Mathematics: The Language of STEM
Graphing: Green Energy
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CONTENT AND TASK DECISIONS

Grade Level(s): 5th Grade

Description of the Task:

Indiana Mathematics Content Standards:
5.AT.6: Graph points with whole number coordinates on a coordinate plane. Explain how the coordinates relate the point as the distance from the origin on each axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x coordinate, y-axis and y-coordinate)

5.DS.1: Formulate questions that can be addressed with data and make predictions about the data. Use observations, surveys, and experiments to collect, represent, and interpret the data using tables (including frequency tables), line plots, bar graphs, and line graphs. Recognize the differences in representing categorical and numerical data.

Indiana Mathematics Process Standards:
PS.2: Reason abstractly and quantitatively
PS.3: Construct viable arguments and critique the reasoning of others.
PS.4: Model with mathematics.

Mathematics Content Goals:
Students will create a data table using the given solar panel data.
Students will interpret data and create a graph when to display energy production over time.
Students will formulate statistical questions based on given information.
Students will draw conclusions to answer the driving question based on the data collection and graphs.

Language Objectives:
Students will create a table representing the kilowatt hours produced per day.
Students will be utilize a handout that displays pictures representing graphical information.

Materials:
Science Journals
Questions to Investigate Worksheet
Getting Ready- practice questions
Pencils

THE LESSON

Before: This phase of the lesson should be designed to get students ready for problem solving. It also provides an opportunity for you to find out what they already know about the topic. Describe how you will accomplish each of the following in this phase of the lesson:

- **Activate prior knowledge**
    - Display the following video to explain how solar panels work and why they are

important. https://www.youtube.com/watch?v=0elhIcPVtKE&feature=youtu.be

- **Be sure the problem is understood,**
    - Ask students to paraphrase the following: How do solar panels work? Why are solar panels important?
    - Tell students today we will be studying our school solar panels, but in order to be deep mathematical scientific thinkers we need to make sure we understand how to ask ourselves the right questions to solve our problem.
    - Explain to students there is a difference between a statistical and a mathematical question and have them write the definitions in their science journal.
        - Mathematical Question: A question that can be determined using a formula
        - Statistical Question: A question that is answered by collecting data. The answer to this question varies based on the data collections.
    - Lead students through a discussion about how to ask themselves statistical questions rather than mathematical questions.
        - (whole group) What are some strategies you might use to create the question for the first problem?
        - (whole group) Have some students share out, strategically pick who you want to share to be sure you have at least 2 different answers. How is group 1's response different from Group 2's response? Are they both statistical questions? How do you know this, justify your claim.
- **Establish clear expectations**
    - Write on the graphs, draw pictures, do whatever you need to do to show your thinking as we work.
    - Underline the variables on each graph before you compose your question and be sure you have included them in your question.
    - Each partner should be involved in developing the questions and in the conversation.

During:

- **Let go,**
    - Now that we have practiced creating statistical question, let me pose a question to you and see if we can work together to find the solution.
    - We have two solar panels outside the school. Our principal has given me access to the data that shows us how much energy is produced each day. When we look at the data, I notice some days are light blue, some that are navy, some that are royal blue, etc. I am wondering why this is. I am thinking if we graph the data by month, it may help us to see the big picture of energy production. My question is: Which month produced the most Kilowatts of energy?
    - Students should be grouped into 3's to work on this task. The data will be displayed on the board and students will be given a handout that has them complete a data chart.
    - After they complete the data chart, they should take the information and begin creating a graph. Each group will be given a small poster board to display their data. Give the following expectations for the display:
        - The top of your display should have the month you are analyzing written clearly and large.
        - The graph needs to be at large enough for the people in the back of the room to see.
        - The graph must have color that makes it easier for the reader (no yellow, orange, etc.)
        - At the bottom of your chart you should have the final number of kilowatt hours

produced in your month
    - Allow students to select their own entry point into this assignment. Let them figure out which graph they feel would best fit this activity.
- **Listen actively,**
    - The teacher should be going from group to group listening to their conversations about how to create their graph. Take note of groups that are graphing differently and their discussions in order to help facilitate a discussion as to why you might choose one graphing method over another in this instance.
- **Provide appropriate support**
    - How many days will be included on your graph?
    - What do you need your graph to represent?
    - What are the various graphing methods you can choose?
    - How does a graph help you as a mathematician?
    - Explain why you chose to organize your results in this way.
- **Provide worthwhile extensions**.
    - If some students finish their data charting early, they could be assigned an additional month to complete. This will add to the data collection and further help students draw conclusions.

After:

- **Promote a mathematical community of learners**
    - Have each group share their findings and collect each graph display to put in order on the board.
    - Students not presenting should be completing a data table in their science journal

Month	Total Kilowatts of Energy Produced

- **Listen actively without evaluation**
    - I noticed group A selected a bar graph to represent their data and group B chose a scatter plot. What is the data in both graphs displaying? Is there a graph that is right and a graph that is wrong? What are the benefits to using Graph A instead of Graph B or vice versa?
    - How did you reach your conclusion?
- **Make connections**
    - Can you give me an example of a day where there was low energy production, but the month it is in had a high kilowatt energy production?
    - Graphs and data tell a story. What is the story behind this data?
    - Is there a pattern that occurs or similarities between different months energy production?
    - I notice in December and January the energy produced is very low. Remind me again, where does the solar panel capture the energy from? (the sun) Interesting point. If we look at May and June the energy production is greater. Why might this be?
    - What does this tell us about the sun?
- **Summarize main ideas**
    - Can you think of a solution to get the maximum energy production to be the same each month?

ASSESSMENT

Observe: Groups will have the opportunity to share their learning through a proposal.

Ask:

Write a proposal as a group, stating your solution to the question. How can we get the solar panels maximum energy production to be the same each month?

Your proposal should clearly state the problem and the solution. Be sure to use the key words we talked about today such as solar panel, sun, tilt, data collection, etc.

Strong proposals use data to support their claim. Make sure to justify your claim by using data from all of the groups.

Be careful to use appropriate sentence structure and proper grammar. You need to have a rough draft completed before you begin typing it.

Each group will submit one proposal.