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| **Name:** Megan Stafford | **Contact Info:** 330-606-2402 | **Date:** 7/03/2018 |

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| **Lesson Title :** Interpreting and creating equations using tables and graphs | **Unit #:** 1 | **Lesson #:** 2 | **Activity #:** 4 |
| **Activity Title:** MacBook Testing Round 2 |

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| **Estimated Lesson Duration:** | 6 days |
| **Estimated Activity Duration:** | 3-4 days |

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| **Setting:** | Classroom with MacBooks |

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| **Activity Objectives:** |

We will begin round 2 of testing the usage of our MacBook batteries.

I will participate in my group to collect data for round 2 of testing using the criteria our designated for improved performance.

We will continue testing our MacBook batteries.

I will participate in my group to collect data in Google Sheets and fulfill my assigned group role.

We will finish our 2nd round of MacBook battery testing.

I will interpret the data collected from round 2.

We will interpret and analyze the results from MacBook testing.

I will interpret our data to create optimal battery usage criteria.

(this can be measured/recorded by students being able to create a Google Spreadsheet and write in their MacBook’s individual theoretical, initial capacity. These Google Spreadsheets will be shared with the teacher to allow for formative checks.)

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| **Activity Guiding Questions:** |

* Can changing the volume or brightness (or other factors) significantly affect the battery’s life?
* Does changing the window size affect the battery life?
* Can different MacBooks in the group have different criteria tested?

(The modified criteria set forth by the group will be tested by each MacBook in the group as this must stay constant because the MacBooks have different cycle lives already and that is a variable to be considered. Changing more than one variable will make crating accurate criteria for optimal battery use more difficult and less accurate.)

* What trend will be seen amongst groups based upon the age of the batteries?
* What trend will be seen amongst the different groups?
* Will movies played from different websites demonstrate similar trends if similar criteria is set forth for round 2?

| **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):** |

F-IF Interpreting Functions-B:4-6--- Students will interpret functions including interpreting key features of graphs and tables, relate the domain of a function to its graph and describe the relationship, and calculate and interpret the average rate of change of a function. This content will be taught and practiced once students have results to compile and interpret.

F-IF Interpreting Functions-C:7,9---- Students will analyze functions using different representations by graphing functions expressed symbolically and showing key features of the graph and students will compare properties of 2 functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal description). This content will be taught and practiced as students analyze the functions they created with cycle life in addition to analyzing the amperage and voltage equations in combination with analyzing the graphs they created using their data from the testing.

F-BF Building Functions-A:1----Students will write a function to describe a relationship between 2 quantities. Students will be able to do this when they write a function to incorporate cycle life after they have practiced using the physics equations involving amperage and voltage.

F-LE Linear, Quadratic, and Exponential Models-A:4---Students will construct and compare different models of graphs when they have compiled their data, arranged into graphs, and compared the 2 different testing rounds.

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

PowerPoint: Created to mirror handout to assist with understanding of applications

Remind students of group roles to ensure full participation.

PowerPoint will also provide Google Sheets hints and additional instructions (as needed).

Handout: *To be used for entirety of Unit.*

Data will be recorded into Google Sheets. Handout will show instructions to ease the use of Google Sheets and clearly outline data to be collected.

Participation rubric: to be completed by reflector (see roles below in activity procedures) and turned in daily.

Resources:

Applications to be used: System information and Activity Monitor

Applications to be downloaded: Battery Health 1 & Battery Health 2

Applications to be used via internet: Coconut Battery, Google Sheets

Supplies: School supplied MacBooks (students are assigned MacBooks at the start of the school year)

Will use Apple TV to screen mirror teacher MacBook and mirror applications as students become accustomed to information supplied in these applications.

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| **Teacher Advance Preparation:** |

* Create/modify PowerPoint as described above.
* Check all groups have shared their Google Spreadsheet with teacher. Identify groups that have not and advise of this before beginning round 1 of testing.

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| **Activity Procedures:** |

Testing round 2 of MacBook usage. During this round of testing students have designated criteria to assist with optimal battery usage (reducing brightness, reducing sound, decreasing window size, etc.) and will test their MacBook batteries with the same usage but applying these criteria. The same applications will be used as described above. Once students have obtained this data they will interpret their data and refine their optimal battery usage criteria. (3 days)

Day 1:

1. Based upon the group’s assigned MacBook usage (movie, game, Netflix…) the students will begin monitoring and recording the data about their groups’ MacBooks’ batteries while using the applications previously introduced.
2. Teacher will remind students of group roles by using PowerPoint to display each role’s duties.
3. Answer any questions about Round 1 of testing or about how to record in Google Sheets.

(will screen mirror Google Sheets to be prepared to answer any questions)

1. Teacher will circulate throughout testing to ensure students are properly recording data as their MacBook batteries are being used and depleted.

Day 2:

1. Teacher will remind students of group roles by using PowerPoint to display each role’s duties.
2. Direct Instruction: Teacher will answer any questions about Round 1 of testing or about how to record in Google Sheets This will be completed using Apple TV screen mirroring to display Google Sheets and actively show students in real time how to fix any issues or demonstrate how to create graphs and insert trend lines and so forth. This can also be completed answering questions group by group.
3. Teacher will prompt students to begin thinking about their data as they collect day 2 data. During this prompting the teacher will ensure students are following the handout for decreasing confusion about using Google Sheets. Additionally, the teacher can spark conversations as students begin to see trends in their data.
4. Teacher will answer any questions that arise while circulating. These questions should be communicated to the teacher from the student designated as the runner, but while circulating other students may have questions as well.
5. Begin testing. Same instruction as Day 1. See #1 above.

Day 3:

1. Teacher will remind students of group roles by using PowerPoint to display each role’s duties. All roles can begin assisting, in their own capacity, with interpreting and analyzing data as described per handout.
2. Direct Instruction: Teacher will answer any questions about Round 1 of testing or about how to record in Google Sheets This will be completed using Apple TV screen mirroring to display Google Sheets and actively show students in real time how to fix any issues or demonstrate how to create graphs and insert trend lines and so forth. This can also be completed answering questions group by group.
3. Teacher will prompt students to begin thinking about their data as they collect day 3 data. During this prompting the teacher will ensure students are following the handout for decreasing confusion about using Google Sheets. Additionally, the teacher can spark conversations as students begin to see trends in their data. Their handout will outline how to begin plotting the data points collected during the previous 2 days of testing.
4. Teacher will answer any questions that arise while circulating. These questions should be communicated to the teacher from the student designated as the runner, but while circulating other students may have questions as well.
5. Begin testing. Same instruction as Day 1. See #1 from Day 1 above.

Day 4:

1. Students will analyze end behavior of their graphs and use Google Sheets to solve for rates of change (slope). This will be outlined via the handout as well.
2. Students will create their final set of criteria for optimal battery usage. This criterion will be supported by the data collected during the 2 rounds of testing.
3. Students will present their results, using graphs from Google Sheets, and present their criteria with the class via a PowerPoint or Keynote presentation (summative).

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

Participation Rubric

Formative points for completion of round 2 of testing (3 days). This will be graded for completion as teacher will have access to each group’s Google Spreadsheet of data and will check for round 2 data to be gathered and recorded.

**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.

Presentation of results (PowerPoint or Keynote)

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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. |

Videos showing how to record data in Google Sheets plus screen shots will be present on the Handout.

Teacher will constantly circulate throughout testing to assist with monitoring, recording, and beginning interpretation of data.

Students struggling with anxiety, especially those students with anxiety about presentations, will be offered an alternative method to demonstrate their understanding of the data. These students will be permitted to submit a PowerPoint answering key questions about their data, for example trends seen and criteria chosen by their group with proper reasoning.

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| **Reflection:** Reflect upon the successes and shortcomings of the lesson.  During this lesson/activity, it was vital I kept a record of where each group was daily as some groups worked faster and were able to practice their presentations once their Power points were created. I kept a check list on a clip board for each class and was able to keep track that way as I circulated daily. Otherwise these days of the lesson/activity went smoothly and as planned. Groups worked well together and continued testing and moving through the items needed for completion. The daily handout worked well with helping students understand Google slides and the handout also was a nice reminder for completing the daily participation survey. |