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| **Lesson Title :** Lesson 1: Data Day | **Unit #: 1** | **Lesson #:**  **1** | **Activity #:**  **1** |
| **Activity Title:** Activity 1: Determining Data Dominance |

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| **Estimated Lesson Duration:** | **240 minutes** |
| **Estimated Activity Duration:** | **120** |

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| **Setting:** | Classroom and computer lab. |

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| **Activity Objectives:**  Students will be able to:   1. Understand a car’s movement to have magnitude and direction and use vocabulary such as speed and velocity. 2. Collect data and practice organizing data into data tables 3. Find measures of central tendency (mean, median, mode, min, max, outliers, mean average deviation) within the data. 4. Graph and analyze classroom data. 5. Practice finding percent increase and decrease within the data. 6. Take into account sampling size, comparing populations, and investigating patterns of association in bivariate data. |

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| **Activity Guiding Questions:**   1. How do cars move around in traffic?   What is the difference between a roundabout, an intersection with a stop sign or a traffic light?  What are the pros and cons to using these?  When is each best used?  How fast can vehicles travel on each type of system?  How exactly does a stop sign and traffic signal work?  What is the definition of a safe intersection?   1. How can we find out information about crash rates?   Who collects this type of information?  Who oversees traffic management?  3 – 6) How do crash rates compare before and after a traffic management system is constructed? |

| **Next Generation Science Standards (NGSS)** | |
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| **Science and Engineering Practices (Check all that apply)** | **Crosscutting Concepts (Check all that apply)** |
| ☐ Asking questions (for science) and defining problems (for engineering) | ☐ Patterns |
| ☐ Developing and using models | ☒ Cause and effect |
| ☐ Planning and carrying out investigations | ☐ Scale, proportion, and quantity |
| ☒ Analyzing and interpreting data | ☐ Systems and system models |
| ☒ Using mathematics and computational thinking | ☐ Energy and matter: Flows, cycles, and conservation |
| ☐ Constructing explanations (for science) and designing solutions (for engineering) | ☐ Structure and function. |
| ☐ Engaging in argument from evidence | ☐ Stability and change. |
| ☐ Obtaining, evaluating, and communicating information |  |

| **Ohio’s New Learning Standards for Science (ONLS)** |
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| **Expectations for Learning - Cognitive Demands (Check all that apply)** |
| ☐ Designing Technological/Engineering Solutions Using Science concepts **(T)** |
| ☐ Demonstrating Science Knowledge **(D)** |
| ☒ Interpreting and Communicating Science Concepts **(C)** |
| ☒ Recalling Accurate Science **(R)** |

| **Common Core State Standards -- Mathematics (CCSS)** | |
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| **Standards for Mathematical Practice (Check all that apply)** | |
| ☒ Make sense of problems and persevere in solving them | ☐ Useappropriate tools strategically |
| ☒ Reason abstractly and quantitatively | ☐ Attendto precision |
| ☐ Construct viable arguments and critique the reasoning of others | ☐ Look for and make use of structure |
| ☐ Model with mathematics | ☐ Look for and express regularity in repeated reasoning |

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| **Unit Academic Standards (NGSS, ONLS and/or CCSS):** |

Forces have magnitude and direction.

Understanding Sampling 7.SP.1, 7.SP.2

Using Mean and Mean Absolute Deviation 7.SP.3, 7.SP.4

Making Comparative Inferences about Two Populations 7.SP.3, 7.SP.4

Investigate Patterns of Association in Bivariate Data 8.SP.A.1

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| **Materials**: |

Laptops or computers

Pink, blue, yellow, green, white index cards

Calculators

Scrap paper/pencils

Red, green, and yellow pre-cut circles

Black pre-cut rectangle

Glue sticks

Popsicle sticks

Colored markers/pencils for entire class (red, yellow, green)

Graph paper

Rulers

Baskets or containers for each team to hold materials

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| **Teacher Advance Preparation:** |

For the hook, the teacher will need to prepare news article clips and photos of local and in-state construction of roundabouts, intersections, and installation of traffic lights (or stories on traffic lights not operating properly).

The teacher will need to reserve the computer lab and gather all materials into a basket.

If necessary, the teacher will decide ahead of time which students will work best together as a group and then designate a particular color to those particular students.

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| **Activity Procedures:** |

Hook for Day 1

1. Present news article clips and photos of local and in-state construction of roundabouts, intersections, and installation of traffic lights (or stories on traffic lights not operating properly). (10 minutes)
2. Four poster papers will be set up on the tables. Using markers, students will take turns writing down their pre-knowledge and brainstorming ideas to the following questions:
3. Name places where you and your family have been stuck in traffic. How long did you wait? What other problems were associated with it?
4. What are some ways traffic is controlled?
5. How is Math related to traffic?
6. Why is it important to use our gas resources wisely? How can this be done? (7 minutes)
7. If possible, a guest speaker will come in to talk about traffic management, specifically about using hand signaling during emergencies or other times when traffic lights are not operating. (As an extension, or challenge, students will be encouraged to research proper hand signaling for bicyclists and a general review of rules for bicyclists.) (13 minutes)
8. A pre-test assessment will be given. (10 minutes)

Day 2

1. As students enter the class, they will be directed to glue together a stop light with red, green, and yellow pre-cut circles, a black rectangular paper, Popsicle stick, and glue stick. They will be advised to use it for quiet communication to the teacher (red = needs help immediately, yellow = having trouble, needs advice, green = no problem). (3 minutes)
2. The teacher will reintroduce the Big Idea which was presented during yesterday’s Hook: Forces, Motion, and Math all have an impact on traffic management. Students will respond to this idea. The teacher will hear the responses and help construct the essential question -- What is the most efficient, and optimal route for cars to travel in a congested area? (10 minutes)
3. The teacher will then pass out a marker to each student. The marker colors will be arranged so that there will be groups of 3. To distinguish one red group from another, a circular sticker on the side of a red marker might read 1 or 2. The teacher will instruct the students to get in their groups. (3 minutes)
4. The teacher will ask students to share within their group what they feel are essential questions to the guiding question. The teacher will walk around to each group to review these essential questions and help them form more, if necessary. The teacher will explain that their task will be two-fold: First they need to find websites that will help them collect data (refer to essential questions) and second the group will need to compile written research on the notecards. Pink notecards will be designated for data on roundabouts, yellow notecards for traffic signals, green for stop signs, blue on general traffic management information, and white for extra information. (2 minutes)
5. The class will then head over to the computer lab to do their research. Students will save their calculations and notecards in a designated team basket. (22 minutes) If necessary, students will continue doing more research at home for homework.

Day 3

1. On the second day of this activity, the teacher will pass out graph paper and rulers and demonstrate on the board how to find measures of central tendency within a set of data (mean, median, mode, min, max, outliers, mean average deviation) using examples. The teacher will demonstrate how best to graph the data (scatterplot, line plot, bar graph, etc.) Students will also practice finding percent increase and decrease within the data. They will take in account sampling size, comparing populations, and investigating patterns of association in bivariate data. (15 minutes)
2. Students will then gather back into yesterday’s groups and work together in analyzing the data, determining mean, median, mode, min, max, outliers, mean average deviation and graphing the data. Each student will be responsible for completing 1/3 of the work in his/her handwriting. (25 minutes)
3. Students will save their calculations and notecards in a designated team basket.

* **Key Vocabulary** to be learned:
  + Measures of central tendency, mean, median, mode, min, max, outliers, mean average deviation, scatterplot, line plot, bar graph, percent increase, percent decrease, sampling size, populations, associations in bivariate data

**Student Instructions**

All student instructions will be oral and the following key reminders can be written on the

Blackboard: Red = I need help immediately, Yellow = I am having trouble and need advice, Green = I have no problem

Pink = data on roundabouts, Yellow = traffic signals, Green = stop signs, Blue = general

traffic management information, White = extra information.

**Formative Assessments:**

The utilization of the traffic lights will allow the teacher to assess which students need assistance with the content or tasks required.

Group classwork assignment analyzing the data, determining mean, median, mode, min, max, outliers, mean average deviation and graphing the data.

**Summative Assessments:**

Half of the questions on the post-test will assess the above math objectives.

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| **Differentiation:** |

Students with ADHD will be allowed to stand up, take water breaks, and squeeze a stress ball throughout the activity. The teacher will repeat the directions slowly to ESL students and ask if there are any questions they might have. The teacher will write key vocabulary words and their definitions on large colored cards and hang them on the wall for the students to refer to. Students with physical disabilities will be assisted with typing, writing, or calculating. Advanced students will be asked to search for additional related online websites and statistics extending the activity, in addition to making additional data analysis and calculations.

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| **Reflection:** |

I found that the students did not necessarily need to utilize the hand-made traffic lights, especially since my class size is fairly small (13 students). Having materials such as the ipads and writing materials organized and ready for them made the students excited to begin their tasks. They felt special using colored index cards and brand new markers, and this excitement flowed into their research. I organized the students into groups where it was a surprise to them (they had to select a number and find their group members), but not a surprise to me, since I handed out group numbers to the students (matching up students who would work best together). Overall, the students did a fantastic job doing their research. One or two of them needed a little guidance towards finding the best type of website (namely government websites), but no one needed specific help finding data-rich sites.