Everything I Ever Needed to Know About Statistics I Learned From a Bag of m&m's®

Learning Targets

Session Goal: Explore classroom activities and questioning techniques that can be used to develop conceptual understanding for the Common Core State Standards in Statistics.

- I can describe the CCSS and AP expectations for statistics.
- I can utilize activities to explore and illustrate statistical concepts.
- I can incorporate questioning techniques into my hands-on activities.

CCSS - Statistics

Interpret Categorical and Quantitative Data

Conditional Probability and the Rules of Probability

Use Probability to Make Decisions

Make Inferences and Justify Conclusions
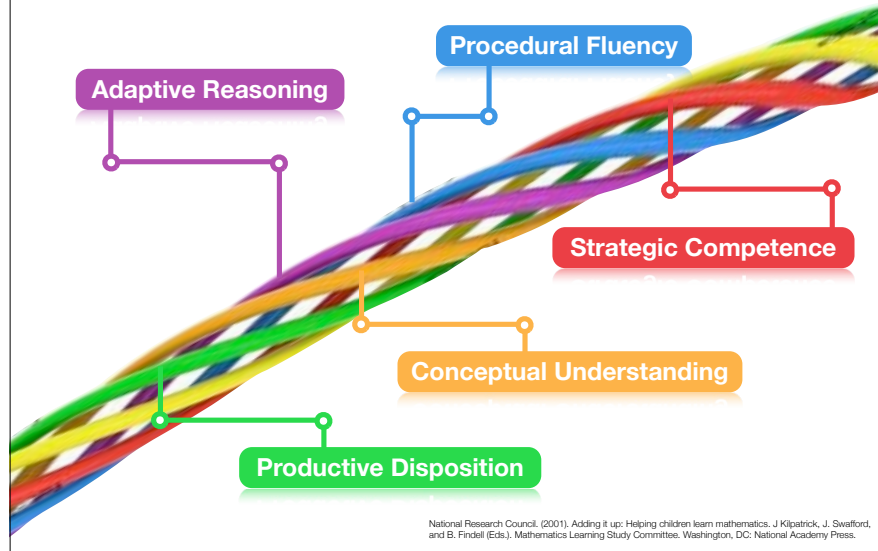

Four Basic Statistics Areas

Producing Data

Descriptive Statistics

Understanding Variability

Understanding Chance Behavior

Inferential Thinking

Statistical Proficiency

- Procedural Fluency
- Adaptive Reasoning
- Strategic Competence
- Conceptual Understanding
- Productive Disposition

National Research Council. (2001). Adding it up: Helping children learn mathematics. J Kilpatrick, J. Swafford, and B. Findell (Eds.). Mathematics Learning Study Committee. Washington, DC: National Academy Press.

Reasoning and Sense Making

"{Instruction} that focuses primarily on students' abilities to...perform basic statistical computations will lead students to believe that reasoning and sense making are not important...

We must ask students to explain their thinking."

NCTM Focus in High School Mathematics: Reasoning and Sense Making

The Bag

What questions could we answer with this bag of m&m's?

Framing Questions

- What are we **interested** in determining?
- What if...
    - What would we **expect** to observe?
- What would we see if we collected **LOTS of samples**?
- What did **we observe** in our sample?
- Should we be **surprised**?
    - What can we **conclude**?

Part I

Descriptive Statistics

- Displaying Data
- Numeric Descriptions
- Describing Location in a Distribution
- Bivariate Relationships

CCSS - Statistics

- **Interpret Categorical and Quantitative Data**

  - Summarize, represent, and interpret data on a single count or measurement variable

  - Summarize, represent, and interpret data on two categorical and quantitative variables

  - Interpret linear models

Collecting Data

http://tinyurl.com/cd6q3sn

m&m Data Collection

Complete this data collection form based on your sample bag of m&m's.
* Required

Your Name

Type of m&m's *
- Milk Chocolate (Plain)
- Peanut
- Pretzel
- Peanut Butter
- Dark Chocolate
- Almond

Total Number of m&m's *

Number of Blue *

Number of Brown *

Number of Green *

Google Drive

Part II

Producing Data
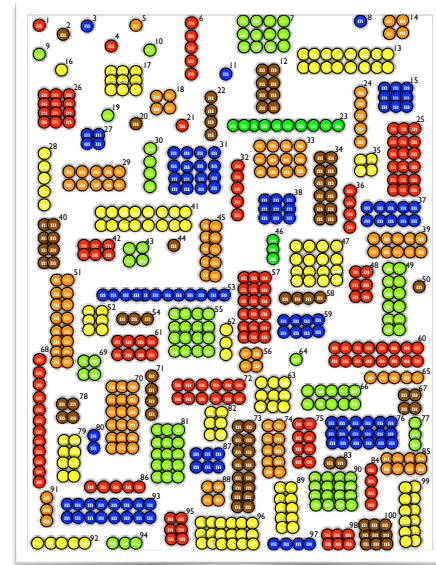
- Experimental Design
- Random m&m's

CCSS - Statistics

- **Make Inferences and Justify Conclusions**

  - Understand and evaluate random processes underlying statistical experiments

  - Make inferences and justify conclusions from sample surveys, experiments, and observational studies

Random m&m's

Part III

Understanding Chance Behavior

- Conditional Probability

Inferential Thinking

- X^2 Goodness of Fit

MARS Candy Memo

"On average, our mix of colors for m&m's milk chocolate candies is

24% blue, 20% orange, 16% green, 14% yellow, 13% red, and 13% brown.

Each large production batch is blended to those ratios and mixed thoroughly. However, since the individual packages are filled by weight on high-speed equipment, and not by count, it is possible to have an unusual color distribution."

CCSS - Statistics

- **Use Probability to Make Decisions**

  - Calculate expected values and use them to solve problems

  - Use probability to evaluate outcomes of decisions

Chi-Square

	Brown	Yellow	Red	Orange	Green	Blue	Total
Observed							
Expected							
$(O-E)^2/E$							

	Brown	Yellow	Red	Orange	Green	Blue	Total
Plain							
Peanut							
Peanut Butter							
Pretzel							
Dark Chocolate							
Total							

CCSS - Statistics

- **Conditional Probability and the Rules of Probability**

  - Understand independence and conditional probability and use them to interpret data

  - Use the rules of probability to compute probabilities of compound events.

What If I Can't Use m&m's?

apstatsmonkey.com