The Indiana HS Science Modeling Curricula

Focus 2015: Science teachers in Northern & Southern Indiana

The *NISMEC* Modeling curriculum workshops in Earth Science, ICP and biology

Northern Indiana Science, Mathematics and Engineering Collaborative

Gordon Berry (Notre Dame), Bob Pustek (Hammond), Lynda Rose (PHM, Mishawaka); *also* Lynne Barden (Union North), Pat Robison & Christine Campbell (Merrillville), Dawn Slein(Triton)

First - ***an introduction:*** **a modeling activity**

- to illustrate the modeling procedures

Second – a quick report on the 2014 workshops

Third – Our plans for 2015….. And beyond

Fourth – How can we best help you?

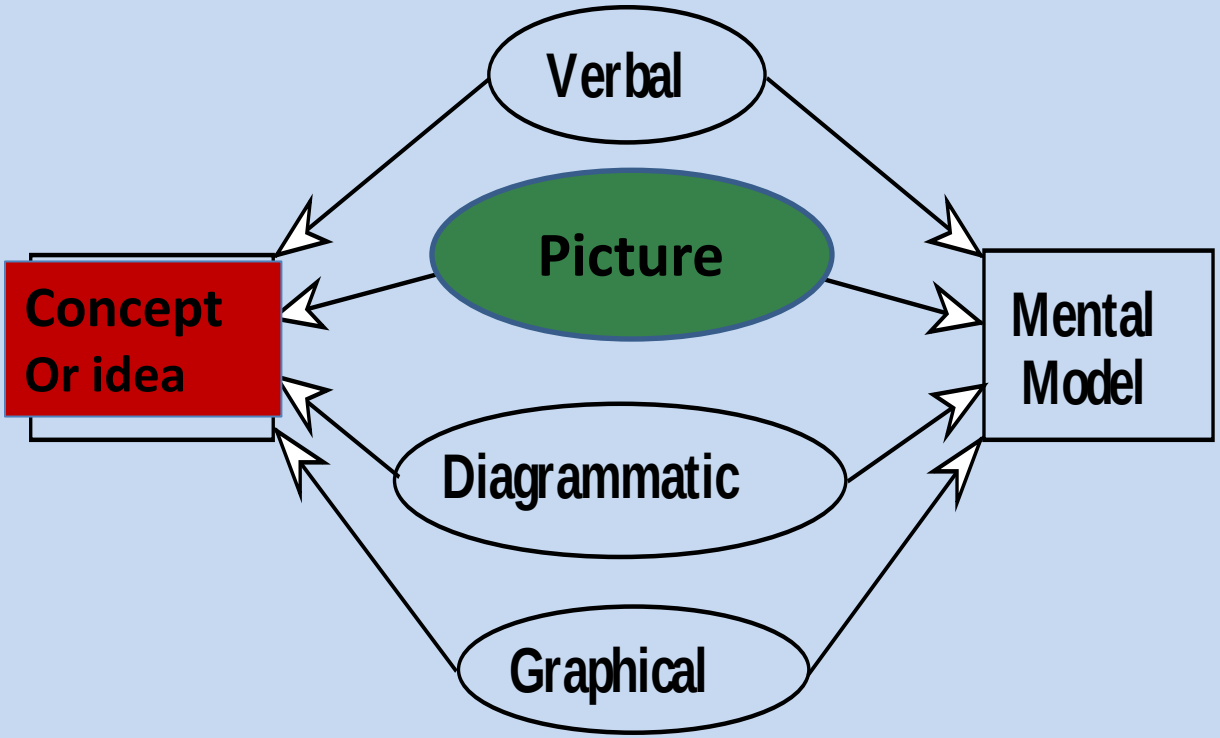
- your suggestions for us……

(as a modeling activity……)

Tonight – a party for all……

What do we mean by "Modeling"*?

MULTIPLE! Symbolic Representations



*Modeling in physics & Chemistry as developed at Arizona State University
The American Modeling Association – AMTA - http://modelinginstruction.org/

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

How can we enhance this procedure???

As you all can expect or know from experience,
it is often DIFFICULT
to persuade some (or most of the) students to make comments….
VERY OFTEN, such discussions tend to be led
or even monopolized by the teacher.

And so we will include ….

An addition to the Modeling presentation system:

"Student" Questions – and answers

(more details on this topic in another talk at this HASTI meeting
Room 208 Thursday, 2/12/2015 8:30 AM - 9:15 AM)
You can get the slides by email from the presenter

An activity to illustrate modeling…

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

Here is a statement that I saw in a recent Indiana newspaper:

"Solids are heavier than liquids"

1. Discuss this statement amongst your group:
   Does it trigger any thoughts about topics in high school science learning?
   …….. In physics or in chemistry or in biology or in earth/space science…….

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**

Reflecting on today's introductory exercise

Who is doing the thinking and learning?
Who is making connections?
Did you use all 8 science practice standards?

The ABCs of learning (Mary Hynes-Berry)
Always Be Connecting
Always Be Communicating
Always Build Confidence

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

The AIR Principle:

for teachers in all classrooms and all grades…

Attend & Intentionally Respond

Attend : *Keenly observe and reflect on the observable indicators of disposition, engagement, and of level of understanding or of misconceptions*

and

Intentionally*: plan what is likely to be a productive next step,* ***based on observations and knowledge of the student*** *as well as of developmental considerations*

Respond *in ways that will support the student in continuing to feel or be restored to feeling safe, valued and competent.*

Why modeling?!

- To help students see science as a way of viewing the world rather than as a collection of facts.
- To make the *coherence* of scientific 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 education.

Why Models?

- Models are basic units of knowledge
- **In all Science Research:**
  - A few basic models are used again and again with only minor modifications.
- Models help students connect
  - Macroscopic observations
  - Sub-microscopic representations
  - Symbolic representations

The students become SCIENTISTS – learning by DOING

Professional Development in Modeling in NW Indiana in Physics, Chemistry, ICP and Biology

Summer 2014*:* ***at Hammond, Merrillville*** – 1 week each workshop
(1) introduction to Modeling (2) ICP modeling, (3) Biology Modeling

Instructors:

Gordon Berry (NISMEC, Notre Dame), Bob Pustek, (Morton HS, Hammond)
Lynda Rose (Penn-Harris-Madison HS), Lynne Barden (LaVille HS),
Dawn Slein (Triton HS), Patti Robison (Merrillville)

Summer 2014*:* ***the Indianapolis area*** – 2 weeks each workshop – Instructors

at University High School, Carmel, – ICP, Chemistry modeling

at Guerin HS, Noblesville, - Hugh Ross(Guerin), Ben Grimes (Roncalli HS)

Funding support: ICHE – Improving Teacher Quality (2013-14)

Some Statistics of the NISMEC Modeling workshop program 2010-2014

Year	Teacher-weeks	# of teachers	No. of workshops	Noshows
2014	93	65	7	**38**
2013	112	82	6	10
2012	110	92	5	7
2011	195	132	6	8
2010	54	28	2	1
Totals	**564**	**399**	**26**	**64**

Note 1. We encourage teachers to attend at least 2 weeks of workshops each year
Note 2. Several teachers have attended more than one year
Note 3. In 2014 many teachers registered but then withdrew from the workshops

NISMEC Modeling Workshops in the coming year – summer 2015

Preliminary schedule

1- Funded:

15-19 June	**Introductory Modeling (at Merrillville)**
22-26 June	**ICP Modeling (at Notre Dame)**
22-26 June	**Biology Modeling (at Merrillville)**

2- still needing funding:

University of Notre Dame: 29 June - 3 July: Development of ESS modeling – 1wk

Evansville, North HS: 6-10, 13-17 July Development of ESS modeling – 2wk

Guerin HS, Noblesville ---- 1or2 weeks June or July: Phys modeling (Adv.)

University HS, Carmel --- 1or2 weeks June or July: Chem modeling (Adv.)

Sign up sheets at the NISMEC Hasti booth or on the NISMEC website.

http://www3.nd.edu/~nismec/nismec11.htm

Contact: hgberry@nd.edu

Final interactive session

1 - Discuss with your group
your top priority for Professional Development modeling workshop needs for the summer of 2015 and beyond…

2 – Present your results ….→ brief discussion

Reflecting on today's session

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The ABCs of learning **(Mary Hynes-Berry)**
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Contacts: *Gordon Berry:* hgberry@nd.edu
NISMEC: http://www3.nd.edu/~nismec/nismec11.htm

HASTI - - February 12-13, 2015
NISMEC presentations and other Modeling presentations

Time	Title	Presenters
Thursday 8:30 am	How Student Questions and Answers Can Bring Quality Learning to Your High School Science Class	Gordon Berry Mary Hynes-Berry
Thursday 10:45 am	Modeling Chemical Bonds and Reactions with Legos	Craig Williams
Thursday 10:45 am	The Indiana Modeling Program for High School Science Teachers - Are You In It? Join Now!	Gordon Berry, Robert Pustek, Lynda Rose
Thursday 12:30 pm	The Scientist Notebook: A Rhythmic Framework to Guide Teachers and Students in Any Classroom Investigation	Joseph Bellina
Thursday 12:30 pm	So You Want to Try Modeling -- A Pedagogy Not a Curriculum	Lynda Rose
Thursday 1:30 pm	Focus Question and Making Meaning Conference, the Bookends for A Classroom Investigation	Joseph Bellina
Thursday 1:30 pm	How to Engage Students in a Whiteboarding Session	Lynda Rose
Thursday 2:30 pm	Using Goal-less Problems in the Chemistry and Physics Curriculum	Amanda Horan, Hugh Ross, Gary Pritts, Karen Kennedy
Thursday 2:30 pm	Making Sense of Graphs, a Natural Math Extension from Science	Joe Bellina
Friday 12:30 pm	Hoosier Modeling Connection: Q & A with New and Experienced Modelers	Erica Posthuma-Adams Amanda Horan, Lori White
Friday 8:30 am	AP Science Courses Redesigned: Impacts and Lessons Shared	Karen Morris, Maureen McGrail
Friday 8:30 am	Using Bar Charts to Introduce the Momentum Conservation Model	Hugh Ross, Ben Buehler, Ben Grimes
Friday 9:30 am	Physical Challenges: Using Lab Practicums in the High School Physics Classroom	Ben Buehler
Friday 12:30 pm	Hoosier Modeling Connection: Q & A with New and Experienced Modelers	Erica Posthum-Adams, Amanda Horan, Lori White
Friday 12:30 pm	Focus: Authentic Learning	Lori White
Friday 2:30 pm	Modeling Chemical Equilibrium: A Conceptual, Particle-Based Approach for High School Chemistry	Jeremy Horner

1 - The ICP and Biology Modeling Curricula
are available on the NISMEC website (Password required)

2 – Further details on the 2015 Modeling workshops
Are also available on the NISMEC website
These will be updated on a regular basis

3 – Visit the NISMEC booth at HASTI-2015
For more information

http://www3.nd.edu/~nismec/nismec11.htm

For a copy of these slides, email me at hgberry@nd.edu