Chapter 22

Sussan Oladipo: Turn Down the Heat

Sussan Oladipo has been an educator for the past 24 years. She taught for 10 years oversees before moving to Chicago sixteen years ago. She has served 14 years' with the Chicago Public School in various roles. She is currently an Assistant Principal and has previously served as a science teacher, teaching chemistry, earth space science, environmental science, and freshmen algebra and was a science department chairperson. She has also held a school director position in a charter school, a CPS voluntary public school choice grant administrator, and network instructional support leader.

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Turn Down the Heat: Exploring Thermal Insulation-from cookbook to inquiry

Grade Level:
Grade 8 but this is also designed to support teacher teams who will teach the lesson

Content Area Topic: Science/Reading/Math

Content Area Standard(s):
- Ask questions to discover how energy moves WHST.6-8.7;
- Plan and carry out investigations to explore the movement of heat in a system WHST-8.2, MP.1;
- Obtain, evaluate and communicate information WHST.6-8.4, SL.6
- MS-PS3-4: Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support claim.

- CCSS.ELA-LITERACY.RST.6-8.3: Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. CCSS.ELA-LITERACY.RST.6-8.4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.
- CCSS.ELA-LITERACY.W.8.9.B: Apply grade 8 Reading standards to literary nonfiction (e.g., "Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient; recognize when irrelevant evidence is introduced").
- CCSS.ELA-LITERACY.W.8.6: Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others.
- CCSS.ELA-LITERACY.SL.8.1.C: Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas.
- CCSS.ELA-LITERACY.RI.8.4: Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyse the impact of specific

word choices on meaning and tone, including analogies or allusions to other texts.

Mathematical Practices:
- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

Learning Objective(s):
- Apply science and engineering practices to our professional learning and daily classroom instruction.
- Engage, Explore, Explain, Elaborate and Evaluate using inquiry.
- Determine effective use of materials to support inquiry science.

Student Outcome Statements:
- Ask questions to discover how energy moves WHST.6-8.7
- Plan and carry out investigations to explore the movement of heat in a system WHST-8.2, MP.1
- Obtain, evaluate and communicate information WHST.6-8.4, SL.6

Suggested Time Allotment: 90 minutes or two periods of lesson

Sequence in Learning:
- This 90-minute lesson is connected to a larger theme on the unit of Conservation of Energy and Energy Transfer. This addresses how thermal energy is transferred between objects or systems and how this concept affects our daily lives.
- This is a lesson from a unit on energy, transfer of energy in form of Heat Transfer and will continue with lessons on different systems and impact of energy transfer.

Prior to this lesson, students need to have learned the various ways that energy moves from one higher-temperature object to another of a lower temperature, cooling the higher temperature object and heating the lower temperature object in the process.
Previous lesson in the unit would have explored concepts of conduction, convection, and radiation and how they are connected to students' everyday lives. Students would have also learned about science practices, including experiment design concepts such as independent, dependent variables, control variables, and scientific explanations.

Materials & Resources Needed:

- A video clip on inquiry science link: https://www.youtube.com/watch?v=LJJoKxDsyoQ
- Bill Nye's heat video URL: https://www.youtube.com/watch?v=j9GDDLwzpAY
- Eight balls of cotton wool per group,
- A piece of 5 by 5 bubble wrap per group
- One thermometer per 2 students
- One 4 by 4 inches fleece
- Two cups of sand per group,
- One cup of hot water and cold water per group
- One notebook journal per student
- Writing materials (pen, pencils, rulers)
- Three paper- bowls per group
- One small container per group, one laptop per group
- Wordle.net website,
- One large post it per group t
- Two post its for creation of anchor charts.
- Website: readworks.org-Informational text titled ***A ball of Energy*** by Gabrielle Sierra
- "Turn Down the Heat" Worksheet (Prentice Hall 1994, p. 483–85),

Lesson Activities & Sequence:

Students will be grouped heterogeneously in twos or threes.

A. Students will read the informational text titled A Ball of Energy in their groups and answer the text- dependent questions in their journals.

Students will watch a short video clip and decode meaning of vocabulary words from context of video. This video is the Bill Nye's heat video URL: https://www.youtube.com/watch?v=j9GDDLwzpAY

They will answer questions on the experiment and reflect on the outcomes of the experiment. Students will answer the question: What have you learned doing this experiment?

(For the teacher teams the video on inquiry will be watched and discussed.)

Students will listen to video on the Promethean board and take notes of salient points in their individual science journals. Teacher will discuss new vocabularies from the video through the following driving questions:

B. Teacher will engage student using driving questions about ways in which energy is transferred. Questions will include:

What are the different ways that energy is transferred through solids, liquids and gases?

- What were the variables in our experiment?

- What variable did we manipulate?
- What was the responding variable?
- How did we ensure it was a fair test?
- How does the temperature change help us determine which material is the best insulator?
- Which material is the best insulator?
- Why is this material a better insulator than the others?
- Are good insulators also good conductors?
- Why or why not?

C. Students will be asked to record responses in their science journals. Teacher will walk around to ensure that student groups were on task and to gather points from what students were writing to be used as teachable moments from what students were writing. Listening in on group discussions will afford teacher a means to formatively evaluate the students as they shared emerging ideas about conduction, convection and insulation.

D. The ideas that the students scripted in their journals will then be shared during a whole-group discussion. Discussion will be centered on how insulators affect student lives. For example, students will share how insulators are used in winter and how students can design an experiment to determine which materials are better insulators and which among the materials provided is the best insulator.

E. Teacher will lead students to plan and use the materials provided to conduct a simple experiment that would provide an explanation for the question they generated during the above discussion.
Teacher will ask the following questions to guide students in planning the experiment:
- What data would you collect to find out if a material is a good conductor?
- Would you record the time it took?
- Which other variables would you use in designing your experiment?
- How would you set up your control?

Students will then work in their groups to carry out the experiment. Teacher will circulate to provide needed help and to assist students in any way needed.
Students will create data tables and graph their data of insulators and the temperature at which they are able to retain heat energy.

Proficiency:
- When students have met expectations for the objectives, they demonstrate understanding of the scientific practices involved in the inquiry activity as well as the underlying core ideas in which

the activity was based. This will be evaluated in the following ways:

- Students will be asked to represent the pooled data using a bar chart, where the *x*-axis represent the insulating materials and the *y*-axis represented the temperature change.
- Students will also be required write a scientific explanation to convey their understanding of the results of the experiments
- The explanations will consist of a claim, which will be a student's understanding of the results of an investigation; the evidence from the data that supported the claim as well as the reasoning that goes with it.
- In addition, when students have met expectations, I will see evidence of students asking questions from teacher and from peers to discover how energy moves. Questions may include why certain conductors are better than others. How people that live in very cold regions of the world conserve energy and insulate their homes.
- Other evidence of proficiency will be students' planning actively with their peers and carrying out investigations to determine which materials are better insulators from the different kinds of materials available.
- Other evidence are students' obtaining, evaluating and communicating information to their partners through speaking and active listening, writing when prompted by teacher.

Rubric:

Elements	1	2	3	4
Journal	Journal has at least one word and its explanation from context.	Journal has at least three vocabularies and the explanation of their meanings form context	Journal has at least five vocabularies and explanation of their meanings form context	Journal includes at least seven vocabularies and explanation of their meanings from context
Experiment design	Only one member of the group is generating questions and ideas about how the design should go	One third members of the group are generating questions and ideas about how the design should go	Two third of the group are generating questions and ideas about how the design should go	All members of the group are generating questions and ideas about how the design should go
Data and Graphic	Data table has only a few necessary parameters populated and graph is only partly labeled and scaled.	Data table has some necessary parameters populated and graph is somewhat clearly labeled and scaled.	Data table has most necessary parameters populated and graph is mostly clearly labeled and scaled.	Data table has all necessary parameters populated and graph is clearly labeled and scaled.
Writing of evidence	Written evidence has one or two claim, evidence and reasoning.	Written evidence has some (two or more) claim, evidence and reasoning.	Written evidence has most (three or more) claim, evidence and reasoning.	Written evidence has all (four or more) claim, evidence and reasoning.
Conclusion	Conclusion summarizes one findings and central idea behind objective	Conclusion summarizes two findings and central idea behind objective	Conclusion summarizes three findings and central idea behind objective	Conclusion summarizes four findings and central idea behind objectives

Feedback

Teachers As Learners:
- Video clip activated prior knowledge
- Video clip allowed students to clear misconceptions, review concepts, introduce new vocabulary words
- Supported visual learners
- Note taking was free format: Students could take notes any way they would like which appealed to multiple learning styles

Elements of Pretty Good Practice:
- Appealed to diverse learners: Kinesthetic, visual, interpersonal
- Visuals: Organized powerpoint
- Activate prior knowledge
- Evidence of thorough planning
- Inquiry based
- Integrated writing math, engineering, speaking standards
- Anchor charts
- Scaffolding the creation of data charts
- Consideration of ELL strategies: visuals, graphic organizers, vocabulary, drawing, audio support
- The use of the 5E model

Modifications and Adaptations:
- Support students who lack perseverance with scaffolding: Ask questions, partner students with teacher leaders, provide guided lab sheet with open ended questions, allow conversation with other lab groups
- Special education: Differentiate the assignment to provide extensive time to build before experimentation
- ELLs: Front load vocabulary

Questions Arisen:
- How can we integrate technology into instruction?
- How can we support students who lack perseverance?
- What are other ways to scaffold inquiry for ELLs and SPED students?

Peer Feedback:
One major suggestion was to scaffold the lesson in multiple ways for the ELL students. However, since this is an inquiry lesson, students are supposed to discover by themselves by asking questions to inquire and discover the ideas, information and concepts embedded in the tasks, the level of scaffolding will vary with ability of the student group. An exception may be made to this strategy by me asking

the students more scaffolding questions to provide some clue to accommodate this suggestion (but on a case by case basis.)

Accommodation for Diverse Learners: Diverse learners will get extra time on task, repeated explanation of task and other accommodations indicated in their individualized learning plans.
There will be audio readings to differentiate for auditory learners and students who are ELLs.
Differentiation: Teacher will circulate, observe to formatively assess what each student is doing individually and in a group. If warranted, teacher will sit and support different groups, and leverage any teachable moment to further advance students skills individually and in groups.

Bibliography:

- If applicable: Exploring Thermal Insulation by Cheryl A. McLaughlin
- Readworks.org: A ball of Energy http://www.readworks.org/sites/default/files/passages/1070_a_ball_of_energy.pdf
- Prentice Hall Science: "Turn Down the Heat" (Prentice Hall 1994, p. 483–85),
- Video clip by Bozeman –asking question series: https://www.youtube.com/watch?v=LJJoKxDsyoQ
- Exploring Thermal Insulation (PPT)