Lesson Six: Engineering Solutions to Real-World Problems

Grade Level: 3rd Grade

Time: 3 Days - Day 1: 30-35 minutes; Day 2: 40-45 minutes; Day 3: 40-45 minutes

Essential Question: How can we be stewards of Wyoming's public and private lands to benefit current and future generations?

Objectives: Students will:
- Explain how they can be stewards of Wyoming lands by solving a problem that will benefit current and future generations.
- Identify and explain how they can demonstrate stewardship by solving real world problems.

Purpose: Students recognize that the use of Wyoming lands requires people to be good stewards.

Required Materials/Resources:
- Challenge Options sheet (either one for display or one per student)
- Engineering Challenge/Solutions Graphic Organizer (two for teacher to model and one per student)
- White paper for model/design (at least a couple of sheets per student)
- Writing Template (one per student)
- Equity sticks, a randomizer, or any other tool ensuring all students participate
- Markers
- Crayons

- Pencils

Suggested Teacher Preparation:
- Preview the websites listed in Sources 1-5 to understand how the organizations/individuals address/handle noxious weed/invasive species/population control challenges in order to provide an example when modeling the graphic organizer for students.
- Decide whether to ask the Assessment step questions throughout the three days of the lesson or wait to ask them at the completion of the lesson.
- Decide if you will let students work in groups for Part 2: step 4.
- Decide amounts of student work time for Day 2 and Day 3.
- Optional activity - Find the name of your local Weed & Pest Control Director (Source 6) http://www.wyoweed.org/about/district-offices#Table and your local Game & Fish Warden (Source 7) https://wgfd.wyo.gov/regional-offices. Contact the person to see if he/she can come in to listen to your students present their final essays on how they are going to be good stewards and help solve problems.

Standards:
Science: 3-LS4-4 (Explicit), 3-5-ETS1-2 (Practiced/Encountered)

Social Studies: SS5.4.2, SS5.4.3 (Explicit)

ELA: 3.W.2.a, 3.W.4, 3.W.8, 3.L.1, 3.L.2, 3.L.3, 3.SL.1, 3.SL.4, 3.SL.6 (Practiced/Encountered)

CVE: CV5.2.2, CV5.3.1 (Explicit)

Vocabulary: No new terms are introduced in this lesson.

Instructional Procedure/Steps:

Day 1:

1. Say: **"In our last lesson, we learned about some people who practice stewardship in their careers every day. These people, as well as several others**

In this task, students will be engaged in the higher order thinking skill of synthesizing by designing, inventing, imagining, and creating their solution to the challenge option.

who are stewards of the land, have been facing the same type of challenges for many years. We have talked about a few of those challenges and why it is important that people are responsible citizens and good stewards. Even though the individuals in these occupations are doing their jobs, it's not enough! People like you and me also need to be stewards and help in the efforts to solve these problems. Today, you are going to pick one of the challenges discussed in this unit, and you are going to 'invent' some kind of technology (machine, device, program, better/safer options with things that already exist) that could help solve these problems."

Either display the Challenge Options or pass out copies to students. Read the Challenge Options aloud.

2. Display the Engineering Challenge/Solutions Graphic Organizer. Model Solution 1 for the Weed and Pest challenge on the graphic organizer. Be sure to explain your thinking out loud to students. An example follows: *"I know that Weed and Pest uses chemicals to spray and kill noxious weeds. This could be my first solution to get rid of these weeds that are harming the land. That means, on my graphic organizer, I will write 'Using chemical spraying' in the Solution 1 box."*

3. Have students share with an elbow partner their opinion about whether the solution is a good solution to the challenge and if it practices good stewardship.

4. Repeat step 2 by modeling Solution 1 for the Game and Fish challenge on the graphic organizer. Be sure to explain your thinking out loud to students. An example follows: *"I know that Game and Fish employees want to make sure that mule deer herds are able to safely migrate between summer and winter habitats. Fencing modifications are one way that Game and Fish employees help maintain*

these migration corridors. That means, on my graphic organizer, I will write 'Fencing modifications' in the Solution 1 box."

5. Have students share with an elbow partner their opinion about whether the solution is a good solution to the challenge and if it practices good stewardship.

6. Say: **"Your job is to help either the Game and Fish or the Weed and Pest organizations and be good stewards by brainstorming possible solutions to the challenges that they are facing."** *It is the hope that students will decide on a topic and develop a problem/solution for that topic. Understanding that the concept may too broad for students not exposed to the real-world problems, the teacher may want to give students access to the websites listed in this and previous lessons.* Either display the Challenge Options again or refer students back to their copy of them. Say: **"Choose which Challenge Option you want to tackle."**

7. Have students brainstorm possible solutions to their chosen challenge. Pass the Engineering Challenge/Solutions Graphic Organizers and sheets of white paper. Say: **"Brainstorm different solutions on the white paper. When you have at least three solutions, fill out the problem/solution boxes to organize your ideas. You may use my examples as one of your solutions if you choose. You can also work with a partner. Do not complete the bottom box today."** Do not have students complete the final box today. They will do that in Day 2 of the lesson. If students are having trouble generating solutions to the challenges, have them back up and think about causes of the problem. For example, if I want to solve the problem of trying to keep mule deer migrations routes open, I might start by identifying why they are at risk. I can then brainstorm solutions that keep migration routes open.

8. When all students have filled in three solutions on their graphic organizers, collect them for Day 2 of the lesson.

Day 2:

1. Pass out students' graphic organizers from Day 1. Say: **"Today, you will share your solution ideas with each other in order to collect feedback to help you make a decision on which solution you think is best."**

2. Have students share ideas with an Inside/Outside Circle. Divide students into two circles with the inside circle students facing the outside circle students. Say: **"Inside circle, rotate two spaces to your right. Now, share one solution idea with the person you are facing. Outside students, listen to your inside student's solution, and let he or she know if you think the solution will solve the problem and show good stewardship practices. After commenting, outside students share one of your solutions with your inside partner, and inside student offer your feedback. We will do this three times. Each time that we rotate, be sure to share a different solution with each new partner."** Rotate circles a total of three times. Either have the inside circle keep moving spaces and directions or alternate by having both circles move. Make sure that students get a new partner each round.

3. After students have shared in the circles, have students return to their seats. Say: **"Using feedback that you received from your classmates, choose which solution you think is best, and complete the last box on your graphic organizer."**

4. When students finish completing their graphic organizers, pass out sheets of white paper. Say: **"Now you will**

In this task, students will be engaged in the higher order thinking skill of evaluation by choose a solution and explaining why that solution is best.

design some kind of technology that will help bring your solution to life. This could be a machine, a device, or even a way to improve a current technology to make it more effective. It must be a realistic design. Aliens cannot be zapping weeds to make the weeds disappear. You will have some time today and a little time tomorrow to finish your design." Set an amount of time for students to work on their designs. If you wish, let students work in groups of two or three. When your time is up, collect students' technology designs and their completed graphic organizers. Students will need both for Day 3 of the lesson. For assessment purposes, students' graphic organizers must have an accurate problem listed, multiple solutions provided, and a "best" solution written and justified in the final box.

Day 3:

1. Pass back students' design sheets. Provide a set time for students to finish their designs. Say: **"You have _____ to finish your designs. Be sure to label the design model."** Students will include with their model an essay in step 3. For assessment purposes, design models must illustrate a design that could be possible. It is not fictitious; for example, aliens vaporizing noxious weeds. It must also serve a purpose and connect to the challenge.

2. Pass back students' graphic organizers. Students will use the information from it and the unit to write a 5-paragraph essay.

3. ⊠ Pass out copies of the Writing Template. It provides paragraph starters to help students organize their ideas. Give students a set amount of time to complete their templates then write essays. When students are finished, collect designs, templates, and essays. To demonstrate proficiency, students' essays must involve students taking

In this task, students will be engaged in the higher order thinking skill of synthesis by thinking about how they have learned to be a better steward.

components from their graphic organizers and effectively implementing at least three of the five components into the writing template.

Assessment:

See Day 2: Step 4 and Day 3: Step 3 for assessment opportunities. If you have time, share design models and essays with the whole class through presentations or a gallery walk. For a final reflection/wrap-up, students will engage in a thoughtful examination of the learning that occurred during the unit. Facilitate this by pulling equity sticks or using another equal opportunity tool. Below are prompts/questions to ask during the reflection:

- Give an example of how you can be a steward.
- What did you learn about Wyoming's culture that makes us unique?
- What will happen to future generations if we do not choose to be stewards
- How do you feel when you see of examples of good stewardship? Bad stewardship?
- Why do you think stewardship of our wildlife, plants, and recreation is important?
- Do you think Wyoming citizens and tourists can continue to enjoy the public lands if we are not stewards? Why? Why not?

Credits/Sources:

1. Wyoming Weed and Pest. (n.d.) *Management Programs*. Retrieved September 16, 2018, from https://wyoweed.org/noxious-species/management-programs/
2. Wyoming Weed and Pest. (n.d.) *What Can You Do*. Retrieved September 16, 2018, from https://wyoweed.org/resources/what-can-you-do/

3. Wyoming Migration Initiative. (2014, March 8). *The Red Desert to Hoback: Mule Deer Migration Assessment.* Retrieved November 28, 2017, from http://www.wyobio.org/files/2014/2446/8224/RDH_Migration_Assessment_Final.pdf

4. Wyoming Beef Council. (2016). *The Fieldgrove Ranch: On Cattle and Conservation*. Retrieved September 16, 2018, from https://www.wybeef.com/meet-our-ranchers/the-fieldgrove-family/

5. Wyoming Game and Fish Department. (2011-2018). *Wildlife in Wyoming: Field Operations*. Retrieved September 16, 2018 from https://wgfd.wyo.gov/Wildlife-in-Wyoming/More-Wildlife/Field-Operations

6. Wyoming Weed and Pest. (n.d.) *District Offices*. Retrieved August 13, 2017, from http://www.wyoweed.org/about/district-offices#Table

7. Wyoming Game & Fish Department. (2011-2018). *Regional Offices*. Retrieved August 13, 2017, from https://wgfd.wyo.gov/regional-offices