

Lake Erie Water Quality: Third graders' experiences and learning outcomes for an authentic, locally relevant, inquiry-based unit

Abigail Recker, Dr. Bridget Mulvey, & Dr. Joseph Ortiz
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Abstract

The investigation aimed to uncover how student learning is impacted when a hands on and meaningful framework is applied to science education. This series of lessons guides grade 3-5 students to understand how natural resources are impacted by human actions through observation, inference, and the use of scientific tools and data. Students acted as assistants to a local scientist to find out why the water in Lake Erie was "polluted." This instructional unit combined hands-on learning opportunities, literary resources, and multiple forms of assessment to support the multimodal and various needs of early learners.

A variety of tools were used to assess student achievement, student engagement, and students' reactions to the overall learning experience.

The results of this learning segment showed that the gap in student achievement fell drastically for all non-literacy based assessments. A qualitative improvement in student work can also be seen in student writing and research notes, when compared to previous units of inquiry and writing assignments.

Intervention: 5-E Learning Cycle Unit

Next Generation Science Standards

3.LS4.4 - Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

5-E Unit Overview

Engage: Students examine local water samples and hypothesize what may cause the differences they observe.

Explore: The research question is explored through hands-on investigation and NASA satellite images.

Question: What is happening to the water quality of Lake Erie?

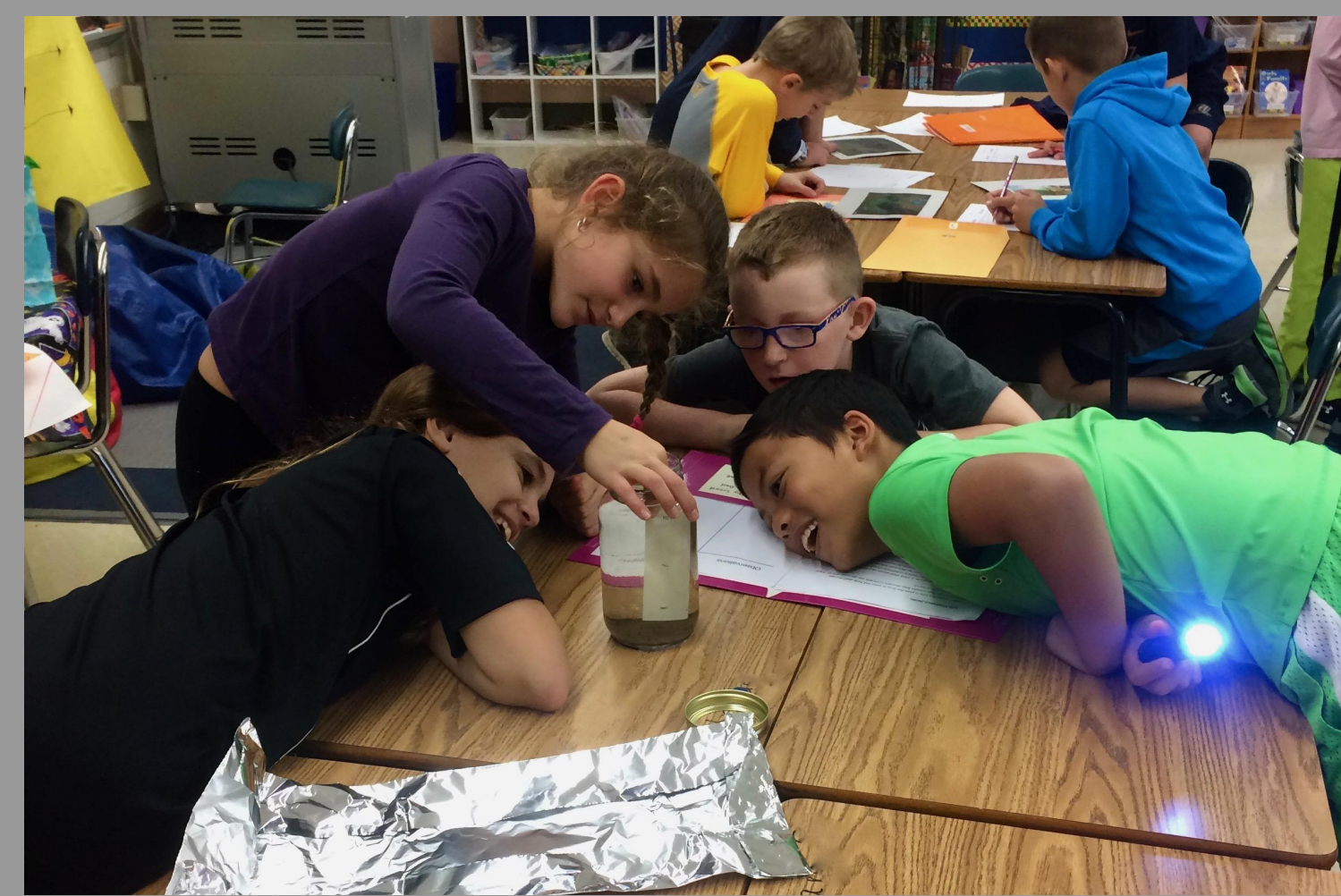
Explain: Students compare their findings with research articles and informational texts. The class discusses findings.

Extend: Teams create action plans for how they could impact local water quality and share out.

Evaluate: Students write letters to a scientist to share their knowledge.

Research Question

What were the experiences and learning outcomes for students engaged in an authentic, locally relevant, inquiry-based unit on water quality?



Setting and Participants

- Setting: Suburban school district in Ohio
- Participants: 25 third grade students, ages 7-9
 - Race/ethnicity: 20 Caucasian, 2 Latina, 1 Indian, 1 Asian, and 1 Egyptian students
 - 14 male students, 11 female students
 - 7 students identified gifted
 - 6 students with identified special needs

Rationale

- 5E Learning Model (Bybee, 2006)
- According to theorist Lev Vygotsky, students learn best within their zone of proximal development, where they are challenged beyond what they could do alone, but not pushed to the point of frustration (Mooney, 2000).
- Maria Montessori states that when education is constructed within a real and meaningful frame work, students will gain a deeper and more meaningful construction of knowledge (Mooney, 2000).

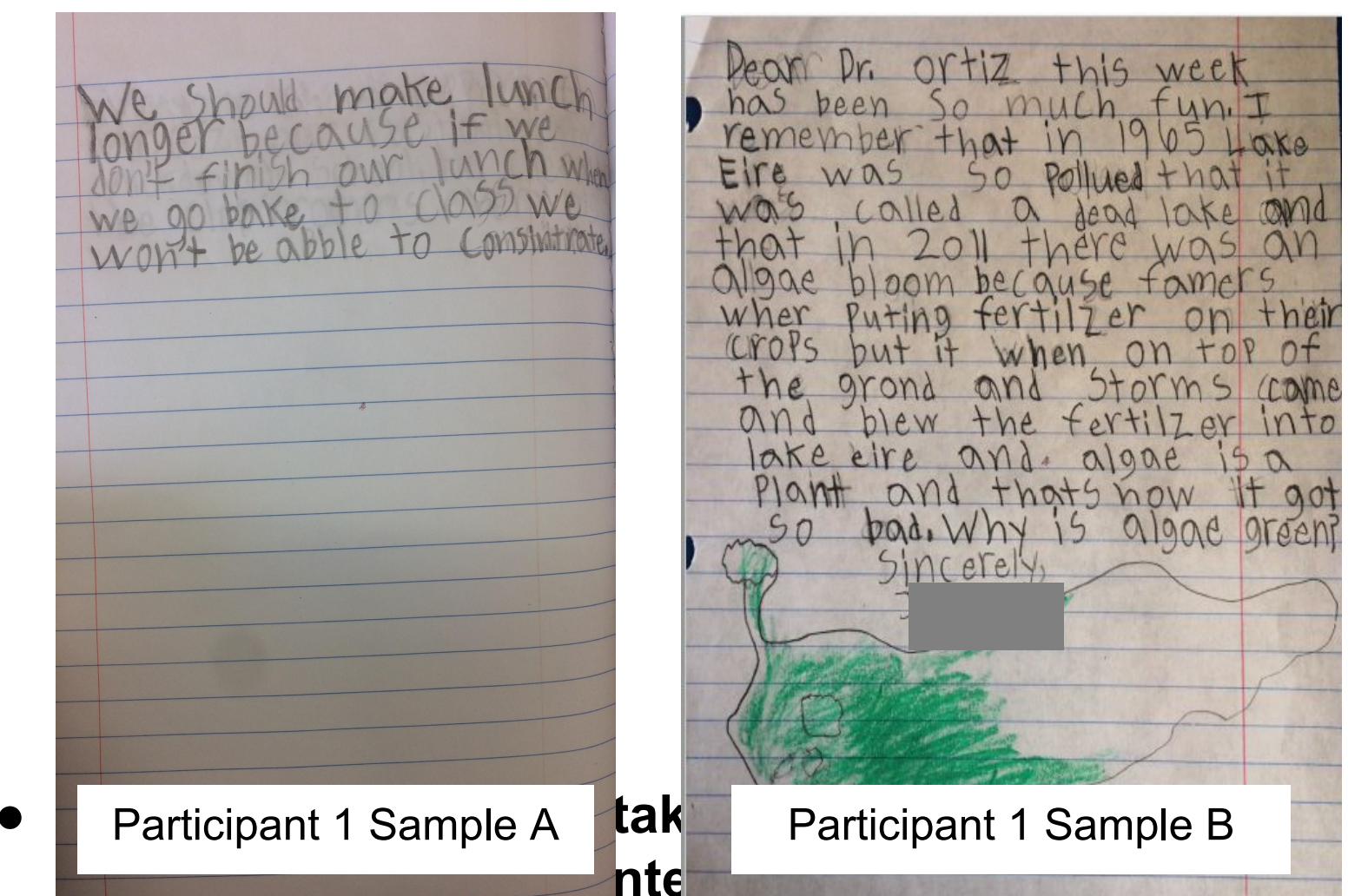
Results

Lesson Outcomes for Varied Learning Needs

Learning Objectives:	#1	#2	#3	#4
Achievement of Entire Class	60%	52%	64%	72%
Achievement of Typical Learners	58%	53%	73%	79%
Achievement of Student with Identified Special Needs	67%	50%	33%	50%

- Objectives 1 and 2 : Addressed through tactile learning experiences with socially constructed learning and verbal communication.
- Objectives 3 and 4 : Addressed through literacy and reading based learning experiences.

Impact of Authentic Material On Student Work Quality



- Participant 1 Sample A
- Participant 1 Sample B
- Student's writing speed increased from .5 wpm to 1.7 wpm.
- Student exhibited higher level thinking and ability to make connections in sample B.

Student Achievement

Students will be able to...	make observations about the water they explore, in relation to water quality and pollution.	make inferences about the water they explore, in relation to water quality and pollution.	show a basic understanding of at least one of the causes of pollution in Lake Erie.	give an example of what they can do to increase water quality in our area.
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The objective was not met.
The student shows a partial understanding or the beginnings of meeting the objective.
The object was fully met with evidence.

Data Sources

- In-person classroom observations
- Audio, video recorded lessons
- Observational checklist, rubrics
- Student work samples (students observational notes, literacy connections, and letters)

Implications

- Students with identified special needs reached the same or higher levels of achievement in non-literacy based assessments.
- Tactile experiences supported meaningful knowledge construction.
- Quality of student work grew within an authentic and meaningful science framework.
- Student letters showed themes of higher levels of analysis and thinking.

Third Grade Researchers: Investigating local water quality through multimodal experiences and an authentic framework

Abigail Recker¹, Dr. Bridget Mulvey¹, & Dr. Joseph Ortiz²,
 Kent State University: ¹ School of Teaching, Learning, and Curriculum Studies and ² Department of Geology



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The investigation aimed to uncover how student learning is impacted when a hands on and meaningful framework is applied to science education. This series of lessons guides grade 3-5 students to understand how natural resources are impacted by human actions through observation, inference, and the use of scientific tools and data. Students acted as assistants to a local scientist to find out why the water in Lake Erie was “polluted.” This instructional unit combined hands-on learning opportunities, literary resources, and multiple forms of assessment to support the multimodal and various needs of early learners.

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Alignment to Standards

Next Generation Science Standards

3.LS4.4 - Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

Common Core ELA Standards

CCSS.ELA-LITERACY.W.3.B - Write opinion pieces on topics or texts, supporting a point of view with reasons. Provide reasons that support the opinion.

Intervention: Lesson Framework

In this unit of inquiry students will be working as assistants to Dr. Ortiz to help discover what is happening to the water in Lake Erie.

5-E Unit Overview

Engage: Students examine local water samples and hypothesize what may cause the differences they observe.

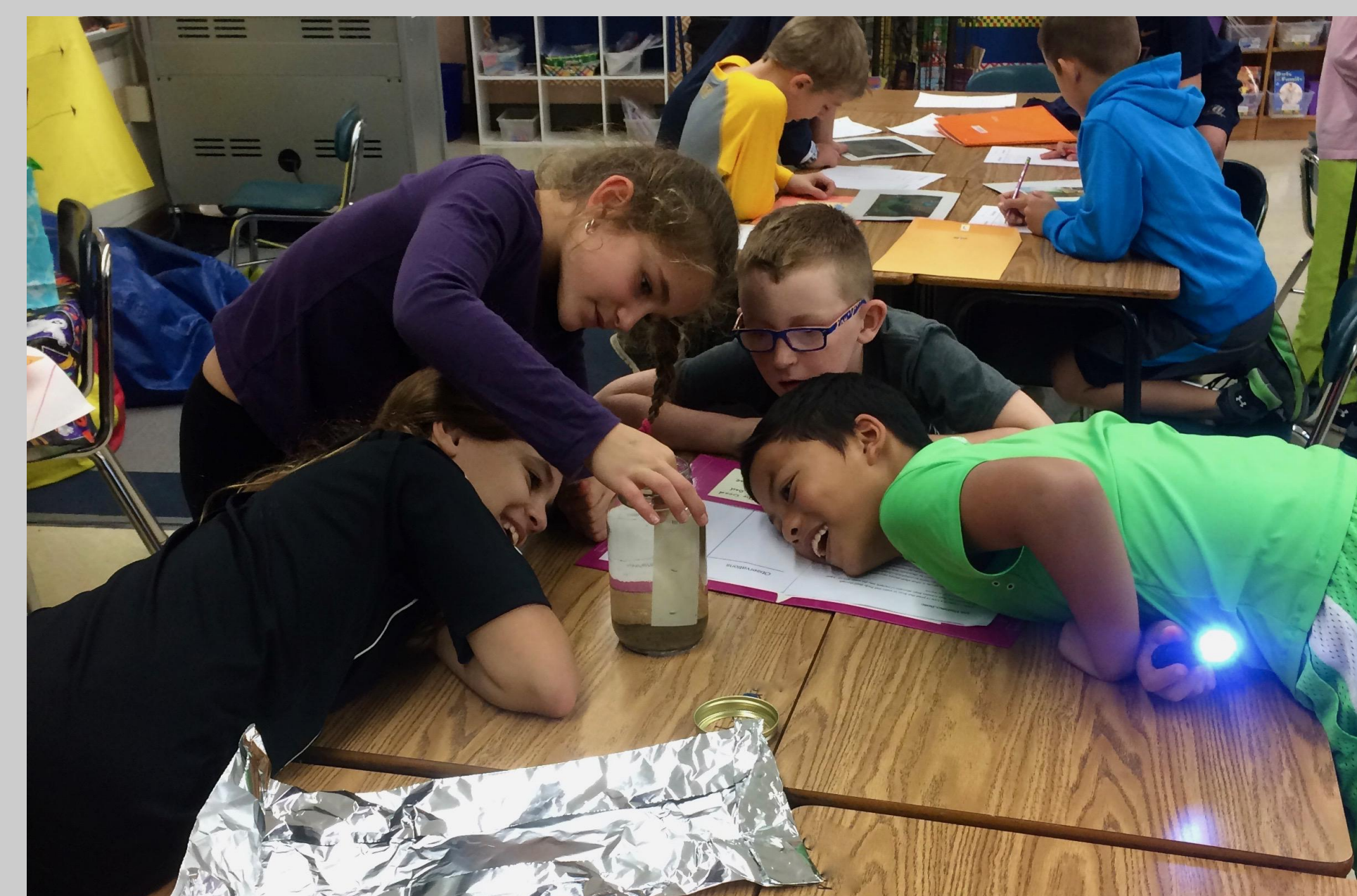
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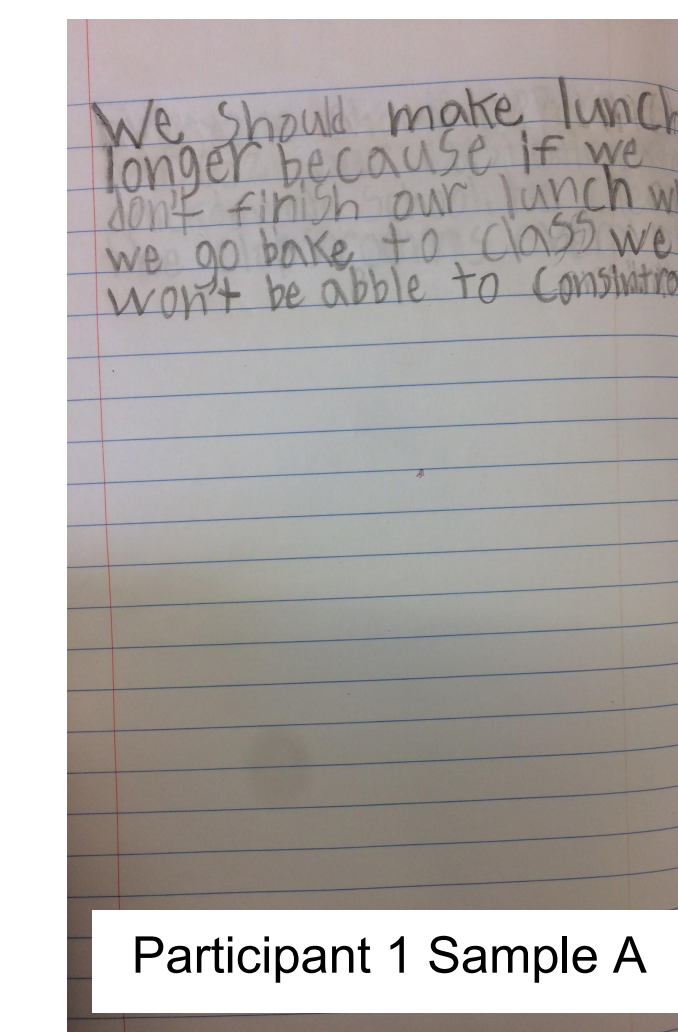
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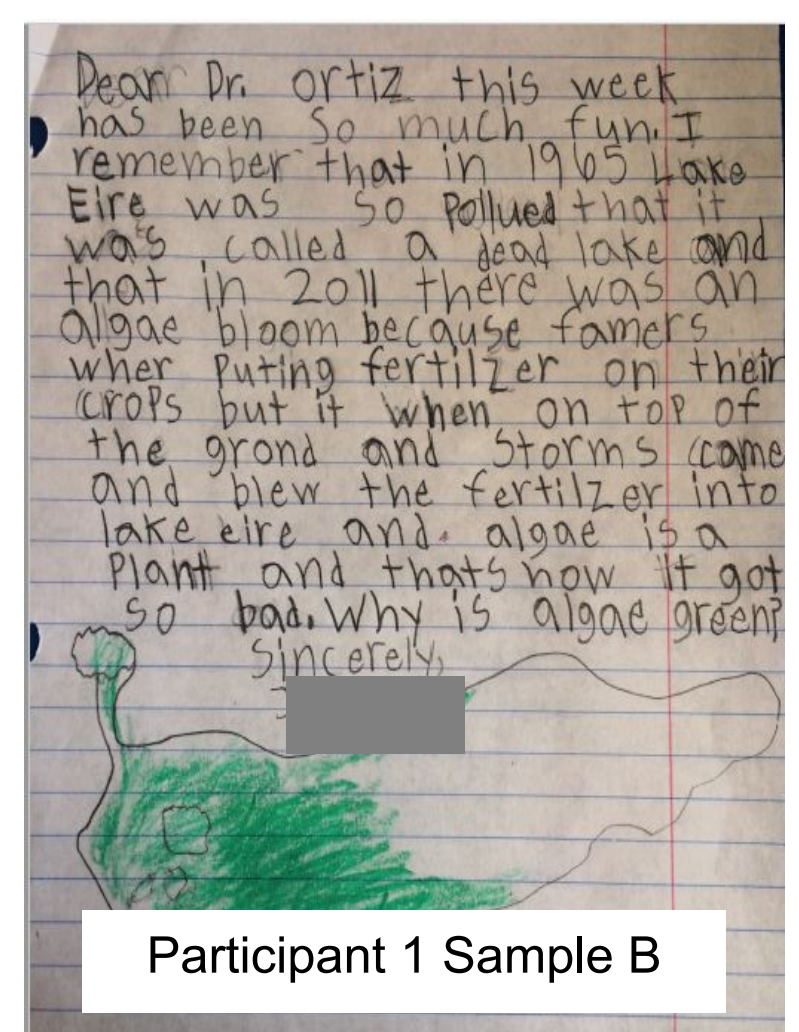
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Impact of Authentic Material On Student Work Quality



Participant 1 Sample A



Participant 1 Sample B

- Both writing samples taken from a work time of 45 minutes with a one sentence prompt.
- Student's writing speed increased from .5 wpm to 1.7 wpm.
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Bibliography

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