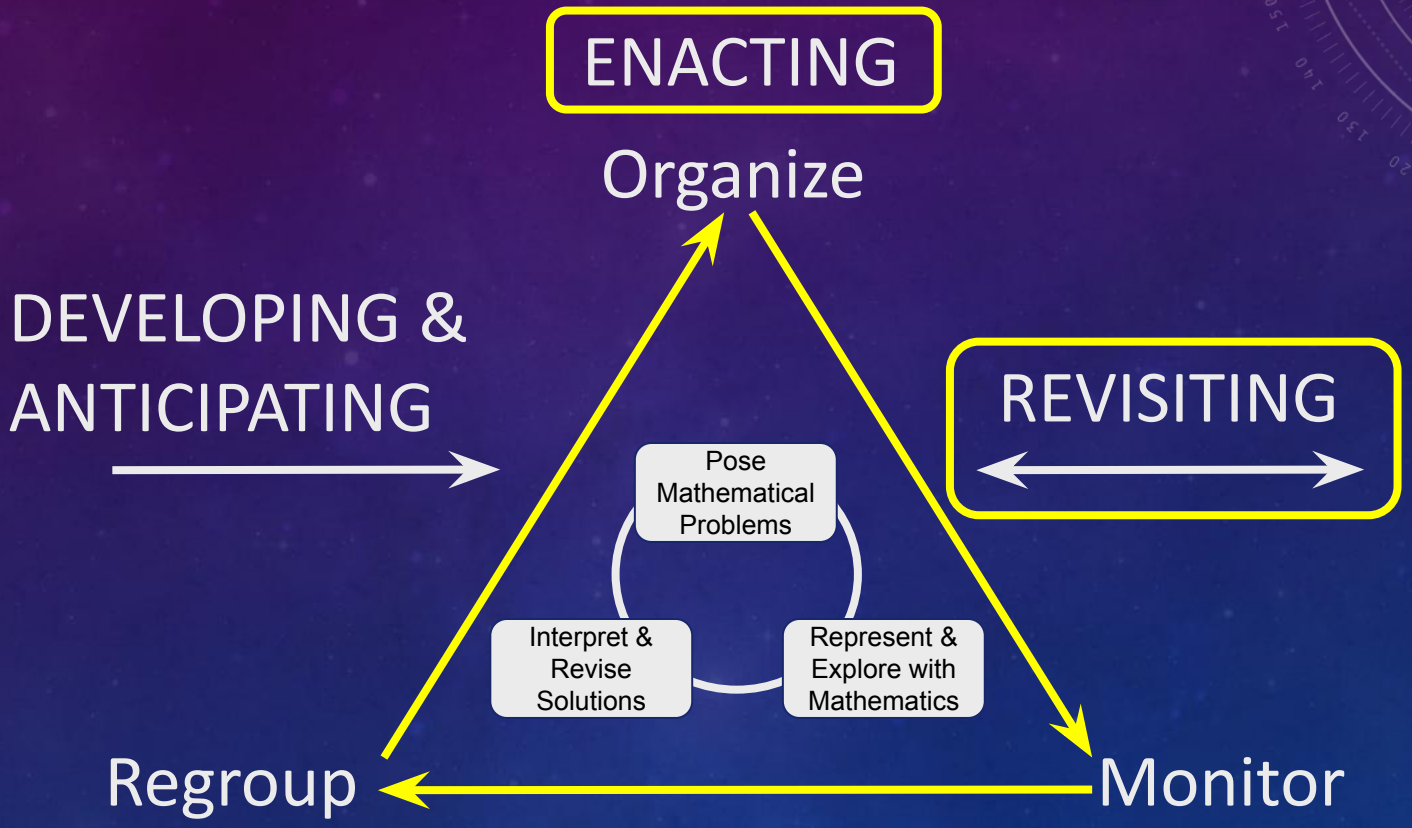


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# https://bit.ly/waterNCTM
# Interpret & Revise Solutions

**Teachers…**

- provide structure or a platform through which students can share their solutions
- facilitate connections back to the authentic situation that motivated the modeling task
- ask questions about the scope of the solution
  - Who else might our model help?
  - How could we change our solution to make it work for _____?

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Source: *Becoming a Teacher of Mathematical Modeling, Grades 6-12*, p.18 (NCTM, 2021)

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# A Framework for Teaching Mathematical Modeling

What questions will you plan to ask about the scope of students' solutions?

How will you structure student sharing of solutions?

How will you ensure students connect to the authentic task?

REVISITING

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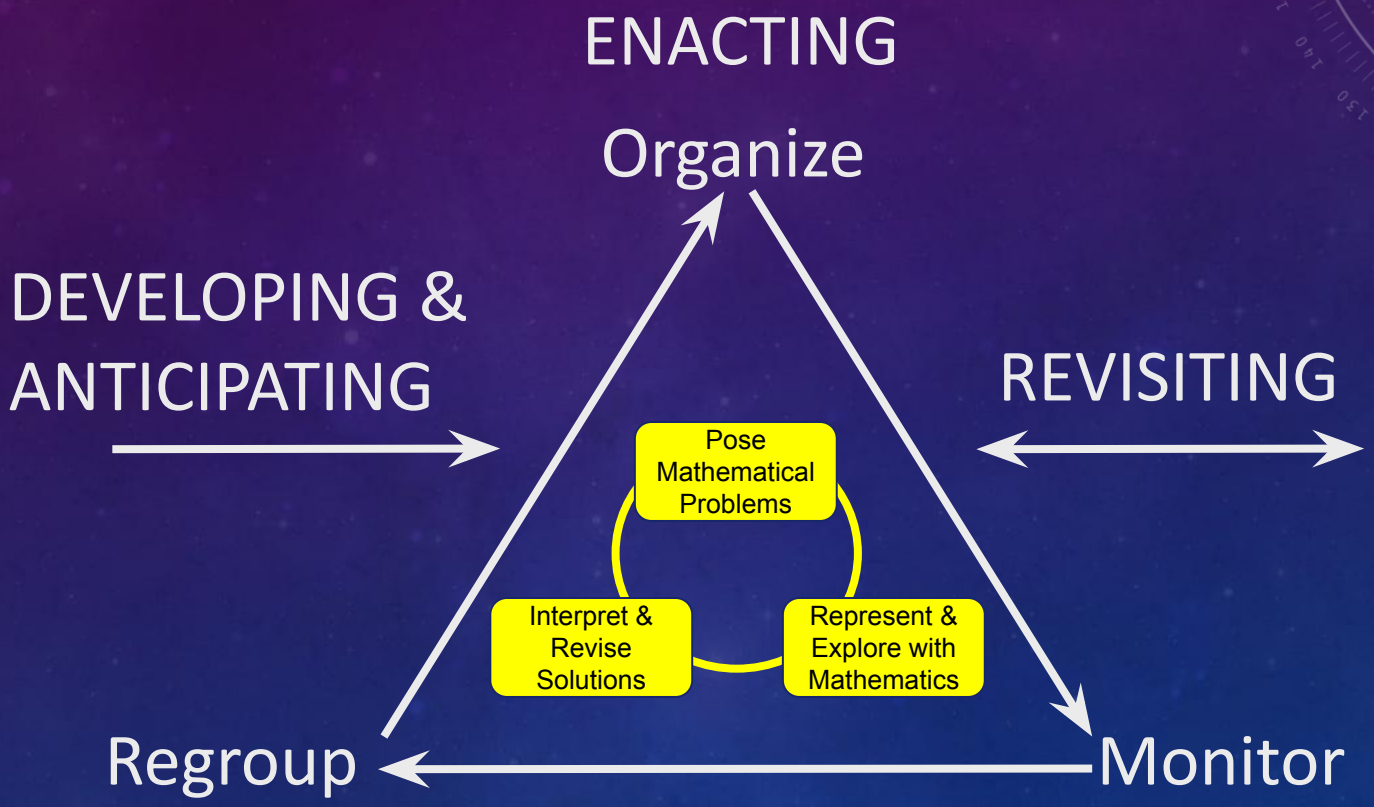


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# Pose Mathematical Problems

**Students…**

- brainstorm and share ideas and questions about the context
- identify what questions can and cannot be answered using mathematics
- select and refine mathematical questions
- pose mathematical problems that will guide their work on the modeling task

Source: *Becoming a Teacher of Mathematical Modeling, Grades 6-12*, p.18 (NCTM, 2021)

# Represent & Explore Situations

**Students…**

- decide what elements of the situation should be represented in the mathematical problem and choose how to represent those ideas
- choose mathematical resources to support their work
- document, explain, and justify their mathematical work
- listen to their classmates' approaches
- decide when and how to adjust or modify their mathematical strategies

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Source: *Becoming a Teacher of Mathematical Modeling, Grades 6-12*, p.18 (NCTM, 2021)

# Interpret & Revise Solutions

**Students…**

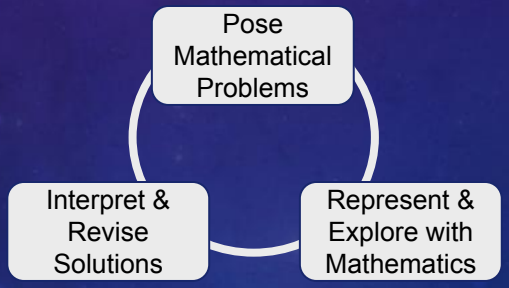
- communicate their solutions in a way that makes sense to themselves, their classmates, and other stakeholders
- interpret their solutions in light of the context of the problem
- articulate where their solution does and does not apply
- decide whether or not the solution is "good enough" and revise it as needed

Source: *Becoming a Teacher of Mathematical Modeling, Grades 6-12*, p.18 (NCTM, 2021)

# A Framework for Teaching Mathematical Modeling

As you think about the modeling task from a student perspective, what else needs to be done in preparation for the task?

How equipped are students to do this already?




How will you make these expectations known to students?

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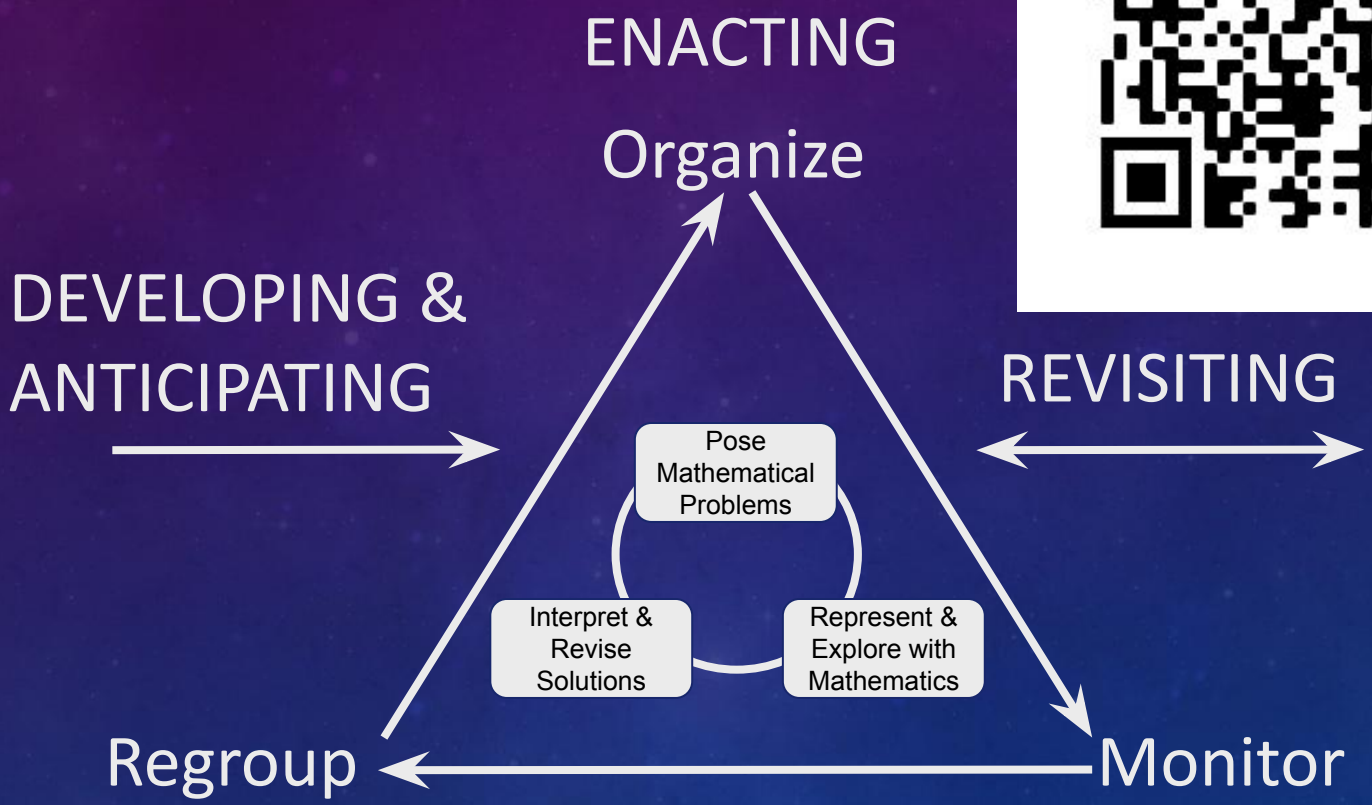


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https://tinyurl.com/MODELatNCTM

# References


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SanGiovanni, J. J., Katt, S. & Dykema, K. J. (2020). *Productive Math Struggle: A 6-Point Action Plan for Fostering Perseverance*. Corwin Press.

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