CHAPTER 10:

Managing Data and Using Graphics

10-CI CHAPTER INTRODUCTION

10-1 Communicate quantitative information effectively.

10-2 Apply principles of effectiveness and ethical responsibilities in the construction of graphic aids.

10-3 Select and design appropriate and meaningful graphics.

10-4 Integrate graphics within documents.

TOPIC 9-CR

TOPIC 10-1

CHAPTER 10:

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10-1 COMMUNICATING QUANTITATIVE INFORMATION

> *Because people tend to make comparisons during analysis, the totals are helpful.*

Before you can interpret quantitative data, the elements must be classified, summarized, and condensed into a manageable size. This condensed information is meaningful and can be used to answer your research questions. For example, assume that you have been given 400 completed questionnaires from a study of your current clients' future travel destinations. This large accumulation of data is overwhelming until you tabulate the responses for each questionnaire item by manually inputting or compiling responses received through an online survey or optically scanning the responses into a computer. Then, you can apply appropriate statistical analysis techniques to the tabulated data.

The computer generates a report of the total responses for each possible answer to each item. For example, the tabulation of responses from each client about his or her future travel destinations might appear like this:

Hawaii	329
Caribbean	278
Alaska	218
Europe	185
Mexico	120

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The breakdown reduces 400 responses to a manageable set of information. The tabulation shows only five items, each with a specific number of responses from the total of 400 questionnaires. Because people tend to make comparisons during analysis, the totals are helpful. People generally want to know proportions or ratios, and these are best presented as percentage parts of the total.

FUTURE TRAVEL DESTINATIONS	NUMBER	PERCENTAGE
Hawaii	329	82
Caribbean	278	69.5
Alaska	218	54.5
Europe	185	46.25
Mexico	120	30

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Now analyzing the data becomes relatively easy. Of the survey participants, 82% selected Hawaii, while only 30% selected Mexico. Other observations, depending on how exactly you intend to interpret percentages, could be that more than half selected Alaska. Combining data in two categories allows you to summarize that all respondents intend to take a tropical island vacation in the future.

When tabulating research results of people's opinions, likes, preferences, and other subjective items, rounding off statistics to fractions helps paint a clear picture for readers. In actuality, if the same group of people were asked this question again a day or two later, a few probably would have changed their minds. For example, a participant who had not indicated a desire to travel to Europe may have attended a travel show that increased her interest in doing so. The next day, the respondent might indicate a desire to travel to Europe in the future.

Fractions, ratios, and percentages are examples of common language. In effect, common language reduces difficult figures to the "common denominators" of language and ideas. Although "218 of 400 expect to travel to Alaska in the future" is somewhat easy to understand, "54.4% prefer..." is even easier, and "one out of two indicate a preference for traveling to Alaska" is even more understandable.

Common language also involves the use of indicators other than actual count or quantity. The Dow Jones Industrial Average provides a measure of stock market performance and is certainly easier to understand than the complete New York Stock Exchange figures. Similarly, oil is counted in barrels rather than in the quart or gallon sizes purchased by consumers. Because of inflation, dollars are not accurate items to use as comparisons from one year to another in certain areas. For example, automobile manufacturers use "automobile units" to represent production changes in the industry. The important thing for the report writer to remember is that reports are communication media, and everything possible should be done to make sure communication occurs effectively.

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Imagine trying to put in composition style all the information available in a financial statement. Several hundred pages might be necessary to explain material that could otherwise be contained in three or four pages of balance sheets and income statements. Even then, the reader would no doubt be thoroughly confused! To protect readers from being overwhelmed or simply bored with data, report writers can design visually appealing graphics that are appropriate for the data being presented. Data reported in a table, graph, or picture will make your written analysis clearer to the reader.

The term graphics is used in this chapter to refer to all types of illustrations used in written and spoken reports. The most commonly used graphics are tables, bar charts, line charts, pie charts, pictograms, maps, flowcharts, diagrams, and photographs.

10-2a Effective and Ethical Use of Graphics

The use of graphics with a written discussion serves three purposes: to clarify, to simplify, or to reinforce data. As you read this chapter, ask yourself if the discussion would be effective if the accompanying graphic figures were not included. Use the following questions to help you determine whether using a graphic element is appropriate and effective in a written or spoken report.

- **Is a graphic needed to clarify, reinforce, or emphasize a particular idea?** Or can the material be covered adequately in words rather than in visual ways? To maintain a reasonable balance between words and graphics, save graphics for data that are difficult to communicate in words alone.
- **Does the graphic presentation contribute to the overall understanding of the idea under discussion?** Will the written or spoken text add meaning to the graphic display?
- **Is the graphic easily understood?** Does the graphic emphasize the key idea and spur the reader to think intelligently about this information? Follow these important design principles:
    - **Avoid *chartjunk*.** This term, coined by design expert Edward Tufte, describes decorative distractions that bury relevant data.* Extreme use of color, complicated symbols and art techniques, and unusual combinations of typefaces reduce the impact of the material presented.
    - **Develop a consistent design for graphics.** Arbitrary changes in the design of graphics (e.g., use of colors, typefaces, three-dimensional, or flat designs) within a written or spoken report can be confusing as the receiver expects consistency in elements within a single report.
    - **Write meaningful titles that reinforce the point you are making.** For example, a receiver can interpret data faster when graphics use a talking title; that is, a title that interprets the data. Consider the usefulness of the following graphic titles for a customer service manager browsing through survey results in preparation for a meeting with top management:

Descriptive Title:	*White-Cell Counts During April*
Talking Title:	*White-Cell Count Has Fallen Throughout April*

COLLECT STUDYBIT

ADAPTING YOUR PRESENTATION FOR YOUTUBE

YouTube is a great potential resource for a business and can be used to distribute your sales message or training material to a wide audience. The easily accessed website can be a great avenue for sharing business presentations; however, some adaptation is necessary for the best effect.

- **Keep it short.** The average viewing time for a YouTube clip is 2.5 minutes. If you must stay with a longer presentation format, divide it into several short segments posted as separate videos.
- **Make it loud and clear.** Use an external microphone rather than relying on one built into the camera. Your audio quality will be much improved.
- **Avoid bulleted PowerPoint slides.** Bullet points will appear blurry on YouTube and be next to impossible to read. Edit your content and change it to full-screen slides before uploading.

Viewers don't have the time or inclination to struggle through a long, poorly prepared video. Make sure your postings on social media sites are "online compatible."*

The talking title saves the manager time in understanding the data and also ensures the accuracy of his interpretation, his recommendations, and the content of his presentation. Similarly, poor business decisions can be averted if graphic titles reveal key information. You will learn more about the appropriate use of descriptive and talking headings as you study the preparation of informational and analytical reports in Chapter 11.

- **Is the graphic honest?** Visual data can be distorted easily, leading the reader to form incorrect opinions about the data.
- **Can a graphic used in a presentation be seen by the entire audience?** Electronic presentations, flip charts, whiteboards, and overhead transparencies are the visual means most often used to accompany presentations.

> *We remember more of what we both see and hear than of what we receive through only one sensory channel. When text and graphics are combined, retention goes up an average of 42%.**

The key to preparing effective graphics is selecting an appropriate graphic for the data and developing a clean, simple design that allows the reader or audience to quickly extract the needed information and meaning.

Categorize each of the following graphics titles as descriptive or talkative.

Customer Complaints for First Quarter	Talking
Emissions Projected to Increase in 2016	Descriptive
Health Care Expenses Rise over Last Year	
Hours Studied by Students with Jobs versus Students without Jobs	
Percentage of Vaccinated Students	
Student Test Scores Fell in 2015	

SUBMIT

TOPIC 10-1 TOPIC 10-3

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Using powerful software programs, managers can perform data management functions discussed in this chapter to produce highly professional graphics. The information can be reproduced in a variety of ways for integrating into reports and for supporting effective presentations.

Selecting the graphic type that will depict data in the most effective manner is the first decision you must make. After determining the message you want to receive to understand, you can choose to use a table, bar chart, line chart, pie chart, flowchart, organization chart, photograph, or other aid. Look over Figure 10.1 to help you choose the graphic type that matches the objective you have in mind.

FIGURE 10.1.
Choosing the Appropriate Graphic to Fit Your Objective

Note: Data presented in charts are fictitious and for demonstration only.

TOGGLE DIAGRAM

Figures 10.2, 10.3, 10.4, 10.5, 10.6, and 10.7 on the following pages illustrate a variety of graphics commonly used in reports. The figures show acceptable variations in graphic design, including placement of titles, type of grid/no grid, number and titles, inclusion or exclusion of grid lines, proper labeling of the figure, percentage versions of the source of data, and other features. When designing graphics, adhere to the requirements in your company policy manual or the style manual you are instructed to follow. Then be certain that you design graphics for a particular document or presentation consistently. When preparing a graphic for a slide or transparency, be concerned about the figure number and include the title only.

Figure 10.2. Effective Table Layout, Identifying Information, Lettering and Source

TRAVEL DESTINATIONS	2014	2015	2016
	(in millions)		
Hawaii	8.1	8.2	8.3
Caribbean	53	55	49.5
Alaska	9.5	10	14.1
Europe	23	25	26.8
Mexico	12	17	18

SOURCE: Fictitious

TOGGLE DIAGRAM

FIGURE 10.3.
Variety of Bar Chart Formats

Note: Data presented in charts are fictitious and for demonstration only.

GROUP DIAGRAM

FIGURE 10.4.
Line Chart

GROUP DIAGRAM

FIGURE 10.5.
Area Chart

GROUP DIAGRAM

FIGURE 10.6.
Map Conveying Statistical Data

Note: Population data are fictitious for demonstration purposes only.

GROUP DIAGRAM

FIGURE 10.7.
Flowchart Simplifying Understanding of Tasks

GROUP DIAGRAM

Drag each objective into the correct position alongside the graphic type which is most appropriate to achieve it.

Graphic Type	Objective
Segmented bar chart	
Pictograms	
Line chart	
Bar chart	
Pie chart	

Objective:
- Show trends over time
- Show parts of a whole
- Show comparisons of numerical data
- Show comparisons of numerical data over time
- Show comparisons of numerical data and the parts of a whole

CHECK

10.3a Tables

A **table** presents data in columns and rows, which aid in clarifying large quantities of data in a small space. Proper labeling techniques make the information clear. Guidelines for preparing an effective table follow and are illustrated in Figure 10.2.

- **Number tables and all other graphics consecutively throughout the report.** This practice enables you to refer to "Figure 1" rather than "the following table" or "the figure on the following page."
- **Give each table a title that is complete enough to clarify what is included in the table without reading the text.** Avoid titles that are too long. For example, you can make your table more clear if data numbers included in the table, and the subject, as shown in Figure 10.2. Titles should be written in either all capitals or upper and lowercase letters. Titles should be placed either above the table or below it, depending on the style that you are instructed to use.
- **Label columns of data clearly enough to identify the items.** Usually, column headings are short and easily arranged. If, however, they happen to be lengthy, use some ingenuity in planning the arrangement.
- The **footer sheet**, another variation of the bar chart, is useful for tracking progress toward completing a series of events over time. The Gantt chart in Figure 10.3e is a footer sheet. Gantt charts are named for Henry L. Gantt, who developed the version of the Gantt chart not only scheduling but also monitoring activities required to complete this research but also the actual progress of each activity when the project was implemented. Gantt charts can be prepared manually or by using software such as Microsoft Excel.

In addition to the suggestions for developing tables, here are further suggestions related to constructing bar charts:

- **Avoid visual distortion that could exaggerate the data.** Begin the quantitative axis at zero; divide the bars into equal increments; and use bars of equal width.
- Maximize chromatographic aid in some other fashion.
- **Use color to convey meaning.** For example, use variations in color to distinguish between the bars in a multiple bar chart or between the segments in a pie chart. Use color that has strong contrast to the background.
- Avoid fancy formatting such as 3D that makes visions more difficult to distinguish.
- **Use the labeling simple to reduce clutter and increase readability.** Include representative information such as data labels, gridlines, and explanatory notes if they are necessary. Do not include unnecessary data that will clutter the chart. Instead of data labels, omit amounts if visual estimation is adequate for understanding the relationships presented in the chart. Include the data values when the bars or the x- or y-axis tick marks are where exports specific data.

Drag each bar chart into the correct position alongside its name.

Vertical bar chart	Horizontal bar chart
Segmented bar chart	Grouped bar chart

CHECK

10.3b Line Charts

A **line chart** depicts changes in quantitative data over time and illustrates trends. The line chart shown in Figure 10.4 shows passenger traffic between airports over a six-hour period. When creating a line chart, keep these general guidelines in mind:

- Use the vertical axis for amount and the horizontal axis for time.
- Begin the vertical axis at zero.
- **Divide the vertical and horizontal scales into equal increments.** The vertical or quantity increments, however, need not be the same as the horizontal or time increments. Choose the scales that will present the data most appropriately. Sometimes scales of unequal increments create false visual relationships.

An **area chart**, also called a *cumulative line chart* or a *surface chart*, is similar to a segmented bar chart because it shows how different factors contribute to a total. An area chart is especially useful when you want to illustrate changes in components over time. For example, the area chart in Figure 10.5 illustrates a company's sales in three regions during one fiscal year. A reader can easily recognize the sales figures by regions and how each compares.

10.3d Pie Charts

The **charts**, like segmented charts and area charts, show how the parts of a whole are distributed. Pie charts are effective for showing percentages (parts of a whole), but they are ineffective in showing quantitative trends or comparisons.

A flowchart is a step-by-step diagram of a procedure or a graphic depiction of a sequence of activities. Flowcharts are especially helpful in showing how a function is supposed to operate and how it actually does operate. Flowcharts are sometimes used to instruct employees in certain work tasks. Including a flowchart with written instructions minimizes the chance of errors. The flowchart in Figure 10.7 illustrates the steps in a simple writing process.

Presenting this information graphically makes it easier to understand than a written explanation of the process.

An organization chart, discussed in Chapter 7, are widely used to provide a picture of the authority structure and relationships within an organization. They provide employees with an idea of what their responsibilities are in relation to terms of the flow of authority and responsibility. When businesses change the nature of an enterprise or reorganization is planned, a reconfigured organization charts must be revised. Revisions to organizational charts are simple when prepared using word processing or graphics software.

10.3g Other Graphics

Other graphics, such as architectural plans, photographs, cartoons, blueprints, and lists of various kinds, may be included in reports. The illustrations of graphics and sophisticated drawing software facilitate inclusion of these more complex visuals in reports and spoken presentations.

Some organizations have their own artists on staff, and others employ graphic artists to understand complex concepts and to create the illustrations more appealing to read. Frequently, you must include some graphic material in a report that would make the narrative discussion otherwise unacceptably dry. In this case, the material might be placed in an appendix and only referred to in the report.

INTRODUCING GRAPHICS IN TEXT

In the sentence introducing a graphic, use a signal to tell the reader (1) what data (2) to look at and (3) what to look for. Following are examples. Pattern (1) is used most frequently.

	EXAMPLE	EXPLANATION
1. Point	Figure 1 shows preferences for shopping locations.	Point forward as briefly as possible, making more than this would be the title of the figure.
2. Acceptable	About two-thirds of the respondents prefer shopping at shops in suburban areas rather than in the city (see Figure 1).	Acceptable because it points to the figure briefly and places the figure reference in parentheses rather than integrating it into the sentence.
3. Better	As shown in Figure 1, about two-thirds of the respondents prefer shopping in suburban areas rather than in the city.	Better than the previous examples but puts reference to the figure in parentheses, thus distracting from the interpretation of the data.
4. Best	About two-thirds of the respondents prefer shopping in suburban areas rather than in the city, as shown in Figure 1.	Best for introducing figures because it integrates the graphic and also includes the introductory phrasing, but only after reviewing the main point.

GROUP DIAGRAM

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CHAPTER 10:

Managing Data and Using Graphics

10-4 INCLUDING GRAPHICS IN TEXT

Read the following description of graphic data, and select the best assessment.

SUBMIT

Text and graphics are partners in the communication process. If graphics appear before readers have been informed, they will begin to study the graphics and draw their own inferences and conclusions. For this reason, always introduce a graphic in the text immediately before the graphic appears. A graphic that follows an introduction and brief explanation will supplement what has been said in the report. Additional interpretation and needed analysis should follow the graphic.

10-4a **Positioning Graphics in Text**

Ideally, a graphic should be integrated within the text material immediately after its introduction. A graphic that will not fit on the page where it is introduced should appear at the top of the following page. The previous page is filled with text that would have ideally followed the graphic. In this chapter, figures are placed as closely as possible to their introductions in accordance with these suggestions. However, in some cases, several figures may be introduced on one page, making perfect placement difficult and sometimes impossible.

When interpreting and analyzing the graphic, avoid a mere restatement of what the graphic obviously shows. Instead, emphasize the main point you are making. Contrast the boring style of the following discussion of graphic data with the improved revision: the following discussion of graphic data with the improved revision:

Obvious Restatement of Data:

When asked to identify the causes of ineffective meetings, 10% of employees blamed poor communication skills, 8% cited egocentric behavior by attendees, 7% attributed nonparticipation, and 6.5% said the discussion became sidetracked.

Emphasis on Main Point:

The most cited reason for ineffective meetings is poor communication skills, while issues related to poor interpersonal communication skills were also blamed.

COLLECT STUDYBIT

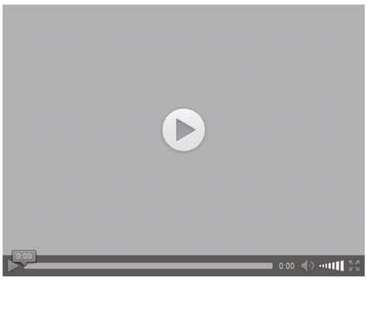
Your analysis may include summary statements about the data, compare information in the figure to information obtained from other sources, or extend the shown data into reasonably supported speculative outcomes. Strive to transition naturally from the discussion of the graphic into the next point you wish to make.

CONSISTENCY COUNTS

Throughout the discussion of tables and graphs, the term *graphics* has been used to include all illustrations. Although your report may include tables, graphs, maps, and even photographs, you will find organizing easier and writing about the illustrations more effective if you label each item as a "Figure" followed by a number; then number the items consecutively.

Some report writers prefer to label tables consecutively as "Table 1," and so on, and graphs and charts consecutively in another sequence as "Graph 1," and so on. When this dual numbering system is used, readers of the report may become confused if they come upon a sentence that reads, "Evidence presented in Tables 3 and 4 and Graph 2 supports..." Both writers and readers appreciate the single numbering system, which makes the sentence read, "Evidence presented in Figures 3, 4, and 5 supports..."

Using Graphics



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CHAPTER 10:

Managing Data and Using Graphics

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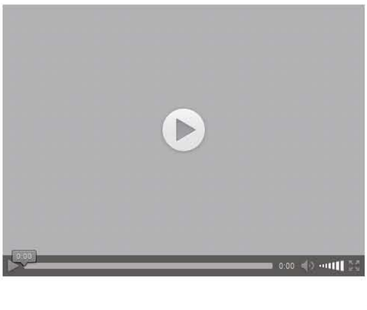
Using Graphics



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Bad Good

SUBMIT

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Bad Obvious Restatement of Data:	When asked to identify the causes of ineffective meetings, 10% of employees blamed poor communication skills, 8% cited egocentric behavior by attendees, 7% attributed nonparticipation, and 6.5% said the discussion became sidetracked.
Good Emphasis on Main Point:	The most cited reason for ineffective meetings is poor communication skills, while issues related to poor interpersonal communication skills were also blamed.

COLLECT STUDYBIT

Your analysis may include summary statements about the data, compare information in the figure to information obtained from other sources, or extend the shown data into reasonably supported speculative outcomes. Strive to transition naturally from the discussion of the graphic into the next point you wish to make.

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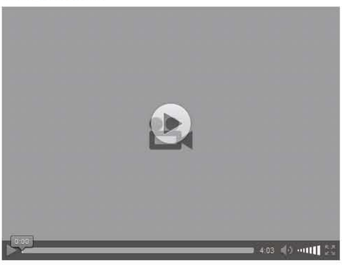
Using Graphics



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CHAPTER 10

Managing Data and Using Graphics

Learning Objectives

10-1 Communicate quantitative information effectively.

Graphics complement text by clarifying complex figures and helping readers visualize major points. Tabulating data and analyzing data using measures of central tendency aid in summarizing or classifying large volumes of data into manageable information you can interpret. You can then communicate this meaningful data using common language—fractions, ratios, and percentages—that the reader can easily understand.

10-2 Apply principles of effectiveness and ethical responsibilities in the construction of graphic aids.

A graphic aid should clarify, reinforce, or emphasize a particular idea and should contribute to the overall understanding of the idea under discussion. It should be uncluttered and easily understood and depict information honestly. Graphic aids used in spoken presentations should be large enough to be seen by the entire audience.

10-3 Select and design appropriate and meaningful graphics.

The type of graphic used in a presentation should be chosen based on its ability to communicate the information most effectively. Tables present data in systematic rows and columns. Bar charts (simple, grouped, and stacked) compare quantities for a specific period. Line charts depict changes in quantities over time and illustrate trends. Pie charts, pictograms, and segmented and area charts show the proportion of components to a whole. Gantt charts track progress toward completing a series of events over time. Maps help readers visualize geographic relationships. Flowcharts visually depict step-by-step procedures for completing a task; organization charts show the organizational structure of a company. Floor plans, photographs, cartoons, blueprints, and lists also enhance reports.

10-4 Integrate graphics within documents.

A graphic should always be introduced in text before it is presented. The graphic will then reinforce your conclusions and discourage readers from drawing their own conclusions before encountering your ideas. An effective introduction for a graphic tells something meaningful about what is depicted in the graphic and refers the reader to a specific figure number. The graphic should be placed immediately after its introduction if possible or positioned at the top of the next page after filling the previous page with text that ideally would have followed the graphic. Analysis or interpretation follows the graphic, avoiding a mere repetition of what the graphic clearly shows.

Key Terms

10.1

common language reduces difficult figures to the common denominators of language and ideas

10.2

graphics all types of illustrations used in written and spoken reports

10.3

table a graphic that presents data in columns and rows, which aid in clarifying large quantities of data in a small space

bar chart a graphic used to compare quantities

grouped bar chart a graphic used for comparing more than one quantity (set of data) at each point along the *y*-axis (vertical) or *x*-axis (horizontal); also called a *clustered bar chart*

segmented bar chart a graphic used to show how different facts (components) contribute to a total; also called a *subdivided, stacked bar*, or *100% bar chart*

pictogram a graphic that uses pictures or symbols to illustrate objects, concepts, or numerical relationships

Gantt chart a specific type of bar chart that is useful for tracking progress toward completing a series of events over time

line chart a graphic that depicts changes in quantitative data over time and illustrates trends

area chart a graphic that shows how different factors contribute to a total; also referred to as a *cumulative line chart* or *surface chart*

pie chart a graphic that shows how the parts of a whole are distributed

map a graphic that shows geographic relationships

Flowchart a step-by-step diagram of a procedure or a graphic depiction of a system or organization

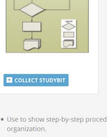
Check Your Communication Types of Graphic Aids

Tables

COLLECT STUDYBIT

- Number tables and all other graphics consecutively throughout the report.
- Give each table a title that is complete enough to clarify what is included without forcing the reader to review the table.
- Label columns of data clearly enough to identify the items.
- Indent the second line of a label for the rows (horizontal items) two or three spaces.
- Place a superscript symbol beside an entry that requires additional explanation, and include the explanatory note beneath the visual.
- Document the source of the data presented in a visual by adding a source note beneath the visual.

Bar Charts



COLLECT STUDYBIT

- Begin the quantitative axis at zero, divide the bars into equal increments, and use bars of equal width.
- Position chronologically or in some other logical order.
- Use variations in color to distinguish among the bars when the bars represent different data.
- Avoid using 3D-type formatting that makes values more difficult to distinguish.
- Include enough information in the scale labels and bar labels for clear understanding.

Line Charts

COLLECT STUDYBIT

- Use the vertical axis for amount and the horizontal axis for time.
- Begin the vertical axis at zero.
- Divide the vertical and horizontal scales into equal increments.

Pie Charts

COLLECT STUDYBIT

- Position the largest slice or the slice to be emphasized at the twelve o'clock position.
- Label each slice and include information about the quantitative size (percentage, dollars, acres, square feet, etc.) of each slice.
- Draw attention to one or more slices for desired emphasis.
- Avoid using 3D-type formatting that makes values more difficult to distinguish.

Maps

COLLECT STUDYBIT

- Use to show geographic information visually.

Flowcharts

COLLECT STUDYBIT

- Use to show step-by-step procedures or graphic depiction of a system or organization.

Grammar Quiz Quotation Marks and Italics

Add necessary quotation marks and italics.

1. Cynthia Cooper's Extraordinary Circumstances is required reading in some forensic accounting classes.
2. The article How to Persuade People to Say Yes appeared in the May 2014 issue of Training Journal.
3. The consultant's accomplishments are summarized on her opening blog page. [Indicate that a word other than accomplishments may be a more appropriate word.]
4. Connie said I want to participate in a volunteer program that serves such a worthy cause. [direct quotation]
5. The term flame is online jargon for a heated, sarcastic, sometimes abusive message or posting to a discussion group.

Grammar Quiz Solutions

1. Cynthia Cooper's *Extraordinary Circumstances* is required reading in some forensic accounting classes. [Italicizes a book title.]
2. The article "How to Persuade People to Say Yes" appeared in the May 2014 issue of *Training Journal*. [Encloses the name of an article in quotation marks and italicizes the title of a journal.]
3. The consultant's "accomplishments" are summarized on her opening blog page. [Uses quotation marks to introduce doubt about whether "accomplishments" is the right label. His undertakings may have been of little significance.]
4. Connie said, "I want to participate in a volunteer program that serves such a worthy cause." [Uses quotation marks in a direct quotation.]
5. The term *flame* is online jargon for "a heated, sarcastic, sometimes abusive message or posting to a discussion group." [Italicizes a word used as a term and encloses its definition in quotation marks.]

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