STEM: Homemade Ice Cream

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Grade Level: 4th Grade

Overview	The purpose of this lesson is to help disadvantaged 4th-grade students in the CMFK program to learn about the Three States of Matter and their interactions with each other. Learning about the Three States of Matter wi not only be of practical use in future science courses, but will also enrich students' understanding of every-day occurrences, like condensation on a glass or the melting of snow. Teaching students how to make ice cream in a bag is an efficient way of packing and transferring information to students, as well as a highly motivational activity designed to peak their curiosity and encourage teamwork with their Mentor.
Description of Learners, Intended Learning Goals, and Lesson Content	**Description of Learners:** *Students:* ● 15-20 students ● 4th grade ● Even distribution on boys and girls ● Disadvantaged, possibly under-motivated ● Partnered with college mentors (ages ~18-22)  *Environment:* ● A large classroom on college campus ● Small whiteboards, wireless internet, projector ● Tables and chairs in small groupings **Intended Learning Goals:** ● To understand the three states of matter: solid, liquid, and gas ● To learn about physical and chemical changes ● To understand what mixtures are and how mixtures are made **Lesson Content:** ● The lesson plan includes a powerpoint detailing information about the different states of matter, energy changes, and mixtures. Students will be engaged, as the teacher will ask them questions for examples of solids, liquids, gases, and mixtures. After a brief introduction, a slide will introduce the activity: making ice cream. With the given materials, students will create a mixture and create ice cream. Mentors will help the students to ensure they don't make a mess, and understand the activity. After the ice cream is made, the students are allowed to eat it. While the students are eating, the teacher will return to the powerpoint and ask students

	questions to assess their understanding of the activity with their Mentor. Technology will be used in form of a powerpoint displayed on the projector.
Objectives	• Given the three states of matter, students will be able to identify two of the unique characteristics of each state. • Upon completion of the lesson, students will be able to coherently and correctly explain how a gas changes to a liquid, how a liquid changes to a solid, and how a solid changes to a liquid. • Without notes, students will be able to coherently and correctly describe what a mixture is, and provide two examples of a mixture
Materials	• Projector to display powerpoint • Supplies for making the ice cream: whole milk, sugar, vanilla, crushed ice, gallon size and sandwich size Ziploc bags, measuring cups, rock salt, spoons. These will be provided on the tables before the lesson.
Procedures	1. At the beginning of class, the teacher will lead students in an Orientation Activity, where they will list the events of the class period on the board: video, powerpoint, questions, and ice cream project. The teacher will also inform the students that their main activity for the day is to make homemade ice cream, and that the main topic of the lesson is the Three States of Matter. If it helps the students, write the title “Three States of Matter” on the board so that they can refer to it and be reminded of it throughout the lesson. This should take **5 minutes** or less. 2. Using the projector, the teacher will then go through the instructional powerpoint on the Three States of Matter with the students. At each slide, the teacher should explain the characteristics of each state of matter. For example: a. Liquids … are able to flow easily b. Solids are… very hard and have a defined shape c. Gases … take the shape of their container This powerpoint should take **10 minutes or less,** including a **3 minute** video. 3. The teacher will then display the PowerPoint slide with the instructions for making ice cream. Mentors will then read through the instructions and the ingredients with the students off the slide. Mentors will make sure that the students are not allergic to any of the ingredients (milk, vanilla, white sugar, ice, and rock salt). This should take **3 minutes.** 4. After reading through the instructions, Mentors and their student buddies will work together in pairs to make the ice cream in their ziplock bags. Ingredients for the ice cream will already be on the tables. Mentors and students will follow the instructions step-by-step to make the ice cream. This should take **5-10**

	minutes. 5. After successfully making ice cream in their ziplock bags, Mentors will go through the list of Post-Project Questions on the Powerpoint with their student buddies. This questions will cover what the students have observed during the process of making ice cream, as well as a review of mixtures and the three states of matter. This should take **3 -5 minutes.** 6. Mentors will pass out sheets with the Venn Diagrams. Students will then be asked to fill out a Venn Diagram and write **two** unique observations about each state of matter in the appropriate space: Gas with gas, solids with solids, etc. 7. In the remaining class time, students are free to eat the ice cream. Spoons will be provided at the tables. If the students have to leave class, they are free to take the ziplocks and plastic spoons with them. While students are eating, Mentors will clean up the supplies and replace them neatly in the center of the table.
Assessment	After making the ice cream and discussing the questions on the powerpoint as a group, students will fill out a Venn diagram with their mentors. On the Venn diagram, they will compare and contrast the characteristics of liquid and solid matter using the ice cream example, and will list **two** unique characteristics of each state of matter in the appropriate space. The mentor will ask the student to describe what caused the change from liquid to solid and vice versa. Students are welcome to use their Venn Diagrams to help them explain the gas changes to a liquid, how a liquid changes to a solid, and how a solid changes to a liquid. Mentors will also ask students what a mixture is and how mixtures are made.
References	Powerpoint is attached separately. Video Link: http://studyjams.scholastic.com/studyjams/jams/science/matter/solids-liquids-gases.htm **Works Cited:** Aquarium of the Pacific. (n.d.). *Science Starts*. Retrieved March 3, 2014, fromhttp://www.aquariumofpacific.org/downloads/ed_1ssIceCream.pdf Gatto, L. (n.d.). Ice Cream in a Bag Lesson Plan. *pbworks*. Retrieved March 3, 2014, from http://mstlnaz.pbworks.com/f/Ice+Cream+In+A+Bag+Lesson+Plan.pdf States of Matter. (n.d.). *States of Matter*. Retrieved March 3, 2014, from http://www.chem.purdue.edu/gchelp/atoms/states.html
Standards	Our standards for this lesson are taken from the National Science Standards:

	• E.B.1 c
	  ○ Materials can exist in different states- solid, liquid, and gas Some common materials, such as water, can be changed from one state to another by heating or cooling.
	• M.B.1 b
	  ○ Substances react chemically in characteristic ways with other substances to form new substances (compounds) with different characteristic properties.
	• H.B.2 e
	  ○ Solids, liquids, and gases differ in the distances and angles between molecules or atoms and therefore the energy that binds them together. In solids the structure is nearly rigid; in liquids molecules or atoms move around each other but do not move apart; and in gases molecules or atoms move independently of each other and are mostly far apart.

Works Cited:

States of Matter. (n.d.). *Purdue Chemistry*. Retrieved March 5, 2014, from http://www.chem.purdue.edu/gchelp/atoms/states.html

Aquarium of Pacific. (n.d.). *Science Stars*. Retrieved March 5, 2014, from http://www.aquariumofpacific.org/downloads/ed_1ssIceCream.pdf

Ice Cream in a Bag Lesson Plan. (n.d.). *Pbworks*. Retrieved March 5, 2014, from http://mstlnaz.pbworks.com/f/Ice+Cream+In+A+Bag+Lesson+Plan.pdf

Journal Entries:

In the article, “Transformative Experience: An Integrative Construct in the Spirit of Deweyan Pragmatism,” Pugh discusses the importance of a transformative experience in pragmatic learning. Pragmatic learning, a concept invented by educator John Dewey, emphasizes the importance of student-led learning through experience and experimenting. A transformative experience occurs when the student realizes the importance and applicability of the information he/she is learning. Our goal, in creating this lesson plan, is for students to learn the concepts of gas, liquid, and solid through experimentation: by creating ice cream and viewing firsthand the transition from a liquid to a solid. Ideally, this will lead to a transformative experience. Students will first be empowered by realizing they can create ice cream all on their own, and also realize how science is applicable to something as seemingly basic as ice cream. Pugh additionally mentioned how “engagement in everyday experience” is an important facet of transformative experience. When ice cream, a common enough food for most students, is linked to scientific ideas, students will be engaged in science through an “everyday experience”: eating ice cream. Integration between such ideas is believed to be crucial to understanding, and ultimately learning.

Pugh, K. (2011). Transformative Experience: An Integrative Construct in the Spirit of Pragmatism. *Educational Psychologist, 46*(2). Retrieved from: http://www.tandfonline.com.ezproxy.lib.purdue.edu/doi/full/10.1080/00461520.2011.558817

Education is becoming more focused on teaching STEM concepts which include science, technology, engineering, and math concepts. In the article, “Considerations for Teaching Integrated STEM Education” by Stohlmann, Morre, and Gillian, it explains the importance of integrating STEM concepts in the classroom based on research. The “benefits of STEM education include making students better problem solvers, innovators, inventors, self-reliant, logical thinkers, and technologically literate” (Stochimann, 29). These are the 21st century skills that students need to acquire. Research shows that by involving students in math and science, they are engaged and their motivation increases, which in turn, shows in their achievement. The article gives some examples of methods that teachers can use to engage students in STEM content, hands-on learning, cooperative learning, discussion and inquiry. Many of these methods are used in the development of our Case 2 lesson plan. We want to make the students the center of learning and provide them with interactive activities that will excite and motivate them while also learning.

Stohlmann, M., Morre, T., & Roehrig, G. (2012). Considerations for Teaching Integrated STEM Education. *Journal of Pre-College Engineering Education Research*, *2*(1), 28-34. Retrieved February 26, 2014, from http://purdue-primo-prod.hosted.exlibrisgroup.com/primo_library/libweb/action/display.do;jsessionid=28CD6A3C60022C488DEAD04AB3725C8F?frbrVersion=2&tabs=viewOnlineTab&ct=display&fn=search&doc=TN_be_cjpeer1054&indx=5&recIds=TN_be_cjpeer1054&recIdxs=4&elementI

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