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| **Lesson Title : The big “why” in data collection.** | **Unit #:1** | **Lesson #:1** | **Activity #:2** |
| **Activity Title: Comparing cost factors in a business model** |

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| **Estimated Lesson Duration:** | **3 days** |
| **Estimated Activity Duration:** | **2 days** |

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| **Setting:** | **Middle school classroom, 8th grade students in an urban setting.** |

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| **Activity Objectives:**  |

**The students will:**

1. **Evaluate cost in terms of linear equations to make educated financial decisions. “What is the best deal?”**

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| **Activity Guiding Questions:****How do businesses decide what to charge their customers?****Does the amount of goods purchased factor into the best deal?** |

| **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):** |

**8.SP.3 Use the equation of a linear model to solve problems in the context of bivariate measurement data,** **interpreting the slope and intercept. *(For example, in a linear model for a biology experiment, interpret a slope of*** ***1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in*** ***mature plant height.)***

**8.SP.4 Understand that patterns of association can also be seen in bivariate categorical data by displaying** **frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing** **data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows** **or columns to describe possible association between the two variables.**
***(For example, collect data from students in your class on whether or not they have a curfew on school nights and*** ***whether or not they have assigned chores at home. Is there evidence that those who have a curfew also tend to*** ***have chores?)***

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| **Materials**: (Link Handouts, Power Points, Resources, Websites, Supplies)Word problems assignmentBrainstorming activity sheetGraph paper for bar graph |

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| **Teacher Advance Preparation: It would be a good idea to have worked through the word problems and developed a plan for displaying the**  |

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| **Activity Procedures:**1. **Review homework and debrief concepts of previous day.**
2. **Check for misunderstandings in the homework. Give students access to key so they can evaluate their own level of understanding.**
3. **Review topic and concepts from previous day’s instruction. What is optimization and why is it important? What did they learn from yesterday’s activity? Discuss guiding questions.**
4. **Introduce today activity. Look at how to create a two way table. When would this be useful? Does this relate to yesterday? How? Is there a better way to display this data so that it is user friendly?**
5. **Work through several practical word problems that require us to collect or organized data in a manner that will assist us in finding a viable solution. Construct two way tables. Look at other means of data collection. Problems supplied by teacher.**
6. **As a review turn a sample problem from the previous set in a bar graph. Students should be familiar with this, and it just needs to be a sketch. It will be important to not use more than 10 minutes of class time for this.**
7. **At this point in class introduce the challenge. Look back through the essential questions and read student comments from the optimization discussion from the previous day.**
8. **They will be using the same groups from the hook activity.**
9. **Show them the rubric and briefly describe the challenge.**
10. **Give them 5 minutes to complete a brainstorming activity. Handout that ask each group member to record “what would you want in a school spirit shirt?” Group work formative assessment.**
11. **Relate the day’s instruction to how it will help them implement a solid business plan. Show some sample business plans.**
12. **Classwork assignment with the remaining time. Students continue to work with two-way tables, both analyzing and constructing.**
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**Formative Assessments:** Link the items in the Activities that will be used as formative assessments.

Group work brainstorming idea sheet. Every student will be held accountable to contribute at least one idea to the sheet and the group. The sole purpose is to just general ideas.

**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. None

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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.The student will be working in their assigned groups for a large portion of this unit. The groups should be designed in such a way as to allow the students to work for several days with the same individuals. This will help them build ideas and trust in one another throughout the lessons.Students needing extra guidance will be able to rely upon group mates or teachers for assistance. The classwork can be modified in a way that will encourage some students to be more independent. Graphs and tables can be started in a way that will help struggling students organize their work. |

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| **Reflection:** Reflect upon the successes and shortcomings of the lesson.I was pleased with this lesson. The students worked on focused practice of building two-way tables and understanding how to read them. I also used a reflective question about cell phone construction as a formative assessment tool, checking student understand of the key points of the previous hook activity.It proved to be a difficult task in leading the students through the process of developing essential questions and arriving at the chosen challenge. We eventually got there and the students left with excitement about the coming challenge of designing a t-shirt.The next time that I implement this unit and activity, I will need to allow additional class periods for working through guiding questions, describing the challenge, and implementing two way table instruction.Pacing and time were the biggest short-coming of this lesson. |