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| **Lesson Title: Don’t Overreact! Reaction Time and Other Driver Behavior Issues on the Road** | **Unit #:****1** | **Lesson #:****2** | **Activity #:** **3** |
| **Activity Title: Reaction Time Lab** |

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| **Estimated Lesson Duration:** | **240 minutes** |
| **Estimated Activity Duration:** | **40 minutes** |

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| **Setting:** | **Science Lab or classroom** |

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| **Activity Objectives:** |

Students will be able to:

1. Investigate if reaction time can be measured and/or improved.
2. Practice organizing data into data tables
3. Tabulating the mean
4. Compare reaction time of boys vs. girls
5. Graph and analyze classroom data.

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| **Activity Guiding Questions:** |

1. What is reaction time? What is a stimulus? What parts of the body are involved with reaction time? What are some naturally occurring reaction times? What are some reaction times that can be improved with practice? How can reaction time affect drivers?

2 – 5) How can we compare this information?

| **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

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| **Materials**:  |

Yardsticks, stopwatches, colored sticky notes

Stoplights (prepared in previous lesson)

Students will have a worksheet of the Reaction Time Lab

 <http://www.education.com/science-fair/article/reaction-time/>

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| **Teacher Advance Preparation:** |

The teacher will prepare all lab materials: yardsticks and stopwatches, worksheets of the lab

The teacher will also prepare the video clip for students to view <http://www.youtube.com/watch?v=LU8eNkZ4ZrA>

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| **Activity Procedures:** |

1. The teacher will show a clip of reaction time and driving. Students will be asked to take a few notes on key words or concepts mentioned in the video on sticky notes. <http://www.youtube.com/watch?v=LU8eNkZ4ZrA> (5 minutes)
2. The students will discuss some of the vocabulary and concepts heard in the video clip. The teacher will help then reintroduce the Big Idea which was presented as the Hook: Forces, Motion, and Math all have an impact on traffic management. Students will respond to this idea and discuss what forces are involved while driving (and stopping the car). The teacher will hear the responses and review the essential question -- What is the most efficient, and optimal route for cars to travel in a congested area? The students will then share what they feel are the essential questions concerning the guiding question, “What is reaction time?” (10 minutes)
3. The teacher will then pass out a lab worksheet to each student. The teacher will remind the students to use their stoplights during lab to communicate if they need assistance. The lab partners (pre-designated) will gather their materials for the lab, read the directions, and begin collecting data. (10 minutes)
4. The class will come back together and each student will record his/her data on the whiteboard. Students will separate the data into two categories, girls and boys. (5)
5. Each student will calculate the mean for each category. The teacher will walk around to help individual students. Students finished early can help their neighbors. (7 minutes)
6. The teacher will pass out graph paper for students to compare the mean reaction time for boys v. the mean reaction time for girls. (3 minutes)
7. The class will close by the teacher asking students to brainstorm what other reaction time factors may affect the safety and efficiency of a traffic management system. Each student will select two factors to research on (write 5 facts on a notecard with website citation) for homework to share back in class the following day. Also for homework, students will write down two sentences under the graph completed in class analyzing the data and graph.

**Formative Assessments:**

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

Calculation of mean, creating a data table, graphing and analyzing data.

**Summative Assessments:**

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

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| **Differentiation:**  |

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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 writing on the board or calculating the mean. Advanced students will be asked to find the mean average deviation for each data set (boys and girls reaction times) and share their conclusions with the class.

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| **Reflection:**  |

The students worked well together, using the same teacher-chosen groups they were in for the Data Day activity. If time permits, it would be a wonderful extension to have a few teachers or parent volunteers come in to test their reactions. This would allow students to analyze data and compare age groups, in addition to male v. female reaction time.