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IT'S TIME TO EXPERIMENT! Our annual guide to science-project success helps your students learn the scientific method—as well as the secrets to creating winning science experiments. They will get tips from four teens whose projects have won awards and gained national attention.

As always, we welcome your suggestions at: scienceworld@scholastic.com.

—The Editors

Visit www.scholastic.com/scienceworld for more resources!

Features

PAGE	CONTENT	TITLE SUMMARY	NATIONAL SCIENCE EDUCATION STANDARDS	LESSON IDEAS
5	Introduction	How to Have a Gold-Medal Science Project Generating a science-project idea.	Grades 5-8, 9-12: • Abilities necessary to do scientific inquiry	Encourage students to enter national science competitions. For information, see TE 2 .
6	Earth: Scientific Method	Cleaning Up Soiled Sites Understanding the scientific method.	• Understandings about scientific inquiry • Evidence, models, and explanation	Quiz students' comprehension of the scientific method with TE 3 . PLUS: Go to www.scholastic.com/scienceworld for an online scientific method checklist!
10	Life: Write a Procedure	Nests That Please Bees Designing a well-organized procedure for an experiment.	• Abilities of technological design	Help students improve procedure-writing skills. Have them try the critical-thinking activity on TE 4 .
13	Physical: Organize Your Findings	All Caught Up Creating data tables and graphs.	• Nature of science	Visit www.scholastic.com/scienceworld for a downloadable version of TE 5 through TE 7 with one type of graph per page.

Coming Next Issue

- Medical cures from the football field to the ER
- How do epidemiologists track diseases like H1N1?
- Teens reintroduce oysters into urban waterways
- Origami-inspired technology

Teacher to Teacher

Tips for using *Science World* in the classroom

Laura Barone, science teacher at Portsmouth Middle School in Portsmouth, New Hampshire, suggests:

This issue is great to help teach the Scientific Method Skills Unit. Each day, I have students do simple classroom experiments that highlight the steps in the scientific method. Before we do an experiment, we read the article that introduces and explains each step: asking a testable question; writing a hypothesis as an "if, then" statement; breaking a procedure into logical steps; collecting and displaying data; and forming a conclusion based on the data. I conduct labs that feature each of these steps, and I use the magazine as a model.



Laura Barone



WINNING-SCIENCE-PROJECT GUIDE

The Scientific Method

make

observation

propose

research question

identify

variables

independent

dependent

do

background research

state

hypothesis

design

experiment

write

record results

display data

procedure

data table

line graph

bar graph

pie chart

finalize

conclusions

communicate

results

publish report

make presentation

RESOURCES

You can access these Web links at:
www.scholastic.com/scienceworld.

SCIENCE-FAIR AWARDS PROGRAMS

Were your students inspired by the young scientists featured in this issue? Encourage them to enter their own project in these national awards programs:

The Young Naturalist Awards

The American Museum of Natural History runs a research-based essay contest, open to students in grades 7 to 12. The program promotes participation and communication in science.

www.amnh.org/nationalcenter/youngnaturalistawards

Discovery Education/3M Young Scientist Challenge

This program is searching for young science communicators! Prizes are awarded to students who demonstrate leadership, teamwork, and scientific problem solving. Open to students in grades 5 through 8.

<http://youngscientist.discoveryeducation.com>

Christopher Columbus Awards

This program challenges trios and quartets of middle school students to solve real-world problems with the scientific method, and make positive changes in their communities.

www.christophercolumbusawards.com

Intel International Science and Engineering Fair

This is the world's largest international pre-college science competition. Students in grades 9 through 12 who have won their local Intel-affiliated science fairs head to this science extravaganza in the spring to compete for over \$4 million in scholarships and prizes.

www.societyforscience.org/ISEF

GENERAL INFORMATION

The book *Science Fair Success Guide*, by *Science World's* editor, Patricia Janes, gives teachers everything they need to host a science fair—from timetables and checklists to scoring rubrics and awarding certificates. To purchase, visit:

www2.scholastic.com/browse

[/search?query=0-439-89518-9&x=19&y=9](http://www2.scholastic.com/browse/search?query=0-439-89518-9&x=19&y=9)

or call **1-800-SCHOLASTIC**.

How do scientists assemble their research reports? Students will get tips from Susan Perkins, a microbiologist at the American Museum of Natural History, at Scholastic's Writing With Scientists Web site. Perkins shows students how to transform a collection of notes, research, and experiments into a well-organized science report. Don't forget to check out the "For Teachers" section for resources. Visit:

<http://teacher.scholastic.com/activities>

[/sciencewriting/index.htm](http://teacher.scholastic.com/activities/sciencewriting/index.htm)

Science Buddies is a non-profit organization that aims to help improve science literacy through hands-on scientific investigations. Its Web site offers free science-fair-project ideas and more. Go to: www.sciencebuddies.org

Name: _____

Science Fair 101

In “Cleaning Up Soiled Sites” (p. 6), you learned about the basic parts of a science project. Test your understanding by completing this worksheet.

Part A: Vocabulary Check

DIRECTIONS: Match the word(s) in the left column with the correct phrase in the right column.

- | | |
|----------------------------|---|
| __ 1. scientific method | a. characteristics in an experiment that change or could be changed |
| __ 2. variables | b. characteristics in an experiment that don't change from trial to trial |
| __ 3. dependent variable | c. variable you change or adjust on purpose, also called a manipulated variable |
| __ 4. independent variable | d. summary of results |
| __ 5. constants | e. standard to which you compare the results of an experiment |
| __ 6. control | f. step-by-step approach to conducting scientific studies |
| __ 7. trials | g. repeated tests in an experiment |
| __ 8. conclusion | h. factor that responds to a change in the manipulated variable |

Part B: Comprehension Check

DIRECTIONS: Answer the following questions in complete sentences.

1. What is a hypothesis?
2. What was the hypothesis of Arthi and Rani's experiment?
3. How did Arthi and Rani conduct background research for their experiment? What did their research uncover?
4. What did Arthi and Rani choose as their experiment's independent variable and dependent variable?
5. Did Arthi and Rani accept or reject their hypothesis? Explain why.

Name: _____

Recipe for a Successful Experiment

In “Nests That Please Bees” (p. 10), you learned about the importance of writing clear steps for an experiment. This activity will help you hone your procedure-writing skills.

YOUR MISSION:

Write a procedure for making chocolate milk.

PART A: MATERIALS YOU’LL NEED

DIRECTIONS: Write down a list of materials that you’ll need to make chocolate milk.

PART B: STEPS TO TAKE

DIRECTIONS: Write a procedure for making chocolate milk. (**Hint:** Be as specific as possible. For example, you’ll have to mention the type of utensil a person would need to stir the drink.)

PART C: TEST IT

DIRECTIONS: Find a lab partner. One student will read his or her list of materials and steps. At the same time, the other student will follow the instructions in the procedure and mime each step to making chocolate milk. After the last step, reverse roles with your partner.

Was your partner successful in making the chocolate milk? If not, evaluate your steps and improve your procedure.

Name: _____

Your Guide to a Winning Display



How do you keep track of the data from your science experiment? And how do you turn the collected information into something visually interesting, such as a chart or graph? First, read “All Caught Up” on p. 13. Then, follow this step-by-step guide to practice making tables, graphs, and charts.

A. DATA TABLE

Use a data table to record your experiment’s findings.

An organized data table should list the independent variables of an experiment clearly. It should also have blank spaces for you to fill in the data from your experiment. Suppose one were to study how various girls competing in the 2008 Junior Gold bowling tournament scored in the first round. The girls competing in the tournament are the independent variables. And the score of each player is the dependent variable.

TO MAKE A DATA TABLE:

1. Draw a blank data table.
2. Give your table a title that identifies the experiment’s variables (“Scores of Various Girls Competing in the First Round of the 2008 Junior Gold Bowling Tournament”).
3. Label the column on the left as the independent

variable (Player). Underneath, list the different names of the players (Michelle Carcagente, Jessica Baker, Sarah Perry, Amanda Halter, Sarah Wethington).

4. Label the columns to the right as the dependent variable (Score). Draw boxes under these columns in which you can record the score for each player for each of the six games.

5. Include columns at the far right to record the average score of each player. To calculate the average, add up the total score of each player. Then, divide the total by the number of games. Round the number to the closest whole number.

Your Turn: Complete the data table below by calculating the average score for each of the following players: Jessica Baker, Sarah Perry, Amanda Halter, and Sarah Wethington.

Scores of Various Girls Competing in the First Round of the 2008 Junior Gold Bowling Tournament

Player	Score						Average
	Game 1	Game 2	Game 3	Game 4	Game 5	Game 6	
Michelle Carcagente	231	228	257	227	216	212	229
Jessica Baker	232	246	206	191	224	194	
Sarah Perry	178	228	211	190	205	209	
Amanda Halter	181	188	208	199	186	169	
Sarah Wethington	134	153	149	171	135	128	

SOURCE: THE UNITED STATES BOWLING CONGRESS

Name: _____

B. BAR GRAPH

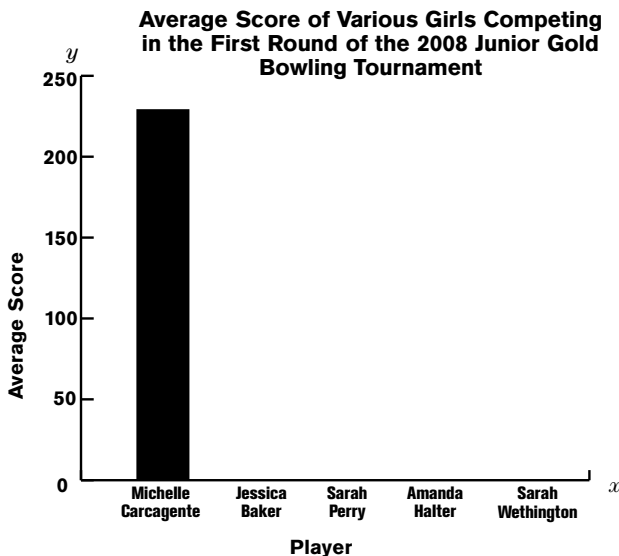
Use a bar graph to compare trends in data.

A bar graph is a great way to show how the independent variables in an experiment stack up against one another. The graph at the bottom of this page compares the average score of various girls competing in the first round of the 2008 Junior Gold bowling tournament.

TO MAKE A BAR GRAPH:

1. On graph paper, draw a set of x - and y -axes.
2. Give your bar graph a title (“Average Score of Various Girls Competing in the First Round of the 2008 Junior Gold Bowling Tournament”).
3. Label the horizontal (x) axis with the independent variable (Player), including a label for each player (Michelle Carcagente, Jessica Baker, Sarah Perry, Amanda Halter, Sarah Wethington).
4. Label the vertical (y) axis with the dependent variable (Average Score) and a scale from 0 to at least the highest number in the dependent-variable results.
5. For each independent variable, draw a solid bar to the height of the corresponding value of the dependent variable. Example: The average score for Michelle Carcagente was 229. Draw a bar above the “Michelle Carcagente” label on the x -axis to the “229” mark on the y -axis.

Your Turn: Use the information in the data table to help you complete the bar graph.



C. LINE GRAPH

Use a line graph to pinpoint changes in data.

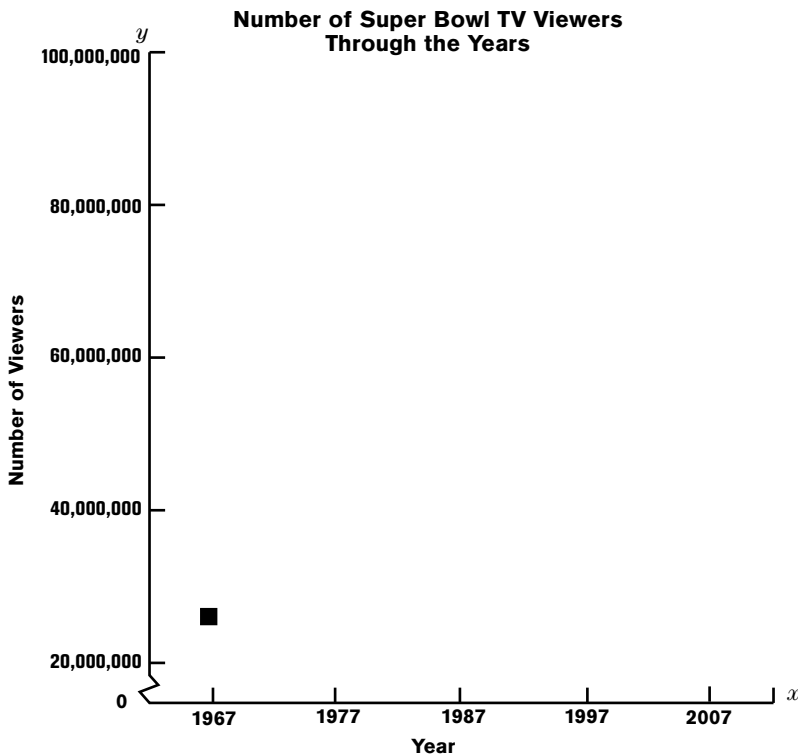
Choose a line graph when you want to see how continuous changes to the independent variable affect the dependent variable. The Nielsen Company has been tracking the number of people who watch the Super Bowl on TV every year, since the first one was played in 1967. Suppose you were to graph how TV viewership of the Super Bowl has changed over time. The independent variable is the year, and the dependent variable is the number of Super Bowl viewers.

TO MAKE A LINE GRAPH:

1. On graph paper, draw a set of x - and y -axes.
2. Give your line graph a title (“Number of Super Bowl TV Viewers Through the Years”).
3. Label the x -axis with the independent variable (Year), and include the values of the independent variable (1967, 1977, 1987, 1997, 2007).
4. Label the y -axis with the dependent variable (Number of Viewers). Use a scale featuring 0 to at least the highest number in the results of the dependent variable. If the data starts at a large number, you can use a broken scale [↗] to conserve space on the y -axis. On your graph, mark a broken scale with a zigzag on the y -axis between 0 and a round number smaller than your lowest data point.
5. Plot a point on the graph for each piece of data. **Example:** The number of Super Bowl TV viewers in 1967 was 24,430,000. To locate this point on your graph, draw an imaginary vertical line from the “1967” label on the x -axis. Then, draw an imaginary horizontal line from the “24,430,000” mark on the y -axis. Plot the point where the lines intersect.
6. Once you’ve plotted the points for all your data, connect the points.

Your Turn: Here are selected years along with the number of Super Bowl TV viewers for each year: 1977: 62,050,000; 1987: 87,190,000; 1997: 87,870,000; 2007: 93,184,000. Use the information to complete the line graph on the following page.

Name: _____



begin, convert your data from percents to angle degrees.

Example: 28 percent of the students surveyed answered “At least once a week,” so the pie wedge for that response category would be 28 percent of the 360° circle, or 101° ($360 \times .28 = 100.8$, rounded to 101). Position a protractor at the center point of the circle. Mark 0° and 101° angles with points on the edge of the circle. Draw a line from these points to the center of the circle.

5. Label the wedge (include its percent).

6. Measure your next wedge from the edge of the first. When you’re finished, the entire circle should be filled and the wedges should add up to 360°.

D. PIE CHART

Use a pie chart to illustrate numbers expressed in percent of a whole.

A pie chart is a circle divided into wedge-shape sections. The circle represents 100 percent. Wedges inside that circle represent data that are a percent of the whole. In a recent survey, 987 students, ages 8 through 15, were asked how often they use the Internet. Their answers fell into the following categories: At least once a week; At least once a day; Rarely. Suppose you were to graph the survey results on a pie chart: The total number of responses represents 100 percent, and each category of response represents a different wedge of the pie chart.

TO MAKE A PIE CHART:

1. Use a compass to draw a circle.
2. Give the pie chart a title (“How Often Students Ages 8 Through 15 Use the Internet”).
3. Mark the center of the circle with a point; this is where each pie “slice,” or wedge, will start.
4. Measure a wedge for each independent variable (At least once a week; At least once a day; Rarely). To

Your Turn:

In the survey, 61 percent of the students answered “At least once a day,” and 11 percent answered “Rarely.” Use this data to complete the pie chart.

How Often Students Ages 8 Through 15 Use the Internet

