Samples Anyone?
Grade Nine

Content Standards:
Data Analysis & Probability

Benchmark E
Evaluate the validity of claims and predictions that are based on data by examining the appropriateness of the data collection and analysis.

Indicator 4
Describe and compare various types of studies (survey, observation, experiment), and identify possible misuses of statistical data.

Benchmark G
Describe sampling methods and analyze the effects of method chosen on how well the resulting sample represents the population.

Indicator 5
Describe characteristics and limitations of sampling methods, and analyze the effects of random versus biased sampling; e.g., determine and justify whether the sample is likely to be representative of the population.

Mathematical Processes Benchmarks

B. Apply mathematical knowledge and skills routinely in other content areas and practical situations.

G. Write clearly and coherently about mathematical thinking and ideas.

H. Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.

Pre-Assessment:
- Write each type of study (survey, observation and experiment) on sheets of papers (one set for each group).
- Divide students into groups of three to four. Have students in the group number off beginning with one.
- Distribute one set of sheets to each group.
- Instruct members of the group to write what they know about each type of study and include their number.
- Allow time for students to think and write.
- Bring the groups together as a class to discuss their statements. Record the comments on chart paper. Collect the papers.
- Discuss any misconceptions. Allow time for students to record needed information about each study in their notebooks.
Scoring Guidelines:
Record student comments as the groups report to the class. Make anecdotal notes and develop clarifying questions to address misconceptions heard during the class discussion.

Post-Assessment:
- Give each student a study (See materials and resources.)
- Each student completes a written analysis of the study.
- Analysis should include:
  - Brief description of the study
  - Type of study (i.e., survey, observation or experiment) and supporting evidence
  - Sample selection method with supporting evidence
  - Assessment and justification of the representative sample of the population
  - Discussion of possible ways data could be misused

Scoring Guidelines:
See rubric on Attachment B.

Instructional Tip:
Using Examples of Types of Studies, Attachment C, as a guide, locate examples of each type of study in newspapers, popular magazines (especially teen magazines), Internet research, etc. Make a handout for students.

Instructional Procedures:
Part One
1. Divide students into groups of four or use the grouping from the pre-assessment.
2. Provide a copy of an example for each type of study to students.
3. Allow time for students to read the examples. Instruct groups to discuss their study, focusing on these types of questions:
   - What type of study is this scenario?
   - What leads you to that conclusion?
   - What method could be used to collect data for this type of study?
4. Have each group share its findings to the class.
5. Informally assess by reviewing the questions above with simple examples.
6. Distribute copies of newspapers, popular teen magazines, other popular magazines and articles from other sources which contain studies.
7. Instruct students to find examples of each type of study.
8. Have each student write an explanation of each type of study, found. Collect the writings and copies of the studies to informally assess student understanding. Discuss misconceptions with each student after class. Allow students to revise their explanations.
9. Have each group brainstorm ways to gather data for each type of study, then report on its methods. Record the methods on chart paper, chalkboard or overhead. Discuss misconceptions. Allow time for students to record information in their journals or notebooks.
**Instructional Tip:**
Assign a project where students conduct a study on a topic that interests them. They should begin researching and collecting published studies on their topic.

**Part Two**
10. Facilitate a discussion using the results of survey questions from articles students found in Step 8. For example, “How many of you listen to rock music?” Poll the class to get their ideas and record them on chart paper, chalkboard, or overhead.
11. Select a topic that interests the class for a model survey. Brainstorm questions for the survey. Select four to five appropriate questions and write them on chart paper. Post the charts around the room and have students circulate around the room to respond to each question. Collect data for four to five questions. Assign groups as experts on one question of the survey.
12. Allow time for groups to make statements about their questions, with supporting evidence, such as finding the percents represented.
13. For each survey question, discuss how the class results compare to each survey. For example, if a survey says that 10% of teenagers listen to rock music and the class poll shows that 15% listen to rock music, discuss reasons why the class results are different from the study.
14. Facilitate a class discussion about randomness and issues of bias, asking questions such as:
   - Why might our results be different?
   - Would it differ if we polled the whole school? Why?
   - Would this still be representative of the sample population? Why or why not?
   - What about surveying the adults in the school or other subgroups in the school (band students, choir, etc.)? Compare these with class results and the original study’s results.
   - What types of questions may be more open to bias? How could you determine if a study is biased?
   - Discuss possible ways to gather information for this survey.
15. Use the same procedures to discuss observational and experimental studies. Students may need more guidance with these types of studies. Allow time for students to take notes.

**Part Three**
16. Brainstorm on issues, local or national, that interest a variety of students by:
   a. Dividing students into small groups.
   b. Asking students to think of three things that they would want to know about themselves as a group (i.e., How many [your school] high school students have cell phones?).
   c. Giving them five minutes to silently write each topic on a self-adhesive note.
17. Create an affinity diagram (described below) to group topics together.
   a. Ask one student to share with the large group one of his/her topics.
   b. Ask the rest of the group members to check and see if they have something similar.
   c. If so, those students should hold up self-adhesive notes.
d. Collect all that apply and give that topic a categorical name.
e. Continue this until all the self-adhesive notes have been collected and each topic has a name.

18. Have students record the list of topics, numbering each topic.

**Part Four**

19. Assign topics to be studied.
   a. Divide students into groups of three to four.
   b. Assign a topic to each group.

**Instructional Tip:**
Assigning topics may be a delicate issue. If a student does not agree with a topic, for whatever reason, allow the student to work on another topic. The student’s beliefs or attitude could affect implementation and design of the study. For example, if supporters of one candidate were conducting a survey about another candidate, the survey would look different if supporters of the other candidate decided to do a survey, too.

20. Explain the assignment.
   a. Hand out written guidelines for the study, *Examples of Types of Studies*, Attachment C.
   b. Read guidelines as students follow along.
   c. Take clarifying questions.

21. Allow students time to discuss their plans for conducting the study and make task assignments for each member in the group.

**Instructional Tip:**
Allow enough time in the plan for students to collect data outside of class. If collecting data from another class, make sure students first ask permission of the teacher.

22. Circulate and offer suggestions when necessary. Listen for some of the following:
   • How students are collecting data;
   • When they plan to collect their data;
   • How they are going to prevent bias; and
   • What each group member is responsible for.

23. Bring the class together for each group to present their ideas for the study and the method for collecting needed data. Allow groups to be questioned by others in the class.

**Instructional Tip:**
Make sure that the type of study presented by each group and the method chosen for data collection are appropriate.

**Part Five**

24. Allow time for each group to present preliminary information and concerns to the class. Listen for any misconceptions. Allow other students to ask clarifying questions. Discuss the misconceptions.
25. Have students write articles using publishing or word processing software to compose, edit and publish the articles about their studies.

26. Closure: Choose two articles to present to the school newspaper editor for possible publication.
   a. Make copies of articles for each person.
   b. Post a copy of each article on the board.
   c. Give each student two colored dots.
   d. Students place dots on the two articles they would like to see in the school paper.
   e. The two articles with the most dots go to the school newspaper editor for consideration.

**Instructional Tip:**
Be sure to leave the names off the articles.

**Differentiated Instructional Support:**
Instruction is differentiated according to learner needs, to help all learners either meet the intent of the specified indicator(s) or, if the indicator is already met, to advance beyond the specified indicator(s).
- Provide examples of the different types of studies as guides for students (tape recordings or handouts).
- Allow students who cannot calculate percents to use calculators or receive review work on percents to be done or as homework.
- Provide students who forget the necessary steps to complete percents a step-by-step direction sheet in a page protector sheet. Assign additional problems for students to work using the guide. Review guide and work with students and make necessary adjustments.
- Use easier-to-read studies that are tied closely to student interest for students who read below grade level.
- Students who need a more challenging assignment could choose two studies on one topic of interest. They would add a critique for each study, followed by another section comparing and contrasting the two studies. Conclude the paper with an evaluation. Consider awarding additional points.
- Schedule individual conferences with students who received no points on the post-assessment to give detailed feedback. Allow students to revise the articles.
- Instead of writing news articles, students present or videotape a newscast.

**Extension:**
Students can make graphs and charts using the data from their studies.

**Materials and Resources:**
*For the teacher:* Self-adhesive notes, colored dots, various types of studies.
*For the student:* Self-adhesive notes, copies of examples of types of studies,
**Vocabulary:**
- bias
- experimental study
- observational study
- population
- random
- sample
- survey

**Technology Connections:**
- Use publishing or word-processing software to write articles.
- Use spreadsheets to make graphs and charts.
- Use computers to research possible surveys completed on subject.
- Use Web sites, such as the American Medical Association, to collect studies.

**General Tips:**
- Discuss the project with the school newspaper advisor before doing Step 9.
- If the class is small, choose one article in Step 9 instead of two.
- Be sure to have various types of studies available for the post-assessment.

**Attachments:**
Attachment A: *Post-Assessment Guidelines*
Attachment B: *Post-Assessment Scoring Rubric*
Attachment C: *Examples of Types of Studies*
Attachment A
Post-Assessment Guidelines

Name _______________________________ Date: __________________

You and your research team have been asked to conduct a study about:

to be published in an upcoming issue of the schools newspaper.

Before conducting your study:
• Determine the best type of study needed to collect this data.
• Determine how you will select your sample and when you will collect the data.
• Determine the role of each researcher on your team.

Conduct your study!

Publish your findings
• Your article should be clear, using appropriate writing techniques.
• Explain the type of study done with supporting evidence.
• Discuss how you selected your sample.
• Discuss your findings in mathematical terms and include appropriate representations.
• Include your team’s commentary about its findings.

Attachment B
# Post-Assessment Scoring Rubric

<table>
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<th>Rubric</th>
<th>Description</th>
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| 4 points | Includes all of the following required components in the presentation and written analysis:  
- Brief description of the study  
- Type of study (survey, observation or experiment) and supporting evidence  
- Explanation of the sample  
- Possible ways to misuse data  
- Appropriate writing techniques  
All data, representations and conclusions are appropriate, accurate and clearly communicated in mathematical terms |
| 3 points | Omits one of the required components in the presentation and written analysis  
Data, representations and conclusions contain few minor errors but clearly communicate in students’ vocabulary  
Uses graphs that are appropriate for the data |
| 2 points | Omits two of the required components in the presentation and written analysis  
Data, representations and conclusions contain several minor errors which affect their communication (may include inappropriate use of terms)  
One to two graphs are inappropriate for the data |
| 1 point | Omits three or four of the required components in the presentation and written analysis  
Data, representations and conclusions contain several errors and are poorly communicated (may include inappropriate use of terms, incorrect descriptions)  
Graphs are inappropriate for the data |
| 0 points | Omits more than four of the required components in the presentation and written analysis  
Data, representations and conclusions contain several errors and are poorly communicated (may include inappropriate use of terms, incorrect descriptions) or omitted  
Graphs are inappropriate for the data |

Attachment C
Examples of Types of Studies

This is an example of an *observational study*:

Additional traffic signals are to be installed at major intersections in the city. Due to limited funds, city officials need to decide placement of the new signals. Determining the average number of vehicles passing through various intersections during the day would be a contributing factor in deciding where to place the signals. The number of accidents reported at various intersections also would be a factor.

This is an example of a *survey*:

How do you get to school most of the time?
- a. Walk
- b. Ride the school bus
- c. Ride in a car
- d. Drive to school

This is an example of an *experimental study*:

An experiment will be conducted over the next two years to determine the effectiveness of a new antibacterial hand wash.

Factors include the type of water used, the length of time used in washing the hands, how much of the hand wash is used and how hands are dried.

People of all ages will be involved in this experiment to determine if different ingredients are needed for different age groups. The hand wash will be used in public as well as private places.