What happens in a Saturday follow-up workshop in Modeling Instruction?

Fortunately, we can answer this question in detail because of the creativity of our External Evaluator, Dr. Rose Shaw. She hired an ASU doctoral student in education to attend the third Saturday follow-up workshop in physical science. He came in unannounced, and I never knew ahead of time that she had hired someone. I never learned his name. Below is an excerpt from her yearly summative report, followed by sections of my e-mails to the 16 participating Arizona physical science and math teachers to remind them of their four follow-ups.

– Jane Jackson, Co-PI, Department of Physics, Arizona State University (Aug. 2010)

Excerpt (page 19ff) from the External Evaluation Report:
Improving the Quality of Arizona Teachers of Physical Sciences and Mathematics
Robert J. Culbertson, Principal Investigator, Arizona State University
Reported by the External Evaluator:
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Report Date: July 30, 2009

Physical Science and Mathematics Follow-up Saturday Workshops
January 24, 2009 (9 AM to 1 PM)

Workshop Observation

The agenda for this workshop at South Mountain High School (Pat Burr and Lee Rodgers, facilitators) was: 1) Adapting your curriculum to modeling style and 2) Socratic dialog. This session was observed from when it started in the morning until noon. Nine middle school and high school teachers participated in the workshop. Disciplines represented by the teachers were Biology, Chemistry, Physics, and Earth Sciences.

Teachers were provided a copy of RTOP assessment materials and a worksheet with the principles of modeling used in the classroom. After a brief welcome, teachers wrote their responses to the focus question: *What makes a lab suitable for implementing the principles of modeling?* The group presented and discussed their responses:

- Student and teacher experience with modeling and laboratory content is important for a successful modeling curriculum. Also, vested interest in the laboratory subject ensures project success.
- Proper and up-to-date computational tools are needed to gather, analyze, and plot data. Along the same line, data must be feasibly gathered in classroom setting (e.g., time constraints, ease of operation, safety precautions, and viable disposal procedures).
- Laboratory theme needs to be engaging and lend itself to further investigation. Models are successful when they promote critical thinking.
- The laboratory must be written in a clear, succinct manner so that the assigned questions are easy to comprehend. Background information must demonstrate the theory behind relevant scientific relationships (e.g., cause and effect, correlation etc.) in a comprehendible manner.

- Teachers need time to design and implement modeling laboratories.[1]
- Students need to be willing to take risks and explore the "unknown". Peer-to-peer collaboration would help facilitate this type of interaction.
- Modeling laboratory needs to relate to scientific and mathematical fundamentals starting with state standards learned in kindergarten.

Pat Burr emphasized the last bulleted point, "Going back to something you know helps you (the student) to make the jump to what you don't know."

Evaluation Comment: The interaction and discussion between teachers and workshop facilitators occurred in a supportive environment. Everybody had time to share their experiences. It appeared that inexperienced gained from this session by having the opportunity to ask more experienced teachers questions about suitable approaches to implementing models in their classrooms. Criteria for logistics of teaching models and supplies needed (e.g., data gathering technology, computers, analytical software, etc.) were discussed at length and from multiple view points. This seemed to help experienced and novice teachers.

The facilitators then asked the teachers to reflect on two focus questions: *What are the principles of modeling? What are the challenges associated with teaching modeling laboratories?* The general themes of the teachers' responses to the first question about the principles of modeling were:

- Teachers need in-depth knowledge of modeling concepts and knowledge of possible student misconceptions.
- Paradigm modeling lab (foundational lab) needs to establish base concepts, modeling procedure and presentation format. This lab can be referenced in future laboratories.
- Collaboration between students is essential to the modeling process.
- Visual representation is important for data analysis and concept reinforcement.
- Modeling assignments need to apply to a variety of formats (e.g., graphical, written, discussion based formats).
- Assignments need to force students to use modeling-type thinking.
- Models need to match real world observations.
- Modeling content needs to be cohesive and needs to build over the course of the semester. Subject areas can be presented in a "story" format with an introduction, arc, and ending. Subjects can stress concept interconnectedness and the interdisciplinary nature of scientific inquiry.
- State education standards are essential to the Socratic process.

These were the challenges that come with teaching modeling:

- The teacher needs to know the fundamental definition of "modeling".[2]

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[1] Evaluator's Note: This was concept was stressed by novice teachers at workshop. Teachers were concerned that they would simply not have enough time to facilitate and adapt modeling laboratories.

[2] Evaluator's Note: There was confusion among the teachers in attendance about the exact definition of the term modeling. In order to address this, Pat Burr gave examples of models used across a variety of disciplines (e.g., ecosystem model, phase state model, Newtonian motion model, etc.). Pat Burr also showed a slide in to further clear this concept up.

- Dialogue between teachers is essential for success. Teachers can share experience, classroom success, etc. Teachers should follow the success of other teachers involved in similar activities.
- Teachers often have to balance students' past education when introducing new concepts. Not all students learn at the same speed.
- Labs need to be designed so that they satisfy multiple state standards in modeling session.
- Teachers need to start small and build concepts up.
- Interconnectedness of concepts should be emphasized.
- Student driven discussions can keep the class on track and provide for opportunities for identification of any concept misconceptions. Students' question can represent novel approaches and insight to modeling concepts.

These were two questions that came out of this discussion, "Curriculum designers have fragmented scientific concepts (e.g., separation of biology, geology, and math disciplines) so how is it possible to maintain concept continuity when it is broken up?" "Separate subject targets make me feel rushed."

After discussion about challenges that come with teaching modeling and the principles of modeling, Pat presented a slide that provided a diagrammatic representation of the proper working definition of modeling. This helped clear up misconceptions.

Workshop pretests were picked up at this point in the workshop.

Next teachers met in small groups according to subject expertise in order to collaborate on future lesson plans. These plans were developed using RTOP guidelines and points raised during the morning discussions. Lesson plans were to be partially completed at the workshop and then finished and sent to Pat Burr as a workshop product. Groups were taken aside by Lee Rodgers for personalized, one-on-one coaching regarding RTOP and model implementation.

The session was still in progress when the external evaluation observation ended.

Overall Evaluation Comment: The workshop was very well organized and it was evident that the facilitators were highly experienced and well-prepared. Lee Rodgers and Pat Burr were highly encouraging with respect to open, constructive dialogue and teacher interaction. Workshop expectations were made clear to all participants, which resulted in a focused, efficient workshop. Repeated references were made to skills gained in past meetings and how that content pertains to current workshop activities, future lesson plans, classroom instruction, etc. Teachers shared experiences and techniques for implementing science modeling in the classroom which was well received by all in attendance. The small size of the group allowed Lee Rodgers and Pat Burr to engage the teachers in a personal, in-depth manner. For example, while the teaching groups were collaborating on their lesson plan product, Lee Rodgers took each group aside for individualized coaching.

Workshop Facilitator's Feedback

The External Evaluator's questions and the facilitators' emailed responses were:

Q1: How do you feel the workshop went?
Response: We both feel it went very well

Q2: From your perspective what were the "learning highlights"?
Response: Teachers developed their skills in developing modeling lessons were explored, strengthened their lesson planning skills, creating a modeling lesson/lab that includes modeling principles and gained more precise understanding of a model.

Q3: Anything you would do different?
Response: No

Evaluator's Note: This is a sample of comments teachers recorded after the workshop:

- "I'm so glad I came."
- "This has been the **best** Saturday meeting."
- "As I design my labs I will look at what we covered today and I will adapt current labs to follow RTOP modeling guidelines.

Reminders about Saturday follow-up workshops in physical science/math

Below is the e-mail announcement about the third Saturday workshop discussed above. It was sent on Jan. 16, 2009 by Project Director Jane Jackson to all teachers who participated in the summer 2008 Physical Science with Math Modeling Workshop.

PHYSICAL SCIENCE OR MATH TEACHER who took a modeling workshop recently:

Reminder: Your third follow-up workshop is
SATURDAY, January 24
from 9am to 1pm,
at South Mountain High School
in Pat Burr & Lee Rodgers' classroom (M215).

AGENDA:
1) Adapting YOUR curriculum to modeling style
2) Socratic dialog

RSVP to our undergraduate student worker …
(Come anyway, even if you can't RSVP. Invite another modeler.)

BRING:
Your students' filled-out NCS answer sheets (unless you brought them last time).
Write their ethnicity on each sheet.
Get the NCS answer sheets for your posttest:
e-mail [our student worker] and tell her how many to bring for you.

DIRECTIONS TO PAT AND LEE'S CLASSROOM: (etc.)

YOUR HOMEWORK: Product - complete inquiry lesson plan using the lab provided by you which incorporates the principles of modeling including the RTOP indicators.

FOLLOW-UP WORKSHOP GUIDELINES:
Any teacher can attend any of our 12 Saturday follow-up meetings.
ALL teachers who have ever had a modeling workshop (or any other of our courses) are welcome to attend.

The stipend for AZ inservice teachers is $60 per meeting: minimum of $120 for two meetings, maximum of $240 for four meetings. (i.e., you must participate in at least two meetings to get a stipend.) Only teachers in summer 2008 courses are eligible for a stipend.

Science teachers who participated this summer qualify for classroom/lab supplies to implement your course learning, if you attend at least two Saturday workshops. Most of you ordered an electronic balance and Eureka video.

Sent by Jane Jackson on Sept. 16, 2008 to remind teachers of the **first** Saturday follow-up:

PHYSICAL SCIENCE with MATH follow-up workshop.
SATURDAY, SEPT. 27, 9am to 1pm
South Mountain High School, in Phoenix
(room M215: Pat Burr & Lee Rodgers' classroom)

Get ready to have FUN! and learn!

AGENDA (from Pat Burr & Lee Rodgers, leaders):
a) share our stories and try to help each other with our unit 1 efforts, focusing on GRAPHING and Socratic dialog.
b) RTOP, a new observation technique that is a very good tool for us modelers to look at our lessons.

RSVP today, to our student worker ------

BRING:
a) Your students' NCS answer sheets for the pretest.
(Get POSTtest answer sheets from ------- . Tell her the # you need. Reply to ------ today!)
b) Please download, read, and bring this document: RTOP Self-Assessment instrument
at http://modeling.asu.edu/MNS/MNS.html (Scroll to the bottom of the webpage).

Larry Dukerich wrote last year:
"... the RTOP Self-Assessment can be a useful way for teachers to reflect on their practice. Our participants should download it and look it over prior to the meeting. ... The value (as I see it) of this instrument is in getting teachers to reflect on their own practice prior to the start of a semester or when they try to design an instructional unit."

YOUR HOMEWORK: Using the RTOP, which indicators address Socratic discourse/questioning directly and why? Do the RTOP SELF-ASSESSMENT sections on Socratic questioning.

(Our grant requires us to have 6-hour follow-up sessions for $60 stipends, so your homework is expected to take two hours.)

TEACHERS' COMMENTS ABOUT THE RTOP SELF-ASSESSMENT:
Three participating teachers in Modeling Workshops last year wrote:
* After completing the [RTOP] self assessment I realized there are many areas where I can improve my goal to create an inquiry-based learning environment.
* This assessment showed how I could become a much better teacher than what I am. It really showed how I teach the way I was taught, which research has shown is not best practice!! Each part of the test was revealing.
* I've attended a few seminars on the use of the RTOP. It's a fantastic teaching assessment tool.

* Pat Burr, instructor of PHS 534, Physical Science with Math Modeling Workshop, was interviewed this summer by our External Evaluator, who reported thusly:
'When asked if there is value to using the RTOP and self-assessment she [Pat] responded, "Absolutely." It is in assessing themselves and colleagues that they see their strengths and the areas in which they need to improve. Pat also reported, "I will use it (RTOP) all the time in Pro-Growth.'

* DeeDee Falls, science specialist, Phoenix UHSD (our primary partnering district) wrote: I did indeed use the RTOP self evaluation form with teachers last school year. We found it to be a wonderfully helpful way to reflect on our teaching practices.

Date: Sun, 28 Sep 2008
From: SIegwart Barry
Subject: PHYSICAL SCI/MATH follow-up workshop feedback
To: Jane Jackson <jane.jackson@asu.edu>
Jane
I wanted to give drop you a note and give you some feedback on Pat and Lee's Saturday workshop. It was a great experience, Pat and Lee are great teachers with so much energy and want the best of their students. They always give great examples of classroom management. I came away realizing if they can try and get their students to do science homework every night then any teacher should be able to. They were generous with all their materials especially the multitude of graphing worksheets.

The reminder sent on Oct. 24, for the **second** Saturday follow-up on Nov. 1, 2008 was similar.

AGENDA:
1) Transfer of energy
2) Socratic dialog
3) Get your lab supplies. Most orders have arrived.

HOMEWORK: How does the 'energy transfer' quiz handout assess the students understanding of the transfer of energy and any misconceptions associated? How will you overcome any foreseen student difficulties?

The reminder sent in February, for the **fourth** meeting on February 21, 2009 was similar.

AGENDA:
1) Periodic table (using two different strategies)
2) Socratic dialog