

What Makes a Good Statistical Task?

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SELECTING A TASK

- Who is your **audience**?
 - What background knowledge do they bring?
 - What are their interests and needs?
- What are the **goals** of the lesson?
 - Procedural fluency
 - Conceptual understanding
 - Realistic application of concepts

CLASSIFYING TASKS

In an article published in *Mathematics Teaching in the Middle School*, Stein and Smith (1998) describe four levels of **cognitive demand**. We have interpreted these levels through a statistical lens, relabeling the highest level of demand as “statistical problem-solving” instead of “doing mathematics.”

Because statistical reasoning is inextricably linked to **context**, we have also added a second dimension to Stein and Smith’s framework to indicate whether the task is set in a rich or simple context.

Longer statistical investigations are composed of multiple tasks that involve various levels of demand.

	Simple Context	Rich Context
Memorization		
Procedures without Connections		
Procedures with Connections		
Statistical Problem-Solving		

Note: This hierarchical ordering is not meant to suggest that you should only use high demand, rich context tasks. It depends on the audience and goals.

LEVELS OF COGNITIVE DEMAND

MEMORIZATION

- Reproducing facts, rules, formulas, or definitions
- Examples:
 - What is the difference between a population mean and a sample mean? What symbols do you use?
 - What is the name of this graphs?

PROCEDURES WITHOUT CONNECTIONS

- Applying procedures with no connection to concepts or other parts of the statistical process; little ambiguity about what needs to be done and no explanations required
- Examples:
 - Describe a procedure to collect a simple random sample of 5 students from our class.
 - Calculate the five-number summary and construct a boxplot to display the fat content (in grams) of all McDonald’s sandwiches.

PROCEDURES WITH CONNECTIONS

- Using procedures with close connections to underlying conceptual ideas or other parts of the statistical problem-solving process
- Examples:
 - Based on given dotplots, which dataset would you expect to have a larger standard deviation? Explain by referencing the formula.
 - A survey finds that vegetarians tends to be shorter on average than non-vegetarians? Can you conclude that vegetarianism stunts growth?

STATISTICAL PROBLEM-SOLVING

- Answering an investigative question using the statistical problem-solving process



CONTEXT OF STATISTICAL INVESTIGATION

A **rich statistical context**...

- Is meaningful to the audience of students
- Is open to interrogation (e.g., how the data were collected, how the variables were measured)
- Promotes multivariable thinking
- Generates new investigative questions

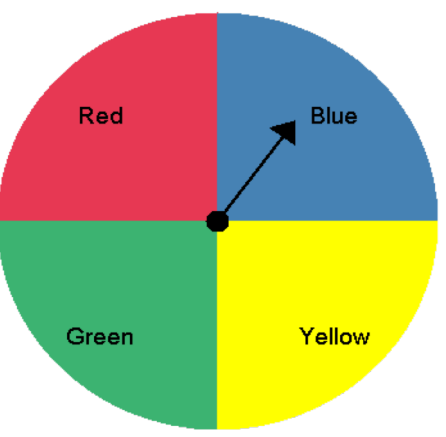
A **simple statistical context**...

- Reduces distractions to emphasize new facts, procedures, or conceptual ideas.

SAMPLE LESSONS

Spinners at the School Carnival

Author: Janis Carthon
Audience: Grades 3-5



At the school carnival, there is a game where students spin a spinner. Three of the sections (red, green, blue) represent a colored toy car and the fourth section is yellow representing no toy car. The parents responsible for organizing this carnival game want to know how many toy cars they must buy if they are expecting about 200 students to play the game.

Don’t Spill the Beans!

Author: Stephen Miller
Audience: Grades 7-8



Which hand can hold more beans, your dominant hand or your non-dominant hand? This activity introduces students to making hypotheses and designing an experiment to test those hypothesis. Students collect and record their data, use graphical methods to describe their data, and finally interpret their results.

NFL Quarterback Salaries

Authors:
Jeanie Gibson
Anna Bargagliotti,
Project-SET
Audience: Grades 9-12



Which variable – pass completion percentage, total number of touchdowns, or average number of yards – is the best predictor of salary among the 30 top paid NFL quarterbacks? Students use software to create scatterplots and find linear regression equations along with the correlation and the coefficient of determination. Then students interpret their results and decide which of the three variables is the best predictor.