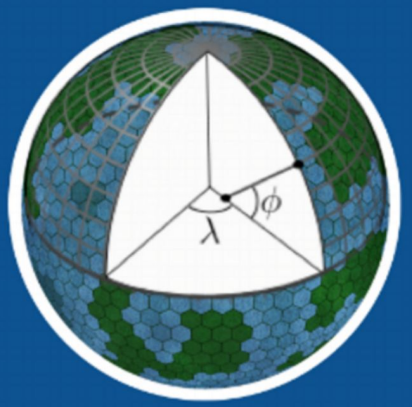
Instructional Strategies to Promote Reasoning and Communication in Statistics

October 19th, 2021



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Goals for This Presentation

You will learn about four different instructional strategies for teaching reasoning and communication in statistics.

1. Error Analysis
2. Peer Critique
3. Building the Model Solution
4. Stand & Talk with virtual variation of Chat Explosion

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BONUS STRATEGY: Quickwrite

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- Promote verbal and written communication around statistics concepts
- Culture of collaboration where mistakes are valued as part of the learning process

Error Analysis

Description: Give students an existing solution and have them identify and describe where the errors have occurred.

Error Analysis Example 1

8. Lisa is a good free throw shooter. The basketball goes in the basket 80% of the time. She tries to make 3 free throws. (6 points)

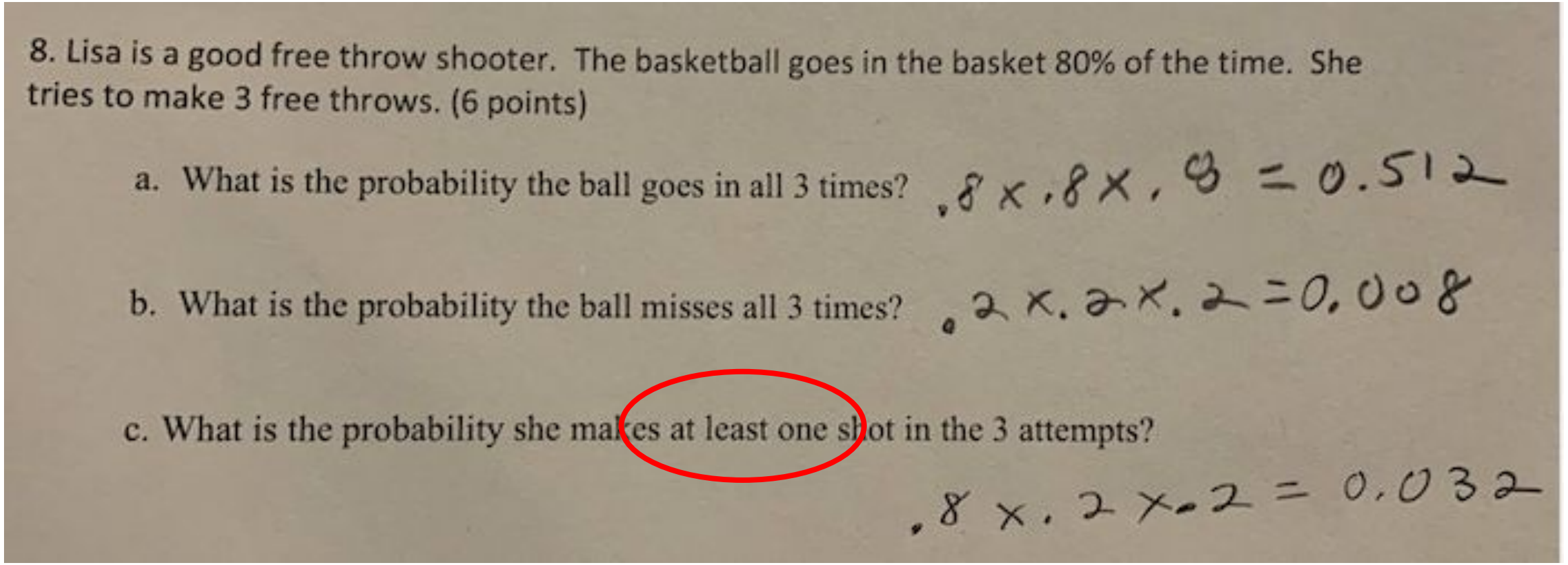
a. What is the probability the ball goes in all 3 times? .8 x .8 x .8 = 0.512

b. What is the probability the ball misses all 3 times? .2 x .2 x .2 = 0.008

c. What is the probability she makes at least one shot in the 3 attempts?

.8 x .2 x .2 = 0.032

Error Analysis Example 1



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Error Analysis Example 2

A change has been made that should improve student satisfaction with parking. Let's assume that before the change, 37% of students approve of the parking that is provided. Fifty students were randomly selected and in the sample 21 approve of the parking that is provided. Is this sufficient evidence that student satisfaction has improved over the previous satisfaction level?

H_0: $p > 0.42$
H_a: $p = 0.37$

The random sample condition is met because 50 students were randomly selected.
The large counts or normal condition is met, because n > 30.

$$z = \frac{0.37 - 0.42}{\sqrt{\frac{0.37\,(1 - 0.37)}{50}}} = -0.732$$

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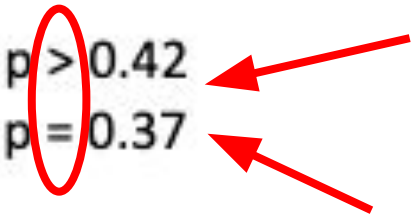

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Error Analysis

Practical Tips

1. Gather work from one year and use it for a future year

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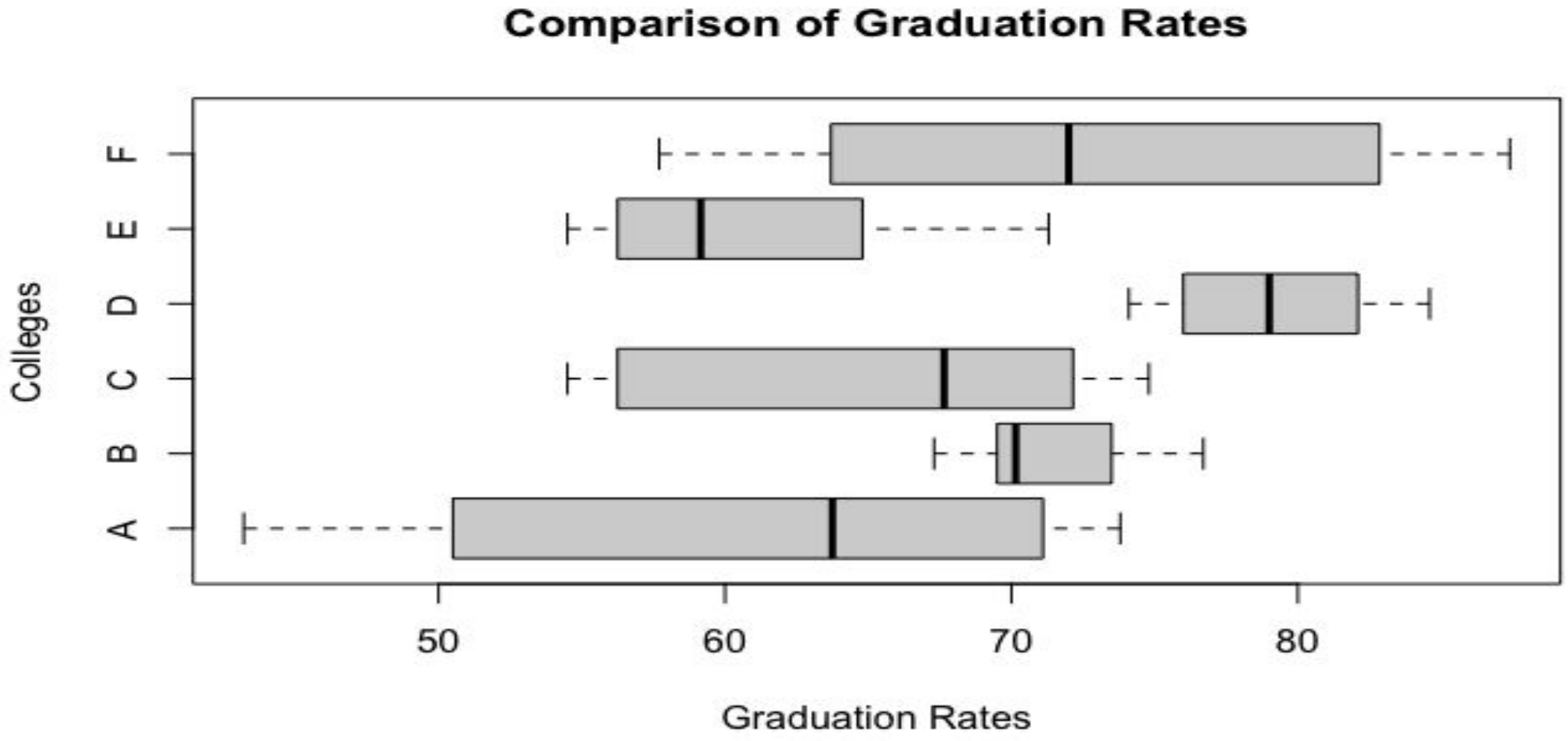
2. Use sample responses from released AP Free Response Questions or your state assessment

Peer Critique

Description: Students work in pairs or small groups to critique solutions to Free Response Questions.

Compare and contrast



Compare and contrast

Half of the colleges have a center above 70% and the other half have a center below 70%. 4 of them have a min that is below 60%, but all sixe have a max of 70%. The two outliers are A's min and F's max.

Criteria	Evidence
Center	
Spread	
Outliers	
Context	
Other Comments	

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3. Have all students answer the same prompt and then share with two others for feedback.

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1) Find a model solution from an AP Free Response question or state assessment.
2) Split it into pieces of 4-5 words in length.

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3) Create 4-5 additional pieces that could be used in place of some of the pieces. This could be based on common student errors, like using mean instead of median or sample instead of population.

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4) Put the words from step 2 and step 3 on separate cards or pieces of paper.

5) Give the students the prompt and the pieces of paper. You may wish to tell them how many “extra” pieces there are that are not part of the solution.

Build the Model Solution Example 1

Fiddle Lake is stocked with fish in the winter for fishing. It is safe to assume that the weights of the fish are approximately normally distributed with a mean length of 7 inches and a standard deviation of 0.5 inches. A random sample of 50 fish was caught and the probability that the sample mean was less than 6.5 inches was calculated.

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If the population distribution was nonnormal, would it still be appropriate to use the normal distribution to compute the probability?

of the sample proportion

says that the sampling distribution

of the sample mean

it would be appropriate to use

is greater than 10

will become exactly normal

Yes. The Central Limit Theorem

Since the sample size

is reasonably large (n=50),

as the sample size n increases.

the normal distribution to find the probability of interest

even though the population is nonnormal.

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Build the Model Solution Variation

Have a full model solution, but leave 3 or 4 blanks for students to complete or give them options for what might go in the blanks.

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Example: The slope of the LSRL is ____. This means that for each additional _____ in height the number of steps to get from the library to the gym is predicted to _____ by _____

$$\hat{y} = 5.2 - 2.3x$$

x is the height in centimeters, y-hat is the predicted number of steps

Stand and Talk

Description: A quick way for students to think about a prompt and then talk about a prompt.

Concept created by: Sara VanDerWerf

Stand and Talk

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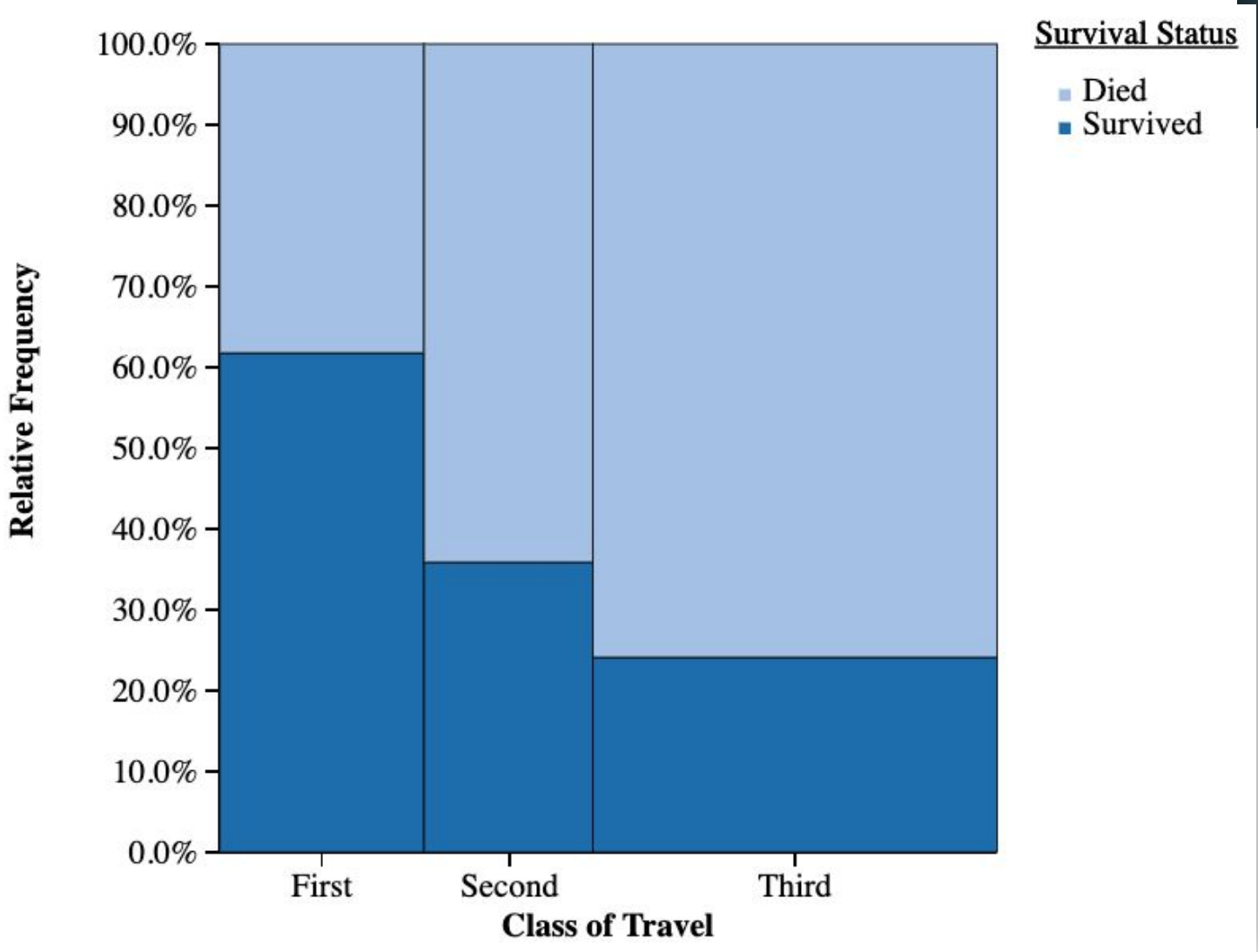
Tip #5 – Keep the momentum – stand and debrief.

Stand and Talk Example 1

What story does this graph tell about the people who were on the Titanic?



Stand and Talk Example 2

placebo

placebo effect

double blind

single blind

random assignment

control

blocking

SRS

strata

cluster

bias

nonresponse

convenience sample

voluntary response

matched pairs

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A good alternative to the stand and talk...however, there is no sharing with a partner prior to typing in the chat.

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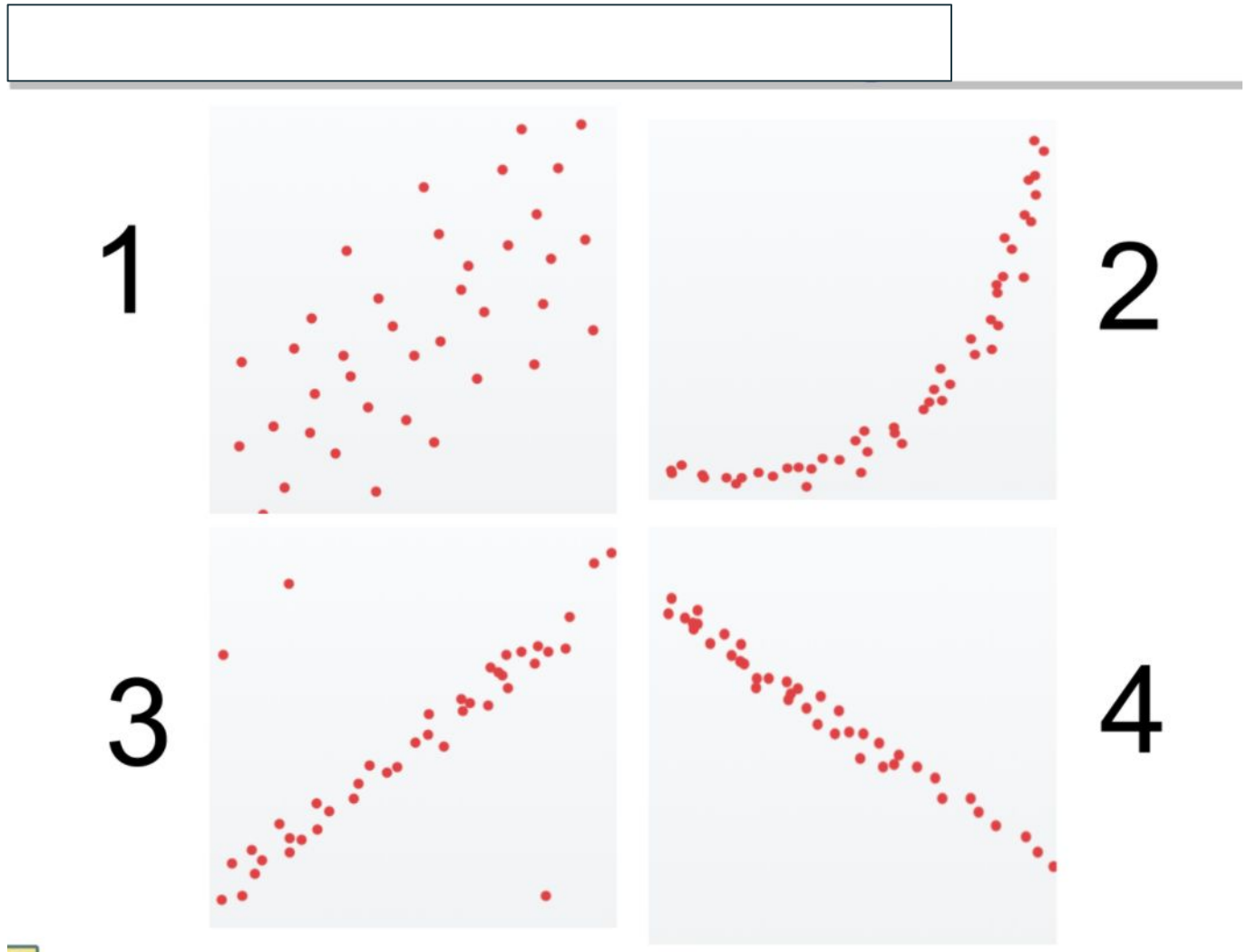
Step #5 – Summarize what you see.

Chat Explosion Example 1

Photo Credit: Vicki Greenberg

Chat Explosion Example 1



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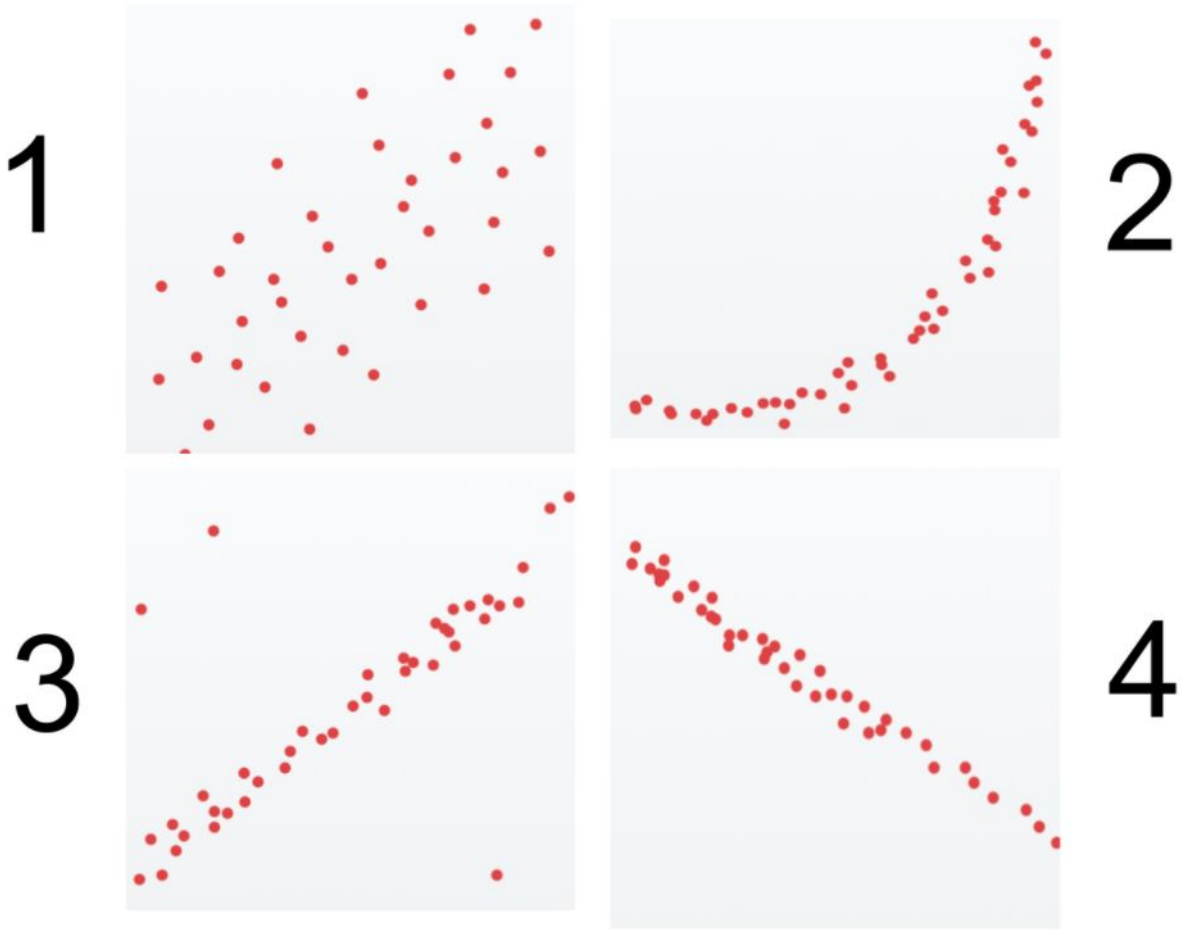
Chat Explosion Example 1

Which One Is Different?



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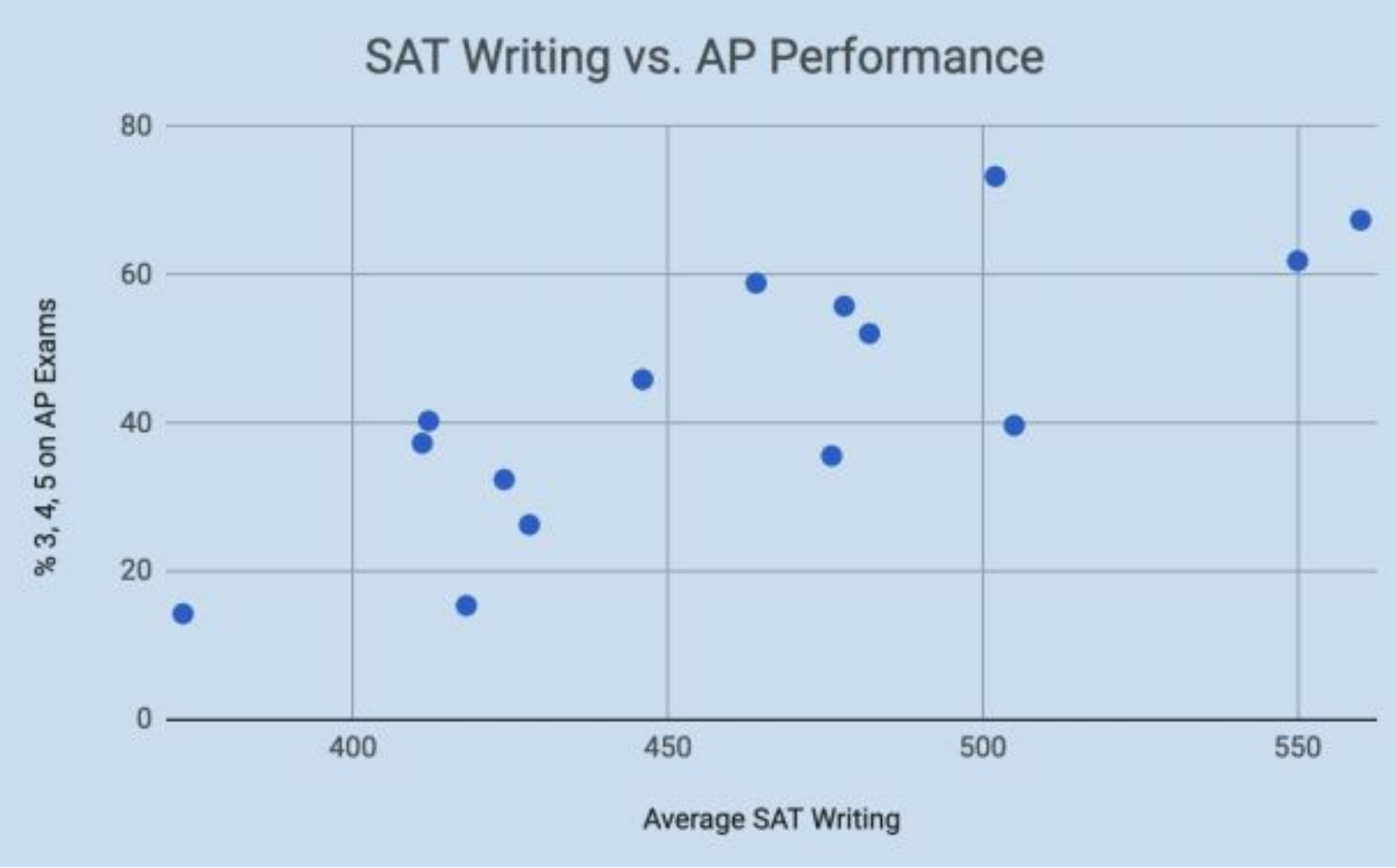

What do you notice?

What do you wonder?

Bonus Strategy: Quickwrite

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Special Side Note: You do not need to provide feedback on everything they do.

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6 heads in 10 flips OR 8 heads in 10 flips

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Which of the following would provide you with more evidence that a coin is not a fair coin?

8 heads in 10 flips OR 80 heads in 100 flips

Final Thoughts

- Encourage writing

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- Give sufficient time for thinking

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- Value mistakes as part of learning

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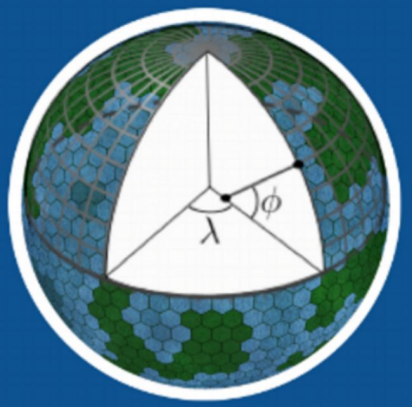

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