TASK OVERVIEW

ELEMENTARY EARTH AND SPACE SCIENCE: RIVER MYSTERY

Three-Dimensional Claim

In this task, students will apply their understanding that rocks, soils, and sediments are broken into smaller pieces through weathering and are transported through erosion to construct explanations and choose solutions for a river that has turned a copper color by explaining the changes in the rate of erosion due to deforestation and how to mitigate the effects on the river.

Disciplinary Core Ideas Crosscutting Concepts Science and Engineering Practices

Tennessee Academic Standards for Science

This task is intended to elicit student learning of the following Tennessee Science Standard:

4.ESS2.1: Collect and analyze data from observations to provide evidence that rocks, soils, and sediments are broken into smaller pieces through mechanical weathering (frost wedging, abrasion, tree root wedging) and are transported by water, ice, wind, gravity, and vegetation.

4.ETS2.2: Determine the effectiveness of multiple solutions to a design problem given the criteria and the constraints.

Next Generation Science Standards

This task is intended to elicit student learning of the following NGSS elements for each of the three dimensions:

Science and Engineering Practices

Constructing Explanations and Designing Solutions

- *Grade 3-5 Element*: Construct an explanation of observed relationships (e.g., the distribution of plants in the back yard).
- *Grade 3-5 Element*: Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.
- *Grade 3-5 Element*: Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.

Disciplinary Core Ideas

ESS2.A Earth Materials and Systems

- *Grade 3-5 Element*: Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.

ETS1.A Defining and Delimiting Engineering Problems

- *Grade 3-5 Element*: Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.

Crosscutting Concepts

Cause and Effect

- *Grade 3-5 Element*: Cause and effect relationships are routinely identified, tested, and used to explain change.

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	STRENGTHS	OPPORTUNITIES FOR IMPROVEMENT
SCENARIO	The scenario uses a real-world and specific example of the Ocoee River (which has a red hue) as the phenomenon. This river is in Tennessee, which could make it more meaningful to local students who live near or know about the Ocoee River or any students that have seen this level of river pollution.	Consider making clearer to students what they will be figuring out throughout this task. While the general context of the "bloody river" stays the same, the central target shifts from a phenomenon of why the bloody river makes animals sick, to what human impact caused the bloody river, to finally how to mitigate the impact. The students never explicitly address the initial framed phenomenon of the bloody river making animals sick.
SENSE-MAKING	Prompts C and D require students to integrate multiple dimensions to make sense of how human activities have impacted pollution in the Ocoee River.	To make the sense-making and coherence stronger in the task, Prompt C could ask students to explicitly tie in what they explained in Prompt B (e.g., how did the mining operations impact the original weathering/ erosion process that resulted in copper in the river?).
INTEGRATED DIMENSIONS	Prompt C is set up well to measure whether students have the skill and ability to engage in the practice of constructing an explanation using evidence from their images at a grade-appropriate level to explain their disciplinary core idea understanding. The targeted disciplinary core ideas are measured several different ways in the task, giving students many opportunities to show what they know.	Without scaffolding to tease out the crosscutting concept more explicitly, student answers would likely not provide a clear indication of whether students can use the targeted element of identifying and testing causal relationships and using them to explain change.
EQUITY	The task uses accessible language and provides students with a choice in Prompt D, which can increase student agency and confidence in a task. The phenomenon is local and real-world, making it more relevant and meaningful to Tennessee students.	The task mostly requires written answers from students, and this may be an obstacle for some students to be able to show what they know. Consider explicitly allowing students to respond with drawing or diagramming options for Prompts B, D1, and possibly C.
FEEDBACK SUPPORT	With some language adjustments to Prompt C, both Prompt C and D create artifacts of student understanding of the targeted science and engineering practice and disciplinary core idea elements.	The Teacher's Guide has many elements, but the scoring guidelines and components are incomplete. Including scoring components in the Teacher Guide and linking each component to the targeted dimension would be helpful for interpreting student responses relative to the targeted dimensions.

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Suggestions for Use

This task best fits as a summative assessment to assess student understanding of weathering, erosion, and how human activities can affect these natural processes. Prior to this task, students should have learning experiences that build understanding of weathering, erosion, deposition, human impacts, how to develop explanations, and how to develop claims regarding the best possible solution. Teachers should ensure students have other opportunities to elicit understanding of the targeted crosscutting concept element.

What Are The Major Takeaways?

SUMMARY POINTS

This task has a strong local connection for students in Tennessee as it presents them with information about the Ocoee River and how it has become polluted. The context is relevant and engaging for students and text and real images are used to present the information. Students have opportunities to show understanding of the targeted science and engineering practice and disciplinary core idea elements in the task in service of making sense of the given phenomenon. With some adjustments, the task's coherence and purpose could be improved.

SUGGESTIONS FOR IMPROVEMENT

Most prompts are established to only allow students to create a written response, which may limit students' ability to make their thinking visible. Allowing students to respond with drawing or diagramming options and adjusting Prompt C to clarify what its first question is asking can better elicit the targeted understanding for this task. Completing a Teacher's Guide with rubrics and scoring support can better guide teachers to interpret student responses and provide meaningful feedback.

What Should I Do Before Using This Task?

Users should review the provided guidance to familiarize themselves with instructions and disclosures before using these tasks.

How Were These Tasks Developed?

The tasks were developed and revised by teacher work groups from participating districts in the Tennessee District Science Network (TDSciN), which was launched in early 2019 and managed by NextGenScience. Tasks were evaluated using an adapted version of the Science Task Screener. Teachers worked collaboratively across districts to develop and revise these tasks after attending multiple professional learning sessions. Find out more about the development process here.

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