Brock University

Activity Summary*

Using Data Management to Investigate Relationships

(Assuming students have completed the Python Basics activity)

Activity summary format inspired from the ScratchMaths program and their presentation of the learning objectives by using the 5E's pedagogy

Learning Objectives:

- **Explore** the meaning of different types of relationships between two variables, including positive relationships, negative relationships, and relationships that are neither positive nor negative
- **Envisage** the type of relationship between two variables based on interpreting a real-world situation, analyzing a data set, and using scatter plots

Activity Description:

- First, students are asked to import Python packages that will aid in their completion of the activity.
- Students are then introduced to several key terms, including a "relation between two variables," an "independent variable," a "dependent variable," and three different types of relationships between a dependent and an independent variable: a "positive relationship," a "negative relationship," and "no relationship" (in the context of the activity, this means a "neither positive nor negative relationship").
- *Practice Question #1* invites students to repeatedly generate a random scatter plot and decide which of the three types of relationships are suggested by the data. In doing so, they may connect their understanding of the written definitions of the three types of relationships with how these relationships may be inferred based on empirical data.
- In *Practice Question #2*, students are introduced to a real-world situation: the dependence of ice cream cone sales on the temperature outside. They are invited to make a hypothesis about the type of relationship that would exist between the average temperature outside (x) and the number of cones sold (y). Students test their hypothesis by analyzing and plotting a given data set.
- The last two practice questions require students to modify the code from *Practice Question #2* to produce and plot their own data sets: one that suggests a negative relationship between x and y, and the other that suggests no relationship between x and y.

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Links to Curriculum Expectations:

Curriculum Expectations	Links to Jupyter Notebook
Pose problems, identify variables, and formulate hypotheses associated with relationships between two variables.	- Students are required to formulate a hypothesis about the type of relationship that would exist between two variables in a real-world situation.
Describe trends and relationships observed in data, make inferences from data, compare the inferences with hypotheses about the data, and explain any differences between the inferences and the hypotheses (e.g., describe the trend observed in the data. Does a relationship seem to exist? Of what sort? Is the outcome consistent with your hypothesis? Identify and explain any outlying pieces of data. Suggest a formula that relates the variables. How might you vary this experiment to examine other relationships?).	- Students are required to make an inference from data and compare with hypotheses about the data in a real-world situation. - Students are required to build knowledge of what it means for a relationship to be "positive," "negative," or "neither positive nor negative," and how such relationships can be observed in data.

Discussion Points:

- In *Practice Question #1*, how did you recognize the different types of relationships in the graphs you observed? In other words: What does the scatter plot have to look like to suggest a positive relationship between two variables? A negative relationship? "No" relationship?
- In *Practice Question #2*, there were two variables: ice cream cones sold and temperature outside. Which was the independent variable? Which was the dependent variable? How do you know?
- In *Practice Question #2*, did you notice any "outlying" pieces of data in the scatter plot? What does it mean for a piece of data to be "outlying"? How could we explain these "outliers"?
- In *Practice Question #3*, what was your strategy for creating points that would have a negative relationship?
- What are some more examples of real-world situations where we would expect to have a positive relationship between two variables? Can we think of real-world situations where we would expect to have a negative relationship or "no" relationship between two variables? How might we go about collecting and analyzing data in order to check our hypotheses?

Things to Note:

- This activity is geared towards students with very little coding knowledge and some basic mathematical knowledge related to the activity. You may want to have students working independently or in groups depending on their skill levels in Python and in mathematics.
- If students are having difficulty getting their code to work, ensure that they are reading the error message from Python and checking for syntax errors (e.g., a missing bracket, comma, colon, etc.).
- The input box for *Practice Question #1* is sensitive: it will only recognize the exact words "positive" and "Positive", "negative" and "Negative", or "none" and "None". Any other response will not be recognized. For instance, a different spelling or capitalization will lead students to get a "Try Again" message.
- This activity relies on the coding concepts that are introduced in the Python Basics activity. This said, there may also be some new elements of code introduced in this activity. If there is an element of code that you would like to know more about, try looking for information online (e.g., if you want to find some more explanation about Python's *if…elif…else…* conditional statements, try Googling "if elif else python"). Note that students do not *need* to understand the more complex code in *Practice Question #1* to do the activity (this is also indicated in the worksheet).

References

http://www.edu.gov.on.ca/eng/curriculum/secondary/math910curr.pdf
https://scratch.mit.edu/about/

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