Chapter 24

Alicia Song: Solving Problems: Save Fred!

I am Alicia Song, bilingual science educator and garden coordinator in the Pilsen neighborhood. I have been a teacher for the Latino community for 23 years. I enjoy working with the Latino community because I identify myself with many of my students. I'm presently teaching science to middle school students in inclusion, gifted bilingual, bilingual and regular classrooms. As garden coordinator in my school, one of my proudest achievements this year was to serve the vegetables students grew in afterschool programs, in the cafeteria.

I believe that all students deserve the best education, one that nurtures the whole child, physically, socially and mentally. All stakeholders working together can provide the best education for all children. I have a bachelor's degree from University of Illinois at Chicago and a Master's degree in School Leadership from Concordia University.

Solving problems: Save Fred!

Grade Level: 5th, 6th or 7th th grades

Content Area Topic: Experimental Design

Next Generation Science Standard(s):

- MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

Reading Standards for Literacy in Science and Technical Subjects:

- 7-3: Follow precisely a multistep procedure when carrying out experiment, taking measurements or performing technical tasks.
- 7-4: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in specific scientific or technical context relevant to grades 6-8 texts and topics.
- 7-7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g. in a flowchart, diagram, model, graph, or table).
- 7-9: Compare and contrast the information gained from experiments, simulation, video, or multimedia sources with that gained from reading a text on the same topic

Science and Engineering Practices

- Asking questions and defining problems. Ask questions so to arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.
- Developing and using models. Evaluate limitations of a model for a proposed object or tool. Develop or modify a model—based on evidence – to match what happens if a variable or component of a system is changed
- Planning and carrying out investigations. Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.
- Analyzing and Interpreting data. Analyze and interpret data to determine similarities and differences in findings.

Learning Objective(s):

- Students will recognize and analyze alternative explanations and predictions
- Students communicate procedures and explanations
- Students recognize different kinds of questions suggest different kinds of explanations
- Students will understand that scientists test their explanations using observations and experiments

Suggested Time Allotment: 60-minute session

Sequence in Learning:

This activity serves as an introduction to problem solving as a series of steps or elements that are present in every scientific investigation. Students in this activity examine the steps involved in problem solving by collaborate working the solution to a problem. The idea is that students connect and learn about various approaches to scientific problem solving. In subsequent lessons examples of real scientists and methods will be observed. Students will build on prior knowledge and understanding on how scientist solve problems, and be able to correlate how our own processes of solving problems relate to scientific processes scientists use. Students introduced to various models of the scientific method so they are able to recognize some of the core elements of the scientific method. In subsequent lessons, students will be prepared to set up problems so they can be solved using a consistent methodology.

Materials &Resources needed:

- For each pair of students you will need:
- 1 gummy candy life preserver
- 1 gummy candy worm
- 1 plastic cup
- 4 paper clips
- Prezi- http://prezi.com/rhppd7jsvwp-/copy-of-save-fred/
- Power point presentation-https://drive.google.com/a/cps.edu/file/d/0B9nodjIKrLEM19iR0NDV1pIN1E/edit?usp=sharing

Technology:

- IPads / computers/ smart board
- Assessment applications Socrative.com or Socrative application
- Sketchbook pro: to visualize steps in procedure
- Notability app: combines handwriting, photos and typing to bring thinking processes to life

Pre-post Assessments in Socrative.com

Solving Problems: Saving Fred!

Part 1-Anticipation Guide

In the spaces below answer agree or disagree to each of the statements, based on your prior knowledge After completing the activity reread the statements and answer again your thoughts on the second line.

	Before	After
1. All scientists solve problems the same way. Agree /disagree	_____	_____
2. There's only one scientific method. __Agree /disagree	_____	_____

Grouping:
Students will be grouped heterogeneously in twos

Sequence in Learning:

Engage prior knowledge

- The first step is to elicit students' ideas about scientific design and pose questions such as: How do you solve problems? What kinds of problems do scientists work to solve? Have you learned about any of the methods scientists use to solve problems? Are these methods similar to the ones you use to solve problems?

Assess prior knowledge

- In their handout students will answer anticipation guide questions 1 & 2 before exposing them to the problem they're about to solve
- **Engage**
- Pose the scenario for students on how we are constantly solving problems and ask them- what problem you had to solve in the past 24 hrs, day, week?

Introduce the problem

- How to save Fred. Access prezi and communicate the challenge for student.
- Distribute materials for each pair of students- cup, gummy worm and gummy lifesaver as well as four paperclips.
- As students are working to solve the problem each pair of students should record observations about their problem solving approach on notability app/ interactive notebook. They have the choice to do this in words or illustrations.

Elaborate

- As students complete the task, have them switch the procedure they came up with and have a different pair of students try following the procedure.

Students will probably encounter problems in solving each

other procedures, which can pose an opportunity to discuss the importance of communicating clearly in words or illustrations; as well as how scientists replicate investigations from others to come up with own conclusions.

You can present them with the traditional scientific method and ask: If they solved the problem following these steps, if so in which order? Students may have difficulty identifying each of the elements of the scientific method depending with familiarity and prior knowledge of experimental design, so it might be necessary to discuss when students were making a hypothesis, following a procedure, collecting data, and drawing conclusions as they attempt to save Fred.

Present students with scientific problem solving models and ask them to identify which of these ways did they use to save Fred. If they did not use any of the methods, students can come up with a new Problem Solving Model 4.

Problem-Solving Model 1	**Problem-Solving Model 2**
1. Identify the problem. 2. Propose a solution. 3. Conduct an experiment.	1. State the problem. 2. Propose a solution. 3. Conduct an experiment. 4. Analyze data. 5. Make conclusions.
Problem-Solving Model 3	**Problem-Solving Model 4**
1. Conduct an experiment. 2. Discuss results. 3. Propose other solutions. 4. Conduct a different experiment.	

Ask students if they think scientists follow only one method to solve problems.

Post-Assessment:
Have students complete the anticipation guide one more time and revisit their preconceptions about solving problems. Allow them to write a reflection if they agree or disagree and if the thinking has changed or remained the same, to respond why?

Proficiency:
- When students have met the expectations for this objective they are able to compare their problem solving method with other problem-solving methods and conclude how scientists solve problems. Students will meet expectations of this objective when they are able to verbalize and identify the different elements of problem solving.
- They will also be able to apply different problem-solving models to new problems and understand that is not the sequence in which you solve problems that is important but that the elements of problem solving model such as hypothesis, procedure, data collecting, analysis of data and drawing conclusions are represented.

Feedback

Teachers As Learners:
Students are challenged when they need to compare their own method of solving problems with different scientific models that are used by scientists today. This activity is a great starter to help students think about a scientific method and process when solving a scientific problem: it also forces students to communicate and listen carefully to one another as they compromise their suggestions and step procedures into one solution for the problem. Supporting documents and Power Points were smooth are useful. Transitions went well with drawing and/or writing procedures.

Elements of Pretty Good Practice:
- Think/Pair /Share, Anticipation guide, Hypothesize, Scientific method approach, Problem Solving Prediction
- Hands-on activity was very good experience using the problem solving task.
- The challenge was given at the beginning. Established a purpose at the beginning.
- Presenting a challenge by using Prezi.
- Learning was summarized at the end to tie everything together from the lesson.
- Time and duration was given

- Directions for trials was given prior to the experiment
- Relate the experiment to real-life coast guard rescue missions

Modifications and Adaptations:

- Take the problem solving steps of the scientific method and have students organize steps without labeling the step number on them as presented in power-point
- Include modifications for diverse learners-some students may need to understand what each of the steps of the scientific method mean in order to understand when they were doing what (visual representation).
- Include what were the methods from solving your problem in a form of discussion. Prior to performing the experiment have students draw up their own procedures and switch with another group.

Questions Arisen:

Are students able to visualize what scientists' processes are when solving problems?Technology can be used to record student data for the experiment, particularly quantitative data. What problem do they have to solve? What procedure and plan they must follow to rescue someone?

Peer Feedback:

Colleagues suggested incorporating the use of technology to collect data specifically qualitatively. In this experiment though the collection of data such as writing a procedure or using a science model when solving a problem. Students can also swap procedures and try to solve the problem from someone else's methods. It was suggested to link this activity to real-life rescue missions and to research on how rescuers solve situational problems. Students may watch interviews of National Guards and what approaches and methods in rescue missions.

Additional Resources:

- **Scientific Method Models:**
- https://docs.google.com/a/cps.edu/