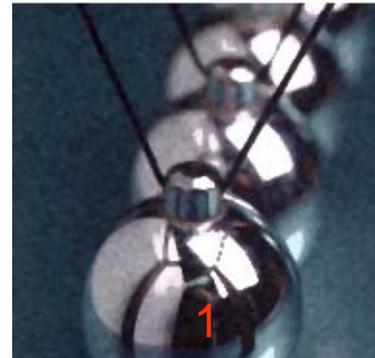


# INQUIRY SCIENCE

## Secondary Level

Pam Dooling

Summer 2008 NBCT PDI  
Inquiry Science--Secondary



# Change in Approach

Less

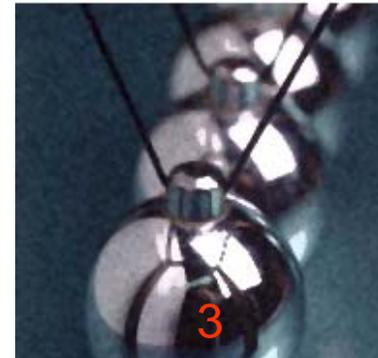
More

- Lectures
- Individual learning
- Knowing facts
- Many topics
- Short investigations
- Cookbook science
- Getting an answer
- Assessing discrete knowledge
- Teacher as technician
- Investigation of questions
- Cooperative learning
- Understanding concepts
- Fewer topics (in depth)
- Long-term investigations
- Learning by doing
- Interpreting evidence
- Assessing understanding
- Teacher as reflective leader



# Inquiry Abilities: National Science Education Standards for Grades 9-12

- Identify questions and concepts that guide science.
- Design and conduct scientific investigations.
- Use technology and math to improve investigations and for communication.
- Recognize alternative explanations and models.
- Communicate and defend a scientific argument.



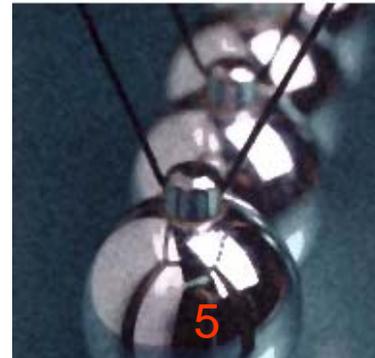
# INQUIRY: Role of Teacher

- Create rich learning environment
- Identify important concepts students will investigate
- Plan the inquiry
- Present the inquiry
- Solicit student input to narrow the focus of the inquiry
- Initiate and orchestrate discussion



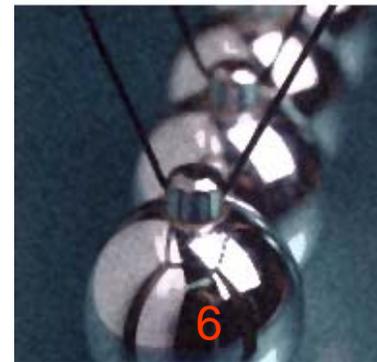


- Ask prompting and probing questions; pursue students' divergent comments and questions, when appropriate
- Guide students' learning in order to get at the core of the content
- Provide opportunities for all students to demonstrate their learning by presenting a product or making a public presentation

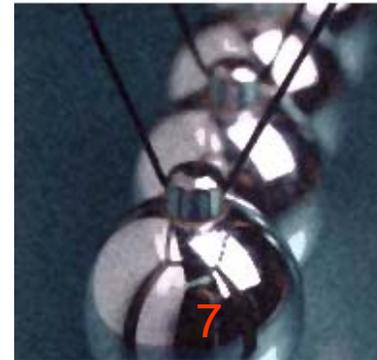


# INQUIRY: Role of students

- Contribute to the planning of an inquiry investigation
- Observe and explore
- Experiment and solve problems
- Work both as a team member and alone
- Reason logically, pose questions
- Confer and debate with peers and the teacher

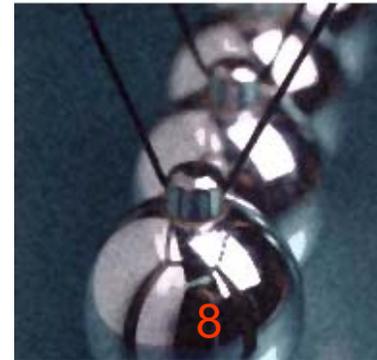


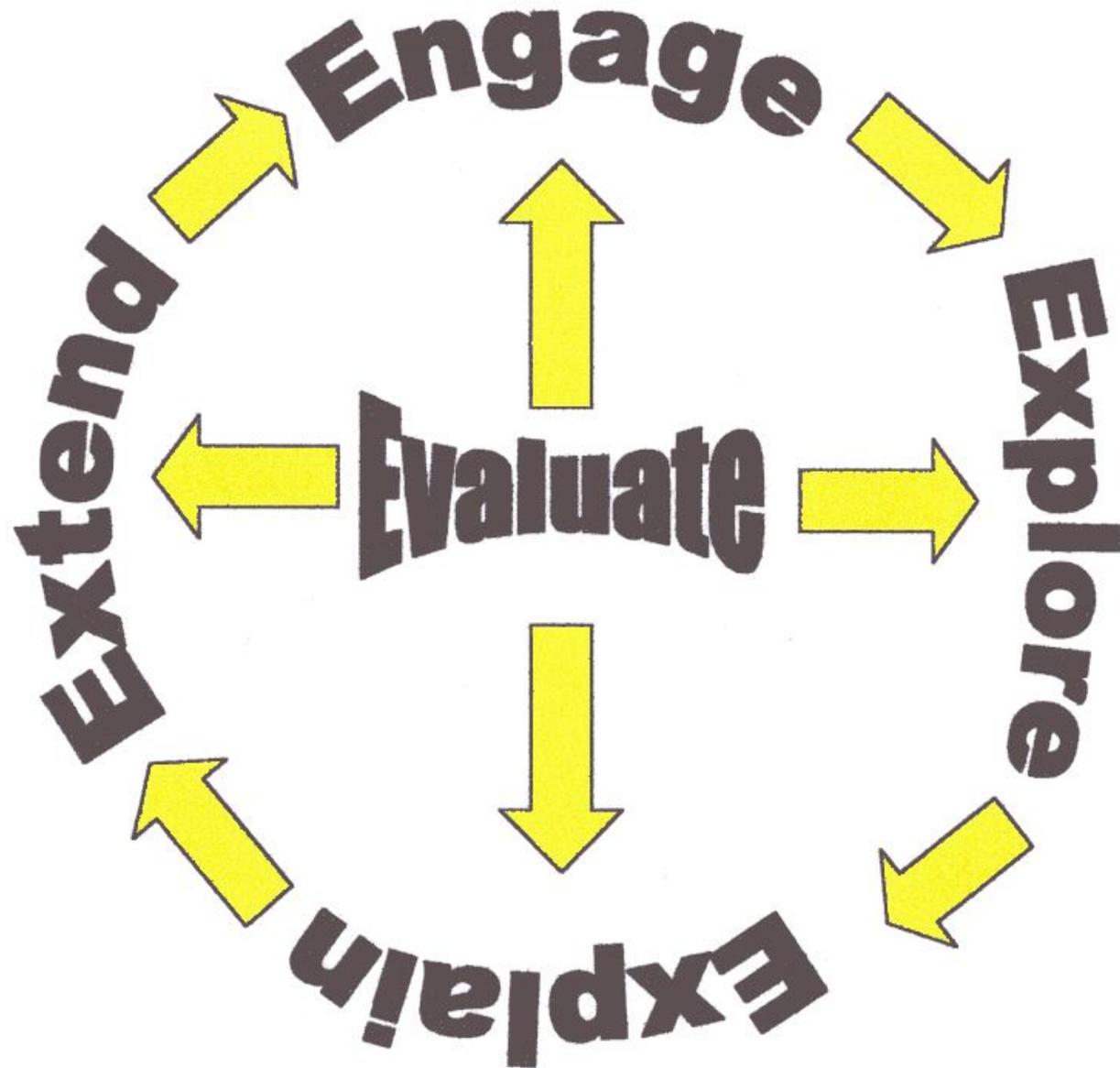
- Discuss their own ideas, as well as develop ideas and knowledge collaboratively
- Make logical arguments and construct explanations
- Test their own hypotheses
- Communicate findings
- Reflect on feedback from peers and the teacher
- Consider alternative explanations
- Retry experiments, problems, and projects



# Inquiry activities w/ high-level thinking skills have these features:

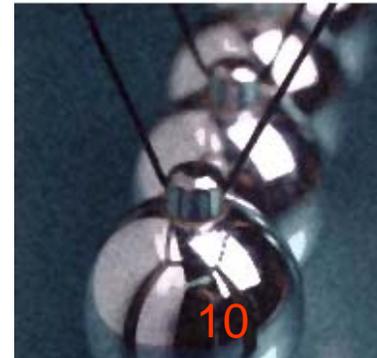
- The path of action is not fully specified in advance
- There are multiple solutions, each with costs and benefits
- Uncertainty exists
- Students direct most of their own steps in the thinking process
- Considerable mental work is involved in elaboration and judgment





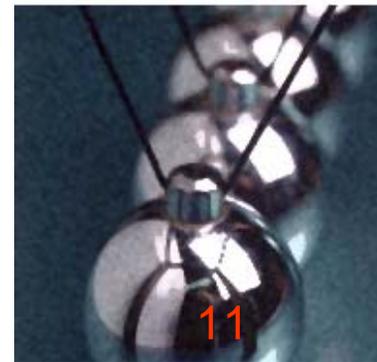
# “Five E” Learning Cycle: Engage

- Initiates the learning task.
- Connects past and present learning experiences.
- Creates interest and generates curiosity.
- Uncovers students’ current knowledge (pre-assessment).



# “Five E” Learning Cycle: Explore

- Provides students with a common base of experiences.
- Gives opportunities for creative thinking and skills development.
- Students test predictions and form new predictions and hypotheses.
- Students record observations and ideas.



# “Five E” Learning Cycle:

## Explain

- Students demonstrate conceptual understanding, skills and behaviors.
- Students listen critically to others’ explanations.
- Students develop vocabulary through applications of concepts.
- Students learn to apply evidence.



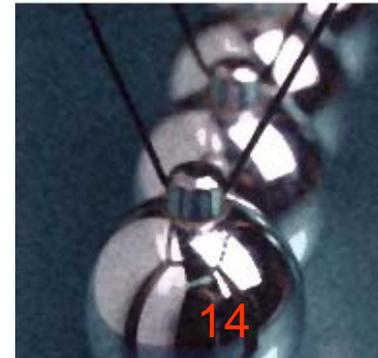
# “Five E” Learning Cycle: Elaborate/Extend

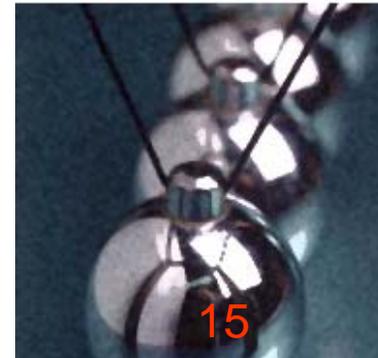
- Challenges and extends students’ conceptual understanding and skills.
- Students use previous information to ask questions, propose solutions, make decisions.
- Students apply concepts and skills to new situations.



# “Five E” Learning Cycle: Evaluate

- Students demonstrate understanding of a concept or skills.
- Students evaluate own progress.
- Teachers evaluate students’ and their own progress.
- Relies on alternate strategies for assessment (should be matched to pre-assessment).





# General tips and suggestions

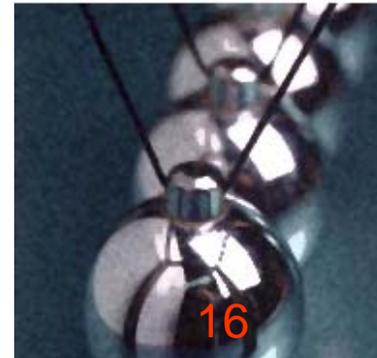
- The class you choose should be one in which scientific inquiry, including investigations, is common practice
- The focus is on your practice, not on the level of student performance
- Choose an investigation in which students are actively involved in the generation and interpretation/evaluation of data
  - You may use secondary data

# Avoid the Following Types of Instructional Activities

**Predetermined or “cookbook”** investigations in which students simply follow a set of established procedures or verify known facts, or simply confirm expected results

Investigations that emphasize **practicing laboratory skills**

**Teacher demonstrations or modeling** with little or no active student engagement in the investigation



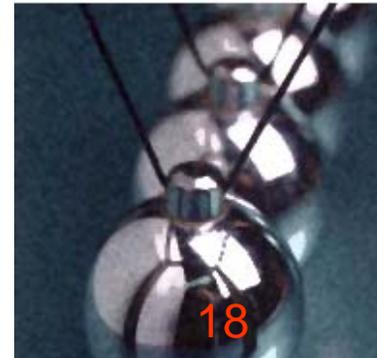
# The Investigation Should Have Students Engaging in Such Inquiry Processes As:

- Observing phenomena
- Asking relevant questions
- Formulating working hypotheses
- Designing experimental approaches
- Analyzing data
- Reaching tentative conclusions
- Crafting scientific arguments
- Communicating the significance of findings



# EA Science – entry 3

- Emphasis is on **your** ability to **engage students in discussion** following the collection of data
  - Help students make sense of the data, draw conclusions, and engage in scientific inquiry
  - Effective discussion may lead to further investigations and inquiry
  - Don't just have students summarize the data
  - 20-minute video, unedited



# MC Gen – entry 3

- Video: (15 minutes max.) which demonstrates how you engage two small groups of students, (at least 3 per group) in a science lesson that integrates mathematics
- Be sure to highlight exploration, discovery, and talk among children and between you and the children
- Make sure the moments in which the students express and respond to one another's ideas are the moments you capture on the video recording (neither the introduction to the lesson nor the transition to activities would be a good choice)



- Review the National Science Education Standards for Ideas (also available from NBPTS website)
- Select an investigation that provides opportunities for your students to **engage** in important aspects of scientific inquiry.



## Northwest Regional Educational Laboratory

- [http://www.nwrel.org/msec/science\\_inq/](http://www.nwrel.org/msec/science_inq/)

BioEd Online; see slide sets → teaching strategies

- <http://www.bioedonline.org/>

8th grade curriculum based on TEKS (TX standards)

- <http://www.tcet.unt.edu/tegs/tegsFinal.html>

EA Science resources

- <http://geocities.com/sciquest2000/eascience.html>

NIH Supplements

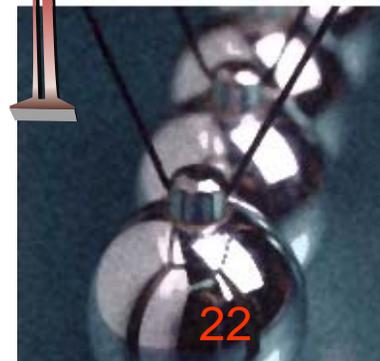
- <http://science.education.nih.gov/supplements>



# LET'S



# BRANNSTORM



# Good Luck!!

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