Math Objectives

- Students will practice selecting and discuss sampling techniques when collecting and analyzing data.
- Students will apply the selecting and usage of these sampling techniques to real world data.
- Students will try to make a connection with how to understand these topics in IB Mathematics courses and on their final assessments.

Vocabulary

- Population
- Continuous
- Sample
- Biased
- Discrete

About the Lesson

- This lesson is aligning with the curriculum of IB Mathematics Applications and Interpretations SL/HL and IB Mathematics Approaches and Analysis SL/HL
- This falls under the IB Mathematics Core Content Topic 4 Statistics and Probability:

  4.1a Concepts of population, sample, random sample, discrete and continuous data.

  4.1b Reliability of data sources and bias in sampling.

  4.1d Sampling techniques and their effectiveness.

- As a result, students will:
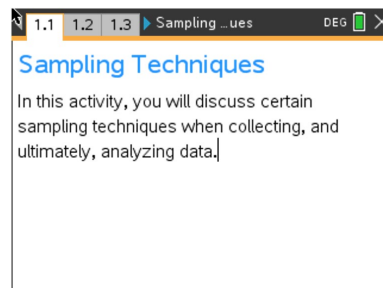 - Apply this information to real world situations

TI-Nspire™ Navigator™

- Transfer a File.
- Use Class Capture to examine patterns that emerge.
- Use Live Presenter to demonstrate.
- Use Teacher Edition computer software to review student documents.
- Use Quick Poll to assess students' understanding
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Activity Materials

- Compatible TI Technologies: TI-Nspire™ CX Handhelds, TI-Nspire™ Apps for iPad®, TI-Nspire™ Software

Sampling Techniques

In this activity, you will discuss certain sampling techniques when collecting, and ultimately, analyzing data.

Tech Tips:

- This activity includes screen captures taken from the TI-Nspire CX II handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials

Lesson Files:
Student Activity
Sampling_Techniques_Student-Nspire.pdf
Sampling_Techniques_Student-Nspire.doc

TI-Nspire document
Sampling_Techniques.tns

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At times, it is a challenge to analyze the entire **population**, the whole group from which you may collect data. When this happens, taking a **sample**, a small group chosen from the population, of the data would be an easier approach. The following questions will provide real world examples where you will be discussing and using the following sampling techniques:

Simple random sample; systematic sample; convenience sample; biased sample; quota sample; and stratified sample.

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1. Using the list from page 1.2, name the technique used in collecting the following sample of data and explain why this is your choice.

Example:
In a high school of 1000 students, a random sample is to be taken on one's happiness based on how many pets they own. The sample requires as close as possible 25% of the students chosen to be Freshmen, 24% to be Sophomores, 23% to be Juniors, and 28% to be Seniors.

Sample Answer: Stratified Sample, because the data was separated into sub-groups or strata proportional to the school population.

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2. Using the list from page 1.2, name the technique used in collecting the following sample of data and explain why this is your choice.

Example:
A company of 20,000 employees wants to select a sample of 500 to survey about work place moral. From a randomly generated list of the employees, they selected every 40th person to survey.

Sample Answer: Systematic Sample, because the company used equal sampling intervals from a random list.

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3. Using the list from page 1.2, name the technique used in collecting the following sample of data and explain why this is your choice.

Example:

A school of 400 students contains 230 males and 170 females. The student government wants to interview students to help decide what the theme of the school dance should be. They will wait outside of the cafeteria and select as participants the first 23 males and first 17 females to enter.

Sample Answer: Quota Sample, because this sample, although biased, maintains the proportion of males to females in the school.

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4. Using the list from page 1.2, name the technique used in collecting the following sample of data and explain why this is your choice.

Example:

A school of 500 students needs to select a sample of 25 randomly to fill out a questionnaire from the head of the school. All 500 names are placed into a bucket and 25 names are selected.

Sample Answer: Simple Random Sample, because with the selection process all 500 students have an equal chance of being selected, as long as each name is placed back into the bucket.

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5. Using the list from page 1.2, name the technique used in collecting the following sample of data and explain why this is your choice.

Example:

A student wanted to survey his school of 600 students to see how many hours they sleep at night. The student hands out his survey to only his first period classmates to get his sample.

Sample Answer: Convenience Sample (and Biased), because the student handed out the survey to the first group of students he interacted with, making no effort to randomize the sample.

> TI-Nspire Navigator Opportunity: *Quick Poll (Open Response)*
> **Please note that any one of these Sampling questions can be used as Quick Polls**

Extension

> **Teacher Tip:** Please know that there are many possible answers for each of these questions. The goal here is to discuss which technique works best for which situation, to avoid as much bias as possible. The goal here is to generate discussion.

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6. Given the previous five examples, discuss with one another and explain why or why not for the following:

    (a) which technique(s) is/are the best;

      Sample Answer: This really depends on the situation and the level of bias you wish to avoid. Make sure students are giving examples where different sampling techniques are better given the circumstances.

    (b) which technique(s) might/may be biased;

      Sample Answer: This also depends on the situation and what sampling technique you choose. Students should try and find bias in as many sampling techniques as possible, stating examples of each. You may even want to have the students try ranking the sampling techniques to see which they think is best to use.

    (c) can more than one technique be used for each situation;

      Sample Answer: This is a great debating question among students. They get to give the pros and cons of which sampling technique might work better for given scenarios.

    (d) sampling is an approved method compared to using the entire population.

Sample Answer: This is a great way to finish the discussion of sampling techniques. Students get to discuss why using a sample is an acceptable situation in place of analyzing the entire population. Make sure students discuss issues revolving around time, effort, man power, cost, etc., as acceptable reasons why.

Application

7. The population of Charleston, SC is 411,406. A company trying to improve on the sanitation in the city conducted a random sample survey of 1500 residents of Charleston to ask for comments on what they think needs to be improved on the most. 712 of the sample chosen were male.

   (a) Find an estimate for the number of males in Charleston.

   Answer: $\frac{712}{1500} \times 411,406 = 195,281$

   (b) The company decided to repeat their survey, this time with a different sampling process. Explain why a systematic sample might not be the best choice for this situation.

   Sample Answer: Since the population contains adults and children, surveying every 15th or every 150th person might lead to selecting a person who cannot answer the survey dealing with sanitation. Adjustments to the list of residents need to be made.

   (c) The company ultimately chooses to use a stratified sample. Name two types of strata (apart from gender) that would be logical for the company to use.

   Sample Answers: Geographical location of residents, age, apartment vs. home owners, etc.

8. A student in IB Applications and Interpretations SL has decided to focus on statistics for their Internal Assessment. She wanted to see how many students used their smart phones during the school day and how often. She created a survey and asked the students if they used their smart phones and in what period they used them. The data is below:

Class Period in which the smart phone was used	1	2	3	4	5	6	7
Number of Students to use them	5	6	m	8	7	4	9

The mean number of times students used their smart phone in a particular class period was 6.

(a) State whether the data is discrete or continuous.

Answer: Discrete

(b) Find the value of *m*.

Answer: $\frac{5+6+8+m+7+4+9}{7} = 6$

42 = *m* + 39

m = 3

(c) The student could not survey the entire school of 300, so she stood outside of the library at the beginning of school and between each class period and handed the survey to the first 42 student that entered. Identify the sampling technique used for the survey.

Answer: Convenience Sample

**Note: This activity has been aligned with the IB Mathematics curriculum, but has not been endorsed by IB™. Also, there are other sampling techniques that can be used for the questions in this activity. The ones chosen are those taught in the Applications and Interpretations as well as the Approaches and Analysis Courses.