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Title of Project: Etowah River Preservation Project

Subject(s): Science, Technology, Engineering, and Math

Grade Level(s): 8th grade

Abstract:

The Etowah River holds a diverse population of fish. It is the one of the most diverse rivers East of the Mississippi. Pollution is tampering with the water and therefore causing a decrease in the amount of fish that continue to thrive in the Etowah River. Our job will be to research, plan, design, and build a fish attractor that will help retain the Etowah's diversity. We will focus on creating awareness and promoting action to help reverse the imperiled Etowah River ecosystem. Students will learn about the physical and chemical properties of water and will then research the Etowah River and the various impacts of local development on the river. Lastly, the students will be asked to design a fish attractor to improve the Etowah River and its declining ecosystem.

Learner Description/Context:

Students will learn about physical and chemical properties of water. We will begin with a quick assessment to ensure understanding of the difference between the two property types. The students will then be presented with basic information regarding the Etowah River and will decide how to help preserve the river from pollution by creating an attractor to draw different species of fish to help them thrive in the Etowah. As we present the project, we will create interest by building on the fact that the younger generation is very globally conscious and wants to be involved in improving their world. The fact that the Etowah is so close to home, combined with the fact that it is a resource many students use on a personal level, should make the project more meaningful to them. Also, the students are taking ownership of the project by coming up with their own solutions to problems. We plan on incorporating social media accounts to help share our information and collaborating with community partners to help make the project more authentic. Ideally, we want others to pitch in and help us make our end goal a reality.

Time Frame: 4 weeks

Standards Assessed:

Science:

S8P1. Obtain, evaluate, and communicate information about the structure and properties of matter.
c. Plan and carry out investigations to compare and contrast chemical (i.e., reactivity, combustibility) and physical (i.e., density, melting point, boiling point) properties of matter.

Engineering and Technology (STEM):

MSENGR-TS-2: The students will develop an understanding of how the design process is used to develop a technological system.
a. Identify the steps of the design process

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ENGR-STEM 3: Students will design technological problem solutions using scientific investigation, analysis and interpretation of data, innovation, invention, and fabrication while considering economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability constraints.

MSENGR-TS-6: The students will recognize relationships among technologies and assess the impact of integrated systems.
a. Identify a complex technological system that is made up of several subsystems
b. Explain how the subsystems work together to enable the complex system

Math:

MGSE8.F.5 Analyze & sketch functional relationships

MGSE8.G.9 Apply the formulas for the volume of cones, cylinders, and spheres and use them to solve real-world and mathematical problems.

ISTE - S:

Global Collaborator 7b Students use collaborative technologies to work with others, including peers, experts or community members, to examine issues and problems from multiple viewpoints.

Empowered Learner 1a Students articulate and set personal learning goals, develop strategies leveraging technology to achieve them and reflect on the learning process itself to improve learning outcomes.

Innovative Designer 4b Students select and use digital tools to plan and manage a design process that considers design constraints and calculated risks.

Learner Objectives:

Student will learn about the chemical and physical properties of water.

Student will learn about the ecosystem of the Etowah River.

Student will apply the Engineering Design Process to solve the problem of declining fish populations.

Student will design a 3D model of their fish attractor design.

Student will share their findings and defend their fish attractor design.

The "hook" or Introduction:

Science hook:

Show pictures of the Etowah River from various years and ask the students to make observations and conjectures about the pictures. This will lead into our discussion of physical and chemical changes.

Engineering and Technology hook:

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Who likes to fish or enjoys kayaking and canoeing? Who has been to the Etowah River to kayak, canoe, or fish? We are going to work together to help make the Etowah and even more awesome resource for you to enjoy for years to come. Here's how……

Process:

Introduction to physical/chemical changes: Pictures of the Etowah River from various years. Students working collaboratively to make observations. Teacher facilitating to ensure that students are on the right track.

Teacher will explain the difference in physical and chemical changes: Teacher guided, as student observe and discuss.

Students collaborate/Teacher facilitate: Students are presented with an envelope filled with pictures/examples and divide them into categories of physical or chemical changes. Students discuss their answers as teacher ensures that the students have the correct answers.

Students will take a quiz to show mastery of the concepts of physical/chemical changes of water.

Students are presented with the Etowah River again and are asked to come up with ideas to ensure that the river will remain clean and attainable. Students will research and find data to support their ideas. The data can consist of water cleanliness (based on testing the water Ph levels), fish populations, plant growth, etc. This is student directed as the teacher is Co-learner/Co-Investigator. Students will have to compile their research using Excel.

Students will use a digital graphic organizer in Office 365 to compile their research in order to decide what type(s) of fish they are going to try and attract. Students will work in groups of 3 with a facilitator, a time manager, and an items manager. This will allow for student collaboration as the teacher facilitates the classroom. This also allows the teacher to be a co-investigator with the students.

A guest speaker from the DNR will talk to the students about the Etowah River. This will most likely be done virtually. Students will take notes and ask questions to help them finalize their research. Designs will be built during their engineering and technology class.

As they are working on their designs in technology, they will be building their final presentations in science using Office 365 (Power Point, Sway), Prezi, or can have another software approved.

Students will then transition into Engineering and Technology.

Students will review the steps of the Engineering Design Process.

Students will go online in groups of 2 to research and brainstorm fish attractor designs. After brainstorming and researching ideas, they will work together to create orthographic projections of their design ideas, then discuss and choose their favorite design.

Using SketchUp or SolidWorks, the group will build a 3D model of their fish attractor using the correct dimensions. These 3D models will be used in their PowerPoint presentation.

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Students will create their PowerPoint presentations and a 2-minute video on iPads presenting their data and design for the DNR.

Students will videoconference with a representative from the DNR to see the selection of the winning design.

Product:

Students will build upon pre-existing CAD knowledge to design a physical fish attractor. Once the students finalize their fish attractor model, they will create a presentation to share with the community and the Department of Natural Resources to illustrate their solutions. The presentation will include research data, graphs, and orthographic projections providing evidence for their design and the reasoning behind their designs. The DNR will select their top three designs based on their expertise and practicality. These designs will ultimately be built for placement into the Etowah.

Technology Use:

Microsoft OneNote, Word, PowerPoint, and One Drive will be used to create documents to share information with one another, keep track of their notes and research, and create their presentations to share their findings.

SketchUp (CAD Software) will be used for creating models for their fish attractors that will ultimately be used as a blueprint to create the final product.

An Instagram account will be created to document our project and to share it with the global community.

References and Supporting Material:

References:

Burkehead, N., Walsh, S., Freeman, B., & Williams, J. (2009). *Status and Restoration of the Etowah River, an Imperiled Southern Appalachian Ecosystem*. Retrieved July 09, 2020, from https://sherpaguides.com/southeast/aquatic_fauna/chapter_16/index.html

Cook, J. (2013). *Etowah River User's Guide: Vol. 4. Georgia River Network Guidebooks Series.* University of Georgia Press.

Supporting Materials:

- Science quiz over chemical and physical changes to water
- Etowah River Research Graphic Organizer
- 3D Design Sheet: Orthographic Isometric Graph Sheet
- Checklist for the various components of the E&T activities
- Office 365 OneNote class notebook entries
- Rubric: Etowah River Fish Attractor Rubric

What modifications have you made since you submitted your "idea" for feedback?

We added specific student/teacher portions of what the lessons would entail.

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Resources, references, and materials have been added to the project.

We created a rubric for the final project which will assess the students' research, design, and development.

We have included the specific technology we will be using throughout the project.

We have included time for a guest speaker which will most likely be done digitally, but hope to eventually have a live speaker in the classroom.

Which indicators of Engaged Learning will be high in this lesson and Why?

Authentic because it involves a river system very close by that is a resource that many of the students use for recreation. It is meaningful because the purpose is to improve upon and counter the negative effects that are consistently degrading the river's ecosystem.

Co-Learning/Co-Investigator as the teacher is involved in the brainstorming process along with the student. The students have free choice in how the design the first attractor, so the teacher does not know exactly in which direction the project will go or which fish will be chosen to preserve. The students are also going through the engineering design process, and along with the teacher(s) are revising various solutions to problems that they collectively discover.

Student-directed as the students will be given direction and tools, but they will have to collaborate to research, design, and create.

Multi-Disciplinary in that it includes Science, Technology, Engineering, and Math. It also incorporates many Georgia Studies concepts and standards.

Culturally Responsive because we are not only trying to preserve a river, but also trying to preserve the different species of fish. Also, we are showing the students that they can make change in the world and are involving the community and striving to create awareness well beyond the confines of our classroom(s).

Which indicators would you like to strengthen?

We believe that based on the feedback we received we have strengthened our weak areas.

What LoTI level do you think this lesson would be and Why?

We believe this is a LoTi level 5. The implementation of our lessons, the technological choices that are used, and end products created by those technologies to create awareness are also factors. These factors and partnerships will be a determining factor in whether this could rise to a level 6

What help would you like to receive from us?

We truly believe we have refined this project over the time we've had and have improved it using the suggestions and feedback. Please let us know if there is anything we haven't thought about or that we have left out.