M³ : Munching Your Way through Mathematical Modeling!
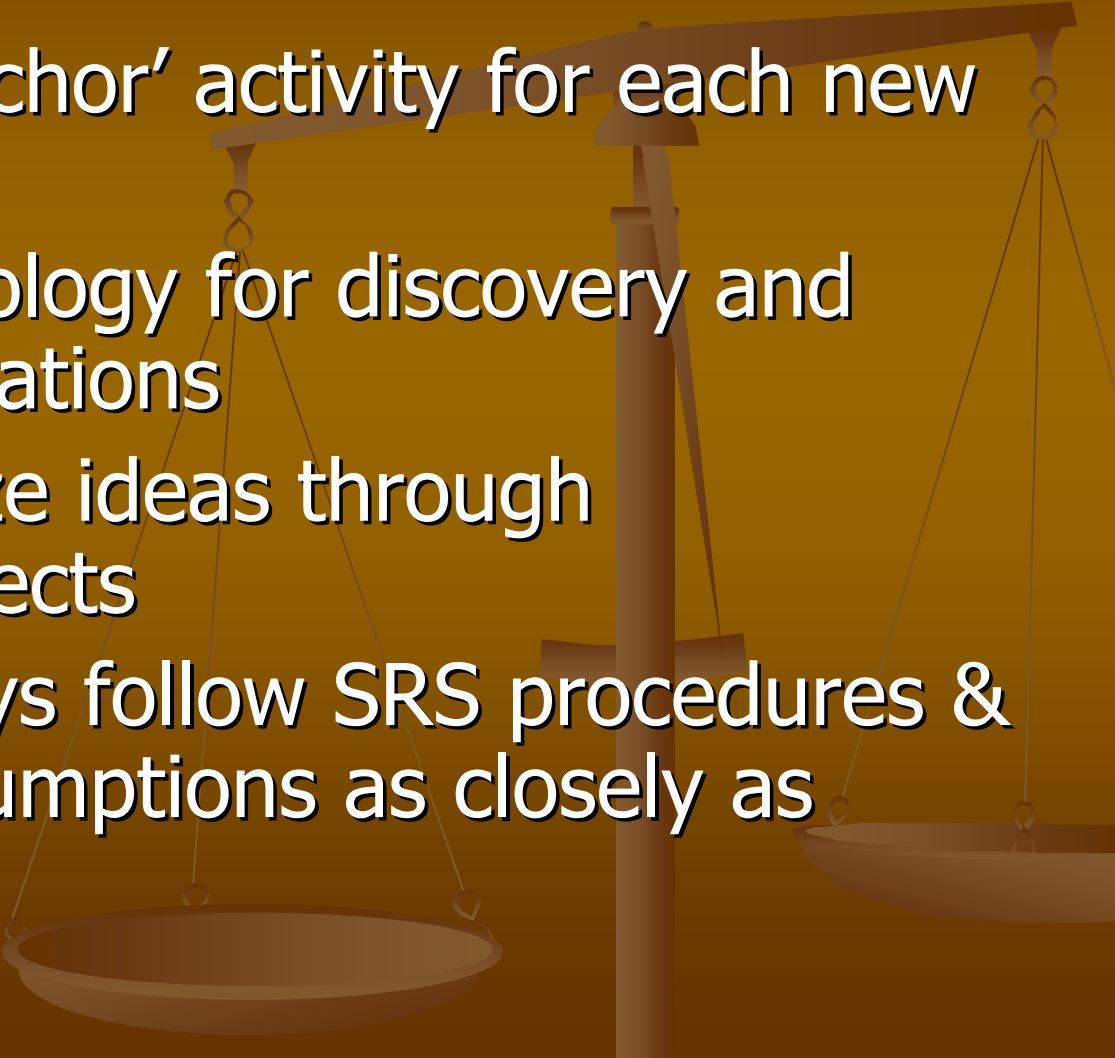
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"Munchy" Connections Across the Curriculum

- Focus on an 'anchor' activity for each new topic/ unit
- Integrate technology for discovery and advanced applications
- Apply/ synthesize ideas through meaningful projects
- Be sure to always follow SRS procedures & abide by all assumptions as closely as possible

Conic Sections
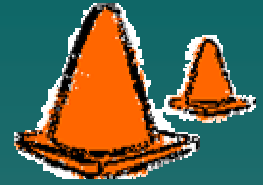
◆ Using patty paper:
  – Begin with a point not on a line and a line.
  – Fold point onto line & crease paper.
  – Repeat process many times making new folds.
  – Others: *circle- with point in circle;*
                    circle- with point outside of circle

◆ Using Jello® Jigglers:
  – Place jello in a cone to set.
  – Use dental floss to cut various conic sections.

SNACK FACT

JELL-O brand gelatin, circa 1890s, was the first gelatin dessert.

JELLO

Regression Revisited

- Walk on the Wild Side:
  - Create ordered pairs from each student
    - Timed walk forward vs. backward for a set distance in seconds (x_f , y_b)
  - Create class scatterplot & run LSRL

- What happened to my M&M's?:
  - Exponential Decay (M&M's Rule!)
    - Count candies
    - Shake, pour out and record M's up. Remove these.
    - Repeat.
    - Create scatterplot $(x_{time} , y_{candies \, left})$

Dealing with Data 'Basics'

- M&M's
  - Qualitative Counts/ shapes & more!
  - Quantitative Counts/ shapes & more!
- "Chippy" Chips Ahoy
  - Are there really 1000 Chips in every bag?
- Integration of Fathom Software
  - Excellent tool for pulling in real data/ examples

Distributions

- Normal Distribution-
  - M&M's- bag totals or color counts
- Binomial Distribution-
  - Success- Brown or Red M&M's
- Geometric Distribution-
  - Draw until you get a success…
- χ^2 Distribution-
  - Popcorn- is it all the same?

Central Limit Theorem

- How skewed are your pennies?
  - Students bring in 100 pennies with dates recorded
  - Code as 1,2,3, etc.
    - Let 1 = (current year – 1)
  - Show as a histogram on large grid paper
  - Note skewed population & calculate μ, σ
  - Take samples of size 4,9,16,25
    - Calculate each sample's mean
  - Demonstrate connection to μ, σ

Confidence Intervals

- ➤ **M&M's with a twist!**
  - Give each student a cup ½ full of m&m's
  - Have students count
    - # of Brown & Reds (this is a success)
    - Cup total
  - Collect these counts to find 'the truth' while students continue activity. (later post the pop proportion)
  - Mix cups thoroughly & pull out a sample (ex: n=20)
  - Record # successes out of n
  - Calculate 95% C.I. for each sample
  - Repeat until class has 100 C.I.'s
  - Generate a graphical display of: #successes (histogram)
  - Have students report # C.I.'s that don't contain *p*

Hypothesis Testing

- ◆ What about your M&M proportions?
  - • 1-sample proportions testing
    - ◆ A continuation/ modification on the CI activity
      - • Company says 40% are brown & red in a regular bag
      - • Test your sample against the claims

- ◆ Are all cookies really created equally?
  - • 2-sample testing (t distributions)
    - ◆ Regular chips ahoy vs. lowfat chips ahoy
    - ◆ Be sure students count same way & don't know which cookie is which. (bag A & bag B)

Experimental Design Anyone?

- **Teddy Grahams Galore**
  - Error in experimental design measurement
  - Discuss applications to other design problems

- **What's your *"Mood"* like today?**
  - Questioning bias made easy
  - Carefully distribute the mood statements and maintain room silence
  - Have students record their score on paper so as not to bias by others.
  - Maintain separate lists for Mood A & B cards

How many TEDDY GRAHAMS can you find? Count them as you go!

Teddy Grahams

LET'S COUNT: 0

What Kind of Errors do you make?

- Hershey mini candy bars
  - Use the Easter or holiday candies for unique colors (pink, green, blue)
  - Work through Type I & II activity to clarify the concepts of errors
  - See an application of power
- Extension to the normal scenario as needed

Projects that make sense

- ## Univariate Candy anyone
  - First day report (A. Coons)

- ## Homework at the mall?
  - PART 1: Observational study to understand basic univariate data

- ## Data Displays-
  - PART 2: Using old USA Today calendars (now online) to create the data

- ## Helicopters flying a new route-
  - Students first complete the helicopter project (Barrett)
  - Next, they create their own series of experiments for

    hypothesis tests but using an edible sample example!

Connections that Make Sense

- Vertical applications to AP Statistics from Algebra I and up

- Real world scenarios that work

- Activities that keep their attention *(mmm good)*

- Hooks to refer key topics back to

- Exciting classroom management

- Excellent differentiation opportunities!