SECTION 5: STATISTICS IN EVERYDAY LIFE

"There are three kinds of lies: lies, damned lies, and statistics."

Benjamin Disraeli

"Like dreams, statistics are a form of wish fulfillment."

Jean Baudrillard

"For every complex problem there is a solution that is simple, neat and wrong."

H.L. Mencken

"Mathematics may be compared to a mill of exquisite workmanship, which grinds your stuff to any degree of fineness; but, nevertheless, what you get out depends on what you put in; and as the grandest mill in the world will not extract wheat flour from peapods, so pages of formulae will not get a definite result out of loose data."

Thomas Henry Huxley

"Geological Reform", 1869; published in Collected Essays, vol. 8, 1894

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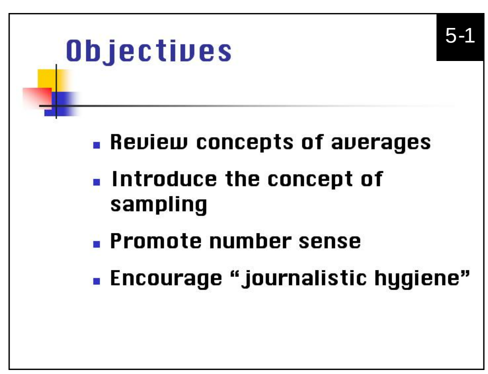
Objectives

■ 5-1 The objectives of this section are to:

1. review the concepts of averages (mean, median, and mode) and the way they are used in popular and scientific media
2. introduce the concept of sampling and discuss its meaning as part of a scientific study,
3. develop mathematical literacy by promoting number sense
4. encourage "journalistic hygiene."



Student Prerequisites & Materials Needed

- Students should know how to round a number to 2 decimal places
- Students should have access to news articles at home or at school
- Each student should have a simple calculator (for Worksheet 5C)

Teacher Background

Although the field of statistics can be intimidating to students, and even at times to teachers, in fact most people use statistics and know more about statistics than they think they know. Statistics are woven into the fabric of our everyday lives. Charts of average heights and weights, batting averages, the number of hamburgers McDonald's has sold to date; all of these are examples of statistics you might encounter in your everyday life. When you are considering buying a new or used car, and consult *Consumer Reports* or some other digest of people's experience, you are using statistics. When you refer to information you read in the newspaper about health — for example, that regular exercise reduces the risk of cardiovascular disease - you are relying on statistical analyses from research studies. Even when you calculate that buying one jar of Sizzle Salsa and getting one free is in fact a worse deal than buying one jar of the salsa you usually buy, you are incorporating statistics into your everyday life.

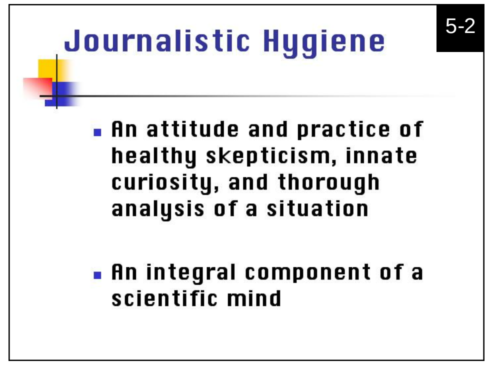
In approaching a topic, we are accustomed to asking the five "W"s and 1 "H": John Paulos, mathematician and author of *Innumeracy*, advises us to add several more questions when we encounter statistics:

Who, What, When, Where, Why, and How

- How were they obtained?
- How confident can we be of them?
- Were they derived from a random sample or from a collection of anecdotes?
- Does the correlation suggest a causal relationship or is it merely a coincidence?
- How is the reporter connected to the story? Are there other ways to tally any figures presented?
- Do such figures measure what they purport to measure?
- Is the precision of the measurements meaningful?

Paulos calls this enlargement of our standard set of questions "journalistic hygiene." This attitude of healthy skepticism, innate curiosity, and thorough analysis of the situation also could be considered an integral component of the scientific mind.

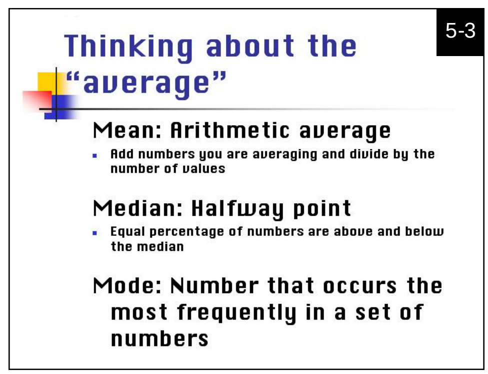
■ 5-2 The scientific mind accepts nothing at face value. Similarly, mathematics is "a way of thinking and questioning that may be unfamiliar to many of us, but is available to almost all of us" (Paulos, 1995, p. 3). It could be argued that students who possess scientific minds, and students who are encouraged to develop scientific minds will be better prepared to handle peer pressure. For example, in situations where decisions need to be made about substance use or non-use or how much money to spend on gambling activities, students who possess scientific minds are more likely to withstand the impact of, and less likely to be swayed by peer pressure.



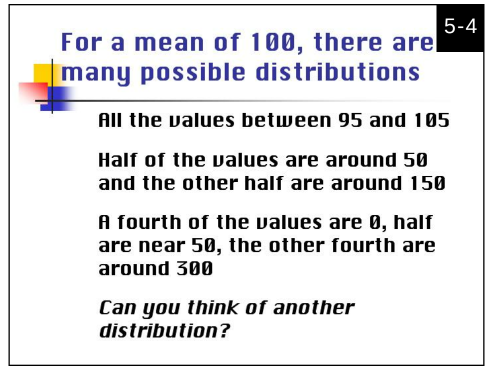
Thinking about the "Average"

The word "average" often conjures up associations of "typical," "common," "middle," or "midpoint." However, statistical averages have a more specific and defined meaning.

■ 5-3 The mean, median, and the mode are different ways of talking about the center of a set of numbers. The **mean** is the arithmetic average: to compute the mean you add the numbers you are averaging and divide by the number of values you have (e.g., the mean of 3, 7, and 11 is 3 + 7 + 11 = 21; 21 ÷ 3 = 7). The **median** is the halfway point. An equal percentage of numbers are above and below the median. If there is an even number of values in the total set of numbers, there will be two numbers in the middle. In this case, the two middle numbers are added and divided by 2 (e.g., the median of 3, 4, 5, 6, and 7 is 5, but the median of 3, 5, 7, and 9 is [5 + 7] ÷ 2 = 6). The **mode** is the number that occurs the most frequently in a group of numbers (e.g., the mode of 3, 8, 8, 9, and 10 is 8; whereas the group 3, 8, 9, and 12 has no mode). Another cautionary note about averages is that they can lure you into believing that the distribution is **normal**.



■ 5-4 In fact, for any one mean, there are many possible distributions that could produce that mean. For example, each of the following three distributions could have a mean of 100: (1) all the values are between 95 and 105; (2) half of the values are around 50 and the other half are around 150; (3) a fourth of the values are 0, half are near 50, and the other fourth are around 300. Although these three distributions all have the same mean, other characteristics of these distributions are very different (Paulos, 1995, p. 127).



EXERCISES

♣ Thinking About Averages

Directions

Present the following stories to the class. These scenarios illustrate the way that the three measures of an average can be used, and sometimes misused.

Example

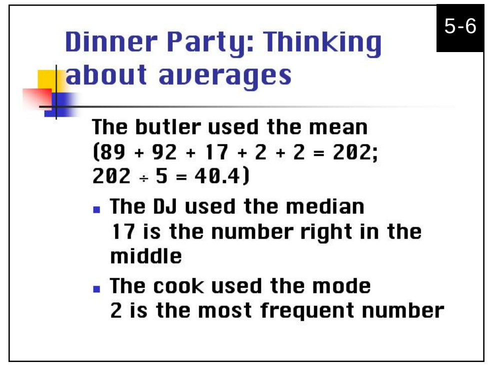
■ 5-5 A wealthy couple is planning a dinner party for 5 guests. Their ages are 89, 92, 17, 2, and 2. The couple gives a list of the guests and their ages to the members of their household staff so that the proper arrangements can be made for the party. As a result, everyone is treated to strained peas, accompanied by the latest CD from The Cranberries, followed by cognac. **What Happened?**

(Vos Savant, 1995)

Classroom Discussion

■ 5-6 The butler reviewed the list and determined that the average age was just above 40 (89 + 92 + 17 + 2 + 2 = 202; 202 ÷ 5 = 40.4). The DJ, who was in charge of entertainment, reviewed the list and figured that the average age was 17 (the age right in the middle). The cook looked at the list and made arrangements based on the average age of 2 (the most commonly occurring age).

While this particular scenario would probably not really occur, the choice of which measure of the average to use can often have serious implications. Students should become aware of the various ways to discuss averages.



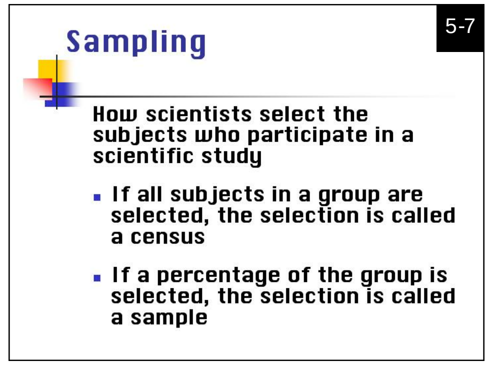
Classroom Discussion

During the baseball strike of 1994, when players' salaries were constantly being discussed in the media, the average baseball player's salary was often quoted as being $1.2 million. This information alone, which is actually the mean salary, is not particularly useful, since most people wouldn't know which average (i.e., the mean, median or mode) was being reported. In fact, the median baseball player's salary was $500,000: half the players earned less than that amount, half earned more (Paulos, 1995). In this case, the median salary is a more accurate portrayal of the "average" baseball player.

- Ask the class why someone would choose to report the $1.2 million figure.
- Try to elicit a discussion about advantages and disadvantages of each measure. For example, in this case, someone who wanted the public to believe that baseball players are millionaires would want to report the mean.

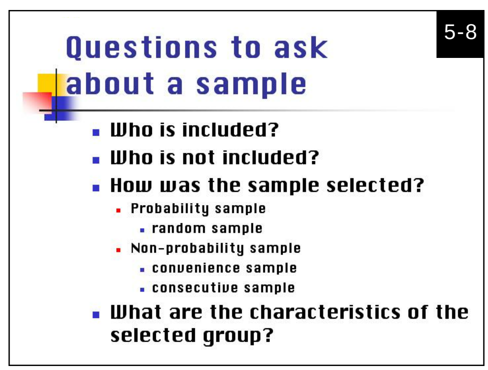
Sampling

■ 5-7 Sampling is the manner in which the respondents in a scientific study are selected. A sample is a small portion taken from the entire population. The entire population would be every individual (or animal, or car, etc.) in the class of all possible observations. When the entire population is examined, it is called a census. Often it is unrealistic to attempt to examine every member of a population, especially if that population is very large. For example, if you wanted to survey residents of Boston to find out their favorite radio station, imagine how long it would take to contact every individual who lives in Boston to ask them your question. By the time you finished asking everyone, the radio stations may have changed formats. In addition to being time-consuming, sampling an entire population is often too expensive.



For practical purposes, studies are usually conducted by selecting a sample from a larger population. To ensure that this smaller sample is representative of the larger population, the sample should be selected according to a random process. In random processes, each member of the population has the same chance of being selected.

■ 5-8 If you asked a random sample of people living in Boston what their favorite radio station was, you could infer that their answers would reflect the larger population. When you look at statistics, whether they are results from a study or data from a public opinion poll, it is always important to ask yourself who was included in the sample and what their characteristics are. If results are accepted without consideration of the sample from which the data were derived, faulty assumptions and inaccurate generalizations are likely to emerge.



Description

The following exercise presents some of the errors that can occur in research studies that involve sampling or surveying respondents. Lead your class in a discussion of this hypothetical scenario and see if they can identify some of the potential errors that would lead to an inaccurate conclusion.

5-9

Thinking About Statistics

Fact reported in newspaper:

- **The average Harvard graduate from the class of 1990 makes $600,000/yr.**

What were your first thoughts when you read this fact?

What factors might make this figure inaccurate?

An Illustration

■ 5-9 Suppose you read in the paper that the average Harvard graduate from the class of 1990 makes $600,000 a year. Most people would probably conclude that Harvard graduates make a lot of money, or that they (or their children) should go to Harvard, or something similar. However, it would be unwise to accept this figure, or any statistics reported in the media, on faith. In fact, there are a variety of factors that could make this figure inaccurate. Some possibilities are listed below (this exercise was derived from Huff, 1954)

1. First of all, unless the researchers surveyed every member of the 1990 class, they are reporting the average for their *sample*, not the class of 1990. The next question is whether their sample is representative of the class of 1990.

2. Selecting and surveying a representative sample usually requires a great deal of effort, and there are many potential problems. For example, suppose that the researcher did attempt to contact every member of the 1990 class, but was not able to locate all of the members. The researcher would probably report the results she obtained. However, the people who could not be located might be significantly different from those who were located: there may be a group of 1990 class members who are homeless, or in jail, or are difficult to locate for some similar reason. In terms of income, these people would probably be very different from those who attended class reunions and kept in touch with the college. The same potential problem exists with a random sample: if a researcher selects a random sample, but only succeeds in obtaining responses from 20% of the random sample, you cannot be confident that the results of the study will be representative of the population being investigated.

continued on next page

An Illustration (cont.)

3. In addition, the people who are contacted but refuse to participate in the survey are not accounted for by the results of the survey. Who would be more likely to disclose his or her income to a stranger: the president of a successful company, or an unpublished poet who works a low-paying job to pay his or her bills? In general, people who volunteer for or are interested in participating in surveys and experiments have significantly different characteristics than those who do not want to participate, or who have to be given some special incentive to participate.

4. Already, we have identified two potential groups that would bring the average annual income level down considerably if they were included in the study. In addition, we don't know how accurate the information given by the respondents was. Did the researcher just ask them, or did she verify the figures somehow? The respondents' self-reported data could have been too high (because of pride) or too low (because they also lied on their income tax reports). In addition, respondents could have had many sources of income other than salary (consulting fees, investments, etc.), and simply estimated inaccurately.

5. Even if we assumed that the average income reported by the researcher is correct (representative), can we immediately assume that Harvard is a better college to attend than any other is? Do we know how this average income compares with the average incomes of graduates from other colleges? If you learned that the average person who graduated from college in 1990 makes $600,000, how would that change the assumptions you made about Harvard?

6. Assume again that the reported average is representative of the Harvard class of 1990. If you then learned that the average 50-year-old surgeon makes $800,000, and 85% of the Harvard class of '65 are surgeons, how would this information change your interpretation of the reported figure? (Harvard graduates do have high incomes, but their income level is not necessarily related to their attendance at Harvard.)

This exercise was designed to show that there are many alternative ways to interpret the findings of this hypothetical study. When information about a study's sample, or other important information about the study, is not provided, there might be many explanations for the study's findings.

Number Sense: Numerical Literacy

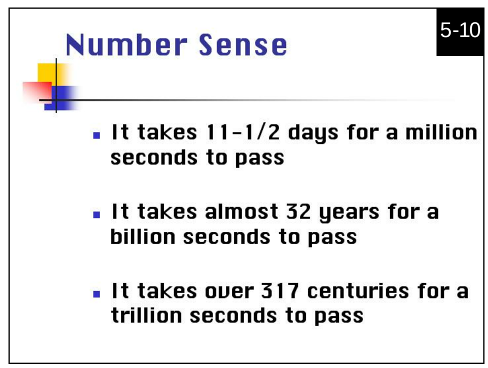
General number sense is very helpful in evaluating gambling opportunities and media claims. Without useful math applications in their everyday lives, students may see math as an isolated field. Understanding mathematical and statistical concepts is vital to a wide range of topics, including personal finances, sports, insurance, risk/reward trade-off of everyday activities, diet and medical claims, and elections. As the National Research Council stated in its report *Everybody Counts* (1989), "To function in today's society, mathematical literacy is as essential as verbal literacy" (p. 8).

Understanding any mathematical concept begins with a general understanding of numbers. In the national media, the numbers reported and discussed are often, for some people, incomprehensibly large (e.g., the federal debt or federal budget). For some, the distinctions between millions, billions, and trillions are lost, and these numbers become meaningless.

An Illustration

■ 5-10 One way to think of these numbers is that a billion is a thousand million and a trillion is a thousand billion, or a million-million. Probably a better way to help students get a conceptual grasp of these numbers is to put the numbers into a context that students understand. For example:

- it takes about 11-1/2 days for a million seconds to tick away, whereas
- it takes almost 32 years for a billion seconds to pass and
- it takes over 317 *centuries* for a trillion seconds to pass (Paulos, 1988).



Comparisons like these can give students a better grasp of the relative sizes of these numbers. The accompanying worksheet entitled *Number Sense* tests students on their knowledge of numbers as these numbers relate to a variety of areas of society. In addition, the worksheet entitled *Time Flies* helps students understand the relationships among different rates. Finally, Worksheet E helps to put numbers of a large magnitude into perspective for students through the use of calculations of per-capita figures.

Facing the Odds:

The Mathematics of Gambling and Other Risks

♠ Section 5 Worksheet A

Number Sense

Match the following categories with the appropriate number:

______ **1.** The approximate distance in miles from coast to coast in the contiguous United States

______ **2.** The amount of money spent on legal gambling in Massachusetts in one year

______ **3.** The number of cigarettes smoked annually in the United States

______ **4.** The population of the United States

______ **5.** The number of people that die on earth each day

______ **6.** The amount of money spent on legal gambling in the United States in one year

______ **7.** The number of people who die as a result of smoking each year in the United States

______ **8.** The population of Massachusetts

______ **9.** The amount of money in the United States cash and checking accounts

______ **10.** The population of the world

______ **11.** The amount of money spent on movies in the United States in one year

A. 6 million	**B.** 5.6 billion	**C.** 400,000	**D.** 500 billion
E. 260 million	**F.** 2,840	**G.** 3.2 billion	**H.** 5.5 billion
I. 250,000	**J.** 231 billion	**K.** 1.1 trillion	

Section 5 Worksheet A Answers: Number Sense

It is helpful for students to develop an awareness of some of the characteristics of their society and the world in a quantifiable way. The following worksheet lists a range of figures; some should be common knowledge, others may be interesting to discuss.

- Pass out the worksheet for this exercise (page 117) and ask the students to try to match the categories with the corresponding numeric value. The answers are included below.

All of these figures are approximate, rounded numbers. Whenever possible, data from 1996 have been used. When 1996 data were not available, data from 1995 or 1997 were used.

2,840	F — **1.**	The approximate distance in miles from coast to coast in the contiguous United States
3.2 billion	G — **2.**	The amount of money spent on legal gambling in Massachusetts in one year
500 billion	D — **3.**	The number of cigarettes smoked annually in the United States
260 million	E — **4.**	The population of the United States
250,000	I — **5.**	The number of people that die on earth each day
231 billion	J — **6.**	The amount of money spent on legal gambling in the United States in one year
400,000	C — **7.**	The number of people who die as a result of smoking each year in the United States
6 million	A — **8.**	The population of Massachusetts
1.1 trillion	K — **9.**	The amount of money in the United States cash and checking accounts)
5.5 billion	H — **10.**	The population of the world
5.6 billion	B — **11.**	The amount of money spent on movies in the United States in one year

Teacher's Instructions for Section 5 Worksheet B: Time Flies

The purpose of this exercise is to give students the opportunity to see how different rates relate to one another and how a rate on one scale (e.g., a daily rate) relates to the same rate on a larger scale (e.g., a lifetime rate). *Time Flies* reviews basic addition, multiplication, and division skills, as well as helping students think through a problem. In addition, an objective of this exercise is to remind students that one of the risks of smoking is a shortened lifespan.

- Divide the class into groups of 4 or 5.
- Give each group a copy of Section 5 Worksheet B (page 120).

Description

The first two facts taken from: Bartecchi, C.E., MacKenzie, T.D., & Schrier, R.W. (May, 1995). The global tobacco epidemic. Scientific American, p. 44-51. The third fact taken from: Bartecchi, C.E., MacKenzie, T.D., & Schrier, R.W. (1997). The human costs of tobacco use. New England Journal of Medicine, 330, p. 907-912.

- Write the following facts on the board or use ■ 5-11

1. Statistically, each cigarette robs a regular smoker of 5.5 minutes of life.

2. A teenager who smokes will smoke for an average of 25 years.

3. Teenage smokers smoke about 0.6 pack per day.

4. Our goal is to estimate how much time off of their lifespan an average teenage smoker will lose.

5. Assist each group in doing the math to solve this problem.

6. When all the groups are finished, check to see if all have arrived at the same conclusion.

Facing the Odds:

The Mathematics of Gambling and Other Risks

♠ Section 5 Worksheet B

Time Flies

- Statistically, each cigarette robs a regular smoker of 5.5 minutes of life.
- A teenager who smokes will smoke for an average of 25 years.
- Teenage smokers smoke about 0.6 pack per day.

How much time would you estimate a teenager who smokes would lose from his or her lifetime?

1. If a teenage smoker smokes about 0.6 pack per day, and a pack of cigarettes has 20 cigarettes in it, how many cigarettes does a teenager smoke per day?

2. If a teenage smoker smokes <u>(answer from #1)</u> cigarettes a day, how many minutes would be lost per day?

3. If a teenage smoker loses <u>(answer from #2)</u> minutes per day, how many minutes would be lost per year?

4. If a teenager smoker loses ____________ minutes per year, how many minutes would be lost in 25 years, the average length of time that teenage smokers will smoke?

5. If a teenage smoker loses ___________ minutes in 25 years, how many hours is that?

6. If a teenage smoker loses ___________ hours in 25 years, how many days is that?

7. How many weeks does a teenage smoker lose who smokes for 25 years?

8. How many years does a teenage smoker lose who smokes for 25 years?

Section 5 Worksheet B Answers: Time Flies

- Statistically, each cigarette robs a regular smoker of 5.5 minutes of life.
- A teenager who smokes will smoke for an average of 25 years.
- Teenage smokers smoke about 0.6 pack per day.

1. If a teenage smoker smokes about 0.6 pack per day, and a pack of cigarettes has 20 cigarettes in it, how many cigarettes does a teenager smoke per day?

0.6 x 20 = 12 cigarettes/day

2. If a teenage smoker smokes **12** cigarettes a day, how many minutes would be lost per day?

12 x 5.5 = 66 minutes lost/day

3. If a teenage smoker loses **66** minutes per day, how many minutes would be lost per year?

66 x 365 = 24,090 minutes lost/year

4. If a teenager smoker loses **24,090** minutes per year, how many minutes would be lost in 25 years, the average length of time that teenage smokers will smoke?

24,090 x 25 = 602,250 minutes

5. If a teenage smoker loses **602,250** minutes in 25 years, how many hours is that?

602,250 ÷ 60 = 100,375 hours

6. If a teenage smoker loses **100,375** hours in 25 years, how many days is that?

100,375 ÷ 24 = 418.23 days

7. How many weeks does a teenage smoker lose who smokes for 25 years?

418.23 ÷ 7 = 59.7 weeks

8. How many years does a teenage smoker lose who smokes for 25 years?

59.7 ÷ 52 = 1.15

Facing the Odds: 

The Mathematics of Gambling and Other Risks

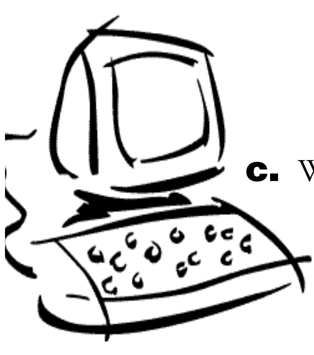
♠ Section 5 Worksheet C

1. This week ask your family to help you locate everyday statistics in newspapers or magazines you have at home.

Cut out at least one example of statistics used in an article. If you cannot find an article, you can use one of the articles that your teacher has. However, looking through newspapers or magazines and finding your own example will probably be more interesting for you and your classmates. Read the article with whichever family member is helping you with this project, and try to answer the following questions:

a. What sample is being used to describe the data? (i.e., who did the researchers interview or survey in order to come up with their data?) How big is the sample?

b. Do you think this sample is representative of the overall population being discussed?



c. What is the conclusion being drawn from the statistics?

d. How much do you trust the information in this article?

2. What comes to mind when you hear the word "average"? With what kinds of averages are you familiar? Give definitions for the mean, median, and mode.

3. "How much money do you think you need to fulfill your dreams?"

The Roper organization regularly polls Americans on this question. Every year the figures go up, in yearly leaps as great as $18,200. Last year 1,993 people were asked the question, and the median sum mentioned was $102,000 a year. But the number of those requiring a million a year for their dreams had nearly doubled since the year before. Why does this example state the median sum as the average measure?

4. You are interested in finding out what the mean, median, and modal height of your class is.

- How would you go about finding out?

- What would your sample be?

Develop a simple data chart to record the data you are collecting in your survey. Choose a sample you would consider representative and record your data. Calculate the mean, median, and mode for your sample.

Hint: to simplify the calculation of the mean, transform your heights from feet and inches into all inches (1 foot = 12 inches).

Report your findings to your teacher.

5. Two American women, Florence Griffith Joyner and "FleetFoot," are competing in the Olympic Games 100-yard dash.

Florence Griffith Joyner's past times were 11.08, 10.81, 10.75, 10.62 and 10.49 seconds, for an average of 10.75 seconds.

FleetFoot's past times were 11.51, 11.25, and 11.89 seconds, for an average of 11.55 seconds.

To calculate the time for the U.S. team, the Olympics officials calculate the average (mean) time of these two runners.

What was the U.S. team's time?

Section 5 Worksheet C Answers

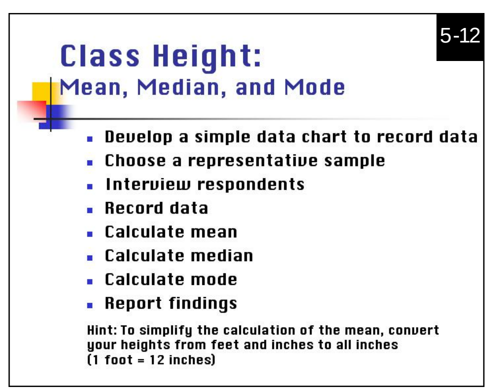
1. This exercise was designed to reinforce the principles of “journalistic hygiene” described earlier. According to these principles, we should always ask the following types of questions when we encounter statistics presented in the media: How were the statistics obtained? How confident can we be of them? Were they derived from a random sample or from a collection of anecdotes? Does the correlation suggest a causal relationship or is it merely a coincidence? How is the reporter connected to the story? Are there other ways to tally any figures presented? Do such figures measure what they purport to measure? Is the precision of the measurements meaningful?

2. The mean is the arithmetic average; the median is the middle value; the mode is the most frequently occurring value. Often when people discuss the “average,” they are referring to the mean. However, since each of these measures represents the average in a different way, the word “average” could refer to any of these three unless mean, median, or mode is specified.

3. The median is probably the most accurate measure of the “average” value. This is true because there are a lot of people who say they would need a very large amount (for example, a million dollars). If the researchers used the mean value, these large amounts would inflate the average to a value that may not be representative of the group as a whole. For example, suppose you were surveying 10 people about the amount of money they would need to fulfill their dreams. If 7 of the 10 reported figure between $100,000 and $150,000 and the other three said that they needed a million dollars, the mean value would be somewhere around $400,000, which isn’t really representative of the group as a whole, or even the majority of the group. The median value, which would be around $130,000, would be a better approximation of the “average” member of the group.

4. On the worksheet in #4, students will be collecting data on their classmates’ heights.

■ 5-12 The first objective of this exercise is to ensure that students are able to calculate means, medians, and modes. The following steps will guide the teacher through this activity.



Briefly discuss ideas for a data collection chart. Two columns, one with a name, the other with a height, is sufficient. Students should be aware of the advantage of organizing their data in a manner to allow for easy future calculation.

Teachers should be aware that each student will most likely choose a different sample (will ask a different combination of students). This is part of the exercise, but the teacher should expect that students come up with a diverse range of means, medians, and modes. Allow five minutes for students to collect their data; some students will collect more data than others will.

Discuss the problem of adding heights that are recorded in feet and inches. How would you add 5′2″ and 4′8″? Try to elicit the idea that if you converted the heights into one unit, inches, they could be added easily. (5′2″ would therefore become 5 x 12 = 60 inches; 60 + 2 inches = 62 inches. 4′8″ would convert to 4 x 12 = 48 inches; 48 + 8 = 56 inches. The heights of 62 inches + 56 inches = 118 inches.) More advanced students can transform the mean back into feet and inches. (For a total of 290 inches from asking 5 students, divide 290 by 5 = 58. 58 divided by 12 [inches per foot] = 4 feet 10 inches.)

The second objective of this exercise is to discuss sampling issues. Discuss whether students selected their sample randomly. A random sample might be every fifth name off the class roster listed alphabetically. Most students probably selected their friends or those who were sitting nearest to them. This might be a **biased sample**; that is, if an 8th grade boy who is 5′6″ sampled his friends, he might be more likely to have friends who are also male and also tall.

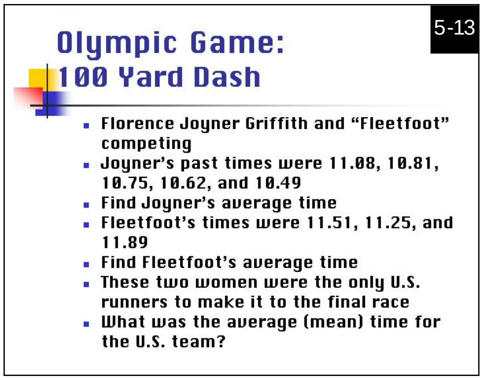
Ask the students what would be the only way to calculate the precise mean, median, and mode of the class. The only way to calculate these three measures exactly would be to include every student in the sample. However, if a random sample was chosen, the three measures may be good estimates.

- If time permits, the teacher can compile the data on the board and ask the students for help in converting the heights into total number of inches. The mean, median, and modal class height can then be calculated.
- Help students see how different their calculations were from the total group results, and speculate as to how their specific sample influenced their results.

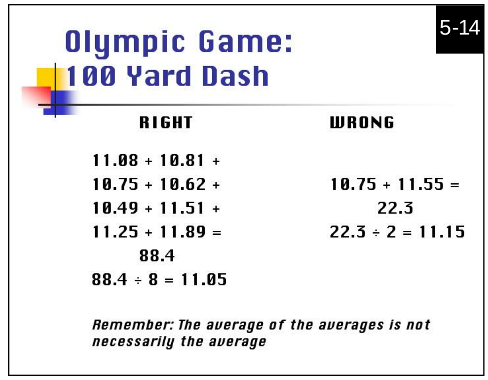
5. The average time of the United States team was 11.05 seconds. This average is calculated by adding the eight values and dividing by 8.

11.08 + 10.81 + 10.75 + 10.62 + 10.49 + 11.51 + 11.25 + 11.89 = 88.4 ÷ 8 = 11.05

■ 5-13



■ 5-14

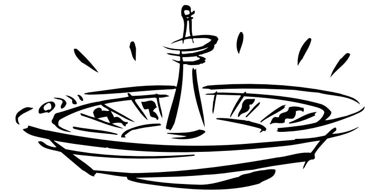


A common mistake with this type of question is averaging the averages — if students added the two averages and divided by 2, they would have answered 11.15.

10.75 + 11.55 = 22.3; 22.3 ÷ 2 = 11.15

This is a common mistake, and can be avoided by remembering that "the average of the averages is not necessarily the average." If both women had equal numbers of races (four each), then you could find the average time by averaging the two averages. However, in this example, Joyner had five times, and "FleetFoot" had three. In this case, when we calculated Joyner's average, we "condensed" five numbers into one, and when we found Fleetfoot's average we "condensed" three numbers into one. Each of Joyner's five times is represented less in her average than each of Fleetfoot's three times is represented in her average. In other words, each of Joyner's times represents one-fifth of her average, but each of Fleetfoot's times represents one-third (a greater portion) of her average. Thus, when you average the averages, Fleetfoot's times are "weighted" more, or represent more, than Joyner's do in the final average.

Facing the Odds:



The Mathematics of Gambling and Other Risks

♠ Section 5 Worksheet D

Gambling in the United States: Thoughts, Feelings, and Opinions

Please read the following statements and circle your reactions to them. Use the table to the right to reference the value you assign to the statement.

SA = Strongly Agree
A = Agree
U = Undecided
D = Disagree
SD = Strongly Disagree

1.	Gambling activity is on the increase in the United States	SA	A	U	D	SD
2.	A higher percentage of adults than teenagers are pathological gamblers.	SA	A	U	D	SD
3.	The majority of adults who are pathological gamblers began gambling when they were teenagers.	SA	A	U	D	SD
4.	Children of pathological gamblers are more likely to have alcohol, drug, gambling, or eating disorder problems than children of non-pathological gamblers.	SA	A	U	D	SD
5.	Adolescent students are equally as likely as adults to become problem gamblers.	SA	A	U	D	SD
6.	Historically, people started gambling about 200 years ago.	SA	A	U	D	SD
7.	Among adolescents, males gamble more than females.	SA	A	U	D	SD
8.	Among problem gamblers, casino games are the most popular form of gambling.	SA	A	U	D	SD
9.	Two-thirds of compulsive gamblers commit illegal acts to support their gambling habits.	SA	A	U	D	SD

Section 5 Worksheet D Answers

This worksheet is designed to encourage discussion among students. They can agree, disagree, or remain undecided about any of the statements presented. Each item is, in fact, either true or false, and these answers are listed below along with the references.

1. **TRUE — Gambling activity is on the increase in the United States** (Eadington, 1992).

2. **FALSE — A higher percentage of adults than teenagers are pathological gamblers.**

   Teenagers have a higher prevalence of pathological gambling than adults who gamble.

3. **TRUE — The majority of adults who are pathological gamblers began gambling when they were teenagers.** Most adults who become pathological gamblers gambled during adolescents (Lesieur & Klein, 1987).

4. **TRUE — Children of pathological gamblers are more likely to have alcohol, drug, gambling, or eating disorder problems.** In addition to the problems listed above, children of pathological gamblers also tend to do more poorly in school, and are more likely to be depressed. Furthermore, compared to their peers, they attempt to commit suicide twice as frequently (The National Council on Problem Gambling, 1993).

5. **FALSE — Adolescent students are equally as likely to become problem gamblers as adults.** Adolescents are two-and-a-half times more likely than adults to become problem gamblers are (Chavira, 1991; Leonard, 1990; Walters, 1990; Shaffer et al, 1995a).

6. **FALSE — Historically, people started gambling about 200 years ago.** Evidence of gambling dates back as far as Egypt in 2000 B.C. (Addiction Research Foundation, 1995). Throughout history, gambling has been present in almost all cultures (Dixon, 1991 as cited in Addiction Research Foundation, 1995).

7. **TRUE — Adolescent males gamble more than adolescent females.** Two surveys of Massachusetts students revealed that adolescent males gamble more than adolescent females (Shaffer, 1997; Shaffer et al., 1995a).

8. **FALSE — Among problem gamblers casino games are the most popular form of gambling.** The lottery is the most popular form of gambling among problem gamblers (Addiction Research Foundation, 1995).

9. **TRUE — Two-thirds of compulsive gamblers commit illegal acts to support their gambling habits.** Crime is associated with gambling behavior (Addiction Research Foundation, 1995).

Facing the Odds:

The Mathematics of Gambling and Other Risks

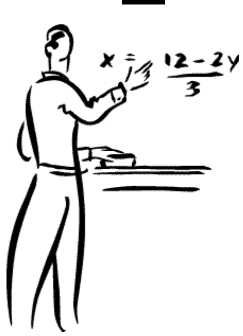
♠ Section 5 Worksheet E

The following data represents population figures and lottery expenditures for the six New England states.

STATE	1997 Population	1997 Expenditures on Lottery Products	1997 Expenditures on All Types of Gambling	1997 Per Capita Lottery Expenditure	1997 Per Capita Expenditure on Gambling
Maine	1,242,000	185,000,000	260,000,000		
New Hampshire	1,173,000	176,655,620	550,000,000		
Vermont	589,000	77,323,314	68,000,000		
Massachusetts	6,118,000	3,100,000,000	3,800,000,000		
Rhode Island	987,000	548,715,864	600,000,000		
Connecticut	3,270,000	500,000,000	7,500,000,000		
NEW ENGLAND TOTALS					

Figures represent actual reported amounts or close approximations based on previous reported amounts.

1. Calculate the per capita expenditures on the lottery (the mean amount spent per person) for each of the six New England states for 1997. Round up your answers to 2 decimal places (for example, 34.837 becomes 34.84). Write your answers in the "1997 Per Capita Lottery Expenditure" column.



2. Calculate the total "1997 population", the total "1997 expenditures on lottery products," and the total "1997 expenditures on all types of gambling" for New England. Write your answers in the table.

3. Calculate the per capita expenditure on lottery in New England for 1997. Write your answer in the table.

4. Rank the states from highest to lowest per capita lottery expenditure. Why do you think the differences among the states are so big?

1.	4.
2.	5.
3.	6.

5. Calculate the per capita expenditure on all types of gambling for each New England state. Write your answers in the "1997 Per Capital Expenditure on Gambling" column.

6. Calculate the per capita expenditure on gambling for New England. Write your answer in the table. How does this number compare to the per capita expenditure on lottery for New England?

7. Rank the states from highest to lowest total expenditures on gambling.
How do these rankings compare to the per capita lottery rankings?
What do you think accounts for the differences?
Can you think of a reason why state per capita expenditures on gambling may be misleading?

1.

2.

3.

4.

5.

6.

8. How much does the average New England resident spend on the lottery **per day?**

9. How much does the average New England resident spend on gambling **per day?**

Section 5 Worksheet E Answers

The following data represents population figures and lottery expenditures for the six New England states.

STATE	1997 Population	1997 Expenditures on Lottery Products	1997 Expenditures on All Types of Gambling	1997 Per Capita Lottery Expenditure	1997 Per Capita Expenditure on Gambling
Maine	1,242,000	185,000,000	260,000,000	148.95	209.34
New Hampshire	1,173,000	176,655,620	550,000,000	150.60	468.88
Vermont	589,000	77,323,314	68,000,000	131.28	115.45
Massachusetts	6,118,000	3,100,000,000	3,800,000,000	506.70	621.12
Rhode Island	987,000	548,715,864	600,000,000	555.94	607.90
Connecticut	3,270,000	500,000,000	7,500,000,000	152.91	2,293.58
NEW ENGLAND TOTALS	13,379,000	4,587,694,798	12,778,000,000	342.90	955.08

Figures represent actual reported amounts or close approximations based on previous reported amounts.

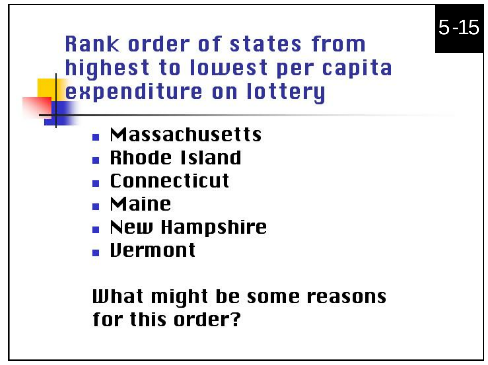
1. To calculate the per capita expenditure on the lottery ifor each of the New England states, divide each state's expenditure on lottery products by the state's population. For example, for Maine's per capita lottery expenditure, \$185,000,000 ÷ 1,242,000 = \$148.95.

2. To calculate the New England totals, add the six figures in the first three columns.

3. To calculate the per capita expenditure on the lottery in New England in 1997, divide the total expenditures on lottery product by the total population. Thus, \$4,587,694,798 ÷ 13,379,000 people = \$342.90 per person. If students add the six state per capita figures and divide by six, they will come up with a figure which is an incorrect answer (see Answers to Worksheet 5A, #5 for a discussion of averaging averages).

4. The states in order from highest to lowest per capita expenditure on the lottery are

1. Massachusetts	4. Maine
2. Rhode Island	5. New Hampshire
3. Connecticut	6. Vermont



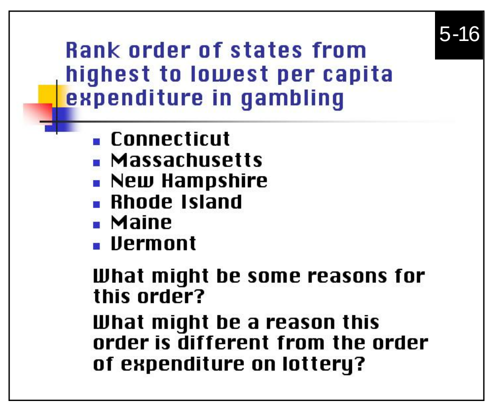
The differences among the states could be attributable to the advertising budgets and techniques of the lotteries, the types of lottery games the states offer, how often new games are introduced, the income levels of state residents, the general attitudes toward gambling in the different states, or other factors.

5. To calculate the per capita expenditure on gambling for each of the New England states, divide each state's expenditure on all types of gambling by the state's population. For example, for Maine's per capita gambling expenditure, $260,000,000 ÷ 1,242,000 = $209.34.

6. To calculate the per capita total expenditure on gambling for New England, divide the total per capita expenditure on gambling by the total New England population. Thus, $12,778,000,000 ÷ 13,379,000 = $955.08.

7. The states in order from highest to lowest per capita expenditure on gambling are

1. Connecticut	4. Rhode Island
2. Massachusetts	5. Maine
3. New Hampshire	6. Vermont



Only Vermont has the same ranking (6th) in both per capita lottery and per capita gambling expenditures. The most extreme difference between lottery and overall gambling expenditures occurs in Connecticut: while Connecticut is third in the lottery, it is by far the highest in overall expenditures, with more than twice the per capita expenditures as the second- highest (Massachusetts). Connecticut's extremely high per capita gambling expenditure is probably attributable to the Foxwoods Casino and the Mohegan Sun Casino. A state per capita gambling expenditure figure may be misleading because residents of any state can gamble at these casinos: a significant percentage of the expenditures at the casinos could have come from people who were not Connecticut residents. Thus, the New England per capita expenditure on all gambling is probably a more accurate figure.

8. The New England per capita expenditure on the **lottery** was $342.90 in 1997. By dividing this figure by 365, we calculate the mean amount spent per person per day on the lottery in New England: $0.94 per day.

9. The New England per capita expenditure on **gambling** was $955.08 in 1997. By dividing this figure by 365, we calculate the mean amount spent per person per day on gambling in New England: $2.62 per day.