


NISMEC Modeling program for Indiana STEM Teachers

Focus 2016-17: Mentoring and Peer-Peer Interactive Support



Northern Indiana Science, Mathematics and Engineering Collaborative

- The *NISMEC* Modeling Academies for middle and high school Math and Science teachers
- Modeling for adult learning academies

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Tonight – a party for all modeling teachers and those interested in modeling.....
 starting at 6:00 p.m at the RAM restaurant downtown
 140 S. Illinois Street, between Maryland & Georgia

The Plan for this session

First - *an introduction to modeling: activity-based student learning*

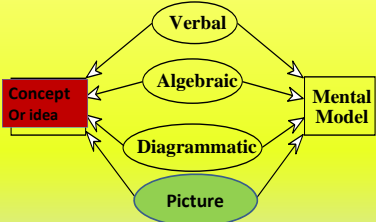
Second – a hands-on modeling experience

Third – NISMEC program of Modeling Academies 2016-17 and beyond

Tonight – a party for all modeling teachers and those interested in modeling.....

What do we mean by “Modeling”*?

MULTIPLE! Symbolic Representations



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    graph LR
      COI[Concept Or idea] --> V[Verbal]
      COI --> A[Algebraic]
      COI --> D[Diagrammatic]
      COI --> P[Picture]
      V --> MM[Mental Model]
      A --> MM
      D --> MM
      P --> MM
  
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*Modeling in physics & Chemistry as developed at Arizona State University
 The American Modeling Association – AMTA - <http://modelinginstruction.org/>

Why modeling?!

- To help students see science (& math) as a way of viewing the world rather than as a collection of facts.
- To make the *coherence* of scientific (& math) knowledge more evident to students by making it more explicit (quantitative).
- *Models and Systems* are explicitly recognized as major unifying ideas for all the sciences by the *AAAS Project 2061* and the *NGSS* for the reform of US science (& math) education.

The NGSS Framework of Scientific and Engineering Practices "The Practice Standards"

1. Asking questions & defining problems
2. Developing & using models ← ←
3. Planning & carrying out investigations
4. Analyzing & interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations & designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, & communicating information

5

An important part of the modeling procedure is to give students a chance to show each other (and the teacher)

To help explain – in their own words – what they have been learning



One way of achieving this ---- is to present the students' group activities to the other groups by transferring their group ideas to large whiteboards Which can then be presented (in various ways) to the other students

Are ALL your science and math classes Satisfying, Intentional and Problem-Solving (SIP) for all your students ??

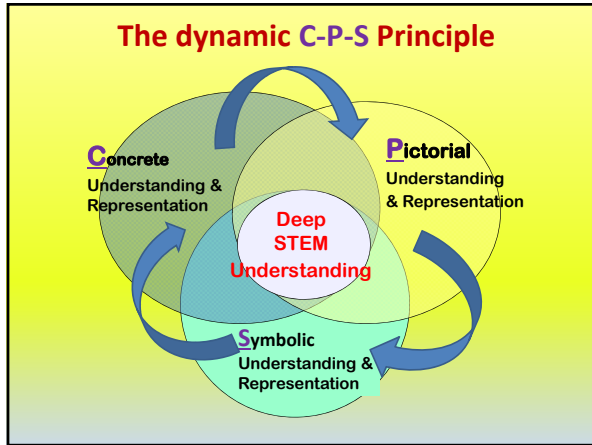
The **SIP principle** [*Satisfying, Intentional Problem-Solving*] describes an effective classroom which uses these characteristics to reach the goal of quality intellectual student work.

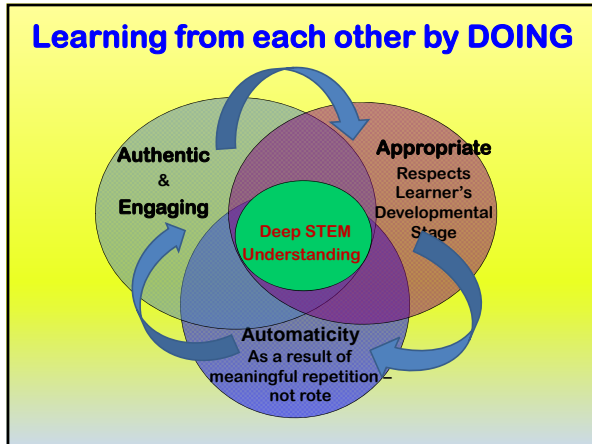
Satisfying: Quality intellectual work which is engaging, intrinsically rewarding, and develops competence and confidence for the student

Intentional: Students constructing models and strategies leading to the students' realization that they are building competence

Problem-solving: Students developing their own progress milestones, accomplishing them and explaining their own achievements.

And ALL these characteristics MUST also be part of Professional Learning Experiences





An activity to illustrate modeling...

As a conservative estimate, the average temperature of the atmosphere has increased by **0.4 deg C** over the last thirty years.

1 - Estimate how much energy has gone into warming up the planet in this way.

2 - Estimate how much burned fuel would be needed to give rise to this increase on the assumption that this were the only cause of changes in the earths temperature.

3 - How much fuel burned per week over the last thirty years per person on the planet would this correspond to?

*Form groups of 3-4 people – each group needs a “whiteboard”, plus some markers. Use **any source or estimate** to help solve the problem – but **justify** your work and answers.....*

Prepare your whiteboard for a presentation to everybody,
Include several **representations**
– e.g. verbal, algebraic, picture, diagram, graph....

Also **include 2 questions** raised by your group.....

→ Presentations

Does this exercise trigger any thoughts about how science and/or math learning takes place in **YOUR** classroom?

Discuss this question amongst your group, and write down a few constructive thoughts for discussion with the whole class.

An activity to illustrate modeling...

Form a group of 3-4 people – you will need a “whiteboard”, plus some writing implements.


Question:
What “turned you on” to science?

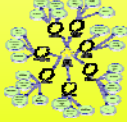
1. Discuss this question amongst your group:
Does the question trigger any thoughts about science learning has taken place in your life and/or takes place in **YOUR** classroom?
2. Prepare your whiteboard for a presentation to everybody, following the precepts laid out it the previous slide – Include several **representations** – e.g. verbal, algebraic, picture, diagram, graph....
Also **include 2 questions** raised by your group.....


→ Presentations

How many “representations” are on your whiteboard?

The Essential ABCs of Learning

Always Be Conversing 

 **Always Be Connecting**

Always Build Competence (Confidence) 

*Thank you for being here! ...Any Questions?
(Please Pick up the "generic" application form)
And/or sign in for 1 or more workshops...*
