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Professional Development Webinars

Exploring “What’s Typical?” Using Sampling and Design

Fall 2017

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Moderator Bio

Mike Houston

T^3 National Instructor
Riverside High School
Ellwood City, PA

Mike is in his twelfth year of teaching high school mathematics in Ellwood City, PA. While participating in a TI-Navigator™ Fast-Track in 2007, he learned how technology can effectively cultivate students' wide range of learning styles. During this time, Mike has served as a T^3 National Instructor and a contributing author for MathForward™.

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Panelists' Bios

Diane Broberg

T³ Regional Instructor

Rochester, NY

Diane has been teaching high school mathematics for 25 years. She has served on writing teams for Texas Instruments and taught many summer workshops. Making math come alive for teachers and students keeps her creative. Outside of math, she's an avid runner.

Jeff McCalla

T³ Regional Instructor

Memphis, TN

Jeff co-founded the TI-Nspire™ SuperUser group with Bryson Perry. He teaches Algebra II and AP* Statistics at St. Mary's Episcopal School in Memphis, TN. In 2009, Jeff received the Presidential Award for Excellence in Mathematics and Science Teaching. Jeff authored the 2nd edition of *TI-Nspire for Dummies* (2011) and the 2nd edition of *TI-84 for Dummies* (2013).

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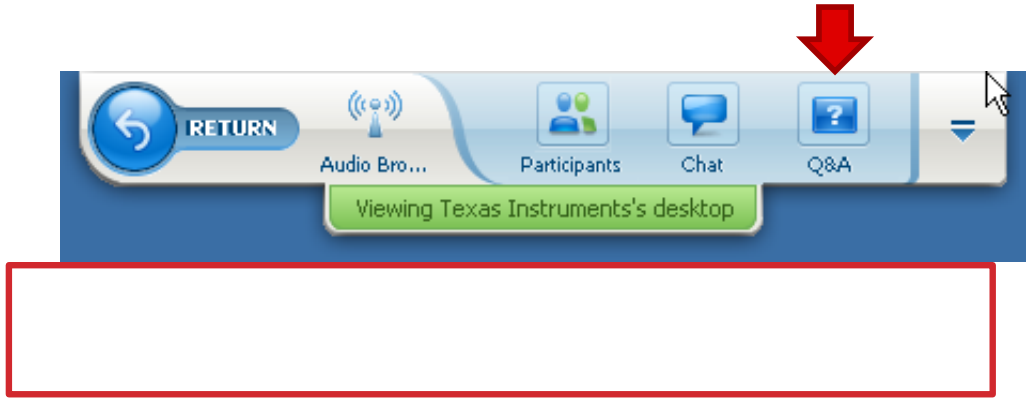

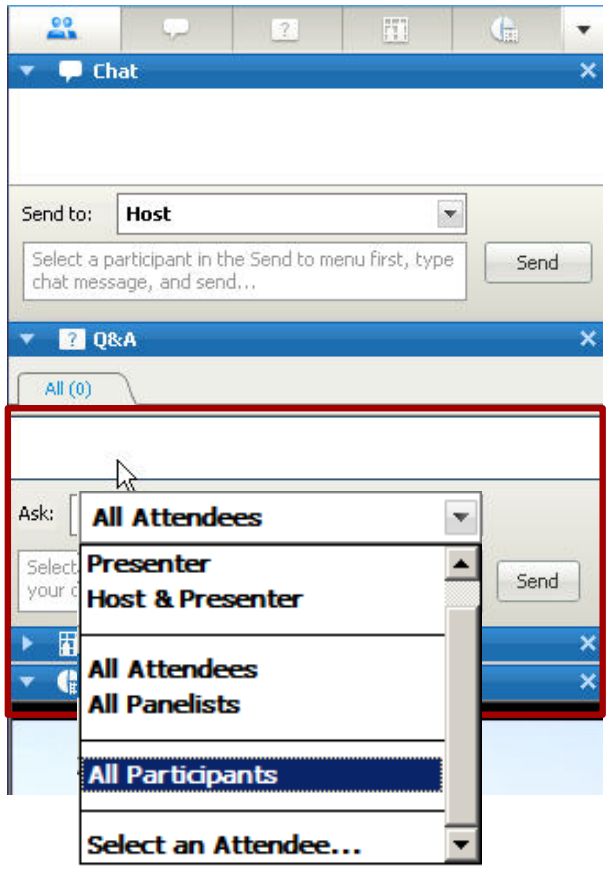

Questions directed to:

•**All Attendees** <u>excludes</u> Moderator and Panelists

•**All Participants** includes everyone in the meeting

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1.Click the “eject” arrow at the far right of the floating toolbar.
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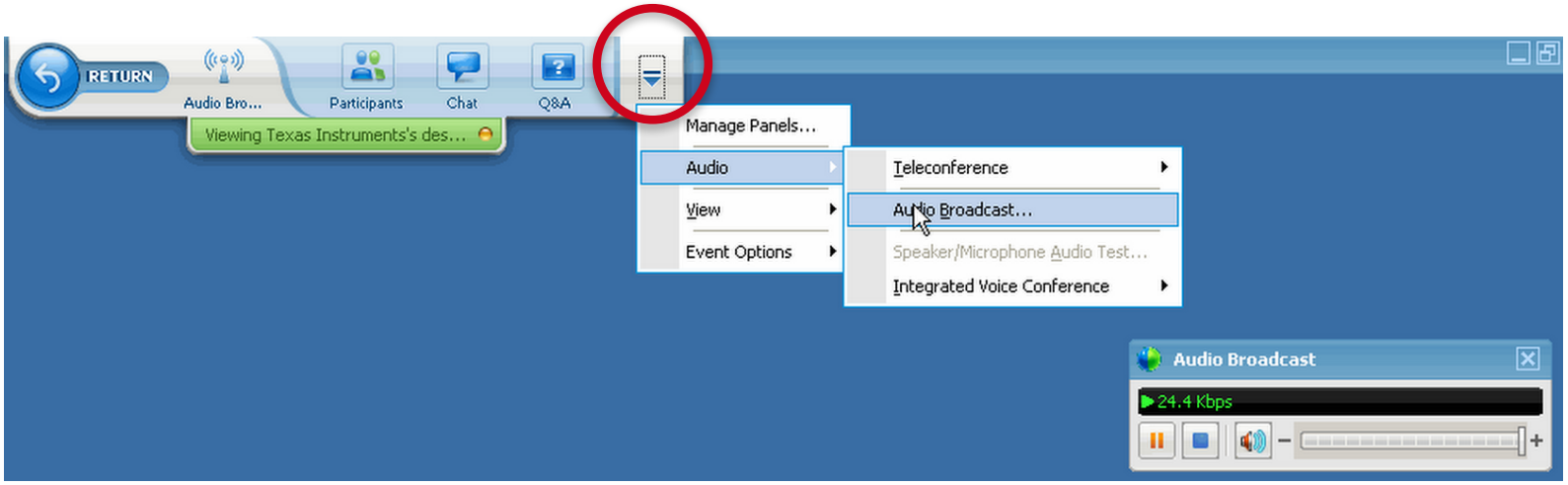

2. If we are not in desktop-sharing mode, go to
Communicate > *Audio Broadcast* and click the “*Play*” icon.

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Agenda

- Welcome & introductions
- Random Sampling
  - Question from SAT
  - Built in commands on TI-Nspire™ to create sampling distribution given any data set
- Activities from Math Nspired to enhance the classroom
- AP* questions that use the concepts
- Online Resources
- **Win registration for two to the 2018 T³™ International Conference**
  Attend this webinar for a chance to win complimentary registration for two to the 2018 T³™ International Conference, March 2-4, 2018, in San Antonio, Texas.

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Expected Outcomes

- **Examine** the two main types of inference and the main obstacle each must overcome (bias and confounding)
- **Demonstrate** random sampling using lists and TI-Nspire™ Technology
- **Use** activities to illustrate when, how and why more complex data-collection procedures such as stratification and blocking may be beneficial
- **Show** good data-collection procedures using visual, technology-based activities and AP* and SAT* questions

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Try this. (SAT* question)...Choose as many as are true

- A polling agency recently surveyed 1000 adults who were selected at random from a large city and asked each of the adults, "Are you satisfied with the quality of air in the city?" Of those surveyed, 78% responded that they were satisfied with the quality of air in the city. Based on the results of the survey, which of the following statements must be true?

I. Of all adults in the city, 78% are satisfied with the quality of air in the city.

II. If another 1000 adults selected at random from the city were surveyed, 78% of them would report they are satisfied with the quality of air in the city.

III. If 1000 adults selected at random from a different city were surveyed, 78% of them would report they are satisfied with the quality of air in the city.

IV. None

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Observational studies vs. Experiments

- Observational studies
  - Random sample
- Purpose – draw inference about population
- Challenge – lurking variables
- Stratified sample
  - Decrease variability in the sampling distribution

- Experiments
  - Randomized assigned
  - Replication
  - Control
- Purpose: Show cause and effect
- Challenge – confounding variables
- Blocking
  - Reduces variation
  - Myth – prevents confounding

2012 AP* Multiple choice

A compact disc (CD) manufacturer wanted to determine which of two different cover designs for a newly released CD will generate more sales. The manufacturer chose 70 stores to sell the CD. Thirty-five of these stores were randomly assigned to sell CDs with one of the cover designs and the other 35 were assigned to sell the CDs with the other cover design. The manufacturer recorded the number of CDs sold at each of the stores and found a significant difference between the mean number of CDs sold for the two cover designs. Which of the following gives the conclusion that should be made based on the results and provides the best explanation for the conclusion?

(a) It is not reasonable to conclude that the difference in sales was caused by the different cover designs because this was not an experiment.

(b) It is not reasonable to conclude that the difference in sales was caused by the different cover designs because there was no control group for comparison.

(c) It is not reasonable to conclude that the difference in sales was caused by the different cover designs because the 70 stores were not randomly chosen.

(d) It is reasonable to conclude that the difference in sales was caused by the different cover designs because the cover designs were randomly assigned to the stores.

(e) It is reasonable to conclude that the difference in sales was caused by the different cover designs because the sample size was large.

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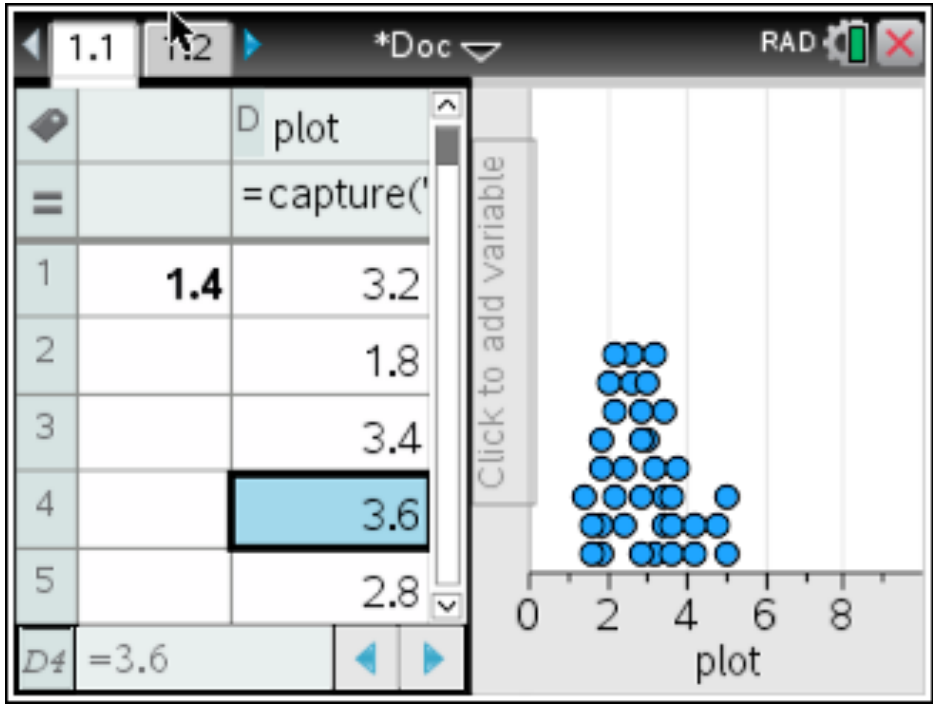
Using TI-Nspire™ to create a sampling distribution.

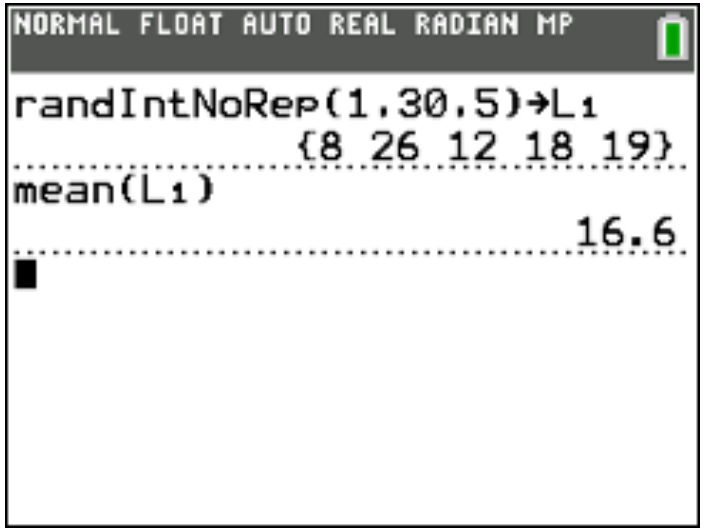


- Use randSamp to choose a set of values from a given list
- Syntax -> randSamp(list, # in sample, 0 or 1) – 0 with repeats, 1 without repeats
- Find mean
- Plot means using Data capture
- Syntax -> capture(variable, 0 or 1) – 0 automatic, 1 manual)

What is the equivalent using the TI-84?

Closest command is RandIntNoRep

1 - Math>Prob>8:randIntNoRep(min,max,# of samples)
2 - Store L1
3 - List>Math>Mean(list)



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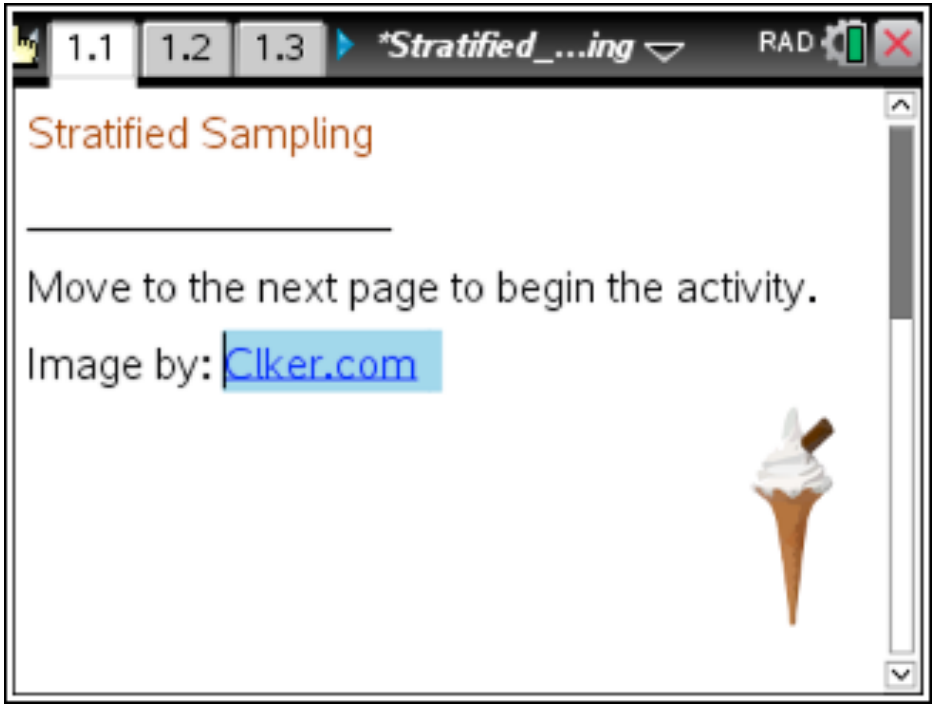
Stratified Sample Activity from TI



This lesson involves determining which of three different sampling methods – a simple random selection design and two stratified selection designs – would be most beneficial in selecting a survey sample within a given context.

The Happy Sundae Ice Cream Company is looking to expand its ice cream truck business into new neighborhoods. From previous business experience, the company knows how many children need to live in a neighborhood for an ice cream truck to be profitable. The neighborhood being considered is bounded by the downtown on the south and a freeway on the east and consists of 36 approximately square city blocks. Sean, Happy Sundae's Director of Marketing, wants to survey six of the city blocks to get an estimate of the total number of children living in the neighborhood.

Compare and contrast stratifying a sample and blocking in an experiment

- Observational study

1. Stratify
2. Sample

- Goal: Reduce variability in sampling distribution

- Experiment

1. Random assignment
2. Block

- Goal: Reduce variability in sampling distribution.
- Myth: Prevents confounding

What is the definition of confounding?
Provide your answer in the chat window.

Definitions of confounding

- Confounding occurs when the experimental controls do not allow the experimenter to reasonably eliminate plausible alternative explanations for an observed relationship between independent and dependent variables. (Stat Trek)
- Mix up (something) with something else so that the individual elements become difficult to distinguish. (Dictionary)
- A situation in which the effect or association between an exposure and outcome is distorted by the presence of another variable. (Penn State stats)
- A variable, other than the independent variable that you're interested in, that may affect the dependent variable. (Handbook of Biological Statistics)
- An “extra” variable that you didn’t account for. They can ruin an experiment and give you useless results. They can suggest there is correlation when in fact there isn’t. They can even introduce bias. (Statistics How to)

1999 AP* Statistics Free Response

The dentists in a dental clinic would like to determine if there is a difference between the number of new cavities in people who eat an apple a day and in people who eat less than one apple a week. They are going to conduct a study with 50 people in each group.

Fifty clinic patients who report that they routinely eat an apple a day and 50 clinic patients who report that they eat less and one apple a week will be identified. The dentists will examine the patients and their records to determine the number of new cavities the patients have had over the past two years. They will then compare the number of new cavities in the two groups.

(b) Explain the concept of confounding in the context of this study. Include an example of a possible confounding variable. Answer in the chat window.

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AP question continued…..

- If the mean number of new cavities for those who ate an apple a day was statistically signicantly smaller than the mean number of new cavities for those who ate less than one apple a week, could one conclude that the lower number of new cavities can be attributed to eating an apple a day?
- Answer the poll that was sent (Yes or No).

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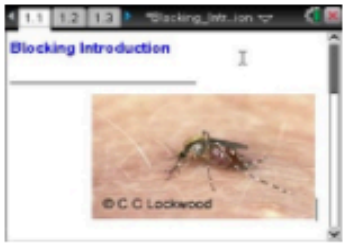
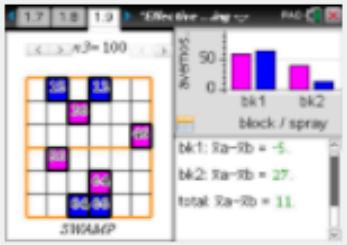
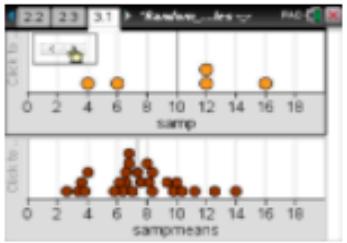
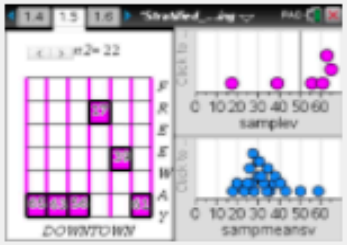
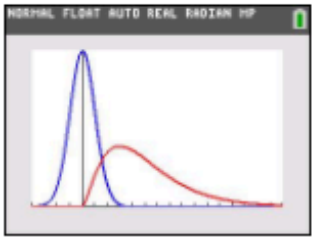
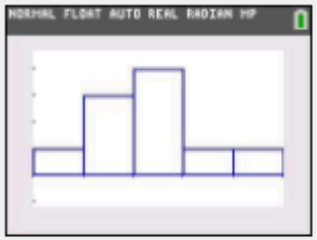
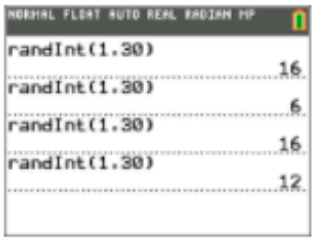
Other activities: Effective Blocking

Statistics: Sampling and Experimentation Classroom Activities	Devices	Download
 **Blocking Introduction** Published on October 07, 2011 This lesson involves investigating the effectiveness of two mosquito sprays in a large tract of land by using two different experimental designs - one randomized design and one randomized block designs. Standards | Textbook	TI-Nspire™ CX TI-Nspire™ CX CAS TI-Nspire™ Navigator™ TI-Nspire™ TI-Nspire™ CAS	3,482
 **Effective Blocking** Published on October 06, 2011 This lesson involves investigating the effectiveness of two mosquito sprays in a large tract of land by using three different experimental designs - one randomized design and two randomized block designs. Standards | Textbook	TI-Nspire™ CX TI-Nspire™ CX CAS TI-Nspire™ Navigator™ TI-Nspire™ TI-Nspire™ CAS	3,268
 **Random Samples** Published on December 06, 2011 Compare the results of the three estimation methods to show that random samples of rectangles provide estimates that, on average, are closer to the true population mean than the other two methods. Standards | Textbook	TI-Nspire™ CX TI-Nspire™ CX CAS TI-Nspire™ Navigator™ TI-Nspire™ TI-Nspire™ CAS	3,456
 **Stratified Sampling** Published on October 05, 2011 This lesson involves determining which of three different sampling methods - a simple random selection design and two stratified selection designs - would be most beneficial in selecting a survey sample within a given context.	TI-Nspire™ CX TI-Nspire™ CX CAS TI-Nspire™ Navigator™ TI-Nspire™ TI-Nspire™ CAS	3,376

TI-84 Activities

- 84 Activity Central
- Middle Grades Math
- Algebra I
- Geometry
- Algebra II
- Precalculus
- Statistics
  - Displaying and Describing Univariate Data
  - Normal Distributions
  - Describing Bivariate Data
  - Probability and Random Variables
  - Sampling Distributions
  - Confidence Intervals
  - Hypothesis Tests
- Calculus
- Science

Statistics | Sampling Distributions

Statistics: Sampling Distributions Classroom Activities	Devices	Download
 **Chi-Square Distributions** Published on February 04, 2013 Students compare the chi-square distribution to the standard normal distribution and determine how the Chi-Square distribution changes as they increase the degrees of freedom. Standards | Textbook	TI-84 Plus CE TI-84 Plus C Silver Edition TI-84 Plus Silver Edition TI-84 Plus	9,532
 **Intro to the Central Limit Theorem** Published on January 23, 2013 Students discover the Central Limit Theorem by simulating rolls of two, four, and seven number cubes via the random number generator. Standards | Textbook	TI-84 Plus CE TI-84 Plus C Silver Edition TI-84 Plus Silver Edition TI-84 Plus	9,272
 **Sampling** Updated on February 19, 2015 Students learn about each of the four types of random sampling methods and use the randInt command to find each kind of sample from a given population. Standards | Textbook	TI-84 Plus CE TI-84 Plus C Silver Edition TI-84 Plus Silver Edition TI-84 Plus	9,786

AP apartment question

An apartment building has nine floors and each floor has four apartments. The building owner wants to install new carpeting in eight apartments to see how well it wears before she decides whether to replace the carpet in the entire building.

The figure below shows the floors of apartments in the building with their apartment numbers. Only the nine apartments indicated with an asterisk (*) have children in the apartment.

11* 12 1st Floor 14 13	21 22* 2nd Floor 24 23*	31 32 3rd Floor 34 33
41 42 4th Floor 44 43	51* 52 5th Floor 54 53	61 62 6th Floor 64 63
71 72 7th Floor 74* 73*	81 82 8th Floor 84* 83	91 92* 9th Floor 94 93*

* = Children in the apartment

(a) For convenience, the apartment building owner wants to use a cluster sampling method, in which the floors are clusters, to select the eight apartments. Describe a process for randomly selecting eight different apartments using this method.

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AP Question continued…

An alternative sampling method would be to select a stratified random sample of eight apartments, where the strata are apartments with children and apartments with no children. A stratified random sample of size eight might include two randomly selected apartments with children and six randomly selected apartments with no children. In the context of this situation, give one statistical advantage of selecting such a stratified sample as opposed to a cluster sample of eight apartments using the floors as clusters.

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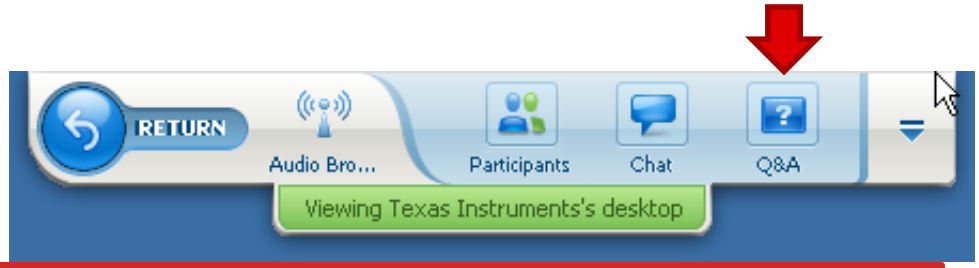

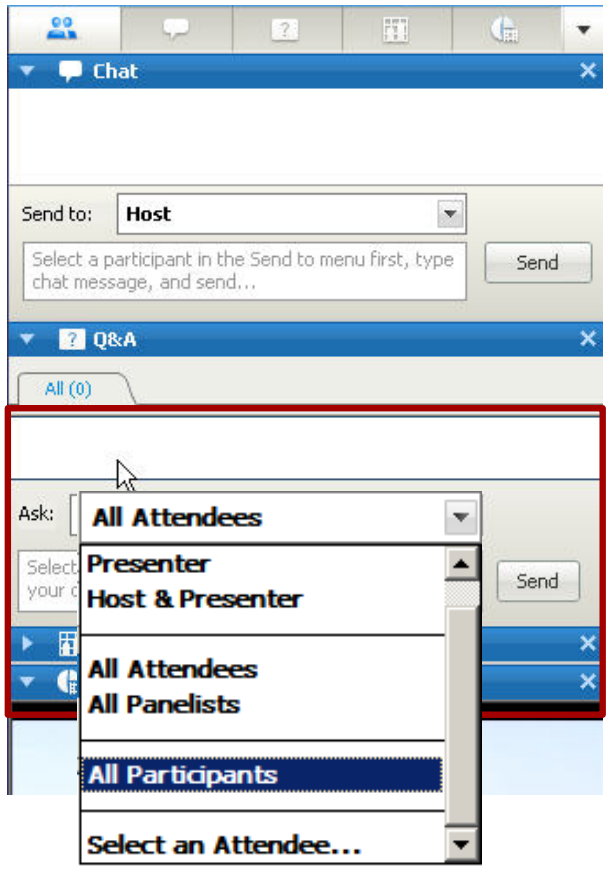

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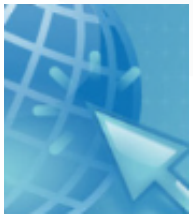

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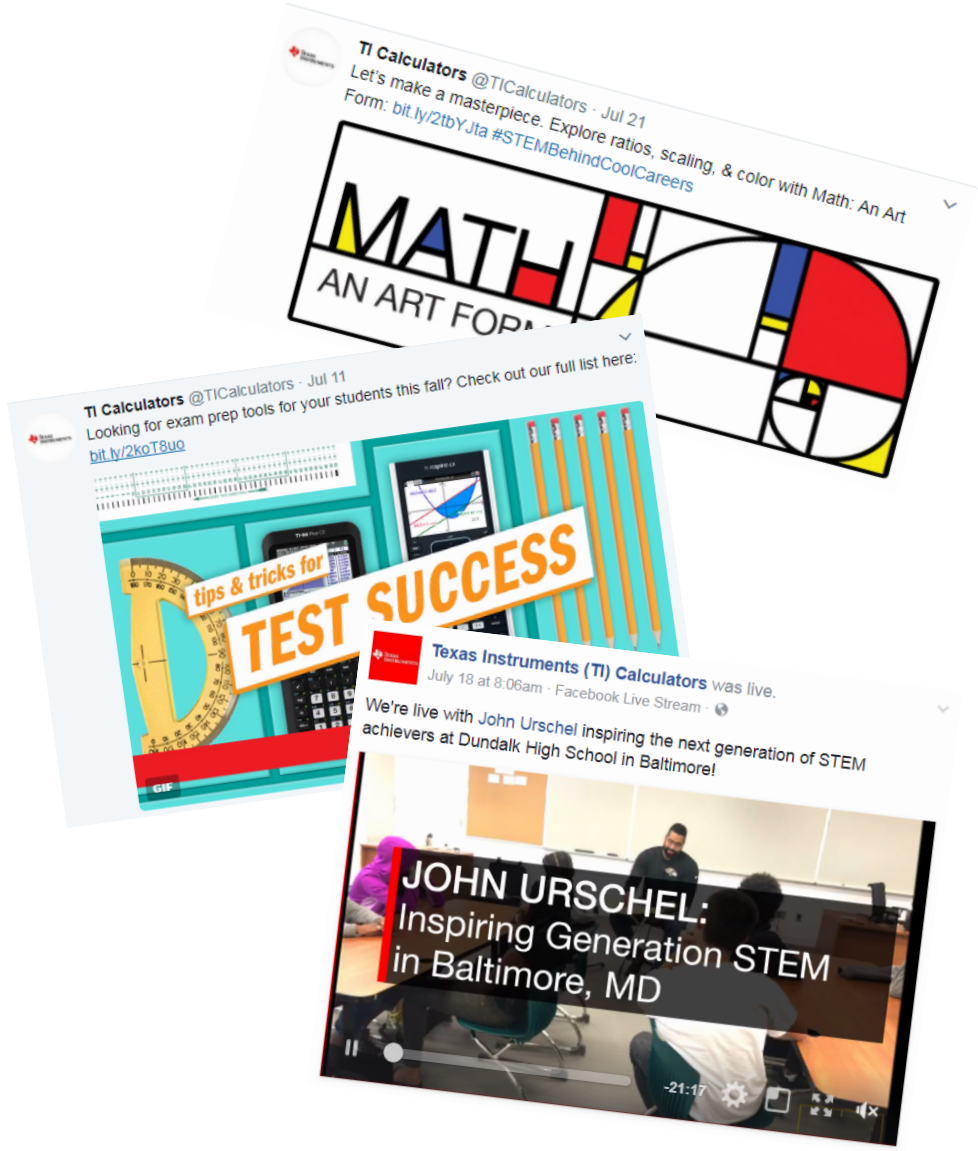

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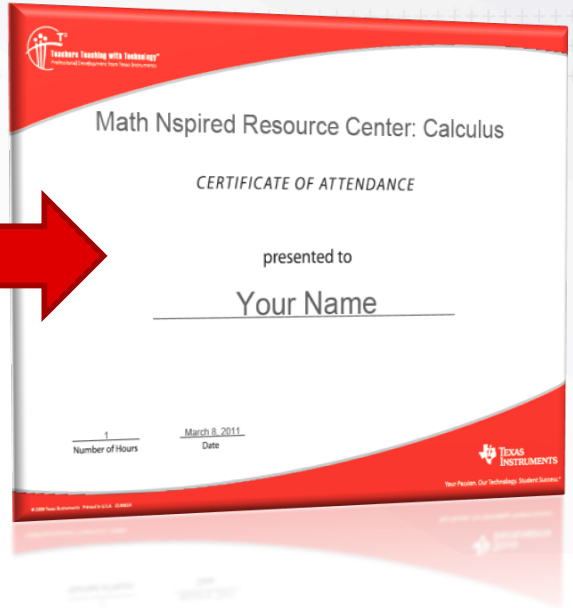

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