Designing Healthy Ice Pops

Adapted from article by Laura Bubnick, Katie Enneking, and Julie Egbers • *Science & Children* • Vol. 54 • Issue 1

Time	Grade Level	Content Area (s)
Four weeks	Grades 3–5	STEM

Objective

Students will participate in an integrated STEM activity to experience the processes of research, design, evaluation, modification, and presentation.

Essential Questions

What are the essential ingredients needed to make a healthy ice pop to sell in the school cafeteria? How could we market and sell the ice pops?

Activity Outline

1 **Week 1:** At the project kickoff, students are given the following scenario:

> *You are ice pop experts who have worked for several years in the frozen snacks business. Your task is to create a new flavor that will be a tasty and healthy treat. Your goal is to sell it to school districts to offer to students at lunch. Your challenge is to present to the principal your new flavor. Include the steps that you have taken in the production of the ice pop to ensure that it is a healthy alternative to the other snacks offered by the school.*

Materials

- Ice pop ingredients (various fruits)
- Blenders, knives, small paper cups
- Internet research tools
- Nutritionist to interview
- Parent volunteers (one for each group)
- Non-latex, food-safety grade gloves and hairnets
- Poster, flyer and video materials

After students are introduced to the project, they should begin planning. In groups, have students determine the steps necessary to achieve their goal. Sample steps include:

- Collect things: real fruit, water, blender
- Consider packaging materials: craft sticks, small paper cups
- Experiment with and taste sample recipes
- Research what goes into a 'healthy' ice pop
- Create the recipes
- Talk to a nutritionist or dietitian about what makes a 'healthy' ice pop

The next step in the design process is for students to invite a nutritionist to class, so that students can ask which foods would make a healthy ice pop and which foods would be important to avoid because of allergy concerns. Once the nutritionist is invited, students should begin their own research on what has been included in their healthy recipes. Using their notes, pairs of students should now create a list of the five main ingredients they feel are essential.

2 **Week 2:** Students should now come up with their own questions and interview the guest nutritionist. Following the interview, have students revise their recipes based on the nutritionist's answers. Organize students into groups, and have each group member take the role of either a researcher or materials manager. Groups will first have to compromise on one version of the recipe, writing specific quantities of ingredients on poster paper. Once all groups have their recipes prepared, we discuss with the class what it means to give constructive feedback to other groups. Have each group critique the other groups' recipes for five minutes, and use different colored markers for feedback about ingredients, quantities, and overall impressions. At the end of the rotations, students return to their own recipes and make modifications based on peer feedback. Once the recipes are finalized, assign an adult to each group to use the knives and operate the blenders. Students will be in charge of collecting, measuring, and adding ingredients. Ensure all students wear non-latex, food safety grade gloves and hairnets. Each group should now taste test its own recipe and make modifications based on their analysis. Ensure they track all changes to the recipe. Have the student recorder for each group write detailed descriptions of what was added/subtracted and the color of the juice. Next, parent volunteers will need to help make enough copies of the final recipes so all students can taste each other's recipes. Provide each student with a sample of the other groups' recipes and have them vote on their favorites. Ask them to record data about what they did or did not like about a specific recipe. Coach students to think about scientific aspects when rating their choices—taste, thickness, aroma, etc. Students should now rate their favorites, and a class tally of results should be prepared to determine the winning recipe.

3 **Week 3:** Once the winning recipe is chosen, students will now focus on marketing their product to the other second-grade classes. Have them brainstorm ways in which to let their classmates know about their product. Examples include: Producing posters to place around the school, fliers for the other classes, and/or a video for the morning announcements. Students will work in groups based on their invididual product interest (flier versus video) to create their marketing strategy and materials. Once finished, distribute the various materials as needed.

4 **Week 4:** Groups will now create multimedia presentations and present their product to administrators. Presentations should focus on the process of the project, not how fun it was to make ice pops. Each of the groups should focus on a different aspect of the project:

- Making recipes
- Researching what goes into a "healthy" ice pop
- Interviewing the nutritionist
- Tasting and voting
- Marketing

Instruct administrators to ask probing questions about the project.

Safety

The nutritionist should speak about foods that would be both tasty and healthy in the ice pops and, based on the allergies on record in the school, what foods to avoid.

To facilitate safety when making the ice pops, assign parent volunteers to use the knives and operate the blenders. Students should never have access to sharps. All participants should wear non-latex, food-safety grade gloves and hairnets.

We Need Your Help! Parent Volunteers Needed!

During enrichment class, we will be blending REAL food with REAL blenders to make healthy popsicles! We are in need of parent volunteers to come in and help students work with the blenders AND prepare test tasting cups.

If you are available to help _____ (Day), please let me know by this by

_____ (Due Date)

We will need parents from _____ (Time) on _____ (Day). On _____ (Day), we will need parents to blend and prepare taste-testing cups BEFORE _____ (Time).

We are excited to begin this project! Thank you for your help and involvement!

We are excited to begin this project! Thank you for your help and involvement!

_____ I can come in and volunteer on _____ (Day) from _____ (Time).

_____ I can come in sometime _____ (Day) [BEFORE _____ (Time)] to prepare test tasting cups.

_____ (Parent Name)

_____ (Your Child's Name)

Name: _____

Ad Name: _____

Popsicle Ad Checklist

Does your ad contain the following important information about the big Popsicle day?
Use the checklist to make sure you have included everything in your ad!

_____ **What** (popsicle tasting)

_____ **Who** (who is invited)

_____ **When** (date and time)

_____ **Where** (example: cafeteria)

_____ **Colorful, BIG pictures!**

_____ **Include how it is YUMMY!**

_____ **Include how it is HEALTHY for ALL** (no sugar, avoided allergies)**!**

Ingredients (cherries, bananas, strawberries, oranges, water not dairy)

Name: _____

Rank Recipes

Now rank the recipes from 1 through 5 in the boxes provided.

1 is your most favorite recipe; 5 is your least favorite recipe.

Cup #1

Comments

Cup #2

Comments

Cup #3

Comments

Cup #4

Comments

Cup #5

Comments

Designing Healthy Ice Pops

A STEM enrichment project for second graders incorporates nutrition and design principles.

By Laura Bubnick, Katie Enneking, and Julie Egbers

Science, technology, engineering, and math (STEM) education piques students' innate curiosity and opens their eyes to hundreds of career possibilities. However, it can also be hard to infuse STEM into a course if it is not a planned, integral part of the curriculum. With the standards that need to be covered, reading and writing initiatives, and preparation for standardized tests, teachers can find it challenging to integrate STEM projects into their lessons.

In grades 3–12, attitudes regarding STEM range from total enthusiasm to sheer unwillingness to participate. Often, teachers hold a misconception that students—specifically, elementary students—can't do STEM. At the start of this school year, I met an exception. Julie Egbers at Independence Elementary wanted to try something new with her second graders. Time had been carved out in the school's schedule—40 minutes each day—for "Tutorial and Enrichment" (TE). Across the building, students were grouped into classes based on need: some for remediation in math and reading, others for enrichment experiences. Mrs. Egbers's TE class consisted of a rambunctious and advanced group of second graders who needed enrichment in the form of a good challenge. She felt a solid and rigorous STEM lesson would be a great place to start.

Luckily, the building principal had some extra funds to support the project. Katie Enneking (the academic coach) joined in as we searched the web and some district-designated STEM sites, but none of their projects seemed to capture the interests and talents of this group of students. We pooled our ideas and created the STEM lesson "Designing Healthy Ice Pops." This lesson, designed to take approximately four weeks, would allow students to experience the process of research, design, evaluation, modification, and presentation, skills that are tied to the *Next Generation Science Standards* (NGSS Lead States 2013). In addition, we used the "Seven Essentials for Project-Based Learning" (Larmer and Mergendoller 2010) to guide our design process. The "Essentials" stress that a project must inspire students with "a need to know;" have a good driving question; allow learners to have more voice and choice; provide opportunities for 21st-century skills such as collaboration, communication, critical thinking, and use of technology; provide opportunities for feedback and revision; and make schoolwork more meaningful by presenting it to a real audience.

Our planning time focused on those ideals. For example, while we sketched out milestones for students to reach each week, there was ample time built in for students to affect the process through their questioning and revisions. We strove to integrate this because most "regular" science lessons do not include time for students to redo an experiment and make revisions to their process. We wanted to allow students the time and ability to update their product based on peer feedback. We felt students needed to design their own recipes and have opportunities to communicate about what was and was not working well. Lastly, students would be given the opportunity to present their final product—a healthy ice pop—to both their peers (i.e., the consumers) and the administration, which would buy the product to sell in the cafeteria.

Week 1: Questions and Research

At the project kickoff, students were given the following scenario:

You are ice pop experts who have worked for several years in the frozen snacks business. Your task is to create a new flavor that will be a tasty and healthy treat. Your goal is to sell it to

school districts to offer to students at lunch. Your challenge is to present to the principal your new flavor. Include the steps that you have taken in the production of the ice pop to ensure that it is a healthy alternative to the other snacks offered by the school.

The work focuses around two essential questions:

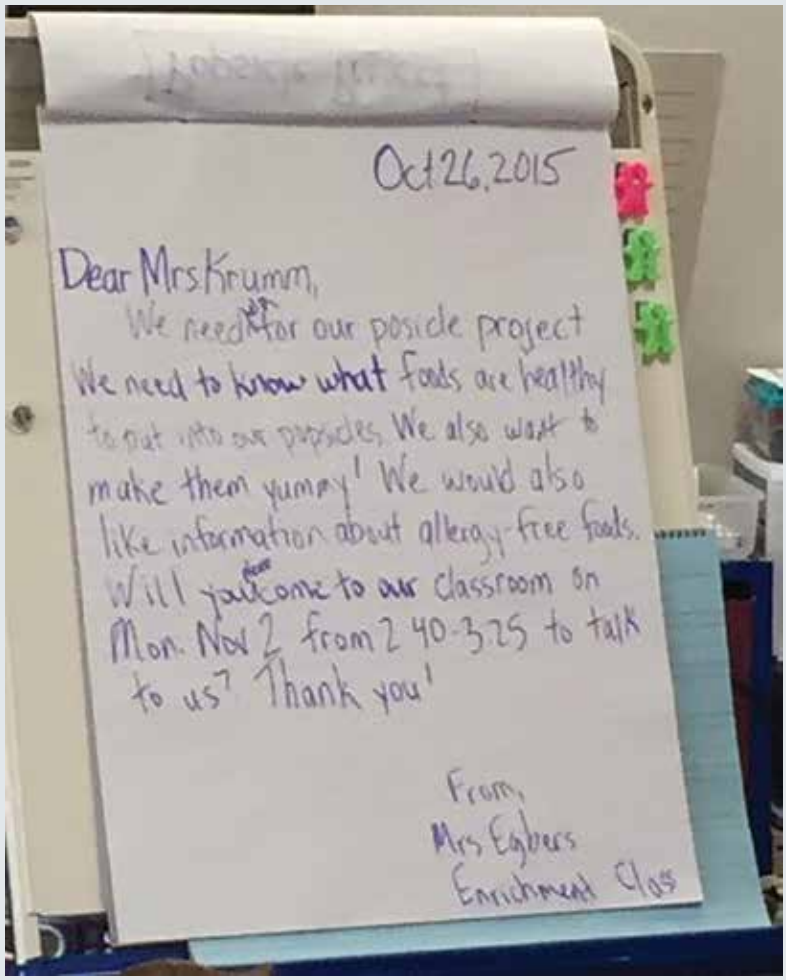
1. What are the essential ingredients needed to make a healthy ice pop to sell in the school cafeteria?
2. How could we market and sell the ice pops?

After students were introduced to the project, they started planning. As a group, they generated the following steps to be taken, in no particular order:

- Collect things: real fruit, water, blenders
- Consider packaging materials: craft sticks, small paper cups
- Experiment with and taste sample recipes
- Research what goes into a "healthy" ice pop
- Create the recipes
- Talk to a nutritionist or dietitian about what makes a "healthy" ice pop

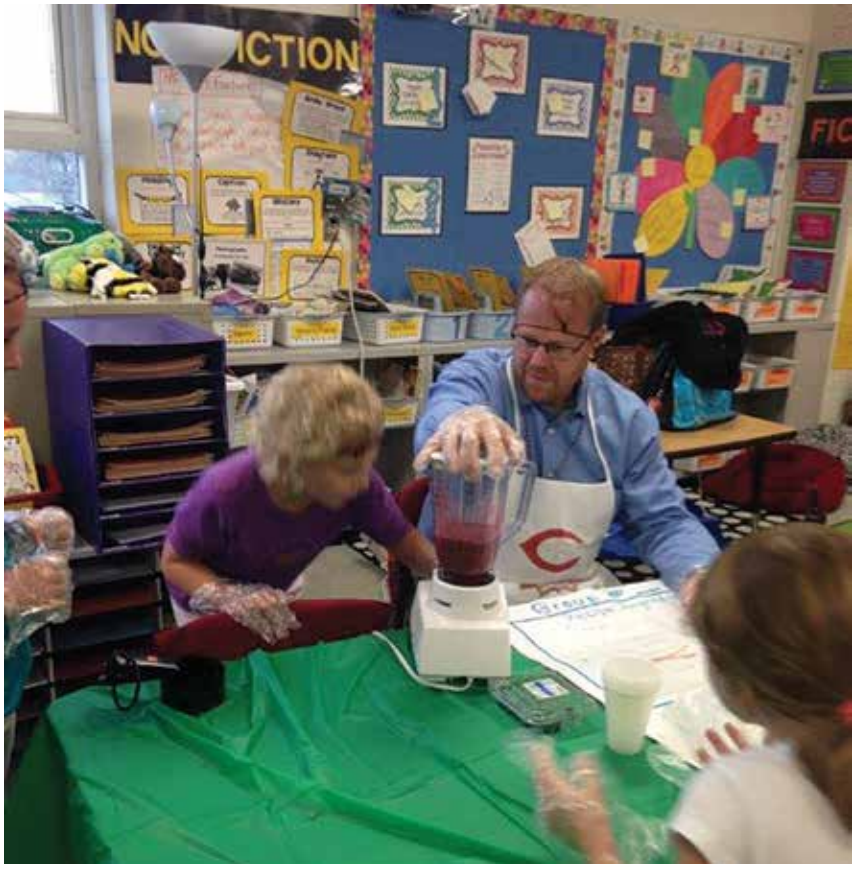
FIGURE 1.

A student-generated letter inviting a nutritionist to speak to the class.



The next step in this design process was for students to generate a letter inviting a nutritionist to class (see Figure 1), so that students could ask which foods would make a healthy ice pop and which foods would be important to avoid because of allergy concerns. Learning about the nutritional aspects associated with foods was integral to the recipe design process and met K-LS1 of the *NGSS*. Students learned about the differences between fruits and vegetables and the nutritional content associated with both.

Once the nutritionist was invited, students began their own research on what should be included in their healthy recipes. Students used iPads to scan a QR code that was posted on each table, which linked to a Symbaloo with some student-friendly



PHOTOS COURTESY OF THE AUTHORS

Adult volunteers help students blend their recipes.

health websites (see Internet Resource). Symbaloo is a free site that allows any teacher to create a board or grid of links to multiple websites. The tiles can be customized by color, symbol, or name to allow a teacher to group by topic—e.g., sample recipes, health information, and so on. The teacher can create the Symbaloo and share the site link with students, where they find a structured place to search within the teacher-designated sites. If a new site needs to be added quickly, the teacher can update the Symbaloo on the fly and refresh it for students to use almost immediately.

Using their notes, pairs of students generated a list of the five main ingredients they felt were essential. Student feedback was positive, excited, and engaged. For example:

Ryan: "All the fruits in season are my favorite!"

Megan: "I like this recipe because it has pineapple in it and I love pineapple!"

Week 2: Recipe Testing and Feedback

Students next generated their own questions and interviewed the guest nutritionist. She spoke about foods that would be both tasty and healthy in the ice pops and, based on the allergies on record in the school, what foods to avoid. In subsequent days, students reworked their recipes based on the new information.

Based on their interests, students were organized into groups, and each group member was given one of the following responsibilities: recorder, project manager, time keeper, researcher, or materials manager. Groups first had to compromise on one version of the recipe, writing specific quantities of ingredients on poster paper. Once all groups had their recipes prepared, Mrs. Egbers discussed with the class what it meant to give "constructive feedback" to other groups. According to Larmer and Mergendoller (2010), formalizing feedback emphasizes the importance of creating high-quality products as part of the project-based learning (PBL) process. Students were given examples of positive, helpful phrases to use when giving feedback to improve or modify other groups' recipes.

Each group rotated around the room at five-minute intervals to critique the other groups' recipes and used a different colored marker to leave feedback about ingredients, quantities, and overall impressions. Feedback ranged from "We think you should add more raspberries" to "Put in less bananas." At the end of the rotations, each recipe was reviewed by all five groups, and members returned to their own recipes and made modifications based on peer feedback.

For students, blending the recipes and taste testing were the most exciting parts of the process. To facilitate

safety, five adults assisted, one of whom was the school's principal (see NSTA Connection). Each adult was assigned to a group to use the knives and operate the blenders; students were in charge of collecting, measuring, and adding ingredients. All participants wore nonlatex, food-safety grade gloves and hairnets. Each group was able to taste test its own recipe and make modifications based on its analysis. They added more ingredients based on taste and were required to keep track of all changes made. The student recorder for each group wrote detailed descriptions of what was added and the color of the juice.

CAUTION

Prior to class the next day, parent volunteers were recruited to reproduce all the recipes in bulk quantity. Small paper cups were filled three-quarters full and were frozen in the teachers' lounge. During class, each student was given a sample of the other groups' recipes and voted on their favorites (see NSTA Connection). Examples of the flavors included "Berry-Banana-Pineapple" or "Cherry-Orange-Banana-Raspberry." All groups decided to use fruits and not vegetables based on taste. Students were required to record data about why they did or did not like a specific recipe. We coached students to think about specific aspects when rating their choices. For example, students needed to think about taste, thickness, and aroma, to name a few. Ultimately, they ranked their favorite choices on scale of 1–5, with 1 being their favorite and 5 being their least favorite. If students didn't like the taste of an ice pop, they would say such things as: "This one is too tart!" or "This needs more cherries!"

The class ranks its favorite recipes.

At the end of class and after taste testing, students tallied up the results and determined the winning recipe based on the number of votes. The winning recipe consisted of cherries, oranges, bananas, and raspberries.

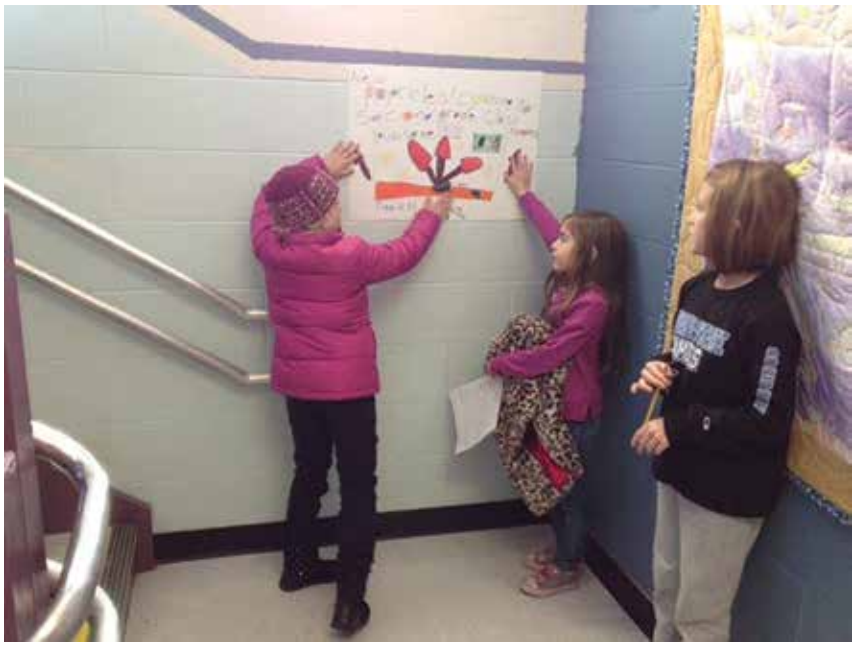
Week 3: Ice Pop Day!

Once the winning recipe was chosen, students focused on marketing their product to the other second-grade classes (see NSTA Connection). They determined the need for posters around the building, fliers for the other classes, and a video for the morning announcements. Students worked in groups, based on their individual product interest (e.g., flier versus video), to create their marketing strategy. Once the items were finished, they were handed out and displayed in the school.

When the official day came to share the ice pops with the other second-grade students, there was a sense of pride and accomplishment among students. Again, parent volunteers blended the winning recipe in bulk and froze it. During lunch the next day, the students distributed sample ice pops to their peers. The feedback was positive and overwhelming. Comments ranged from, "Quite a few people told me they wanted more of them!" to "My friends were sad because it broke when they tried to eat it."

Week 4: Group Presentations

Finally, groups created multimedia presentations using the website Educreations and presented their product to administrators. The presentations



Students display a poster.

focused on the *process* of the project, not how fun it was to make ice pops. Each of the five groups focused on a different aspect of the project: making recipes, researching on iPads, interviewing the nutritionist, tasting and voting, and marketing. To demonstrate what they had learned in each phase, students used digital pictures, recorded their voices, and drew their own images. After that, students showed their presentations to administrators and gave a short summary of their part of the project. Administrators asked probing questions and students relayed their understanding. Students had many takeaways:

- "We had to work together to make it work. Nobody could just have their own way."
- "I felt pretty grown up!"
- "I think it was fun but hard."

Final Thoughts

This project was a success because it provided choice and voice for students, as well as the opportunity to make modifications based on feedback. Students were presented with a problem and given a scenario that could impact their lives, which made it real and engaging. Assessment of student learning was achieved through formative and summative means, such as daily discussions with the teachers and written notes. We merely provided the resources and structure to make this project happen. The students made the tough decisions about what would work best and how to tackle the problem at hand. In addition, the groups of students were self-sorted and regrouped multiple times throughout the four weeks, based on their interests in each phase of the project. This kept students engaged because the group work played to their strengths and interests.

Integrating STEM into the classroom can be a challenging and time-consuming effort, but the results are worth the investment. When other teachers balk at the idea of STEM in an elementary classroom, I use this experience as an example. If these second graders, using a PBL framework, could drive this four-week project on their own, then any group of students can do it. ■

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Internet Resource

Project Symbaloo
www.symbaloo.com/mix/grade2healthyPopsicles

References

Larmer, J., and J.R. Mergendoller. 2010. Seven essentials for project-based learning. *Educational Leadership* 68 (1): 34–37.

NGSS Lead States. 2013. *Next Generation Science Standards: For states, by states*. Washington, DC: National Academies Press.

NSTA Connection

Download a parent volunteer letter, a checklist for creating the ice pop ads, and the taste-testing worksheet at *www.nsta.org/SC1609*.

Connecting to the *Next Generation Science Standards* (NGSS Lead States 2013):

K-2-ETS1-1 Engineering Design
www.nextgenscience.org/k-2ets-engineering-design
The chart below makes one set of connections between the instruction outlined in this article and the *NGSS*. Other valid connections are likely; however, space restrictions prevent us from listing all possibilities. The materials, lessons, and activities outlined in the article are just one step toward reaching the performance expectations listed below.

Performance Expectation	**Connections to Classroom Activity** *Students:*
K-2-ETS1-1: Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.	• developed original, healthy recipes based on research and observations of what makes a "tasty" ice pop. • identified common school allergens to dictate safe food choices in the ice pops. • developed questions for the nutritionist and used the information gained to improve recipes. • gathered information from the Symbaloo to drive their decision-making about the components of the recipes.
Science and Engineering Practices	
Asking Questions and Defining Problems Developing and Using Models Analyzing and Interpreting Data	• obtained information about healthy food choices through questioning, pictures, models, websites, and interviews. • constructed and created samples of original recipes using research-based methods. • analyzed peers' recipes and provided constructive feedback; collected data and modified recipes based on peer review.
Disciplinary Core Ideas	
ETS1.A: Defining and Delimiting Engineering Problems • A situation that people want to change or create can be approached as a problem to be solved through engineering. • Asking questions, making observations, and gathering information are helpful in thinking about problems. ETS1.C: Optimizing the Design Solution • Because there is always more than one possible solution to a problem, it is useful to compare and test designs. LS1.C: Organization for Matter and Energy Flow in Organisms • All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow. (K-LS1-1)	• recognized the need for healthy alternative treats in the cafeteria and developed guiding questions to address the problem. • initially developed recipes on paper and shared these with a small group to get feedback. • asked questions for class discussion based on observations and used feedback to modify the product. • recorded observations on data sheets throughout the process and discussed data and results to modify the product. • compared several recipes during the taste-testing process and drew conclusions about which was the most viable for sale to other students. • worked with the nutritionist to expand their knowledge of what types of foods are better for fueling their bodies. • asked questions and performed research about allergens, nutritional content, and macromolecule makeup.
Crosscutting Concept	
Structure and Function	• analyzed and evaluated the successful ingredients in the recipes of all groups. • self-evaluated their own recipes to make a final iteration.