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| **Lesson Title : Collecting, Analyzing, and Presenting Data** | **Unit #: 1** | **Lesson #:**  **2** | **Activity #:**  **3** |
| **Activity Title: Collecting Data** |

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| **Estimated Lesson Duration:** | **6 days of class time, over the course of 3 weeks** |
| **Estimated Activity Duration:** | **1 day** |

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| **Setting:** | **College classroom** |

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| **Activity Objectives:** |

Students will be able to:

1. Use their smartphones to collect data.
2. Create a plan to take data related to their chosen topic.

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| **Activity Guiding Questions:** |

1. What apps are available for my smartphone that could be useful for taking data on my chosen topic?
2. What kind of data should we take for my chosen topic?

| **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 Learning Standards for Science (OLS)** |
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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)** |

| **Ohio’s Learning Standards for Math (OLS) and/or**  **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, OLS and/or CCSS):** |

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| **Materials**: (Link Handouts, Power Points, Resources, Websites, Supplies) |

1. Worksheet 1.2.3e “Smartphone physics apps”
2. Accelerometer, *etc.* for iPhone (search for Lab4Physics in app store)  
   <https://itunes.apple.com/us/app/lab4physics/id1049405068?mt=8>
3. Accelerometer, *etc.* for Android (search for Lab4Physics in Google Play store) <https://play.google.com/store/apps/details?id=com.lab4u.lab4physics&hl=en_US>
4. GPS logger for Android (search for GPS Logger in Google Play store)  
   <https://play.google.com/store/apps/details?id=eu.basicairdata.graziano.gpslogger&hl=en_US>
5. GPS logger for iPhone (search for “myTracks - The GPS-Logger” in app store)  
   <https://itunes.apple.com/us/app/mytracks-the-gps-logger/id358697908?mt=8>
6. Putting GPS data into Google Maps: <http://maps.google.com>, “Your places” in menu on left, “MAPS” tab, “CREATE MAP” at bottom, import from CSV.
7. Shooting slow-motion video with iPhone  
   <http://www.idownloadblog.com/2017/11/22/how-to-shoot-slo-mo-video-1080p-at-240fps-iphone/>
8. Software for tracking objects on video, and using this to determine velocity, acceleration, *etc.* (from this website you can download the software for Windows, Mac, or Linux)  
   <https://physlets.org/tracker/>

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| **Teacher Advance Preparation:** |

1. PowerPoint presentation of research that was previously done.
2. Notify students that for this class they will need to bring their smartphones with plenty of charge.

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| **Activity Procedures:** |

1. Give a presentation that incorporates data taken using a smartphone.
2. Give students the links above for various apps and software, and have them complete the activities on Worksheet 1.2.3e.
3. I will monitor the groups’ activities as they complete the worksheet. They will likely not finish during class time, so will be allowed to finish the worksheet as homework to be turned in at the beginning of the next session.
4. Homework: The students, as a team, will decide upon the data that should be taken to support their final project and submit a plan for collecting the data for approval.
5. After they receive approval, the team will collect the needed data.

**Formative Assessments:** Link the items in the Activities that will be used as formative assessments.

Monitoring as they start the worksheet in class, the completed worksheets 1.2.3e, and the data collection plan

**Summative Assessments:** These are optional; there may be summative assessments at the end of a set of Activities or only at the end of the entire Unit.

The summative assessment will be the final presentation at the end of the unit.

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| **Differentiation:** Describe how you modified parts of the Lesson to support the needs of different learners.  Refer to Activity Template for details. |

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| **Reflection:** Reflect upon the successes and shortcomings of the lesson. |

I learned of a new smartphone app that is better than Lab4Physics just one week before class: PhyPhox (<https://phyphox.org/>). It is also free and available for both iPhone and Android. The lesson was good, but time consuming as expected. Many students had trouble creating a Google Map with data from the GPS tracker, and I was not able to come up with a good way to help them all to do it quickly and efficiently. The process seems to work better with some phones than it does with others. In some cases students were able to help each other.

Using Tracker was successful for almost everyone, and several of the groups ended up using smartphone video and Tracker to analyze their data, so that was definitely a useful activity.