Methods of Inquiry and the New Standards: A Teacher's Perspective

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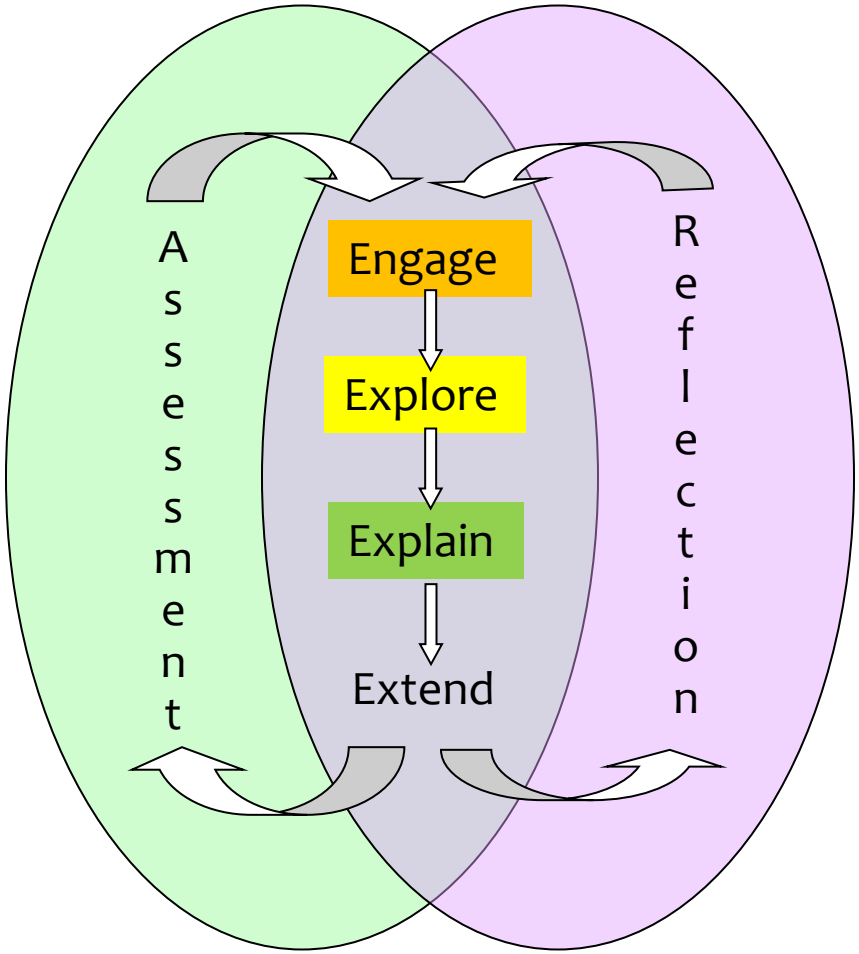
Inquiry in Motion Professional Development Institutes

* PDI-1 for first year participants
* PDI-2 for second year participants

* Help teachers experience content-embedded inquiry teaching

* Support the development, implementation, refinement, and evaluation of Lesson Exemplars based on the 4E x 2 Instructional Model (*www.clemson.edu/iim*)

4E x 2 INSTRUCTIONAL MODEL



Critical for Inquiry: Students must be allowed to Explore ideas before Explanation of concepts occurs

ENGAGE

Assess prior knowledge and make connections to prior learning

* Brainstorm ideas
* Student Observations
* Discourse

EXPLORE

Investigate and Collect Data

* Research
* Experiments
* Experiences
* Discussion

EXPLAIN

Build Student Understanding and Critical Thinking Skills

* Effective communication skills to share information and data
* Clarify misconceptions and knowledge gaps
* Use of informal assessments

Meaningful Learning

* It is not about the number of worksheets, your acting ability, or the number of activities you provide.
* Meaningful learning—engages all learners and challenges them to think, observe, and interact in the world around them.
* For Teachers, this is an intentional action—not just happenstance.

Life Science

* **SC Science Standard 7-3 Human Body Systems and Disease**

7-3.3 Summarize the relationship of the major body systems (including the circulatory, respiratory, digestive, excretory, nervous, muscular, and skeletal systems)

* **NGSS MS-LS1 From Molecules to Organisms: Structures and Processes**

MS-LS1-d Design and conduct an investigation to gather evidence to support explanations that the body is a system of interacting subsystems composed of groups of cells working to form tissues and organs specialized for particular body functions, and that scientific advances in understanding those systems have led to improvement in nutrition, health, and medicine

Engage-Assess Prior Knowledge

Students hold their arms straight out beside them.

When students begin to drop their arms or complain about being tired, they sit down.

Points for discussion

* How did your arms feel?
* Why did your arms begin to feel this way?

Explore-Investigate and Collect Data

Students will be asked to squeeze a clothespin as many times as possible in 1 minute and record their data.

Repeat this 3 more times and graph the results.

* What enabled you to squeeze the clothespin?
* What did you notice happened to the number of times you were able to squeeze the clothespin from Trial 1 to Trial 4?
* Why do you think the number changed?

Explore-Investigate and Collect Data

* What would happen if the clothespin had more resistance (harder to squeeze)? How would this have affected your data on the different trials and why?
* Why do you think some students' graphs are different? Why aren't all our graphs the same?
* What could you do to increase the number of squeezes in each trial?
* Do you think this same type of thing happens in other areas of your body? Explain.

Explain-Build Understanding

Students use the data they collected and write a definition for *muscle fatigue*.

(This question would come after you have introduced this term. *"Okay students, what you have just been describing is something called muscle fatigue. Based on our discussion how would you define…"*)

Extend-Demonstrate Understanding

Exit slip or short writing activity

Prompts:

What other body systems were involved in the clothespin activity?

Explain what role the other body systems played and how important was their contribution.

Earth/Space Science

* **SC Standard 8-4 Astronomy: Earth and Space Systems**

8-4.5 Explain how the tilt of Earth's axis affects the length of the day and the amount of heating on Earth's surface, thus causing the seasons of the year.

* **NGSS MS-ESS1 Earth's Place in the Universe**

ESS1-b Use models of the Earth-sun system to support the explanation that the seasons are a result of Earth's tilt and are caused by the differential intensity and duration of sunlight on different regions of Earth over a year.

Engage-Assess Prior Knowledge

Teacher leads class in a discussion:

* *What changes do you observe outside as the year progresses?*
* *Are these changes the same everywhere around the world? Why or why not?*
* *What causes these changes?*
* *Give evidence to support your claims.*

Explore-Investigate and Collect Data

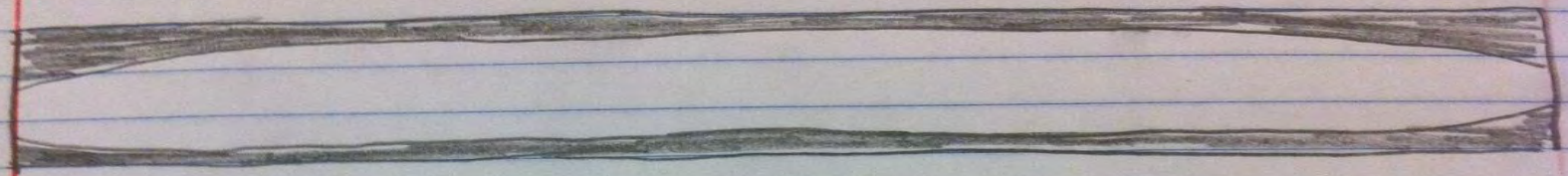
* Students observe graphs representing the daylight hours for four locations around the world.

* Students sketch and record their observations of each graph.

7 Sunrise / Sunset Graphs 11/28/11

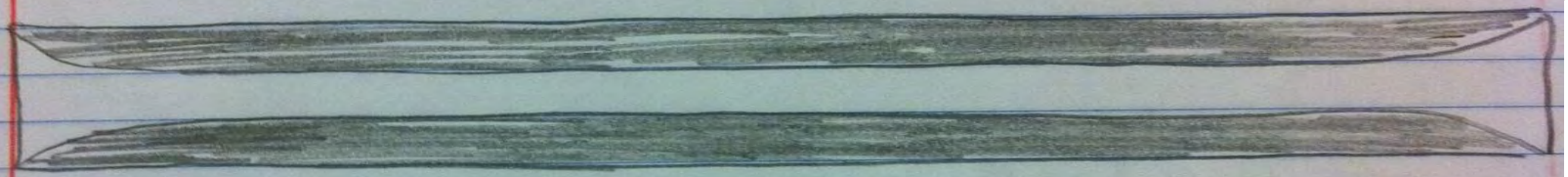
Anderson, SC:

fig 3



Punta Arenas, Chile

fig. 4



Nairobi, Kenya

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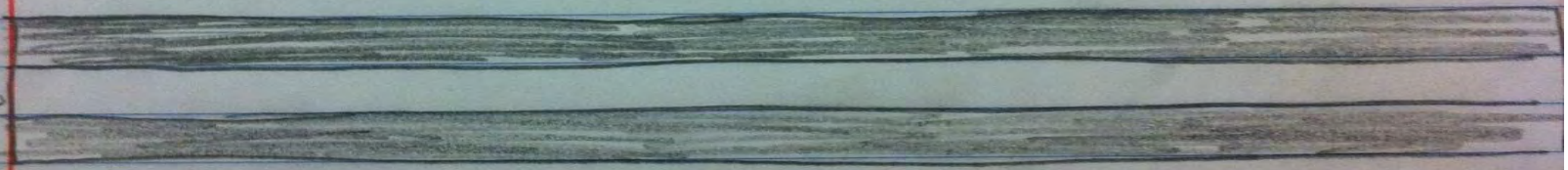
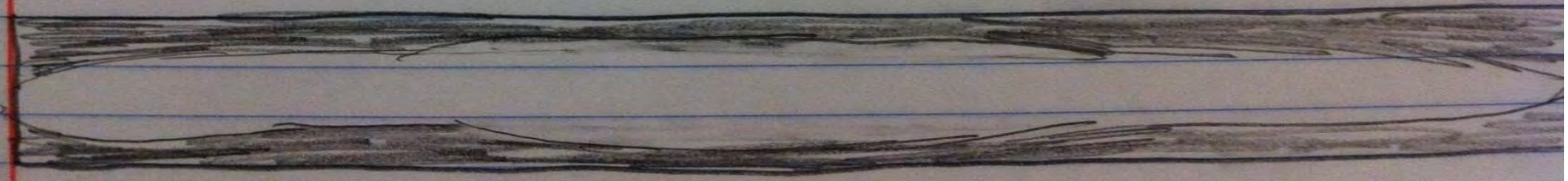


Oslo, Norway

fig 8



Explain-Build Understanding

Teacher facilitates a discussion to assist students in making connections between number of daylight hours and distance from the Equator

* *What did you observe about each graph?*
* *How do they compare to each other?*
* *What would cause these results?*
* *Support your answer with evidence.*

Sunrise/Sunset Observations

a. Oslo, Norway
- shaped like a lava lamp
- larger in the middle
- caves in towards middle

b. Nairobi, Kenya
- a continous straight line
- the white area is smaller

c. Punta Arena, Chile
- has an hour glass
- smallest in the middle
- very little orange

d. Anderson, SC
- lava lamp shape
- large in the middle
- curved at the edges

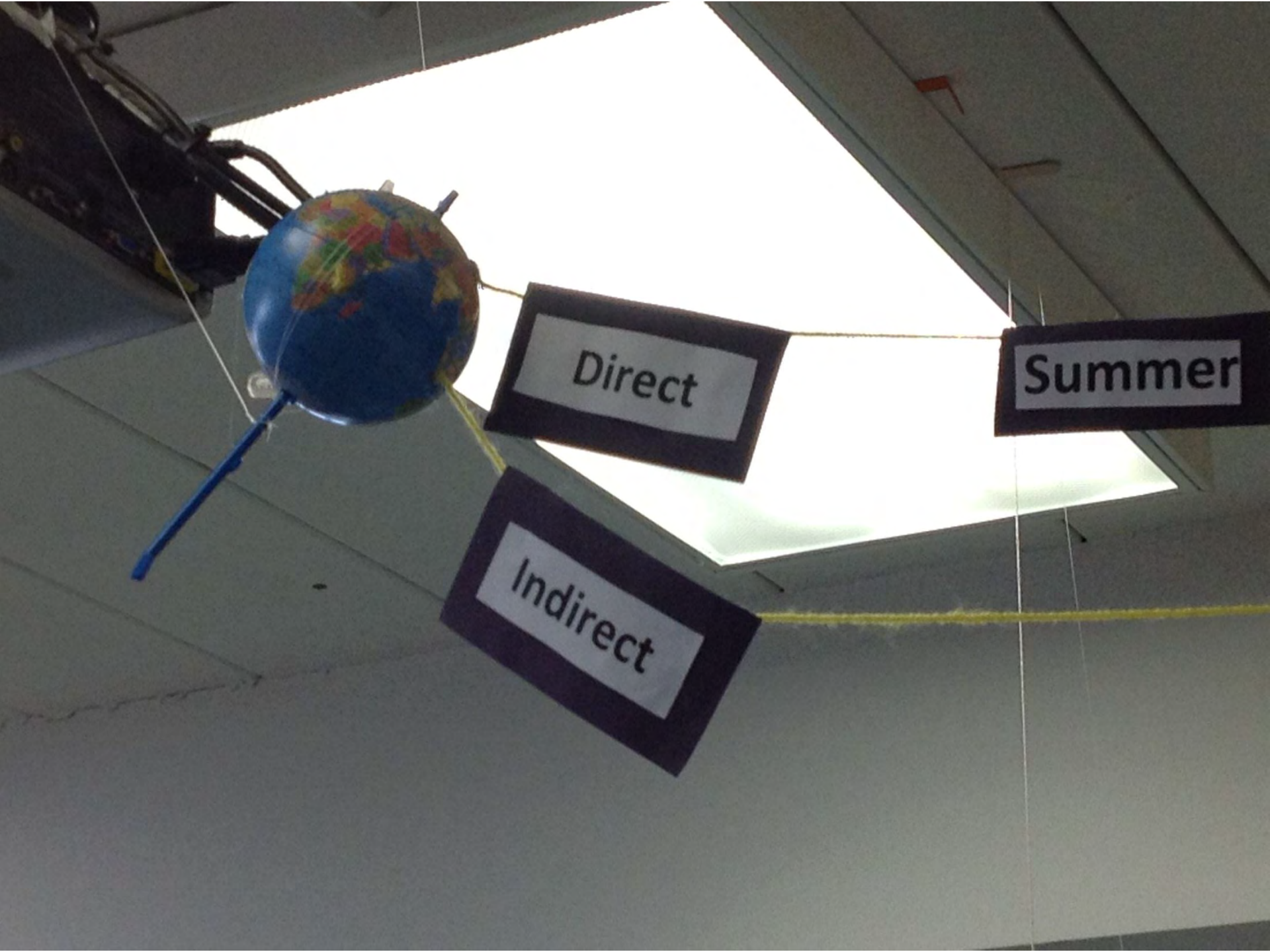
Explanation: The sunrise/sunset appears that way because of the angle it is striking at (the earth tilts up and down).

Extend-Demonstrate Understanding

* Students create models demonstrating the position of the Sun and Earth

* Students provide evidence for how their model demonstrates differences in daylight hours and a change of seasons

Example of a student model illustrating the relative position of the Sun and Earth during the four seasons


Direct
Summer
Indirect

Physical Science

* **SC Standard 6-5 Conservation of Energy**

6-5.6 Recognize that energy is the ability to do work (force exerted over a distance).

6-5.7 Explain how the design of simple machines (including levers, pulleys, and inclined planes) helps reduce the amount of force required to do work.

6-5.8 Illustrate ways that simple machines exist in common tools and in complex machines

* **NGSS MS-PS-2 Motion and Stability: Forces and Interactions**

MS-PS2- f Define a practical problem that can be solved through the development of a simple system that requires the periodic application of a force initiated by a feedback mechanism to maintain a stable state.

Engage-Assess Prior Knowledge

Technological Design Brainstorming

Design and build a complex machine to move a block three meters

* What do you know about simple machines?
* What supplies do you need?
* Sketch your initial design

Explore-Investigate and Collect Data

Using the Technological Design Process

* Predict
* Build and test model from sketch
* Record data on movement
* List an idea for improvement

Explain-Build Understanding

Students communicate their research on simple machines

Teacher steps in to correct misconceptions

Students re-evaluate their design to identify and problem solve design flaws

Extend-Demonstrate Understanding

* Writing assignment about what were the best and worst parts of using the technological design process to solve the problem

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INQUIRY IN MOTION

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A Vision for Education

Inquiry in Motion seeks to improve the motivation, potential, and achievement of students and teachers through rigorous and authentic inquiry-based learning experiences.

News and Events

2010 Professional Development Programs

Posted on April 24, 2010

Beginning in July, 28 math and science teachers from Anderson 5 School District (Southwood Middle and Lakeside Middle) and Oconee County School District (Walhalla Middle) will participate in a year-long professional development initiative designed to improve both inquiry-based instruction and student achievement. Funding for this program comes from the Center of Excellence for Inquiry in Math and Science.

Additionally, 8 teachers from Greenville and Oconee School Districts will participate in a second year initiative that seeks to develop and sustain

Time for Questions