Take a Snapshot of Your Science Program

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Agenda

- Phase I: Effective Science Instruction
- Phase II: Classroom Observations
- Phase III: Reflective Questions

Leading Instruction in Science

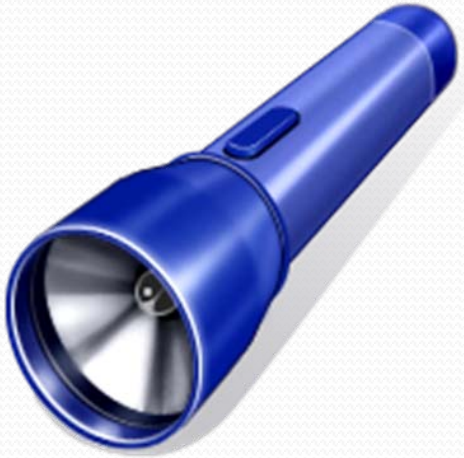
- Where are we at?
- Where do we want to be?
- What do we do to get there?

Perspectives
Think-Pair-Share

- Describe what you would observe in an “ideal” science class.
- Describe your memory of a science class you were enrolled in.

The Set-Up

- How is a flashlight designed as a simple circuit?




InterventionCentral
2-Minute 'Count Down' Timer
02:00
www.interventioncentral.org

The Challenge

Problem:

How may ways can you get a bulb to light using a battery, a bulb, and a single paperclip?

Rules:

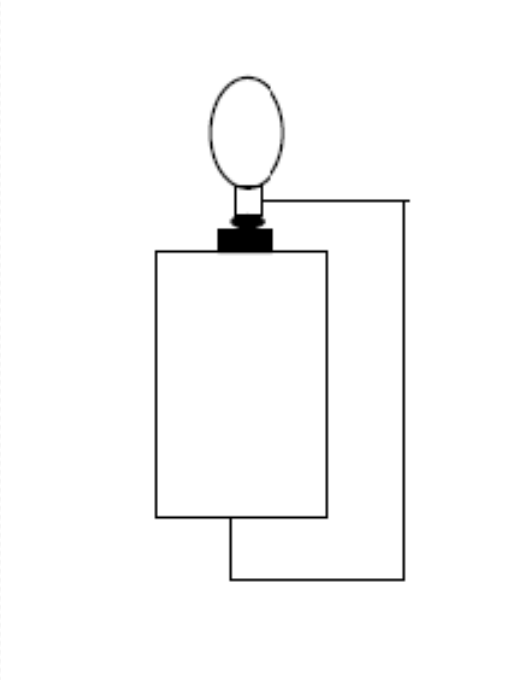
You may use ONLY the materials provided.

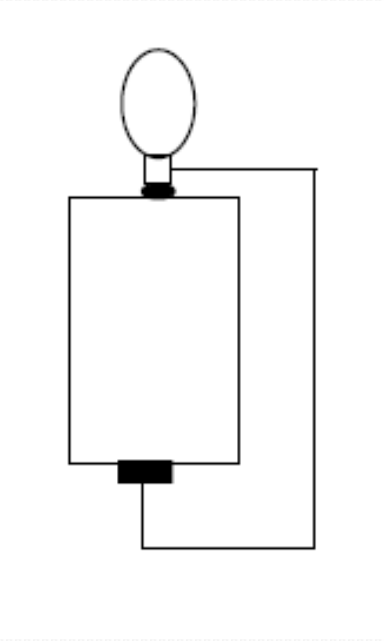
Task:

Discuss with your group what the problem and the rules mean to you.

Develop a plan for solving the problem.

Possible Solutions





Strategies That Work

- Identifying similarities and differences
- Summarizing and note-taking
- Reinforcing effort and providing recognition
- Homework and practice
- Representing knowledge
- Learning groups
- Setting objective and providing feedback
- Generating and testing hypothesis
- Using questions, cues, and advance organizers

Marzano, R.J., Pickering, D.J. and Pollock, J.E. (2001) *Classroom instruction that works; research-based strategies for increasing student achievement.*

Science Meta-analysis

- TAMU Center for Mathematics and Science Education, College of Science
- Purpose:

Identify the most effective science instructional tools and methods to improve student achievement

Treatment Categories

- Collaborative Learning Strategies
- Enhanced Context Strategies
- Enhanced Materials Strategies
- Inquiry Strategies
- Instructional Technology Strategies
- Manipulation Strategies
- Questioning Strategies
- Testing Strategies

Meta-Analysis Results

Strategies	Effect Size	Rank
Enhanced Context Strategies	1.4783	1
Collaborative Learning Strategies	0.9580	2
Questioning Strategies	0.7395	3
Inquiry Strategies	0.6546	4
Manipulation Strategies	0.5729	5
Testing Strategies	0.5052	6
Instructional Technology Strategies	0.4840	7
Enhanced Material Strategies	0.2908	8

Teaching Science as Inquiry

- National Science Education Standards (NRC)
- Benchmarks for Science Literacy – Project 2061 (AAAS)

National science education standards, (1996). Washington DC: National Research Council, National Academy Press.

National Science Education Standards- Teaching Standard B

Teachers of science guide and facilitate learning. In doing this, teachers

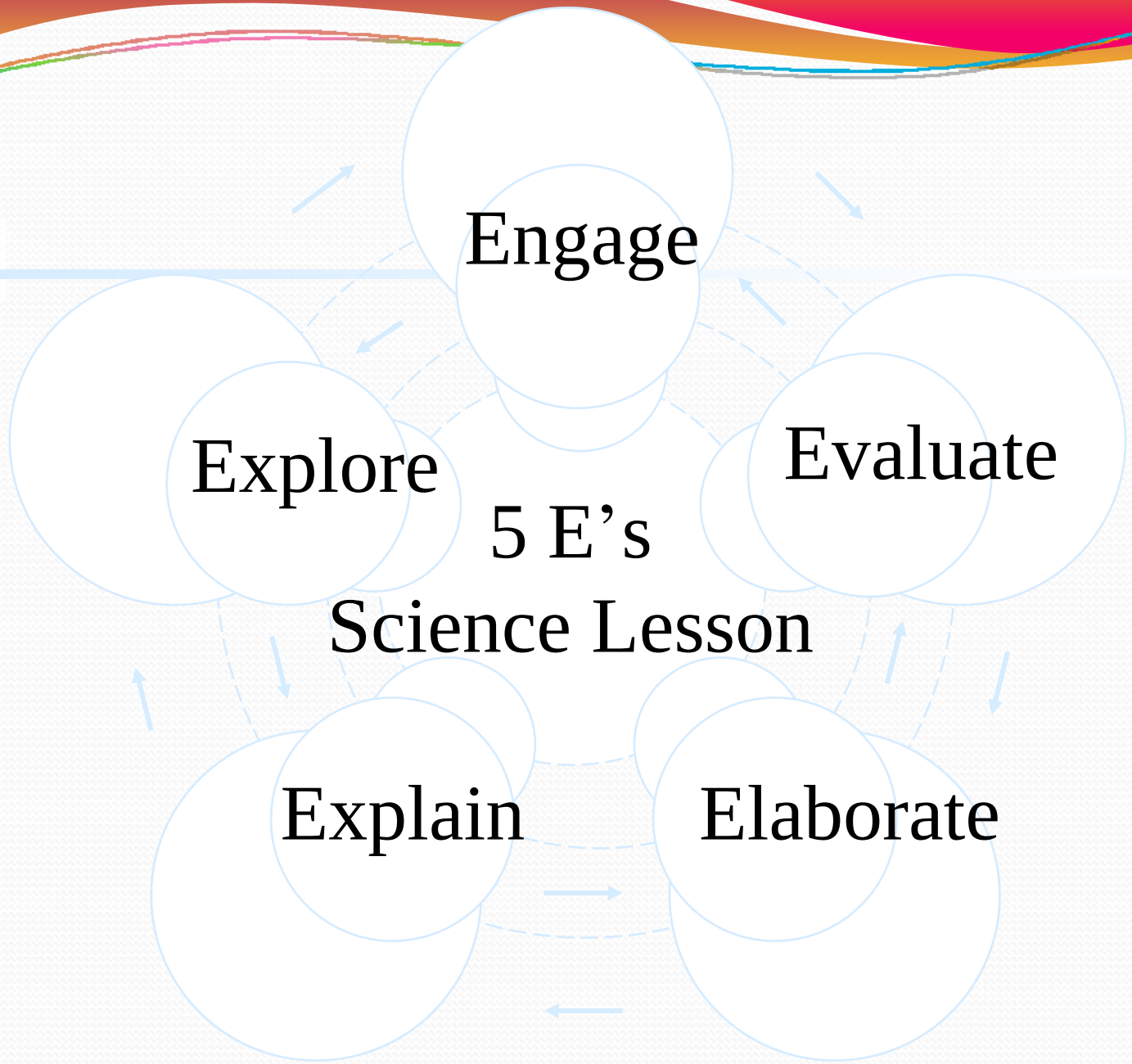
- Focus and support inquiries while interacting with students
- Orchestrate discourse among students about scientific ideas
- Challenge students to accept and share responsibility for their own learning
- Recognize and respond to student diversity and encourage all students to participate in science learning
- Encourage and model the skills of scientific inquiry

National science education standards, (1996). Washington DC: National Research Council, National Academy Press.

5-E Model of Instruction

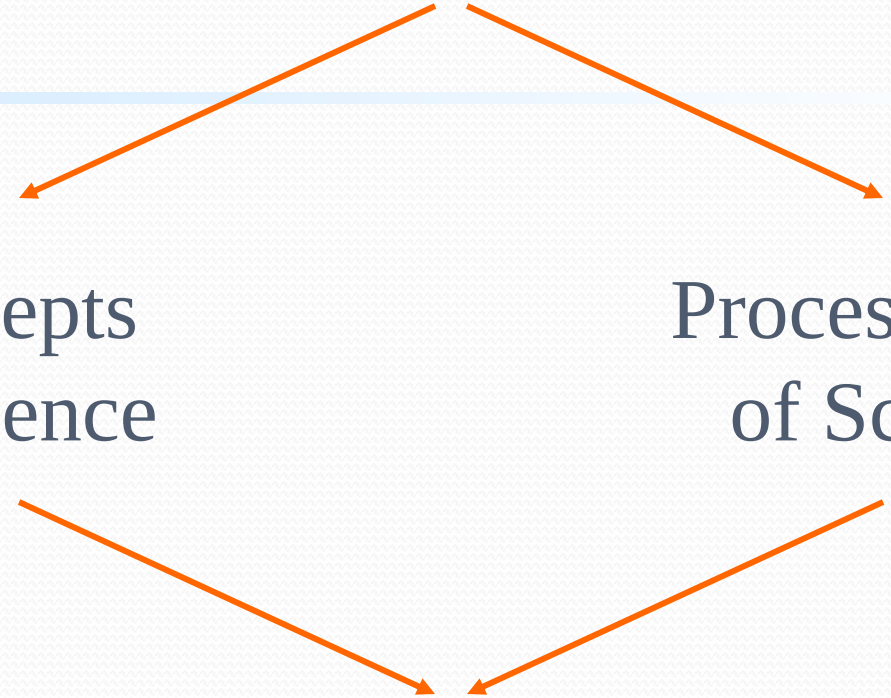
- Engage
- Explore
- Explain
- Elaborate
- Evaluate

Bybee, R. 1978, Shymansky J. 1984, Trowbridge, L. & Bybee, R. 1990.



Bybee, R. 1978, Shymansky J. 1984, Trowbridge, L. & Bybee, R. 1990.

Science Content



Concepts of Science

Process Skills of Science

Students use the process skills of science to develop an understanding of the scientific concepts.

5-E Instructional Model

Engage	Brings the learner's mind into the frame to learn something new
Explore	Provides or creates a common experience for all learners and helps the teacher identify prior knowledge
Explain	Lets the learner construct an explanation. The teacher provides information to increase the accuracy of the explanation.

5-E Instructional Model

Elaborate	Builds on current understanding to increase the depth and breadth of understanding.
Evaluate	Provides an opportunity for learners to assess their own understanding and be able to demonstrate the depth and breadth of that understanding to others.

Bybee RW (2002). “Scientific inquiry, student learning, and the science curriculum” IN Bybee R. Learning Science and the Science of Learning. National Science Teachers Association Press, Arlington, VA.

Engage

Suggested Activities

- Demonstration
- Reading
- Free Write
- Analyze a Graphic Organizer
- KWL
- Brainstorming

Bybee, R. 1978, Shymansky J. 1984, Trowbridge, L. & Bybee, R. 1990.

Engage

What the Teacher Does

- Creates Interest
- Generates curiosity
- Raises questions
- Elicits responses that uncover what the students know or think about the concept/topic

Bybee, R. 1978, Shymansky J. 1984, Trowbridge, L. & Bybee, R. 1990.

Explore

Suggested Activities

- Perform an Investigation
- Read Authentic Resources to Collect Information
- Solve a Problem
- Construct a Model

Bybee, R. 1978, Shymansky J. 1984, Trowbridge, L. & Bybee, R. 1990.

Explore

What the Teacher Does

- Encourages the students to work together without direct instruction from the teacher
- Observes and listens to the students as they interact
- Asks probing questions to redirect the students' investigations when necessary
- Provides time for students to puzzle through problems

Bybee, R. 1978, Shymansky J. 1984, Trowbridge, L. & Bybee, R. 1990.

Explain

Suggested Activities

- Student Analysis & Explanation
- Supporting Ideas with Evidence
- Structured Questioning
- Reading and Discussion
- Teacher Explanation
- Thinking Skill Activities: compare, classify, error analysis

Bybee, R. 1978, Shymansky J. 1984, Trowbridge, L. & Bybee, R. 1990.

Explain

What the Teacher Does

- Encourages the students to explain concepts and definitions in their own words
- Asks for justification (evidence) and clarification from students
- Formally provides definitions, explanations, and new labels
- Uses students' previous experiences as basis for explaining concepts

Bybee, R. 1978, Shymansky J. 1984, Trowbridge, L. & Bybee, R. 1990.

Elaborate
Suggested Activities

- Problem Solving
- Decision Making
- Experimental Inquiry
- Thinking Skill Activities: compare, classify, apply

Bybee, R. 1978, Shymansky J. 1984, Trowbridge, L. & Bybee, R. 1990.

Elaborate

What the Teacher Does

- Expects the students to use formal labels, definitions, and explanations provided previously
- Encourages the students to apply or extend the concepts and skills in new situations
- Reminds the students of alternative explanations
- Refers the students to existing data and evidence and asks, What do you already know? Why do you think . . .?
- Strategies from *Explore* apply here also

Bybee, R. 1978, Shymansky J. 1984, Trowbridge, L. & Bybee, R. 1990.

Evaluate

Suggested Activities

- Any of the Previous Activities
- Develop a Scoring Tool or Rubric
- Test (Selected Response, Brief Constructed Response, Extended Constructed Response)
- Performance Assessment
- Produce a Product
- Journal Entry
- Portfolio

Bybee, R. 1978, Shymansky J. 1984, Trowbridge, L. & Bybee, R. 1990.

Evaluate

What the Teacher Does

- Observes the students as they apply new concepts and skills
- Assesses students' knowledge and/or skills
- Looks for evidence that the students have changed their thinking or behaviors
- Allows students to assess their own learning and group-process skills
- Asks open-ended questions, such as: Why do you think. . .? What evidence do you have? What do you know about x? How would you explain x?

Bybee, R. 1978, Shymansky J. 1984, Trowbridge, L. & Bybee, R. 1990.

Why Use the Five E Model?

1. Student-centered instruction.
2. Studies suggest that this strategy facilitates learning more effectively for a broader range of students than traditional "lecture-first" strategies.
3. The model promotes greater retention of the subject matter than traditional strategies.

Bybee, R. 1978, Shymansky J. 1984, Trowbridge, L. & Bybee, R. 1990.

Leading Instruction in Science

CLASSROOM OBSERVATION

- What instructional strategies can your teachers effectively implement?
- What instructional frameworks do your teachers consistently use?
- Which of the effective strategies do your teachers consistently utilize?

Classroom Walk-Through

- Tool to give principals a quick snapshot of student learning.

Classroom Walk-Through

- Used to engage teachers in conversations about how to improve teaching

Classroom Walk-Through Goals

- Improved classroom instruction
- Improved student discipline
- Higher student achievement across SES and cultural lines

Classroom Walk-Through Outcomes

- Identification of Best Practices/Needs
  - School-wide picture made up of many snapshots
- School Improvement Planning
- Professional Development
- School-wide Reflective Practice

Steps to Classroom Walk-Through

Steps to Classroom Walk-Through

Step One: Determine the Focus

Step Two: Determine Type of Feedback

Step Three: Survey the Learning Environment

After the Walk:

Step Four: Analyze Data Collected

Step Five: Reflection with Teacher

Before Walk
Step One: Determine a Focus

- Is the objective clear to the students?
- Is the lesson on target with the district curriculum?
- Is the teacher asking higher-order thinking skills?
- How are students engaged?
- What types of instructional strategies are used in the lesson?

Before Walk
Step Two: Determine Type of Feedback

- Reflective feedback with prompt
- Reflective feedback with limited response by teacher
- Reflective conversation

Science CWT Snapshot

TEACHER OBSERVATION FORM

Teacher _____ Grade _____ Planning Conference Date: _____

Focus of the Observation: _____

Lesson: _____ Date: _____ No. of Students _____

Beginning Time: _____ Ending Time: _____

Classroom Observation		Comments/Strengths/Areas to Address Reflective Questions
Students Were Observed:		
Actively involved in the science process such as:	Yes or No	
☐ Following safe lab procedure ☐ Making accurate measurements ☐ Creating data tables ☐ Recording observations ☐ Interpreting data, seeking patterns from causal relationships		
Actively engaged with hands-on tools such as:	Yes or No	
☐ Lab equipment ☐ Calculators ☐ Models ☐ Pictures, diagrams, tables and graphs		
Actively engaged with technology such as:	Yes or No	
☐ Computers ☐ Internet ☐ Probes ☐ Other		
Actively engaged within a positive learning environment such as:	Yes or No	
☐ Working in partners or small groups ☐ Participating in classroom discussion ☐ Presenting and explaining solutions to others ☐ Listening to, responding to, and questioning the teacher and one another		

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Science CWT Snapshot

Teacher Was Observed:		Comments/Strengths/Areas to Address Reflective Questions
Supporting an inquiry learning environment such as:	Yes or No	
☐ Ensuring a safe learning environment ☐ Providing activities that allow the student to observe, collect data, reflect, analyze data ☐ Giving students active roles in the design and implementation of investigations		
Leading discussion by:	Yes or No	
☐ Connecting scientific ideas to the real world ☐ Posing questions that engage and challenge students' thinking ☐ Extending student responses beyond mere right or wrong answers ☐ Asking students to clarify and justify their ideas ☐ Emphasizing scientific reasoning and evidence ☐ Reinforcing and validating student ideas and questions ☐ Taking steps to engage every student in class discussion		
Managing the learning environment by:	Yes or No	
☐ Promoting respect for diverse ideas, skills, and experiences of all students ☐ Encouraging the use of a variety of tools ☐ Directing instruction appropriately as the situation demands		

Science CWT Snapshot

Lesson Planning	
C-A-I Alignment:	
Science 5 E Instructional model □ Engage □ Explore □ Explain □ Elaborate □ Evaluate	
Lesson Attributes: Objectives and Goals Connections and Relevance Questioning and Inquiry Feedback and Reinforcement Monitoring and Assessment Application	

Mr. Lomize Teaching Biology

http://video.google.com/videoplay?docid=2481832322334402247&ei=5mDgSo7kK4nYrQLe6vzqBw&q=biology+teaching

After Walk
Step Five: Reflection with Teacher

- Determine how, when, where…
  - Email or face to face
  - Within the first 24 hours
  - Informal location-hall, classroom, duty area
- Determine prompt…
  - Related to the focus
  - Non-judgmental language
  - Stimulate thought

Critical Attributes of Reflective Questions

- What will happen next time (future)
- The Context or Situation
- The Topic or Point of Consideration
- The Teacher or Person Making the Decisions
- Decision(s) to be Made
- Impact on Student Performance (measurable)

Costa, A.L. and Garmston, R.J. (2002) & York-Barr, J., Sommers, W., Ghere, G. & Montie, J. (2001).

Examples

- As you think about the last time you taught this lesson, what are some of the outcomes you want to have happen again?
- When you reflect back on your lesson, what would you do differently next time you teach this lesson?
- How do you think the lesson went? What happened that caused it to go that way?

Costa, A.L. and Garmston, R.J. (2002) & York-Barr, J., Sommers, W., Ghere, G. & Montie, J. (2001).

Sample Prompts….

- When I was doing my walk-through today, the students were in their seats responding to questions. How do you plan your lesson to encourage the students to be active participants?

Sample Prompts….

- When you are planning lessons, what criteria do you use to actively involve your students in the science process skills?

Sample Prompts….

- As I was watching the students work the problems today, I was wondering how many arrived at correct answers. How did you conclude how many of the students worked the problems correctly?

Disciplined conversations will help move a school from words to action.

Phillip C. Schlechty

Schlechty, P.C. (2002). *Working on the work.*

Next Steps….

- How will the data be used?
  - Identification of Best Practices/Needs
  - School Improvement Planning
  - Professional Development
  - School-wide Reflective Practice