

*Mathematics: The Language of STEM*  
**How can we use statistics to influence people around us?**  
Paula Shank

**CONTENT AND TASK DECISIONS**

**Grade Level(s): Sixth**

**Time Frame: 3-4 Class Sessions**

**Description of the Task:**

Students will be able to develop their own statistical question and perform a research study using that question. They will choose an issue pertaining to their school that they would like to change.

**Indiana Mathematics Content Standards:**

6.DS.1: Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for the variability in the answers. Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

6.DS.2: Select, create, and interpret graphical representations of numerical data, including line plots, histograms, and box plots.

6.DS.3: Formulate statistical questions; collect and organize the data (e.g., using technology); display and interpret the data with graphical representations (e.g., using technology).

**Indiana Mathematics Process Standards:**

**PS.3: Critique Reasoning**

- Students will be working in teams of 2. When making decisions about developing their statistical question they will need to defend their reasoning behind their choices. They will need to communicate with their partner in order to successfully complete the task.

**PS.4: Model with Mathematics**

- Students will use visual representations in the form of graphs to represent their findings.

**PS.7: Look for and Make Use of Structure**

- Students will be collecting and organizing data. Students will need to determine which graphs would represent their data best.

**Mathematics Content Goals:**

- Learn about different types of graphs and tables used in statistical analysis. (Frequency table, dot plots, histograms, box and whisker plots)
- Find mean, median, mode, range and quartiles
- Learn about distribution of data
- Learn how to interpret graphs
- Learn about sample/populations sizes
- Compose graphs and tables to represent data using technology

**Language Objectives:**

- Key Vocabulary: Students will be able to define the terms mean, median, mode, range and quartiles.
- Listening and Reading: Students will be able to follow the instructions that were read aloud, provided on the board and provided on paper.
- Speaking: Students will be able to use academic language to share their statistical question along with their poster that represents their data. Students will be able to share with their classmates the reason they choose their statistical question and why they used each particular graph or table to represent their findings.

**Materials:**

- Video: Song about statistical questions: <https://www.youtube.com/watch?v=Y633-M3QHWY>
- Computer
- Printer
- Computer program to develop graphs
- Poster board
- Markers

**THE LESSON**

**Before:**

**Activate prior knowledge:**

- Students have learned how to find the mean, median, mode and range for a set of data.
- Students have developed fluency in adding, subtracting, multiplying and dividing rational numbers.
- Students are familiar with different types of graphs and tables used in statistical analysis.

**Questions:**

- Why is it important to analyze and interpret graphs and tables?
- Why is the sample size/population important to consider when conducting a study?
- What are errors? What are possible errors you may come across in your study?
- What are variables or factors in your study that may affect your findings?
- What conclusions can you make about your findings?
- How can graphs be misleading?
- Who would want to show a misleading graph and why would they want to do this?

**Be sure the problem is understood:**

Task: With your partner you will choose an issue pertaining to your school that you would like to change. Develop a statistical question for the issue. Question must be approved by teacher. Some examples may include: School dances, uniforms, better cafeteria food. After polling you will use the statistics from your poll to complete the following:

**Display your data on a poster:**

- Is your statistical question included?
- Include a sample of the poll given.
- Do you have a data table containing all your data?
- Is your data represented three ways using technology?
- Make sure you can justify your graph choices.
- Do you have a misleading graph representing the same data?

**Complete “What Does It Mean” for each graph used to represent your data.**

Show sample to students so they are aware of expectations.

**Write a persuasive letter to the principal asking for change at your school according to the data collected.**

- Letter must include an introduction, body and conclusion.
- Letter must be checked for spelling and punctuation.
- Letter must include data collected.
- Letter must support the other side of the argument.
- Letter must be respectfully written and teacher approved.

(The task will also be given to students in the form of a checklist.)

**Establish clear expectations:**

- Communicate with your partner to agree on a statistical question.
- Statistical question must be approved by teacher.
- Conversation should be on task.
- Polling for statistical question must be organized and the time must be teacher approved.
- Work together to complete the task, have fun.

**After giving children checklist they will share with a partner what the task is and what steps are needed to complete the task.**

**During:**

**Let go and Listen Actively**

- Once students have watched the video and know the task and requirements, step back and let them begin. Give them time to discuss, brainstorm, struggle and problem solve. Don't step in when they struggle but listen in and ask guiding questions to help them come to a conclusion.

**Questions you could ask:**

- That's a good thought, what other thoughts do you have?
- Do you both agree? If not can you combine your thoughts?
- Are you ready to begin the task?

**Provide appropriate support**

- What are some other examples of statistical questions?
- How do we find the mean, mode, median and range for a set of data?
- Why is it important to find the mean, mode, median and range for set of data?
- What is a quartile? How can we find out if we don't know?
- What is sample size/population? How might this affect your data?
- What are the different types of graphs used to represent data? Where can we find sample of these graphs?
- How will you represent your data?
- What made you decide to represent your data in this way?

**Provide worthwhile extensions.**

- You have the option to use Photoshop, iMovie or Weebly (Website maker) to present your findings.
- You may develop a second statistical question of your choice and report your findings.

**After:****Promote a mathematical community of learners**Group Share:

- Share your final solution with the class.
- What were some things you had to discuss with your group?
- What worked well for your group?
- What are some struggles you faced?
- How did you arrive at your solution?

**Listen actively without evaluation**

- Your teamwork was very impressive.
- You worked hard and you came up with an attractive poster that represents your statistical question.

**Make connections**

- Students will make connections between statistical questions and the different graphs and tables used in statistical analysis.
- Students will make connections between real world statistical analysis and misleading graphs and the reason behind them.

**Summarize main ideas**

Ask these questions, have students discuss with a partner.

- What is a statistical question?
- What is mean, median, mode and range?
- What are some different types of graphs and tables used in statistical analysis?
- Why are graphs important?

**ASSESSMENT****Observe:**

As the students are working with their partner, the teacher is moving from group to group listening for math talk, collaboration, and problem solving. The teacher will look for ways students are demonstrating knowledge of statistical questions, graphs and tables. This could include their discussions, graph and table representations, and final designs/presentations.

**Ask:**

Students will complete a short quiz at the end of the activity:

**Assessment:**

**(Answer these questions using smart answers.)**

- 1. Write three inferences or conclusions about your data.**
- 2. What two things stood out about your data?**
- 3. Are you satisfied with the variety or accuracy of your results? Why or why not? Write a paragraph using evidence to justify your answer. Use evidence from your study to convince why you are satisfied.**
- 4. Are there any possible errors in your study? What are the possible errors in your data?**
- 5. What is one new thing you learned while completing this activity?**

Students will complete a poster meeting all requirements given on checklist.

Students will complete “What Does it Mean” for each graph used.

# TASK

## *Project Checklist:*

With your partner you will choose an issue pertaining to your school that you would like to change. Develop a statistical question for the issue. (Question must be approved.)

Some examples:

- School dances
- Uniforms
- Better Cafeteria food

After polling you will use the statistics from your poll to complete the following:

### **Display your data on a poster:**

- Is your statistical question included?
- Is your data represented three ways using technology?
- Include a sample of the poll given.
- Make sure you can justify your diagram choices.
- Do you have a data table containing all your data?
- Do you have a misleading diagram representing the same data?

**Did you complete “What Does It Mean” for each graph you used to represent your data?**

**Write a persuasive letter to the principal asking for change at your school according to the data collected.**

- Letter must include an introduction, body and conclusion.
- Letter must be checked for spelling and punctuation.
- Letter must include data collected.
- Letter must support the other side of the argument.
- Letter must be respectfully written and teacher approved.

**Complete “What Does It Mean” for each graph used to represent your data.**

*What Does It Mean?*

*Graph Analysis*

Title of the graph:

Type of graph:

Are there axes?

Are the axes labeled?

What kind of info was collected to make this graph?

Summarize the finding of the graph in one to two sentences.

Are you confident the information on this graph is accurate? Why?

Who would this graph be useful to?

# **QUIZ**

**(Answer these questions using smart answers.)**

**Write three inferences or conclusions about your data.**

**What two things stood out about your data?**

**Are you satisfied with the variety or accuracy of your results? Why or why not? Write a paragraph using evidence to justify your answer. Use evidence from your study to convince why you are satisfied.**

**Are there any possible errors in your study? What are the possible errors in your data?**

**What is one new thing you learned while completing this activity?**