Conducting Original Research Projects
Lesson Plan

Subject Areas: Math, Social Studies, and Science

Grade Levels: Grades 6–12 (ages 11–18)

Time: At least two 50-minute class periods; time outside of class as necessary

Lesson Objectives:
Students will:
• Develop an understanding of the basics of choosing a sample from a larger population.
• Develop an understanding of the concepts of representation, randomness, and bias in statistical sampling and how these affect the results and interpretation of a set of data.
• Collect and represent data with personal meaning.
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• Build data literacy skills by using statistics and dynamic, visual plots to analyze data, interpret results, and draw conclusions.
• Explain their findings in writing and visual slide shows.

Standards:
Common Core State Standards1:

Common Core State Standards for Mathematics:

Mathematical Practices
• Reason abstractly and quantitatively.
• Use appropriate tools strategically.

Interpreting Categorical and Quantitative Data
• Summarize, represent, and interpret data on a single count or measurement variable.

Measurement and Data
• Represent and interpret data.

College and Career Readiness Anchor Standards for Writing:

Standard 6. Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
Overview:

InspireData makes it easy for students to conduct original research projects. For example, this lesson explains how students can design a survey that measures individual views and/or practices related to an issue. There are so many issues facing today’s world and local communities that students can investigate such as environmental issues like recycling, which is the example used throughout this lesson. Students will form questions that yield both categorical and numerical results and gain experience validating fields to produce data that can be analyzed graphically and numerically. In addition to learning the principles of survey design, students will understand random sampling techniques and issues of sample size and bias. Students will also gain experience in analyzing survey data to draw inferences and conclusions. They will explain their findings and analyses in annotated slide shows.

Less than half of males surveyed (compared to 75% of females) reported drinking 3 drinks in disposable containers or more per week. The person surveyed who reported drinking the most number of drinks in disposable containers, however, is a male (at 15 per week).
Preparation:

- This lesson requires the InspireData® software application published by Inspiration Software, Inc. You can download a 30-day trial at http://www.inspiration.com/InspireData.
- Arranging access to library resources and/or the Internet might also be helpful for student research.

Lesson:

1. Begin by asking the class to estimate the percentage of students at school that recycle. Most likely, some students will inquire further: Do you mean paper, cans, or plastic bottles? Does recycling only occasionally count? Do you mean recycling at home or at school? Encourage these questions and discuss their importance. Ask students if they have ever taken a survey or read a survey in a magazine that had a very unclear question. How does that lack of clarity impact the data? Explain to students that they will be conducting their own original research in which they will have to think about these types of questions while creating a survey to gather and analyze data with InspireData.


   Please note: The database is web based and only available to students if they are connected to the Internet. If they are not connected, you can provide them with the InspireData database that was downloaded with this lesson plan.

3. Examine the sample data as a class to show students the type of table they will be building.
4. Demonstrate for students how to create a new database from the **InspireData Starter** screen. Alternatively, you can show students how they can save time by customizing the table in the **Database Template** tab in the **Original Research Projects** database.

5. As a class, brainstorm clear questions that might be asked to discover other students' levels of commitment to recycling, for example: How often do you recycle? What materials do you recycle? How many drinks in disposable containers (coffee, soda, water, etc.) do you purchase every week? Develop questions that will yield both categorical and numerical results. Categorical results refer to choices such as “always,” “occasionally,” etc. Numerical results are simply numbers such as “5.”

6. Ask a student volunteer to construct the database designed to answer questions such as these while the class discusses how fields should be named, defined, and validated. Direct students to choose concise names for the fields. Define each field as Number, Text, True/False, etc., as appropriate. To validate fields, select the field to validate and click the **Validation** button. For example, in a number field it may be appropriate to accept answers within a specific range of numbers. For a text field, such as Gender, use the gender predefined validation list to constrain choices to female and male.
Custom lists can also be created so that survey participants select from a specified list of choices. Define fields as List fields when it is necessary to allow survey participants to choose more than one answer (paper, plastic, glass, etc.).

From a list that includes paper, plastic, glass, metals, and

7. From the Table menu, select Edit Survey and set up the survey so that respondents see questions and/or prompts. Enter a title, and, if data will be entered using the e-Survey tool, enter invitation text.

![Edit survey prompts for Recycling Survey:](image)
8. To publish the e-Survey, select **Publish e-Survey** from the **Table** menu.

![e-Survey Published]

- Your survey database was published to the e-Survey website.
- The e-Survey ID will be required to fill out the survey.
- Please use a web browser to visit the website.
- Results may be accessed from the InspireData Starter screen or by selecting 'Open e-Survey Database' from the File menu.
- IMPORTANT: Print this text. The Owner ID will be required when you choose to end the e-Survey.

**Date:** Friday, November 4, 2011 9:57 AM

**Database:** Database Template

**Survey ID:** 465145

**Owner ID:** 465145-9810

For more information, refer to InspireData Starter>Learn to Use>Documentation>Handouts>Learn to Use Surveys.

9. Lead a class discussion on how statisticians and researchers use random samples from a larger population to describe an entire population. Stress that for the survey to yield valid, reliable results, the sample must be randomly chosen from the population at large. As a class, decide on the population of interest and a data collection strategy to obtain survey responses. Students may decide to conduct a stratified random sample in which a proportionate number of subjects are chosen from each group. In this case, the strata may be grade level and the sample would contain a proportional amount of freshman, sophomore, junior, and senior students. As a class, discuss the biases inherent in different sampling methods. What if a student conducting the survey selects a freshman at the Environmental Club meeting? What biases might arise? How might bias be minimized? How many students should be sampled?

10. Set a deadline for survey completion. On the day surveys are due, have students share them with each other and you for feedback. Have students revise the surveys as necessary and share them again until they are clear and concise, with both categorical and numerical data fields.
11. Once surveys are finalized, students can collect data in a number of ways. One is to conduct the survey by having participants enter data using either the local Survey tool or with the e-Survey tool. Students could direct survey respondents to take the online e-Survey at http://esurvey.inspiredata.com by providing them with the e-Survey ID that is established once the survey has been published, as explained in step 8.

(\textit{Tip}: To provide a direct link to the survey without the need for survey respondents to enter the ID, e-mail them the direct web address of the survey when it is displayed in the web browser, such as http://esurvey.inspiredata.com/server/survey/?surveyid=465145.) Alternatively, surveys can be printed (\textit{Table}>Print Survey) and administered on paper, with the data entered into the database later.

12. After sufficient data has been gathered, it can be analyzed. If students used an e-Survey, the database can be opened from the \textbf{InspireData Starter} screen by clicking the e-Survey button.

13. Ask each group to create at least eight plots that summarize the survey results. Require that a summary statistic be added to each plot (percentages, mean, counts, etc.). For each plot, students should use the Notes area to record their analysis and then create a slide with the Capture Slide button in the \textbf{Slide Sorter}. 
14. Students should prepare a slide show and present their completed project to the class.

15. Conclude the lesson with a discussion about what was learned over the course of the project, both in terms of the data the students gathered and analyzed, and the new skills they learned such as survey design and random sampling techniques. Questions to stimulate thinking and discussion could include:

- Did the survey results provide enough information to answer the initial question(s) of interest? Are there other questions that students would include if they were to administer the survey again?

- Do students feel that survey results obtained through random sampling represented the behavior of the larger population? What factors may have influenced the responses to the survey? Could a change in the survey design or administration lessen any potential bias?

- Does the data collected represent all people or adolescents in general? If not, how could the survey be altered so that it did?
• How could the students use the results of their studies for the benefit of the school or wider world?

Adaptations/Extensions:
• The slide shows that students create in Step 9 can also be presented to other classes, the whole school, parents, or community members.
• Specify plot types that must be included in the slide show. For example, require that students include at least one axis plot showing a line of best fit and discuss the meaning of the correlation coefficient.

As students' level of reported environmental awareness increased, the reported number of drinks they consumed in disposable cups each week decreased. However, the correlation coefficient was only -0.3, indicating that the correlation was not particularly strong.

• Direct students to the InspireData handouts for help with different plot types and product features (Help>Documentation>Handouts). You may also want to pass out the “Learn to Use Plots” handout for student reference.
• Students may use Inspiration® to create a diagram that summarizes their findings. If desired, this information could also be elaborated on in Outline View, or transferred to a word processor to complete a written report.

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