

Lesson 1- Community, Engineering and Core Curriculum

Essential Question: What are problems in the community that can be solved by skills you are learning in the classroom?


Standards

Next Generation Science Standards: HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

ETS1.b- When evaluating solutions, it is important to take into account the range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural and environmental impacts.

Materials

- GE Focus Forward- Bicycle Airbag Helmet
- Multimedia presentation
- Student Sheets
- Student notebooks
- Student Exit Slips
- <http://www.cyclelicio.us/2010/airbag-bike-helmet/>
- <http://www.digitaljournal.com/article/362275>

Activities			
Activity	Name of the Activity	Photocopies	Materials
1	Preparation for Class - 1.3 and 1.8- Teacher Toolbox. Assigning Team rolls- 1.13 Teacher Toolbox- Roles and Responsibilities		Student page Video: Bicycle Airbag Helmet Notebook
2	Standards Statement (Option: Unpacking the standards Teacher toolbox 1.12- Unpacking the standards)	1 Student Sheet 	PowerPoint Presentation 1 Student Sheet
3	Video- Bicycle Airbag- Helmet		Video embedded in PowerPoint 1 Student Sheet
4	Solving a need in the community		PowerPoint Presentation 1 Student Sheet
5	Reflection and Formative Assessment	Exit Slips	PowerPoint Presentation Notebook Formative Assessment Sheet

Overview

In this first lesson the students will be working to make the connection to determine needs in the community and how those needs can be addressed through a service-learning project. Service-Learning is a way for students to learn content integrated into actual projects that will improve the lives of members of their community.

Major Concepts

- Service-Learning in the community
- Researching skills
- Application of Engineering to solve a real world problem
- Notebook and team building

Objectives

Students will:

- Apply components of Service-Learning
- Work with classmates to build teaming skills.
- Evaluate information to determine if an engineering design meets the need of the community based on criteria.
- Brainstorm ideas about how service-learning can impact the community and students.

Lesson Preparation

Preparation

- **Lesson Preparation:** For specific directions on preparing lesson materials, see 1.3 and 1.8 documents in the Teacher Toolbox.
- **Instructional Resource:** Make sure that you have the **PowerPoint presentation** and the **video- Airbag Helmet** ready for class viewing.

• Procedure

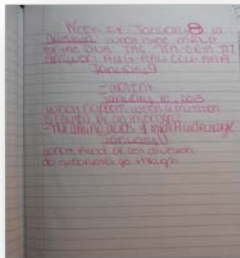
Activity 1: Preparation for the Class

Multimedia Presentation: This lesson will have a multimedia presentation that will help to get the students thinking about the lesson and walking them through the information. Download the presentation in the folder to have the videos attached.



Preparing the notebooks- see document 1.3 in the Teacher Toolbox for specific instructions concerning notebooking.

1. **Line of Learning-** The line of learning is a chronology of the learning for each student. This is a personal reflection and a way to track the progress of the unit and learning.



1Entry-

Question: *What are problems in your community that can be solved by the skills you are learning in this class?*

Date the entry and put a line after each entry.



Team Roles and Responsibilities- For more detailed information about team roles; use 1.13 Teacher Toolbox Team Roles and Responsibilities.

Activity 2: Unpacking the Standards

Class Explanation: Explain to the class that they are going to be exploring a real world engineering invention to serve a need in any community, a Bicycle Airbag helmet. In Service-Learning the students are actively engaged in learning content while serving the community. As a way of developing this skill, the students will be exploring NGSS HS-ETS1-3 and ETS1.b-

Note to Teacher: Look above to see the standards that will be addressed through this lesson. The students need to understand the focus of the lesson, so an examination of the standards is a way of addressing this lesson essential.

Here is a possible Standard Statement which incorporates the standards used in this lesson:

Students will use the resources given to answer questions about service learning and its uses with engineering and learning core content. They will be using different sources to synthesize the information into a document that will be added to their notebooks as an artifact of this unit. Students will be looking at engineering standards with ELA standards that are used to evaluate information.

Optional Lesson Component: As an additional component for this lesson, you may use Teacher toolbox 1.12- *Unpacking the standards in a Student Centered Classroom*. This gives procedures to help your students create their own standards statement.

Activity 3: Application of Engineering to Serve the Community.

Note to teachers: This first video is an explanation of the Bicycle Airbag helmet. Make sure that all of the students have their notebooks open and ready to write notes along with the student sheet 1

1. Review of Service-Learning

- What are the key elements of Service-Learning
 - Must integrate meaningful Community Service that makes the lives better for its residents.
 - Students must learn and reflect on the learning through the experience
 - Students will develop a sense of Civic responsibility

2. Watch the video of the Bicycle Airbag helmet

3. Group Discussion of the Video:

- How would this engineering design project be considered Service Learning?
- How would this helmet serve the community?
- Who would it help in your community?
- What skills in what subjects would you use to be able to design and test this product?

4. Watch the video again

Discussion in small groups: Using the Standard ETS1.b as a basis for small group discussions.

ETS1.b- When evaluating solutions, it is important to take into account the range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural and environmental impacts.

5. EQ: Do you have enough information to be able to determine the constraints of the projects? Can you determine the cost, safety, reliability and aesthetic appeal of the product just from the video? Also can you determine the social, cultural and environmental impacts of the product?

- Each group will discuss the question and make inferences with some of the constraints given by the standards which include cost, safety, reliability, and aesthetic appeal, social, cultural and environmental impacts.
- Students will record the inferences in their notebook.

6. What are questions that we would still need to answer?

- Students will create a listing of questions that they would still need to answer if they were going to use the constraints that were outlined.

Enrichment: Students can use the following websites as possible resources.

<http://www.cyclelicio.us/2010/airbag-bike-helmet/>

Note to Teacher: Remember that the point of this activity is to just get the students thinking about the connection between Service-Learning, the community and the academic connection. Some of your students may want to research this further as an out of class enrichment.

7. Academic Standards- Students will think about their academic contents and what skills they would need to be able to test and develop this project. This process will get the students thinking about the connection between skills learned in the classroom and the application to a real world project and product.

Essential Question: What academic skills and disciplines would you need to master to be able to test and develop this project?

- **Note to teacher:** You may need to give the students some prompts to get them thinking.
Possible prompts:
 - How would we test this helmet? What discipline would we use? (Physics, Math)
 - What is the propulsion for the deployment of the bag? (physics, Chemistry?, Math)
 - How would we test this product? (Math, Scientific Method)
 - How would we do a redesign to improve the product (Engineering Practices)
 - How would we market the product (Technology, ELA Reading, Writing)
 - 21st century skills
 - What kind of thinking skills and problem solving skills will we need?
 - What kind of teaming skills would we need?

In groups, brainstorm the application to Academic Skills and Standards:

- Students will discuss the skills and the disciplines and the academic standards that would apply to this project.
- Students will create a list of at least 3 skills and disciplines that they would need to have mastery to be able to complete the testing and production of this project.

Share small group academic applications with the class- One member on the team will share out each group's information.

8. Social, Cultural or Environmental issues.

Whole Group: Are there any social, cultural or Environmental issues that would be associated with this project? Explain.

Have the students use their notebook and write down information.

Activity 4: Limitless Imagination

Essential Question: What are some of the Engineering projects and or products that you see in your community that demonstrate "Limitless Imagination"?

The students are now ready to look at your community to see how engineering projects and products are seen and used in everyday life and how they make all of our lives better.

1) Independent work: The students will determine an engineering example in the community that could be classified as a Service-Learning project.

They will need to:

- Define the engineering example
- What academic skills and discipline the designer would need to be able to complete the project
- Who the project will serve in the community
- Sketch the product or project.

2) In Groups: Have the students share their examples in their groups.

- Remind the students that they will need to defend their decision that this would serve the community and would apply academic content for the students.
- Give each person 3 minutes to share their examples in group.
- Have the group share one example from the group that will be shared with the rest of the class.

Activity 5: Wrap-Up: Reflection and Formative Assessment

1) Back to the Standards:

Go back to the original class document about the standards.

Ask the students did they:

- Evaluate a solution to a real world problem and determine the constraints?
- Explore how Service-Learning involves community, students and academics
- Evaluate data from different sources to determine if it was authentic and valid?



2) Formative Assessment and student reflection: Last 5 minutes of class

- Pass out the **Exit slips**. This will give you an idea of what they have learned in the lesson.
- Make sure that they students have their **notebooks open** with their two sheets taped in their books.

Notebook check:

As the students are filling out the slips, walk around the room and check to make sure that the student have the following information in their notebook:

- ✓ Completed the 1student sheet.
- ✓ Completed their evaluation of an engineering design in the community. The students may need more time to complete their example.
- ✓ Have the students turn in the exit slips



3) Teacher Reflection: Look at the student's exit slips and the student notebook. The teacher reflection sheet is helpful to reflect on the day's learning. It is also helpful as an artifact for the class and how they are progressing through the learning experience.

Questions:

- ✓ Have the students expressed an understanding of the correlation between Serving the community, Engineering Practices and Academic standards?
- ✓ How are the students reflecting in their notebook?
- ✓ Are the students showing self-efficacy when reflecting on their own learning in the class?

Resources:

- GE Focus Forward- *Short Films, Big Ideas, a partnership between GE and cinelan.*
- <http://www.cyclelicio.us/2010/airbag-bike-helmet/>
- <http://www.digitaljournal.com/article/362275>
- NGSS Lead States. (2013). Next Generation Science Standards: For States, By States. Washington, DC: The National Academies Press. For more information see <http://www.nap.edu/NGSS/>
- National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010). *Common Core State Standards for English language arts and literacy in history/social studies, science, and technical subjects*. Washington, DC: Authors.