Create an Arroyo PSA

Pollution in the Arroyo Unit, Lesson 5

Lesson Summary: Students will create a PSA to share a solution to a challenge they see impacting the arroyo network in Santa Fe.

Suggested Timing: 1 hour

New Mexico State Standards

Performance Expectation(s):

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
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.
MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
Constructing Explanations and Designing Solutions: Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. Apply scientific principles to design an object, tool, process or system. Asking Questions and Defining Problems: Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models. Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. Engaging in Argument from Evidence: Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument	ESS3.C: Human Impacts on Earth Systems: Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. ETS1.A: Defining and Delimiting Engineering Problems: The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. ETS1.B: Developing Possible Solutions: There are systematic processes for evaluating solutions with respect to how well they meet	Cause and Effect: Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. Influence of Science, Engineering, and Technology on Society and the Natural World: All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions.

that supports or refutes claims for either explanations or solutions about the natural and designed world. Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. Analyzing and Interpreting Data: Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. Analyze and interpret data to determine similarities and differences in findings. Developing and Using Models: Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs.	the criteria and constraints of a problem. Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. ETS1.C: Optimizing the Design Solution: Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design.	

Evidence Statements:

- MS-ESS3-3 Evidence Statements
- MS-ETS1-1 Evidence Statements
- MS-ETS1-3 Evidence Statements
- MS-ETS1-4 Evidence Statements

ELA CCSS Connections:

- RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts. (MS-ETS1-3)
- RST.6-8.7. 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). (MS-ETS1-3)
- RST.6-8.9. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ETS1-3)

Math CCSS Connections:

- MP.2. Reason abstractly and quantitatively. (MS-ETS1-3)
- 7.EE.3. Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-ETS1-3)

Content Objectives and Daily Learning Targets	**Objectives**: ● I can evaluate an environmental challenge and develop a solution.

	● I can educate others about a potential solution. ● I understand and can explain different challenges related to arroyos, erosion, pollution, stormwater, and runoff.
Focus Question	How can I help my community better understand pollution and how they can be a part of the solution?
Language Objectives	● Students can use scientific vocabulary and explain to others what it means. ● Students can write a PSA using data and evidence they collected.
Vocabulary	● **Impermeable** - not allowing water to pass through. ● **Infiltration** - the downward entry of water into the soil. ● **Permeable -** allowing water to pass through. ● **Pollution** - the introduction of harmful materials into the natural environment that will have negative effects. ● **Runoff** - the flow of water occurring on the ground surface when excess rainwater, stormwater, meltwater, or other sources, can no longer sufficiently rapidly infiltrate in the soil. ● **Solution** - a means of solving a problem or dealing with a difficult situation. ● **Stormwater** - runoff is generated from rain and snowmelt events that flow over land or impervious surfaces, such as paved streets, parking lots, and building rooftops, and does not soak into the ground.
Materials	● Student notebooks ● Materials students request for their PSAs (art materials, video, etc)
Assessments (Formative/ Summative), Rubrics, Success criteria	● PSA ● Success Criteria ○ Students can clearly explain a problem that needs to be addressed. ○ Students create a clear message with solutions and action items the public can take to help solve a problem.
EL Supports	● Students work in small groups. ● Provide key vocabulary in English and the student's native language.
Culturally Relevant Strategies	● Students work with classmates to identify challenges and solutions caused by local environmental factors. ● Students practice social and academic skills they will need.
Special Education Modifications	● Follow student IEP. ● Carefully assign lab partners to build on student strengths and offer needed support.

Lesson Plan Details

ENGAGE (~5 min):	● Ask students to review their plans from the previous class and ensure

	they have a way to create the product they want to see.
EXPLORE (~10 min):	● Have students create their PSA. This will be a rough draft of the PSA to share with the class, review, and revise.
EXPLAIN (~15 min):	● Share the PSAs for each group. Get feedback from the rest of the class. ● Ask them to provide feedback on: ○ Is there a clear issue that is being addressed? ○ Is there a clear solution that is proposed? ○ Is there a specific action that individuals watching the PSA can take?
ELABORATE (~20 min):	● Have students create the final draft of their PSA.
EVALUATE (~10 min):	● Ask students to create a plan to best share their PSAs. Ask them to consider the audience and where they might be able to best make a difference. ● Optional: Invite City water staff, Santa Fe Watershed Association, parents, school administration, or other stakeholders to a presentation of the PSAs.

Additional Sources:

- 5 Es of Science Instruction
- 5E Model of Instruction
- ISEC model of lesson sequence