Advanced Manufacturing & Prototyping Integrated to Unlock Potential

6th Grade Math Data Representation (6DVS)

Data Saves the Whales!

Whale Challenge

Module Description	Students will model plankton and temperature data collected at different ocean depths in the Antarctic to discern whether a variable is independent or dependent in the relationship. They will construct coordinate graphs of the data to identify whether the data is linear or non-linear and reason quantitatively about the data relationships. The module covers GSE concepts in identifying independent and dependent variable relationships. *Module will feature the work of Dr. Ellery Ingall of Georgia Institute of Technology Earth & Atmospheric Sciences.*	
Related Mathematics Georgia Standards of Excellence	**MGSE6.EE.2c** Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). **MGSE6.EE.6** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. **MGSE6.EE.9** Use variables to represent two quantities in a real-world problem that change in relationship to one another. a. Write an equation to express one quantity, the dependent variable, in terms of the other quantity, the independent variable. b. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.	
Module Timeline	**50-minute class periods:** 4 days Day 1: Sections 1,2 Day 2: Section 2 Day 3: Section 2,3 Day 4: Sections 3,4	**90 minute blocks:** 3 days Day 1: Sections 1,2 Day 2: Sections 2 Day 3: Sections 3,4
Documents Included in the Download	<u>Student Materials Folder</u> • Student Edition *(recommended to be printed double sided)* • Student Worksheet Packet *(recommended to be printed double sided)* <u>Teacher Materials Folder</u> • Materials List • Annotated Teacher's Edition • Teacher's Edition • Teacher Preparation Guide • Videos	

5E Stage	Student Activities How will students engage actively in the three dimensions throughout the lesson?	Teacher Activities How will the teacher facilitate and monitor student learning throughout the lesson?
Engage How does the lesson capture student interest, activate prior knowledge, and connect to a complex question, global issue, or real world problem?	• Students will discuss each video and explain the relationship between plankton and whales. *(1.1)* • Students learn their challenge of determining the depth that whales feed on plankton and the temperature of the water that plankton prefer. *(1.1)*	• Guide students through each video • Explain challenge to students • Introduce students to marine environments and aquatic ecosystems:
Explore How does the lesson allow students to develop a common base of experiences by actively investigating the phenomenon or problem?	• Students are given canisters representing different depths with temperatures and the plankton collected at that depth. They will chart the data and use it to draw pictographs to visualize where the plankton live and form a hypothesis of where the whales should feed. *(2.1, 2.2)*	• Guide student discussions about what a simulation is • Discuss independent and dependent variables and relationships • Guide students through the text and discuss the questions at the end of the sections
Explain How does the lesson allow students to develop, share, critique, and revise their own explanations before connecting those to accepted scientific explanations and terminology?	• Students will connect the simulation experience with the math content covered *(2.3,3.1,3.2,3.3)* • Students will graph their group data and share with the class their group data and graph it on the class pictograph • Students will form ordered pairs with temperature and depth *(2.3,3.1,3.2,3.3)*	• Facilitate the reading and discussion on the relationships of dependent and independent variables • Discuss the basics of linear and non-linear relationships
Elaborate How does the lesson allow students to extend their conceptual understanding of the three dimensions through opportunities to apply knowledge, skills, and abilities in new experiences?	• Students will plot the ordered pairs they created of temperature and depth onto the same graph *(3.2,3.3)* • Students will write a letter to Dr. Ingall about the research data collected and conclusions they have drawn about where the whales feed. *(4.1, 4.2)*	• Guide students with plotting their ordered pairs onto the same graph. Using 2 y-axes is probably a new skill for them • Facilitate the discussion with the students on their class pictographs and their chart of ordered pairs.
Evaluate How does the lesson—through both formative assessments embedded throughout the lesson and a summative assessment that might coincide with the elaborate phase—make visible students' thinking and their ability to use practices with core ideas and crosscutting concepts to make sense of phenomena and/or to design solutions?	Formative: Ongoing questioning and discussion *(all sections)* Temperature Data Sheet *(2.3)* Plankton Weight Data Sheet *(2.3)* Pictograph Sheet *(2.3)* Summative: Interpreting Graphs (3.3) Letter to Dr. Ingall sharing the research data and conclusions drawn (4.2)	

	1.1	1.2	2.1	2.2	2.3	3.1	3.2	3.3	4.1	4.2
Engage	—	—								
Explore			—	—						
Explain					—	—	—	—		
Elaborate									—	—
Evaluate					—					—

Section 1 – The Data Saves Whales Challenge *(25 minutes)*

The focus of Section 1 is to introduce students to The Whale Challenge. Students will work as teams to determine the depth at which whales feed on plankton. Students will simulate and analyze data and use graphs to represent the results.

Preparation

Materials	Student Pages
• Video #1: Oden • Video #2: Julia's Research • Video #3: CTD	• N/A
Prep the Day Before: Have all videos prepped and ready	

Planning

GSE	**MGSE6.EE.9** Use variables to represent two quantities in a real-world problem that change in relationship to one another. a. Write an equation to express one quantity, the dependent variable, in terms of the other quantity, the independent variable. b. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.
CCSSM	CCSS.Math.Content.6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation

Key Terms and Concepts	Essential Questions	Assessment and Grading Opportunities
• Plankton • Marine environment • Aquatic ecosystem	• How does one variable affect another? • How can that relationship be defined?	• Discussion Questions: **Formative** • Participation: **Formative**

Section 2 – The Ocean Data Simulation *(115 minutes)*

In order for students to understand the dynamics of the aquatic environment they must understand the relationship between the plankton, water depth, and temperature. Through the simulations they will determine which variables influence other variables in the environment.

Preparation

Materials	Student Pages
• Plastic container with split peas and temperature • Digital scale (tared)	• Temperature Data Sheet • Plankton Weight Data Sheet • Pictograph Sheet • Whale Challenge Data Sheet
Prep the Day Before: Put students in groups. Place all materials in a basket or science tray for each group: booklets, handouts, canisters, digital scales. Make sure there are working batteries in the scales.	

Planning

GSE	**MGSE6.EE.9** Use variables to represent two quantities in a real-world problem that change in relationship to one another. a. Write an equation to express one quantity, the dependent variable, in terms of the other quantity, the independent variable. b. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.
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Key Terms and Concepts	Essential Questions	Assessment and Grading Opportunities
• Independent variable • Dependent variable • Pictograph • Simulation	• How does a change in one variable affect the other variable in a given situation? • How are simulations used to represent real life events?	• Discussion Questions: **Formative** • Participation: **Formative** • Temperature Data Sheet: **Formative** • Plankton Weight Data Sheet: **Formative** • Pictograph Sheet: **Formative** • Whale Challenge Data Sheet: **Formative**

Section 3 – Cartesian Coordinate Graphing *(45 minutes)*

During this section, students will use data visualization to determine the relationships between the variables.

Preparation

Materials	Student Pages
● N/A	● Whale Challenge Data Table Sheet ● Whale Challenge Data Table-Ordered Pairs Sheet ● Whale Challenge Coordinate Graph Sheet ● Interpreting Graphs Sheet
Prep the Day Before: Students will need the data from the Whale Challenge Data Table sheets	

Planning

GSE	MGSE6.NS.6 *Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.* MGSE6.NS.6b *Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.*
CCSSM	SS.Math.Content.6.NS.C.6.b Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes. CCSS.Math.Content.6.NS.C.6.c Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

Key Terms and Concepts	Essential Questions	Assessment and Grading Opportunities
• Linear • Non-linear • Coordinate plane • Ordered pair	● How are charts and graphs used to display data?	• Discussion Questions: **Formative** • Participation: **Formative** • Whale Challenge Data Table Sheet: **Formative** • Whale Challenge Data Table-Ordered Pairs Sheet: **Formative** • Whale Challenge Coordinate Graph Sheet: **Formative** • Interpreting Graphs Sheet: **Formative**

Section 4 – Return to the Challenge *(15 minutes)*

Now that students have completed the simulations, analyzed the data, and used graphs to visually represent the data they will communicate their findings by comparing the depth the whales fed at with the water temperature.

Preparation

Materials	Student Pages
• N/A	• Letter to Dr. Ingall Student Sheet
Prep the Day Before: Each group will need their completed data collection sheets	

Planning

GSE	**MGSE6.EE.2c** Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). **MGSE6.EE.6** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. **MGSE6.EE.9** Use variables to represent two quantities in a real-world problem that change in relationship to one another. a. Write an equation to express one quantity, the dependent variable, in terms of the other quantity, the independent variable. b. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.
CCSSM	CCSS.Math.Content.6.EE.A.2.c Evaluate expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. Perform arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). CCSS.Math.Content.6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. CCSS.Math.Content.6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation

Key Terms and Concepts	Essential Questions	Assessment and Grading Opportunities
• Independent variable Dependent variable • Ordered pair • Coordinate plane	• How is data collected and shared? • What conclusions can be drawn from the data?	• Discussion Questions: **Formative** • Participation: **Formative** • Letter to Dr. Ingall: **Summative**