

# Writing and reflecting: How middle school students learn from data visualizations during field trips

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This material is based upon work supported by the National Science Foundation under Grant No. 2115905/2115610/2115603

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Thank you to Leigh Peake, Amanda Dickes, Eliza Jacobs, and Jeff Bate at GMRI for their support collecting and sharing data.

# Introduction

- Informal learning experiences (i.e., field trips) can encourage STEM interest and learning. However, field trips' effectiveness can vary by activity design and school characteristics (DeWitt & Storksdieck, 2008).
- Student interactions with visual representations can increase STEM engagement and comprehension (Ainsworth et al., 2011).
- We asked the following questions:
- 1. How do students' annotations vary across different types of visual



# **Reflection Coding**

• Transcripts of students' reflections were analyzed for STEM-related talk.

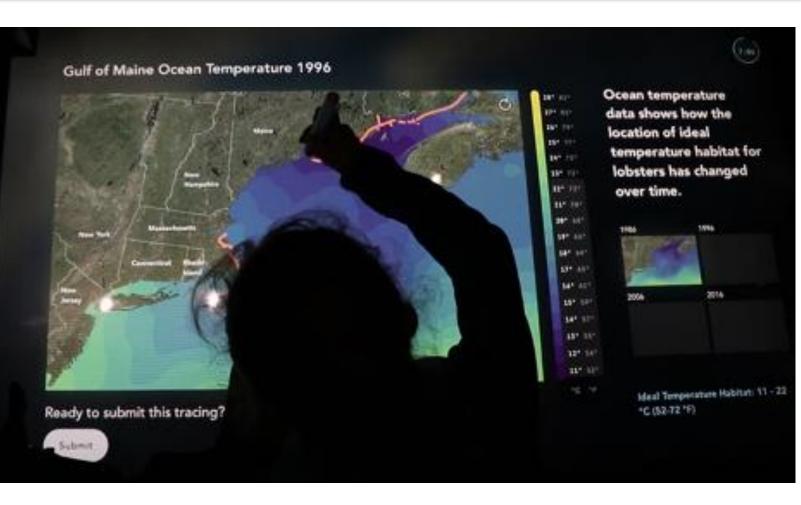
Code	Definition					
Biology	Talking about biological processes (eating, dying), marine species (lobster, black sea bass), or marine habitats					
Climate	Talking about climate or climate change (temperature, hotter)					
Spatial	Describing spatial locations, patterns, features, orientations, etc.					
Temporal	Describing timing of events (years, days, before, after, next)					

representations?

- How does the content of students' reflections vary across field trip activities?
- 3. How do students' annotations relate to the STEM content of their talk during reflection?

# Participants & Procedure

- Groups of 3-7 students participated in a 2.5hour field trip at GMRI.
- Across four activities, students analyzed and annotated visual representations about marine life and climate change in Maine.
- After their activities, students recorded short video reflections about their learning.
- We analyzed reflections from 225 student groups across 30 schools during SY 22-23. o52% coastal, 48% non-coastal communities

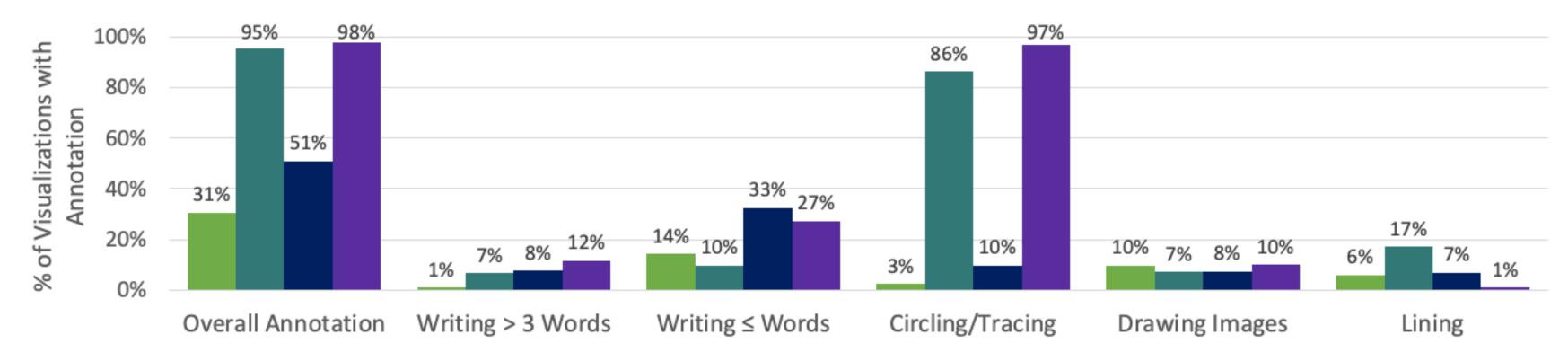




Data Analysis	Making data observations or referring to visualizations (map, table)
Math	Mentioning quantities or mathematical formulas

### Results

#### Figure 1. Students' Annotations across Visual Representation Types



#### Plankton Bar Chart Otolith Scatter Plot Black Sea Bass Data Table Sea Surface Temperature Map

•As shown in Figure 2, there were significant differences between the black sea bass and sea surface temperature reflections for students' use of biology, climate, temporal, data analysis, and math language, *t*s > 4.00, *p*s < .001.

Figure 2. Students' STEM Talk in Reflections across Activities

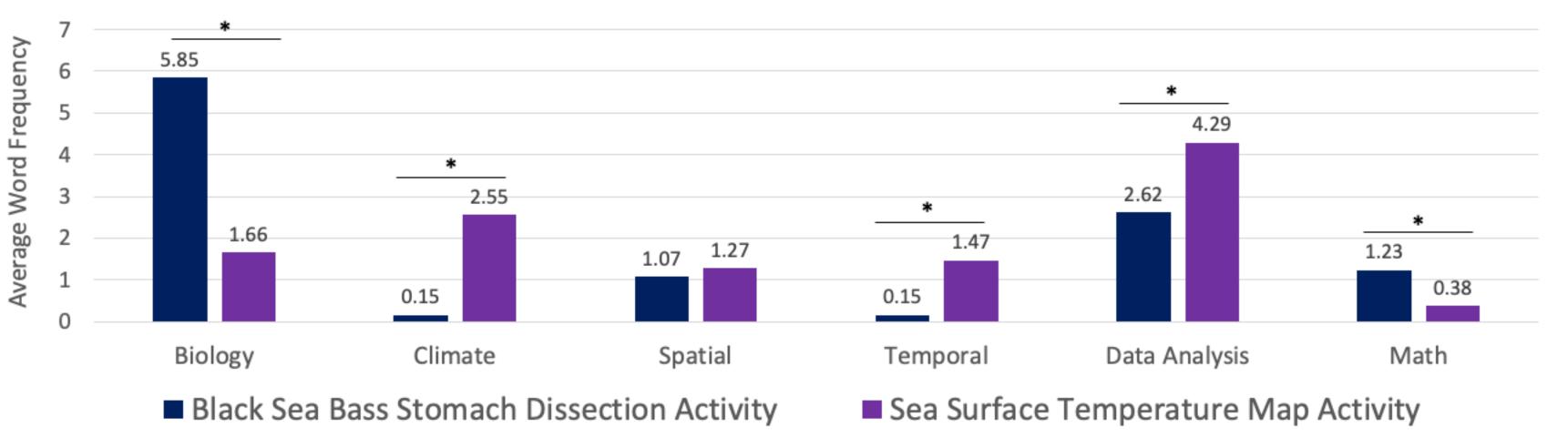
o32% from schools coming ≤ 10 years, 68% from schools coming > 10 years

# **Data Visualizations and Annotation Coding**

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Plankton Microscope Analysis Bar Chart
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Otolith Tracing Scatter Plot

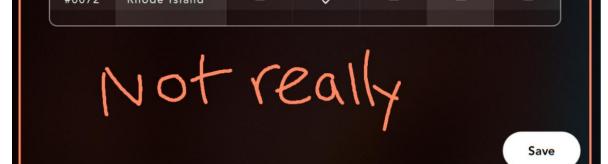
	Codes	Definition				
¥	Writing	Using words or numbers (sub- coded as > or ≤ 3 words)				
5	Circling/ Tracing	Outlining an area or circling data				
	Drawing	Drawing images and symbols (fish, happy face)				
	Lining	Highlighting, under rlining, or crossing out text				

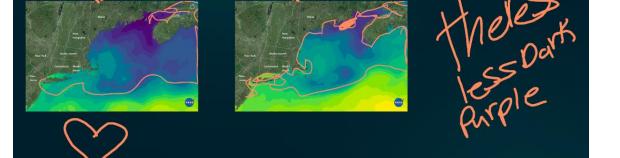


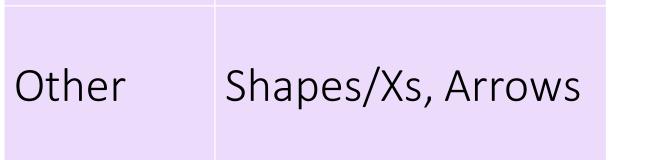
- Students who drew images (M = 3.19) talked more about biology than students who did not draw (M = 1.84), F(1, 144) = 7.12, p = .008.
- For the sea surface temperature activity, students from coastal communities (M = 2.45) talked more about biology than students from non-coastal communities (M = 2.23), F(1, 144) = 4.38, p = .038.

### Discussion

- Students' use of annotations varies across activities and visual representations and may relate to their talk about STEM content when reflecting.
- Students use more annotations when activity prompts direct them to do so, so







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educators can promote annotation through direct instruction.

Students' personal backgrounds (e.g., residing in a coastal/noncoastal community)

may impact how they use and discuss STEM-related information.

Black Sea Bass Stomach Dissection Data Table

