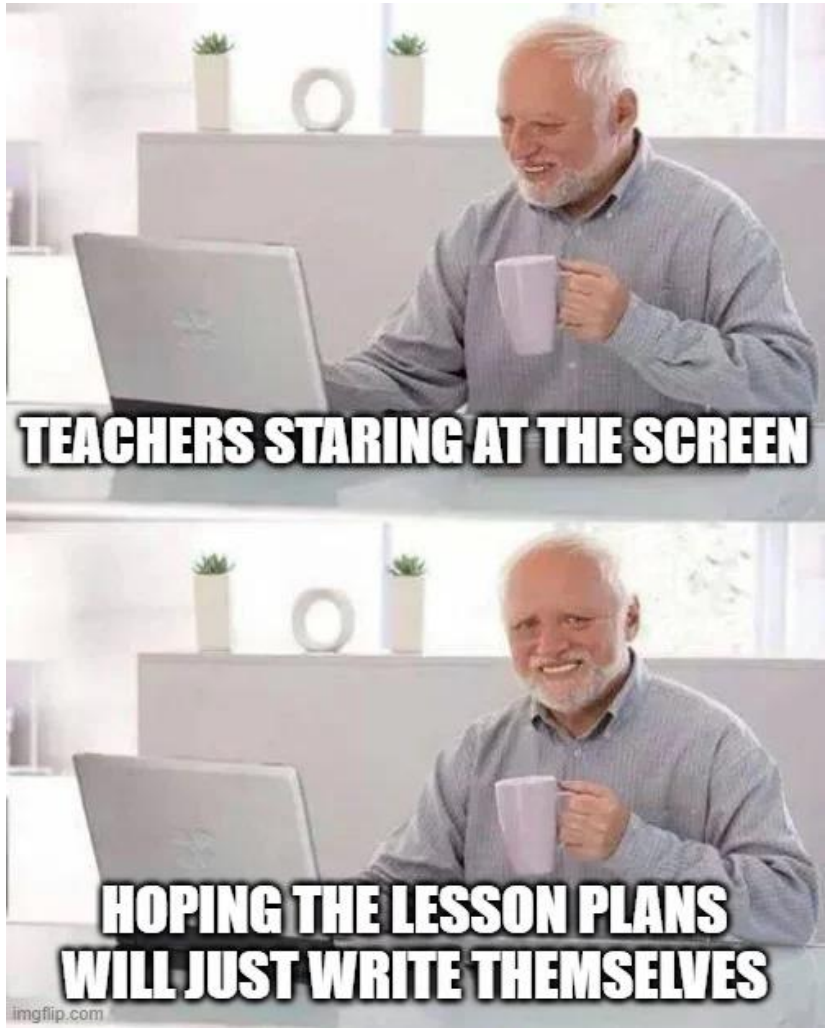
SciREN and K-12 Lesson Plans

Dr. Armen Amirkhanian, P.E.

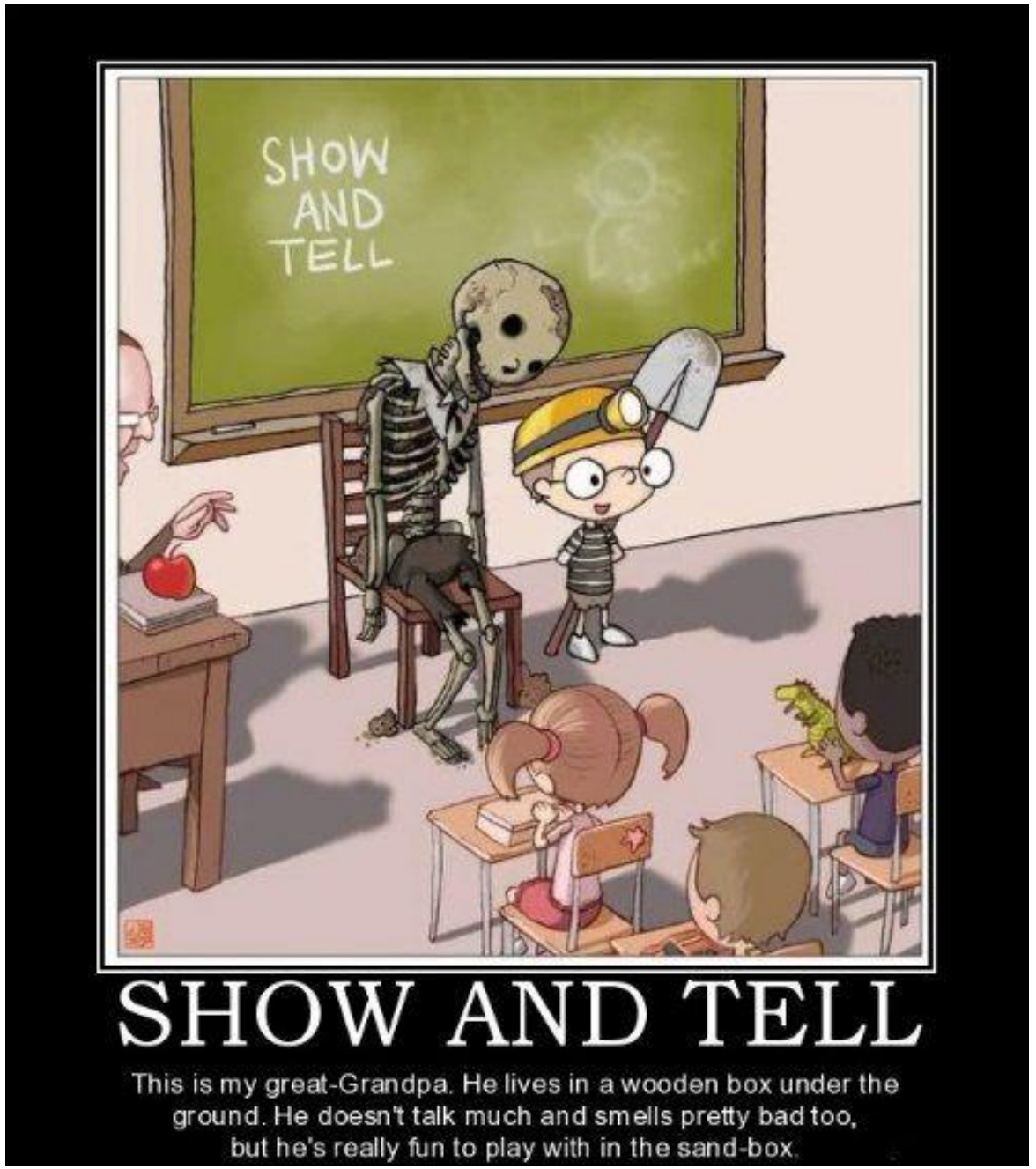
The University of Alabama

We would get fired as teachers



- We don’t have to make lesson plans
- We don’t have to turn in our lesson plans to our principal for review
- We don’t have to follow “state standards”
- We don’t peer evaluate each other

Primary Education Is About Teaching, Not Just Showing



Designing a classroom activity

Scientific Research and Education Network

SciREN aims to achieve our goals and mission through annual networking events and lesson plan workshops. The networking events bring researchers and teachers to the table for **face-to-face interaction and exchange of ideas and materials**. The lesson plan workshops help researchers translate their work into classroom-ready exercises that meet state and national standards.

SciREN

I have a PhD, I don't need to meet with teachers to come up with a lesson plan…

In the Alabama Grade 6 COS, there are ____ standards for science.

I have a PhD, I don't need to meet with teachers to come up with a lesson plan…

- Arts Education
- Career and Technical Education
- Digital Literacy and Computer Science
- Driver and Traffic Safety Education
- English Language Arts
- Health Education
- Mathematics
- Physical Education
- Science
- Social Studies
- World Languages

- It's not just science!
- The curriculum has to address EVERYTHING!

More Broadly

Science and Engineering Practices (SEPs) Grades 6-8 SEPs are taken from *The NSTA Quick Reference Guide to the Three Dimensions.*	
Asking Questions and Defining Problems	Specifying relationships between variables, clarifying arguments, and models.
Developing and Using Models	Developing, utilizing, and revising models to describe, test, and predict more abstract phenomena and to design systems.
Planning and Carrying Out Investigations	Designing and conducting investigations that use multiple variables and provide evidence to support explanations or solutions.
Analyzing and Interpreting Data	Extending quantitative analysis to investigations, distinguishing between correlation and causation, and employing basic statistical techniques of data and error analysis.
Using Mathematics and Computational Thinking	Identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.
Constructing Explanations and Designing Solutions	Constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.
Engaging in Argument from Evidence	Constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).
Obtaining, Evaluating, and Communicating Information	Evaluating the merit and validity of ideas and methods.

Crosscutting Concepts

Crosscutting Concepts (CCCs) Grades 6-8 CCCs are taken from *The NSTA Quick Reference Guide to the Three Dimensions.*	
Patterns	Macroscopic patterns are related to the nature of microscopic and atomic-level structure. Patterns in rates of change and other numerical relationships can provide information about natural and human-designed systems. Patterns can be used to identify cause and effect relationships. Graphs, charts, and images can be used to identify patterns in data.
Cause and Effect: Mechanism and Prediction	Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. Cause and effect relationships may be used to predict phenomena in natural or designed systems. Phenomena may have more than one cause, and some cause and effect relationships in systems can be described only by using probability.
Scale, Proportion, and Quantity	Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. The observed function of natural and designed systems may change with scale. Proportional relationships among different types of quantities (e.g., speed as the ratio of distance traveled to time taken) provide information about the magnitude of properties and processes. Scientific relationships can be represented through the use of algebraic expressions and equations. Phenomena that can be observed at one scale may not be observable at another scale.
Systems and System Models	Systems may interact with other systems; they may have sub-systems and may be part of larger complex systems. Models can be used to represent systems and their interactions (such as inputs, processes and outputs) and energy,

State Standards – AKA the ACI 318 Code

COURSE OF STUDY STANDARD

Science (2015) Grade(s): 6

SC15.6.14

Analyze and interpret data (e.g., tables, graphs, maps of global and regional temperatures; atmospheric levels of gases such as carbon dioxide and methane; rates of human activities) to describe how various human activities (e.g., use of fossil fuels, creation of urban heat islands, agricultural practices) and natural processes (e.g., solar radiation, greenhouse effect, volcanic activity) may cause changes in local and global temperatures over time.

Students must know…

- Natural processes and/or human activities may have affected the patterns of change in global temperatures over the past century, leading to the current rise in Earth's mean surface temperature (global warming).
- Natural processes may include factors such as changes in incoming solar radiation, the greenhouse effect, or volcanic activity.
- Human activities may include factors such as fossil fuel combustion, the creation of urban heat islands, and agricultural activity.
- Natural processes and/or human activities may lead to a gradual or sudden change in global temperatures in natural systems (e.g., glaciers and arctic ice, and plant and animal seasonal movements and life cycle activities).
- Natural processes and/or human activities may have led to changes in the concentration of carbon dioxide and other greenhouse gases in the atmosphere over the past century.
- Patterns in data connect natural processes and human activities to changes in global temperatures over the past century.
- Patterns in data connect the changes in natural processes and/or human activities related to greenhouse gas production to changes in the concentrations of carbon dioxide and other greenhouse gases in the atmosphere.
- Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.

Skills

- Organize given data on various human activities, natural processes, and changes in local and global temperatures to allow for analysis and interpretation.
- Analyze the data to identify possible causal relationships between human activities and natural processes and changes in local and global temperature over time.
- Interpret patterns observed from the data to provide causal accounts for events and make predictions for events by constructing explanations.

What does that look like?

LESSON PLAN

CONSEQUENCE OF BURNING FOSSIL FUELS

Subject Area: Science **Grade(s) :** 6

Overview

In this lesson, students will explore a consequence of burning fossil fuels: the greenhouse effect. By the end of the lesson, students will be able to interpret data to explain the greenhouse effect on temperature and how various human activities could cause changes in local and global temperature over time.

This lesson results from a collaboration between the Alabama State Department of Education and ASTA.

Learning Objectives

- LEARNING OBJECTIVES
- PROCEDURES/ACTIVITIES
- LEARNING ACTIVITY (BEFORE)
- LEARNING ACTIVITY (DURING)
- LEARNING ACTIVITY (AFTER)
- ASSESSMENT STRATEGIES
- ACCELERATION AND INTERVENTION

Primary Learning Objectives

Students will be able to

1. analyze and interpret experiment data to describe changes in temperature over time.
2. recommend solutions for reducing use of fossil fuels.

▾ APPROXIMATE DURATION

Total Duration

91 to 120 Minutes

▸ BACKGROUND AND PREPARATION

▸ MATERIALS AND RESOURCES

Procedure

- LEARNING OBJECTIVES
- PROCEDURES/ACTIVITIES
- LEARNING ACTIVITY (BEFORE)
- LEARNING ACTIVITY (DURING)
- LEARNING ACTIVITY (AFTER)
- ASSESSMENT STRATEGIES
- ACCELERATION AND INTERVENTION

Procedures/Activities

Engage:

Review terms: fossil fuels, climate change, and air pollution, greenhouse effect.
Ask students what they think happens when fossil fuels are burned. Turn and talk. Many students know that burning anything will lead to air pollution, so use this as an opportunity to introduce the concept of greenhouse gases.

Watch NASA greenhouse gas video.

Ask students to turn and talk to describe their new knowledge about what happens when fossil fuels are burned. (formative)

▾ APPROXIMATE DURATION

Total Duration

91 to 120 Minutes

▸ BACKGROUND AND PREPARATION

▸ MATERIALS AND RESOURCES

Assessment

- LEARNING OBJECTIVES
- PROCEDURES/ACTIVITIES
- LEARNING ACTIVITY (BEFORE)
- LEARNING ACTIVITY (DURING)
- LEARNING ACTIVITY (AFTER)
- ASSESSMENT STRATEGIES
- ACCELERATION AND INTERVENTION

Assessment Strategies

Teacher observation

Assessment strategy Framed Paragraph Cause and Effect

▾ APPROXIMATE DURATION

Total Duration

91 to 120 Minutes

▸ BACKGROUND AND PREPARATION

▸ MATERIALS AND RESOURCES

Assessment

FRAMED PARAGRAPH: CAUSE AND EFFECT

FILL IN THE BLANK WITH THE APPROPRIATE ANSWER.

In this lesson, we learned _____.

The possible **causes** for this (**effect**) might be _____,

The problem(s)/ issue(s) with this effect are _____, _____, and _____.

How does SciREN help?

- Provides a mechanism to bring researchers and teachers face-to-face
- Teachers get PDHs
- Researchers get direct, immediate, and honest feedback

LISTEN TO THE TEACHERS!

What does it look like?

- Calcium Sulfoaluminate Cement “coasters”
- Individual activity

Science (2015) Grade(s): 8

SC15.8.5 Observe and analyze characteristic properties of substances (e.g., odor, density, solubility, flammability, melting point, boiling point) before and after the substances combine to determine if a chemical reaction has occurred.

Science (2015) Grade(s): 8

SC15.8.6 Create a model, diagram, or digital simulation to describe conservation of mass in a chemical reaction and explain the resulting differences between products and reactants.

Science (2015) Grade(s): 8

SC15.8.5 Observe and analyze characteristic properties of substances (e.g., odor, density, solubility, flammability, melting point, boiling point) before and after the substances combine to determine if a chemical reaction has occurred.

Knowledge
Students know:

- Each pure substance has characteristic physical and chemical properties that can be used to identify it.
- Characteristic properties of substances may include odor, density, solubility, flammability, melting point, and boiling point.
- Chemical reactions change characteristic properties of substances.
- Substances react chemically in characteristic ways.
- In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.

Skills
Students are able to:

- Observe characteristic physical and chemical properties of pure substances before and after they interact.
- Analyze characteristic physical and chemical properties of pure substances before and after they interact.
- Analyze the properties to identify patterns (i.e., similarities and differences), including the changes in physical and chemical properties of each substance before and after the interaction.
- Use the analysis to determine whether a chemical reaction has occurred.

Understanding
Students understand that:

- Observations and analyses can be used to determine whether a chemical reaction has occurred.
- The change in properties of substances is related to the rearrangement of atoms in the reactants and products in a chemical reaction (e.g., when a reaction has occurred, atoms from the substances present before the interaction must have been rearranged into new configurations, resulting in the properties of new substances).

3 Years Running

Thank you for LISTENING!