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# **How to Write an Effective Research Report**

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## **Abstract**

This guide for writers of research reports consists of practical suggestions for writing a report that is clear, concise, readable, and understandable. It includes suggestions for terminology and notation and for writing each section of the report—introduction, method, results, and discussion. Much of the guide consists of suggestions for presenting statistical information. An appendix compares several common types of graphs.

Key words: writing, technical writing, research reports, graphs

## **Acknowledgment**

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## **Purpose of This Guide**

This guide is intended to help researchers write more effective and more readable reports of empirical research studies. It will be helpful to people who are generally good writers but have little or no experience at writing this type of research report. It may also be helpful to people who are experienced at writing this type of research report but whose reports are not as readable and effective as they might be.

This guide is not intended to be a complete course in writing—not even a complete course in writing research reports. It focuses on the problems that arise in the writing of a particular type of research report. Many people who write reports of empirical research studies also write theoretical papers, methodological papers, position papers, book reviews, or other types of articles. Some of the advice in this guide may apply to those other types of writing, but much of it will not.

This guide is intended to be a compendium of helpful advice, not a list of requirements. The advice it contains is the product of many years of experience in writing research reports and attempting to help others write them. Nevertheless, it represents the opinions of one person. It does not necessarily represent the position of ETS.

## **Characteristics of an Effective Research Report**

An effective research report has—at least—the following four characteristics:

- **Focus:** an effective report emphasizes the important information.
- **Accuracy:** an effective report does not mislead the reader.
- **Clarity:** an effective report does not confuse the reader.
- **Conciseness:** an effective report does not waste the reader's time.

## **Working Ahead**

**You can begin writing the report of your study before you have actually done the study.** Working ahead on your report allows you to use your time more efficiently, but there is an even better reason for doing it. Working ahead on the report helps you plan and conduct the study, because it forces you to think systematically about what you want the study to accomplish.

**You can begin writing the introductory section of the report as soon as you have decided on the general approach your study will follow.** You don't have to wait until you have determined all the details of the method.

**You can write the method section of the report before you have analyzed the data.** You can even begin describing your method before you have collected the data, although you may have to make some changes if the procedure does not go exactly as planned.

**You can begin writing the results section of the report before you finish analyzing the data.** You can begin writing it before you finish collecting the data, or even before you start collecting the data! Of course, you won't have any results to report, but you can use made-up data to create examples of the tables and figures that will communicate your results. The decisions you make in creating these tables and figures will help you decide how to analyze your data.

## Terminology, Notation, and Writing Style

### Terminology

**Know your audience and what terms they understand.** Many research reports include technical terms. *Before you start writing the report, decide who your intended readers are.* If you don't know whether those readers will be familiar with the technical terms you intend to use, make an effort to find out. If you are going to use any technical terms that will be unfamiliar to many readers, provide an explanation of those terms—but don't include detailed explanations of technical terms that the people reading the report will already know and understand correctly.

**Label each variable in your report with a term that describes only what it actually measures.** Avoid labels that have *excess meaning*—labels that imply more information than the measurement of the variable actually provides. If the measurement is a score on a vocabulary test, call it *word meanings*; don't call it *verbal ability*. If the measurement is a score on a task of classifying objects, call it *classifying objects*; don't call it *nonverbal reasoning*.

**If your report introduces a new concept, don't use labels that are commonly used for some similar concept.** Avoid using terms like *Type I error* and *Type II error* or *liberal* and *conservative*. When readers see a familiar term, they expect that term to have its usual meaning. If the meaning you intend is not exactly the same as the usual meaning of the term, the readers will be confused. Use a different term.

**If you introduce a new term, make sure the readers understand that you are introducing a new term.** Don't explain the term in a way that implies that your new term is already in common use. Instead of saying simply, "ABC [your new term] means XYZ," say, "In this report, we will use the term ABC to mean XYZ."



**Use short, descriptive labels.** If your report includes two or more treatments (or conditions, or measurements, or groups of students, etc.), try to identify each one by a short descriptive label of one, two, or three words. Labels like “Treatment A” and “Treatment B” don’t help the reader remember which treatment is which. Short descriptive phrases make much better labels. Finding a short phrase that accurately describes a treatment or condition is sometimes difficult, but if you can do it, you will make your report much easier to read.

**Don’t use the same term to mean two or more different things.** If you use the term *weighted average* to refer to an average of subscores on a test, don’t use that same phrase to refer to a statistic computed for a combined group of students.

**Don’t refer to the same thing by two or more different names.** Your readers will not all realize immediately that *interactive learning* refers to the activity you described as a *small-group exercise*. You cannot assume they will all know that the *effect size* is the same thing as the *standardized mean difference*. Choose one term for each concept and use it consistently throughout the report.

## **Abbreviations**

**Avoid unfamiliar abbreviations.** Don’t use abbreviations (or acronyms, like NAEP or STEM), unless you are sure they will be familiar to the readers. Unfamiliar abbreviations make your report hard to read. The more new or unusual abbreviations your report contains, the harder it will be for the readers to remember what each abbreviation means. If you want your report to be readable, the ideal number of new abbreviations to use is zero. Don’t even think about using a new or unfamiliar abbreviation unless (a) the phrase it replaces is quite long or very difficult to read and (b) that phrase appears many times in your report.

**You may find that using abbreviations makes it easier for you to write the report.** In that case, go ahead and use them in your first draft. Then use a “find and replace” instruction in your word processor to replace each new or unfamiliar abbreviation with the phrase it represents.

**Include the complete phrase at least once.** Every abbreviation or acronym in the report should be written out in full where it first appears in the report—even if it will be familiar to most readers, even if you think it is obvious or common knowledge.

**Be careful when you make up a new abbreviation.** If you must use a new abbreviation in your report, don’t use an abbreviation that your readers will associate with a different term or

phrase. Also avoid any abbreviation that readers might consider inappropriate because it looks like some other word. Before you decide on a new abbreviation, find some people like those you expect to read your report, show them the abbreviation you intend to use, and ask them if they have ever seen it before —and, if so, what its meaning was. Also ask them if they can think of a way the abbreviation might be seen as inappropriate. Finally, make sure you are not using the same abbreviation for two different phrases. (The “find” instruction in your word processor makes this kind of checking easy to do.)

### **Mathematical Notation**

Reports that include mathematical formulas or equations are often difficult to read because of problems with the notation. A thorough discussion of these problems would be beyond the scope of this guide, but some problems are too common or too basic to ignore.

**Each symbol should have one and only one meaning.** Don’t use a symbol to mean one thing in one formula and then use the same symbol to mean something else in another formula. If your report includes mathematical formulas, check to make sure you haven’t used the same symbol to mean two different things.

**Don’t change notation.** Don’t use different symbols to represent the same thing in different parts of the report.

**Avoid new uses for symbols that have traditional meanings for your readers.** If your readers are accustomed to seeing a symbol used with a particular meaning, you will confuse them if you use that symbol to mean something different. For example, in psychometrics,  $\theta$  is commonly used to represent an unobservable ability that the questions on a test are intended to measure, but in statistical decision theory, it is used to represent the unknown true value of any variable. Many readers will be accustomed to seeing  $r$  for a correlation,  $\mu$  for a mean, and  $\sigma$  for a standard deviation; in general, try to follow the conventions your readers are accustomed to. If you are writing for readers who are accustomed to seeing capital letters for population values and lower case letters for sample values, follow that convention in writing your report. If you are unsure what your readers will think when they see a particular symbol, find some people like those who will read your report, and ask them about the symbols you intend to use.

## Writing Style

Many research reports are ineffective because the writing style makes them hard to read. A discussion of the problems commonly found in bad writing (ambiguous pronouns, misplaced modifiers, etc.) would be beyond the scope of this guide. However, some kinds of problems are especially common in research reports.

**Avoid long sentences.** This problem is easy to eliminate. All you need to do is to divide each long sentence (35 words or longer) into two or more short sentences. The total number of words may increase, but the result will be clearer communication.

**First-person pronouns such as *I* and *we* are now allowable in scholarly writing.** For many years, authors of research reports observed (and journal editors enforced) the custom of avoiding the words *I* and *we*, and the possessive *our*. Those days are over. Simple sentences beginning with *I* or *we* are now acceptable in research reports, and they tend to make your writing clearer and more readable. The *Publication Manual of the American Psychological Association* (American Psychological Association [APA], 2010) includes the following examples:

*Correct:* We reviewed the literature.

*Incorrect:* The authors reviewed the literature. (p. 69)

*Preferred:* We conducted our survey in a controlled setting.

*Nonpreferred:* The survey was conducted in a controlled setting. (p. 77)

## Writing Each Section of the Report

### Writing the Introduction

According to the *Publication Manual of the American Psychological Association*, “The body of a manuscript opens with an introduction that presents the specific problem under study and describes the research strategy. Because the introduction is clearly identified by its position in the manuscript, it does not carry a heading labeling it the introduction” (APA, 2010, p. 27)

**Decide what background information to include.** (By *background information*, I mean general information about the topic, rather than information specifically about the research you are reporting.) Many research reports include far too much background information; a few reports do not include enough. Unnecessary background information tends to be either (a) information that

anyone likely to read the report would almost surely know or (b) information that is not necessary for understanding the report.

**State the research questions early.** The most important thing to include in the introduction of a research report is a clear, concise, explicit statement of the questions that the research was intended to answer. This statement should come near the beginning of the report—as soon as the reader has enough information to understand the reason for doing the research. Unfortunately, in some reports, the first explicit statement of the research questions comes at the end of a long introduction,<sup>1</sup> or (worse) after the description of the method for the study, or (still worse) after the presentation of the results. And in some reports (worst of all), there is no explicit statement of the research questions.

**State the research questions in plain and simple language.** Use technical language only where it is absolutely necessary. State the effects you are investigating in positive terms; don't state them as statistical null hypotheses to be rejected.

**State the research questions precisely.** The research questions should be questions that the research described in the report can actually answer. In some research reports, the research questions are stated in language that goes far beyond anything that the study described in the report could possibly determine. The statement of the research questions should not promise more information than the results of the study could possibly deliver.

**Before you cite a paper (or article, book chapter, etc), read it and think about it.** In most research reports, the introduction includes a review of previous research, with a brief summary of the findings of each study. When you write a review of previous research, read the report of each study you include, and decide for yourself what the study really showed—don't simply quote the generalizations, recommendations, speculations, or opinions of the person who did the research.

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<sup>1</sup> Putting the research questions at the end of the introduction is consistent with the *Publication Manual of the American Psychological Association*, which states, “After you have introduced the problem and have developed the background material, explain your approach to solving the problem. In empirical studies, this usually involves stating your hypotheses or specific questions” (APA, 2010, p. 28). Nevertheless, I stand by my recommendation to state the research question earlier, which I believe will result in a more reader-friendly report.

## Writing the Method Section

In many research reports, the method section is tedious, or confusing, or both. It doesn't have to be that way.

**Begin with an explanation of the logic of the research design.** Don't describe the details of your method until you have outlined the general procedure and explained how it will answer the research questions you stated in the introduction. Detailed descriptions of the participants, the measurement instruments, and the data collection procedures become far more meaningful when the reader understands the basic design of the study and the reasoning behind it.

**Include the important details; leave out the unimportant details.** Deciding which details are important enough to include in the report is sometimes difficult, but there is a general principle that may help. The report should include the details that could make a substantial difference in the results. If the study includes a questionnaire or a test that many readers will not be familiar with, the report should include examples of the questions or problems. (If the test or questionnaire is under copyright protection, you will need to get permission from the author or publisher.) It may also be worthwhile to include the entire questionnaire or test in an appendix, if it is not too long.

**Think about how much detail to include in describing your procedures.** The basic principle to follow is that your report should include the details that a reader would need in order to conduct a similar study. It is especially important to describe unusual or unfamiliar aspects of your study and your procedures. To satisfy this rule while still keeping your report readable, you can include a brief, general description of the procedures in the body of the report and present the details in an appendix.

**If you transformed any variables, explain why.** Some research data analyses involve transformations of one or more variables. A measurement may be replaced by its square root or by its natural logarithm. A percentage may be replaced by a normal deviate (the score having that percentile rank in a normal distribution). If your data analysis includes any transformations of variables, explain the reason for using each transformation, unless you are sure that the reason will be obvious to all readers of the report.

## Writing the Results Section

In many research reports, the results section proceeds step by step, with each step forming the basis for the next. First come the results showing that the variables were measured reliably and

that the samples were representative of their populations. Then come the results showing that the data met the assumptions of the statistical procedures used in the main analyses. Then, finally, come the results that actually answer the research questions. This organization of the results section is systematic and logical, but it is also, for most readers, a waste of time.

**Put the most important results up front.** Write the results section as if you expected half the readers to stop reading after the first paragraph and half of the others to stop reading after the first page. Begin with the results that directly answer the research questions. Then, for the benefit of those readers who are more deeply interested, present the results of the other analyses that support the main results.

**Think about which statistical information to include.** When you finish your data analysis, you will probably have enough statistical information to tell the readers of your report far more than they want to know about your research. Most authors of research reports tend to include too much statistical information, possibly to make sure they are not leaving out anything important. However, if the report is too long, people will not read it. (If your report is too long because your study attempted to answer several research questions, you may need to write two or more separate reports.)

**Think about how to present the statistical information.** When you write your results section, you will have to decide what information to present in tables and graphs and what information to present in the text of the report. Present the most important results—those that directly answer the research questions—in more than one way. You can describe those results verbally in the text and illustrate them visually in graphs or present them numerically in tables.

**Start with the tables and graphs.** A good way to approach the task of writing the results section is to begin by making the tables and graphs. First, make a small set of tables and graphs that will communicate the important results of the study. Then, add the tables or graphs that will make it easy for the more deeply interested readers to find the additional information they are likely to want. When you make each graph or table, use the title and the labels to give the reader *enough information to understand that graph or table without looking at anything else in the report*. Finally, write the text of the results section. Summarize briefly in words what each table and each graph shows, adding further details or explanations where you need to. Write the text so that it will communicate the important results clearly to someone who reads it without looking at any of the tables and graphs.

**What really matters is the size of the effects.** The important statistical information in your results is the size of the effects, not their statistical significance levels. It is important to report statistics describing the size of the effects, even if the effects are not statistically significant. This information not only tells the reader how large an effect you actually observed; it is also important for researchers who want to include your study in a meta-analysis. Your results, combined with those of other researchers who investigated the same question, may yield a statistically significant effect, even if your results by themselves did not.

I am not arguing against reporting statistical significance levels. Significance levels caution people against overinterpreting results that are based on small numbers of observations. They provide some assurance that an observed effect is not just a result of sampling variability. But remember that the level of statistical significance is not as important as the size of the effect or the difference that answers each research question.

**Don't report meaningless significance levels.** It is not necessary to report a significance test for every statistic, and in some cases it makes no sense at all. If you used people's scores on a measure to separate them into a high-scoring group and a low-scoring group, you don't need to show that the groups differ significantly on that measure. If your study includes two measures of the same characteristic, you don't need to show that the correlation between them is significantly different from zero.

**Use statistics that communicate your results clearly.** What statistics should you use to report your research findings? There is no one-size-fits-all answer to this question, but there is a basic principle worth keeping in mind. Use statistics that answer the research questions as directly as possible, in terms that will be easy for the readers of the report to interpret. For example, a table of group means and standard deviations is nearly always easier to interpret than an analysis-of-variance table. The results of a regression analysis can often be described clearly by reporting the predicted values of the outcome variable for a few carefully selected values of the predictor variable.

**Numbers or a percentage?** Often, the statistical information that directly answers a research question is a proportion represented by a pair of numbers: 23 of 35 students, 14 successes in 18 attempts, etc. In these cases, you have to decide whether to report the absolute numbers, the percentage, or both. In general, when the numbers are large, the percentage is more meaningful; 138

of 437 is difficult to process, while 32% is clear. But when the numbers are small, it is better to report the absolute numbers; 2 of 7 is more informative (and easier to visualize) than 29%.

**What if the percentages do not sum to 100%?** Often, a research question can be answered effectively by reporting category percentages (for example, the percentages of students classified as basic, proficient, and advanced). Many research reports use category percentages to report demographic information, such as the ethnic composition of a group of students. Normally, these percentages sum to 100%, but sometimes they do not. Missing data can result in a sum of less than 100%. Overlapping categories can result in a sum greater than 100%. Rounding error can make the sum either slightly greater or slightly smaller than 100%. When category percentages do not sum to 100%, explain the reason. A single sentence in parentheses or a one-sentence footnote will do the job.

**A table or a graph?** Sometimes it is hard to decide whether to present the results of a particular analysis in a table or in a graph. To make this decision, ask yourself what you are trying to communicate—the actual numbers (scores, percentages, etc.) or the relationships between the numbers. Tables are better than graphs for presenting the actual numbers, but graphs are far better than tables for showing the relationships between numbers.

## Tables

The most common use of tables in research reports is to present numerical information. I think it makes sense to distinguish between two purposes for presenting this information:

1. To communicate the main results of the study to the readers of the report; or
2. To provide a reference document containing the detailed results of the study.

**The tables that are intended to communicate the main results should appear in the body of the report.** They should be small and simple, so that readers can get the essential information from them quickly and easily. The level of precision (the number of decimal places) should be no higher than is needed to show the important effects. Tables that are intended for reference purposes should be placed in an appendix. They can be larger and more complex, and the numbers can be reported to a greater level of precision.

**For the tables in the body of the report, smaller is better.** The fewer numbers a table contains, the greater the impact of each number. One way to make a table smaller is to include



fewer levels of each variable. Although you may have computed the results for ten different values of a variable, three selected values may be enough detail for most readers.

**To make your tables readable, don't include more precision than you need.** Your computer printout may show the mean scores for the experimental group and the control group as 3.4452 and 2.7836, but the comparison will be clearer (and the table easier to read) if you report them as 3.4 and 2.8. Your computer printout may show correlation coefficients to four decimal places, but correlations are traditionally rounded to two decimal places, and your report will be easier to read if you report them that way.

**Label your tables clearly.** Whether a table is intended mainly for communication or for reference, be sure to label it clearly. Give the table a title that says clearly what the table is intended to show. Use row and column headings that can be clearly understood, even by a reader who has not read anything else in the report. Do not use symbols or abbreviations as row or column headings, unless those symbols or abbreviations are so commonly used that you can be sure that everybody who reads the report will know them. Make sure to specify the units in which the numbers are expressed: scaled-score points, standard-deviation units, minutes of instruction, etc. This information should be in the row or column headings, if it is not in the title of the table.

Some useful advice on constructing tables for presenting different types of statistical results is available in *Presenting Your Findings*, published by the American Psychological Association (Nicol & Pexman, 2009).

**You can use tables for non-numerical information.** Tables are often used to present numerical information, but they are also useful for presenting non-numerical information. Many types of information can be presented more clearly and concisely in a table than in a written paragraph. Presenting the information in a table can also make the organization clearer to the reader. Table 1 is an example of a non-numerical table. It summarizes the information in the first two paragraphs of this section.

**Table 1*****Two Types of Numerical Tables in Research Reports***

	Tables for communication	Tables for reference
Purpose	Communicating results to readers	Documenting results for future reference
Location	Body of report	Appendix
Size	As small as possible, given the purpose of the table.	Large enough to contain the results to be stored for reference
Precision	Low—just enough to show the important comparisons	Low, medium, or high

**Graphs**

**Graphs are nearly always the best way to show comparisons or relationships between numbers.** Of course, the type of graph you use must be appropriate for the information you want to communicate. Different kinds of information call for different kinds of graphs. See the appendix for advice about using some common types of graphs to communicate different kinds of statistical information.

**Label each graph clearly.** Give each graph a title that says clearly what the graph is intended to show. If the graph has axes, label them in terms that can be clearly understood, even by a reader who has not read anything else in the report. Don't use symbols or abbreviations to label the graph, unless those symbols or abbreviations are so common that all readers of the report will surely interpret them correctly (e.g., the usual abbreviations for the months of the year). If the graph has axes, make sure that either the axis label or the title of the graph clearly indicates the units of measurement for the numbers on each axis (e.g., scaled-score points, standard-deviation units, minutes of instruction).

**Don't try to put too much information into a single graph.** A graph that includes too much information will be difficult to read. But how much information is too much? That question has to be answered on a case-by-case basis. A line graph with three lines that lie close to each other and cross in several places will be difficult to read—more difficult than a graph with six lines that are clearly separated and do not cross. A bar graph with five groups of four bars can be fairly easy to read, if the four bars in each group show the same pattern. But if the pattern is different for each

group, the graph is likely to be confusing. One way to find out whether a graph is easy to read and interpret correctly is to make the graph, label it clearly, and ask one or two people *unfamiliar with your research* to interpret it. If they cannot interpret it easily and correctly, you need to simplify the graph.

**Don't let the graphing software make all the decisions.** Many graphs are confusing or misleading because of the default options in the software that produced the graphs. You don't have to accept those default options. You can usually make better choices, if you think about what you want the graph to show.

**Make the symbol shapes and shadings meaningful.** One way that the default options produce bad graphs is by their choice of shapes and shadings. Shadings that represent ordered categories (such as basic, proficient, and advanced) should change steadily from lighter to darker in a way that corresponds to the order of the categories (e.g., light shading for basic, darker for proficient, and darkest for advanced). If a graph shows data points for groups that vary in two different ways, the shape and shading of the symbols should indicate the ways in which the groups differ. For example, if your graph compares male and female students in grades 3, 5, and 7, you can use symbols of a different shape for each grade, with light shading for female students and dark shading for male students. If other graphs in your report compare the same groups, you should use the same shapes and shadings in those graphs also.

**Specify the range of values.** Another way that the default options produce bad graphs is by their choice of the range of values of each variable to include in the graph. Sometimes the range of values shown in the graph extends beyond the range of values that are possible. Sometimes the range of values shown in the graph leaves out a large part of the possible range, resulting in a graph that makes small differences look large. Often, if a report includes two or more graphs of the same variables, the default options will produce graphs with different ranges of values for the same variables. As a result, an amount or a difference of a given size (e.g., 20 scaled-score points) will look larger in one graph than in the other. Readers will find it difficult to compare the results reported in the two graphs. Specifying the range of values for each variable in each graph is worth the effort. It enables you to produce graphs that communicate clearly without confusing or misleading the reader.

**Adjust the shape of the graph to avoid distortion.** In some graphs (especially in some scatterplots), the two axes of the graph represent the same variable, with the same range of possible

values. In this case, the graph should be square; the two axes should be the same length. But even if you specify the range of values to be the same on both axes of the graph, the software may produce a graph with the horizontal axis much longer than the vertical axis. The resulting graph will give the reader a distorted view of the relationship the graph is intended to show. Differences on the horizontal axis will look much larger than the same size differences on the vertical axis. If that happens, change the dimensions of the graph, to make the two axes the same length.

**Make sure the graphs in your report are large enough to be read easily.** The main purpose of using a graph is to present information in a way that makes it possible to see the important relationships quickly and easily. If the graphs in your report are too small, the labels will be difficult to read, and the graphs will not clearly show the relationships they are intended to show. If you reduce four pages of graphs to two pages, but the graphs are too small to read, you haven't saved two pages; you've wasted two pages!

**Keep the graphs simple, for clearer communication.** Resist the temptation to decorate your graphs with shadow effects, three-dimensional effects, etc. These kinds of decorations actually make the graphs less effective at communicating the information they are intended to communicate. Use shading only where it is meaningful. For example, there may be regions of a graph where no data are possible. You can use shading to indicate those regions.

### **Writing the Discussion Section**

The discussion section is the part of the report where you summarize the results of your study and relate them to the research questions your study was intended to answer.

**Return to the research questions.** A good way to begin the discussion section is to repeat the research questions, following each question with a brief description of the relevant results. For some of the research questions, your results may not clearly imply an answer. If that happens, explain why your results do not answer the question.

**Point out the limitations of your study.** It is unlikely that your study was so methodologically perfect, so complete, and so comprehensive as to provide the ultimate answer to each of the research questions. Most research studies can include only a few of the conditions worth investigating—different types of schools and students, different ways of measuring each variable, etc. It is not likely that the set of conditions included in your study was so large and diverse that you

can safely generalize the results to every situation that readers would want to know about. Let the readers know that you are aware of the shortcomings of your study as well as its strengths.

**Discuss possible alternative explanations for the results of your study.** These could include anything that might account for your results, *other* than the variables you investigated. After presenting each of these alternative explanations, you can explain why you think it is less plausible than your own explanation.

**Compare your research results to the results of other studies on the same topic.** Be sure to present these comparisons in a way that will be meaningful to a reader who does not know about those other studies.

**Conclude by explaining the importance of your study.** What are the practical implications of your results? Who can use the information your study provided?

**What about suggestions for further research?** Specific suggestions for research studies that someone might do as a follow-up to your study are always appropriate for the discussion section. But do *not* conclude your report with a general plea for more research on the same subject. If your readers have read more than one or two research reports, you can be fairly sure that they are tired of reading, “Clearly, more research is needed.”

### **The Abstract**

The abstract is the most important part of a research report (except possibly for the title). Many people who read the abstract will not read any other part of the report.

**Write the abstract last.** Although the abstract will be the first thing the readers read, it should be the last part of the report that you write.

**Establish priorities.** The abstract must be concise and clear. It does not need to be complete. When you write an abstract, you have to establish priorities for the information to include in it. First, what was the study about? What questions was it designed to answer? (To keep the abstract brief, you may have to include only the most important research questions.) Next, what type of study was it? (An experimental comparison, a longitudinal study, a cross-sectional comparison, etc.) What kinds of people participated, and how many of them? Finally, what were the most important findings?

**Keep it within the word limit.** Make sure your abstract is within the specified word limit. If it is slightly too long, you can probably eliminate a few words here and there, without making it

unclear or hard to read. If the abstract is more than a few words over the limit, you will have to take something out. You may have to leave out the less important results or some information about the research method. But first, take out any background information that is not absolutely necessary. The abstract is not the place for it.

### **Writing for Journals**

Writing a journal article is very different from writing a project report. Probably the most important difference is that you are writing for different people. *Never* take a portion of a project report and submit it, unaltered, to a journal.

**Who reads project reports?** Project reports tend to be read by people who have a particular interest in the project. Other people may read a project report if they are especially interested in the specific research questions investigated, but most of the readers are people involved in some way with the research or with the organization sponsoring the research. Consequently, project reports tend to contain a large amount of detail about the participants (and the organizations they represent), the measuring instruments, the results, and even the sponsorship of the project.

**Who reads journal articles?** Journal articles are published for a group of people who are much more diverse in their interests. The people who read a journal article tend to be much less interested in the specific participant populations and measuring instruments in the study, but much more interested in the extent to which the results will generalize to other populations and measuring instruments. Few journal readers will be interested enough to read through a detailed presentation of the results. What they want is an answer to the question, “What is especially interesting or important about this research?” If you are writing a paper that you hope to get published in a journal, write it with this type of reader in mind.

**Journal space is limited.** Conciseness is important. Journal editors will appreciate it if you minimize the number of tables and figures. A paper for a journal should include only those tables and figures that communicate the main results of the study. Any readers who want to see your results in greater detail can contact you and request them.

**Use the format specified by the journal you are writing for.** Journal editors want submitted papers to follow the journal’s specified format for headings, tables, figures, equations,

etc. That information is available on each journal's website, usually in the form of a reference to a particular style manual, with any exceptions noted specifically.

**Look at the journal.** The best way to know whether your report is appropriate for a particular journal is to look at several issues of the journal. Notice the content, style, and length of the articles. If the content of your report seems appropriate for a particular journal, but the style or length is noticeably different, rewrite the report before submitting it to that journal.

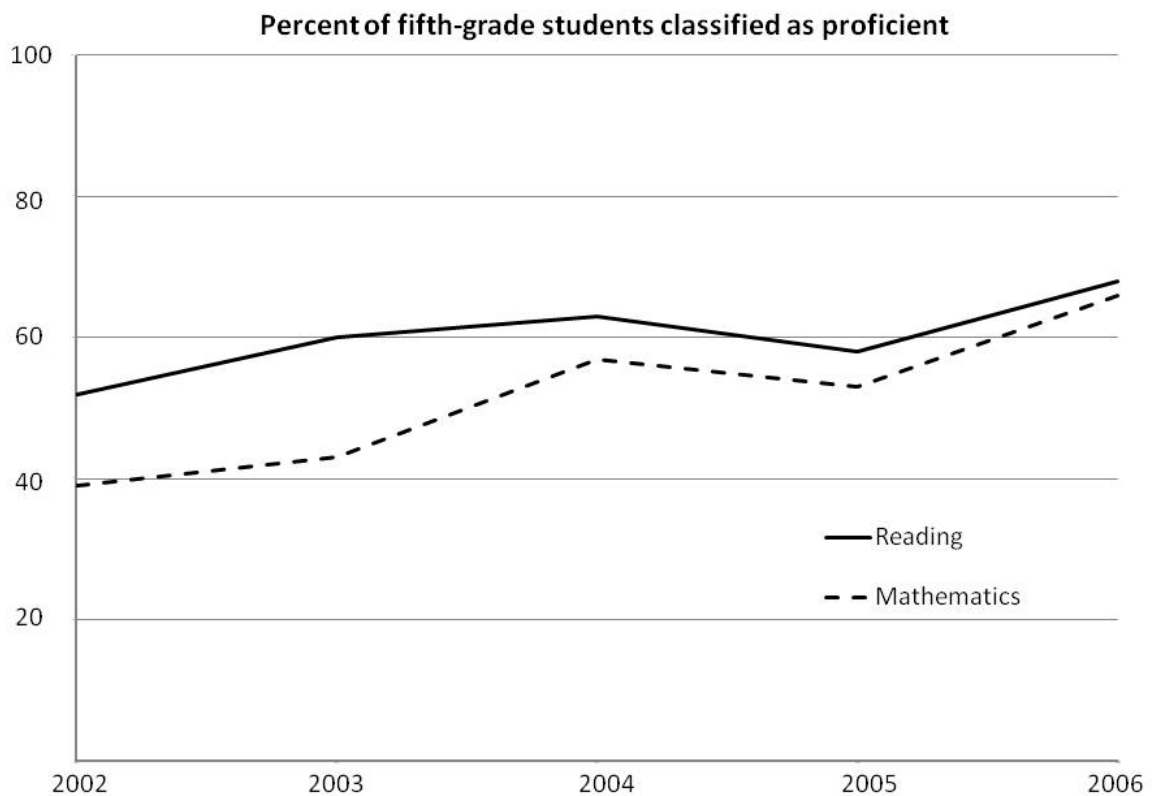
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- Nicol, A. A., & Pexman, P. M. (2009). *Presenting your findings* (6th ed.). Washington, DC: American Psychological Association.



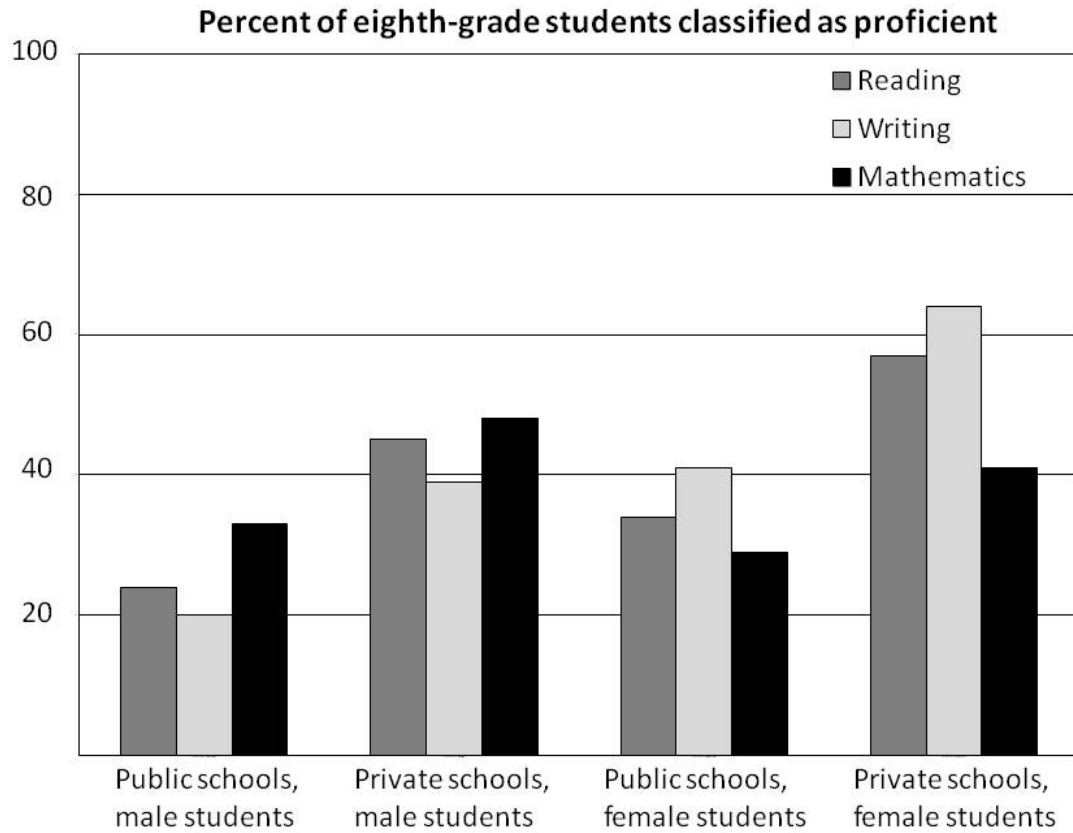
## Appendix Types of Graphs

A line graph (see Figure A1) shows one variable as a function of another. It is particularly useful for showing trends or changes over time, and also for showing how one variable (the  $y$ -variable) changes in response to changes in another variable (the  $x$ -variable). A line graph is appropriate when the  $x$ -variable is a measurement or a quantity. A line graph can also be appropriate when the levels of the  $x$ -variable are categories, if there is a meaningful ordering of those categories (for example, levels of education). If there is no meaningful ordering of the categories, it is better to use a different type of graph.



**Figure A1. A line graph.**

A bar graph (see Figure A2) is appropriate for comparing quantities (scores, averages, percentages, etc.) computed for discrete groups or categories, whether there is a logical ordering of the categories or not.



**Figure A2. A bar graph.**

A histogram is simply a vertical bar graph of a distribution of some variable, and it is usually the clearest way to show the distribution of a single variable. However, putting two or more histograms on the same graph is not a good idea; such a graph is usually unreadable. To compare two distributions, it is better to use horizontal bar graphs extending left and right from a vertical center line. Demographers use this type of graph to show the age distribution of a population, separately for males and females; they call it a “population pyramid.” (See Figure A3.)

### Score distributions for male and female test takers.

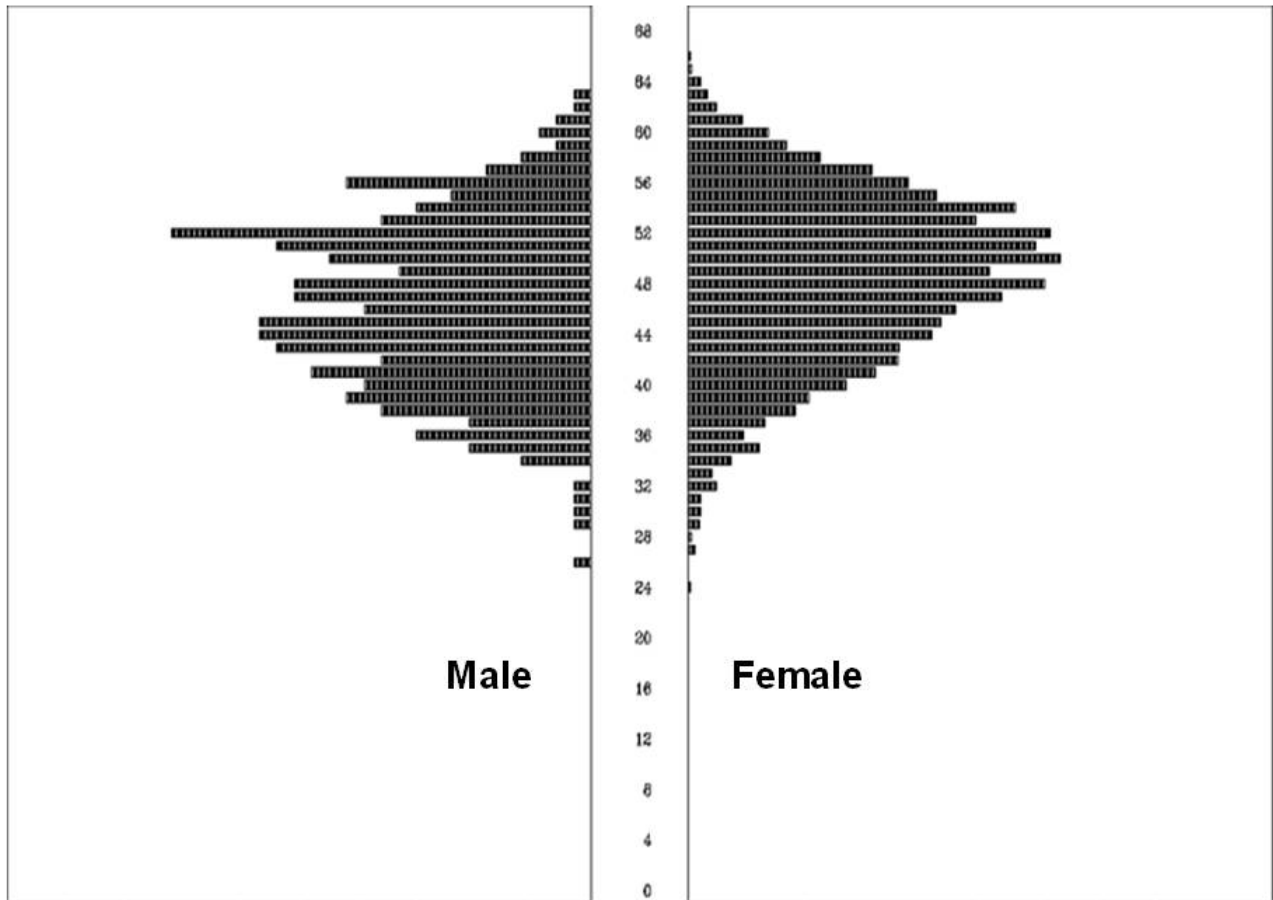
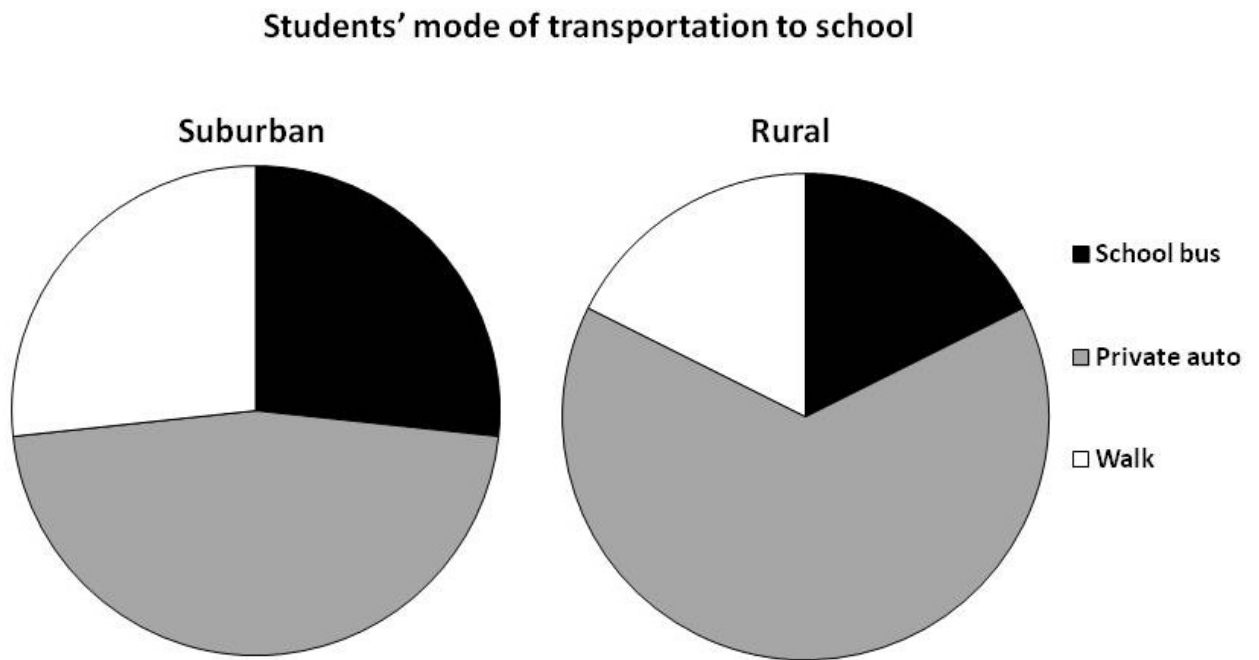


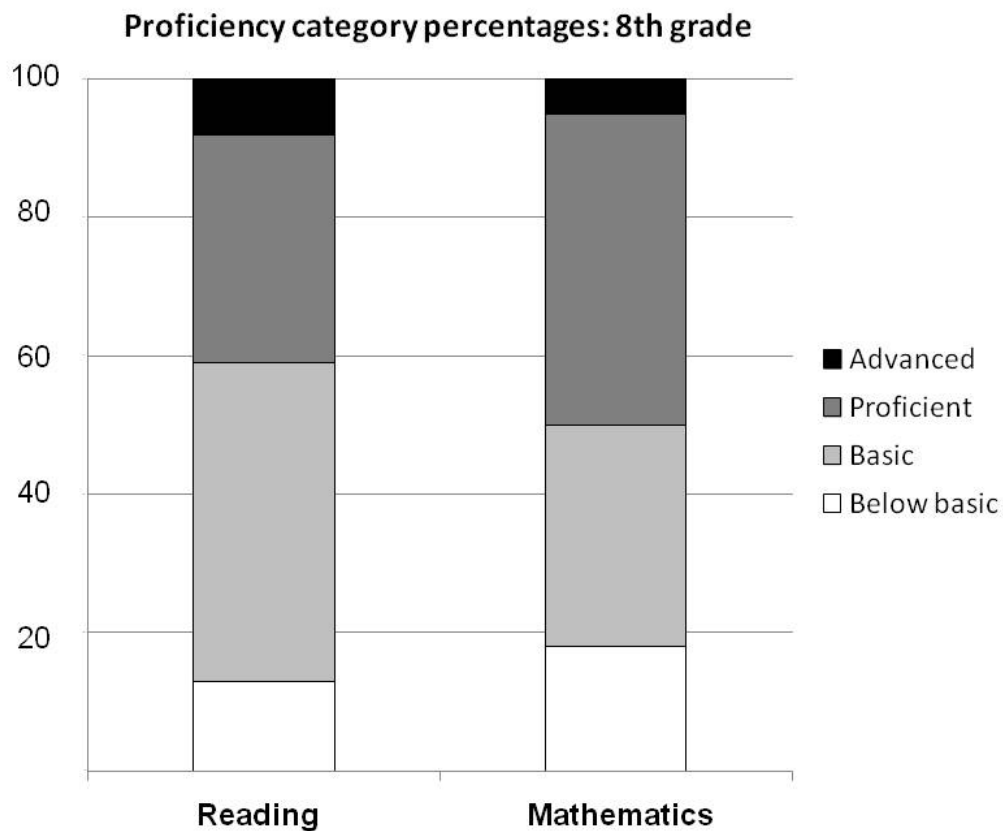
Figure A3. A “population pyramid” for comparing two distributions.

A circle graph, sometimes called a “pie chart,” (see Figure A4) is appropriate for showing percentages that must sum to 100%. A circle graph is easier to read if the number of categories (represented by sectors of the circle) is small. A circle graph is especially appropriate if the categories have no logical ordering. (If the categories have a logical ordering, it is better to use a stacked bar graph, described below.) Two circle graphs side by side can be an effective way to show differences between groups in their percentages for the same categories. If the groups differ in size, you can communicate that difference by making the area of each circle proportional to the size of the group.



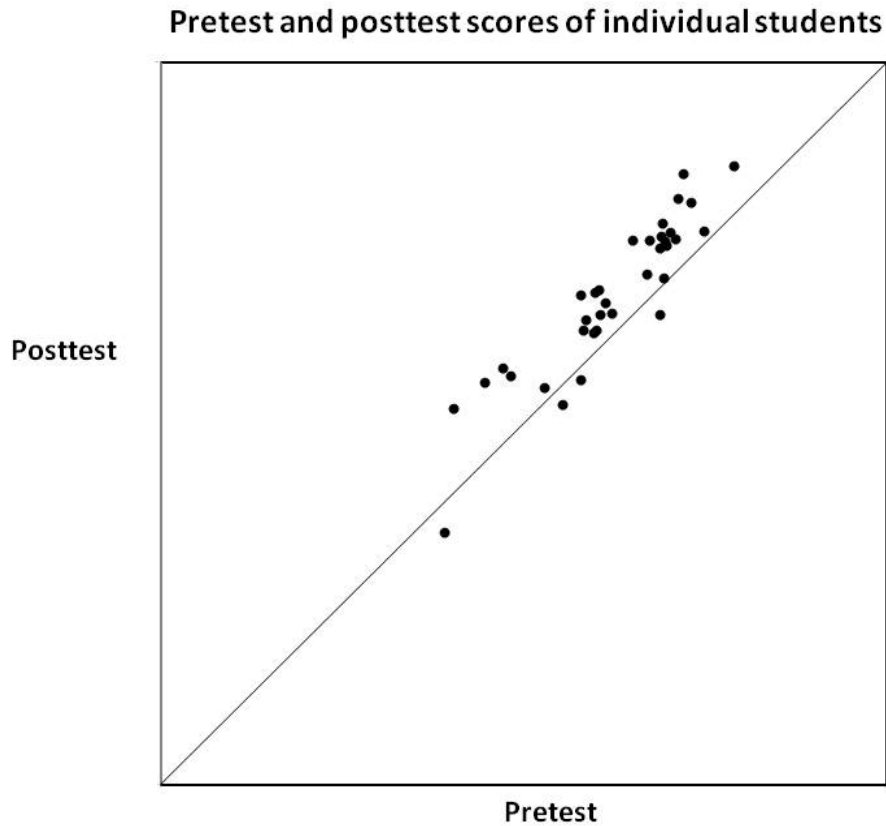
**Figure A4.** A circle graph.

A stacked bar graph (see Figure A5) is a bar graph in which the bars are divided into sections. Each bar represents a group (usually a group of people) that has been divided into categories. Stacked bar graphs work best for categories that have some kind of meaningful ordering (e.g., basic, proficient, advanced). The bar for each group is divided into sections corresponding to those categories, arranged in order (e.g., highest to lowest). The size of each section corresponds to the percentage of the group classified into the category it represents. The ordering of the sections makes it easy to compare both the percentages (e.g., the percentage of the group classified as basic) and the cumulative percentages (e.g., the percentage classified as basic or lower).



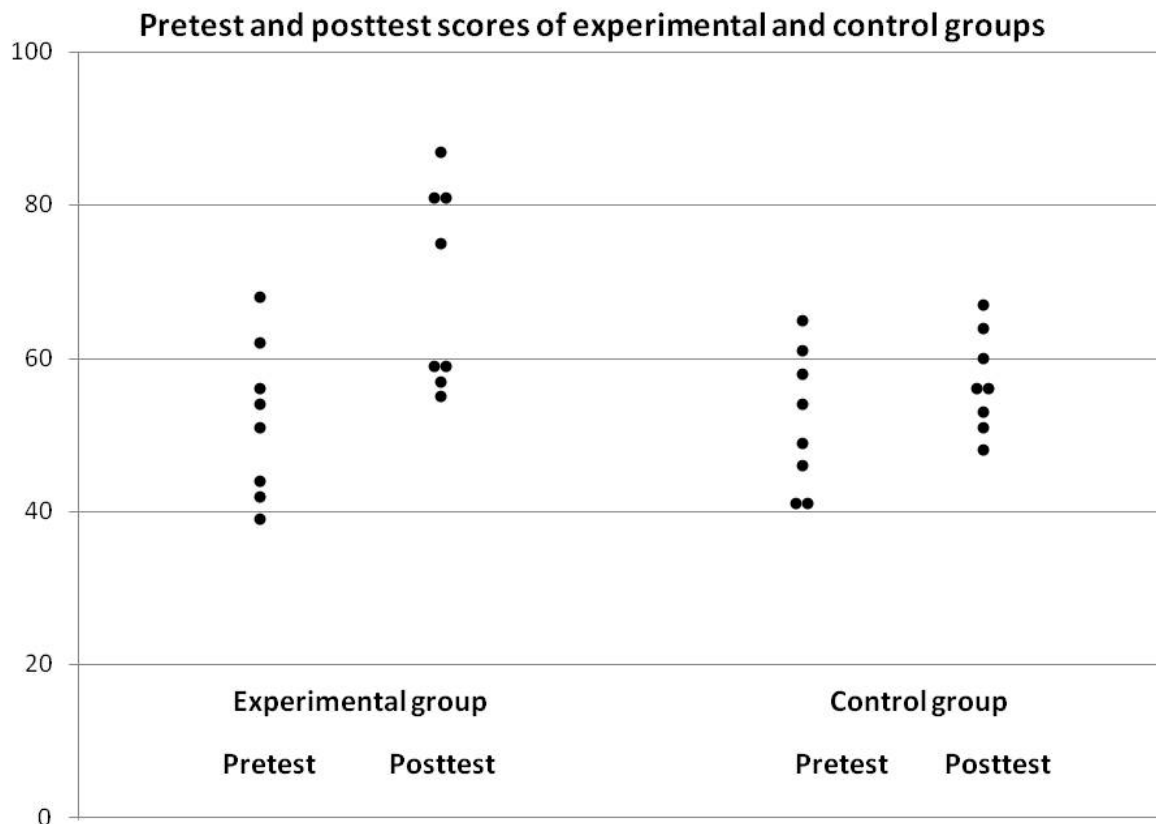
**Figure A5. Example of a stacked bar graph.**

A scatterplot, sometimes called an “XY plot” (See Figure A6), is a good way to show the joint distribution of two variables when there are many possible values of each variable. Each data point represents a single observation. The position of the point shows the values of the two variables. Scatterplots work well for both small and large numbers of observations (unless there are so many observations that the reader cannot see the individual data points).



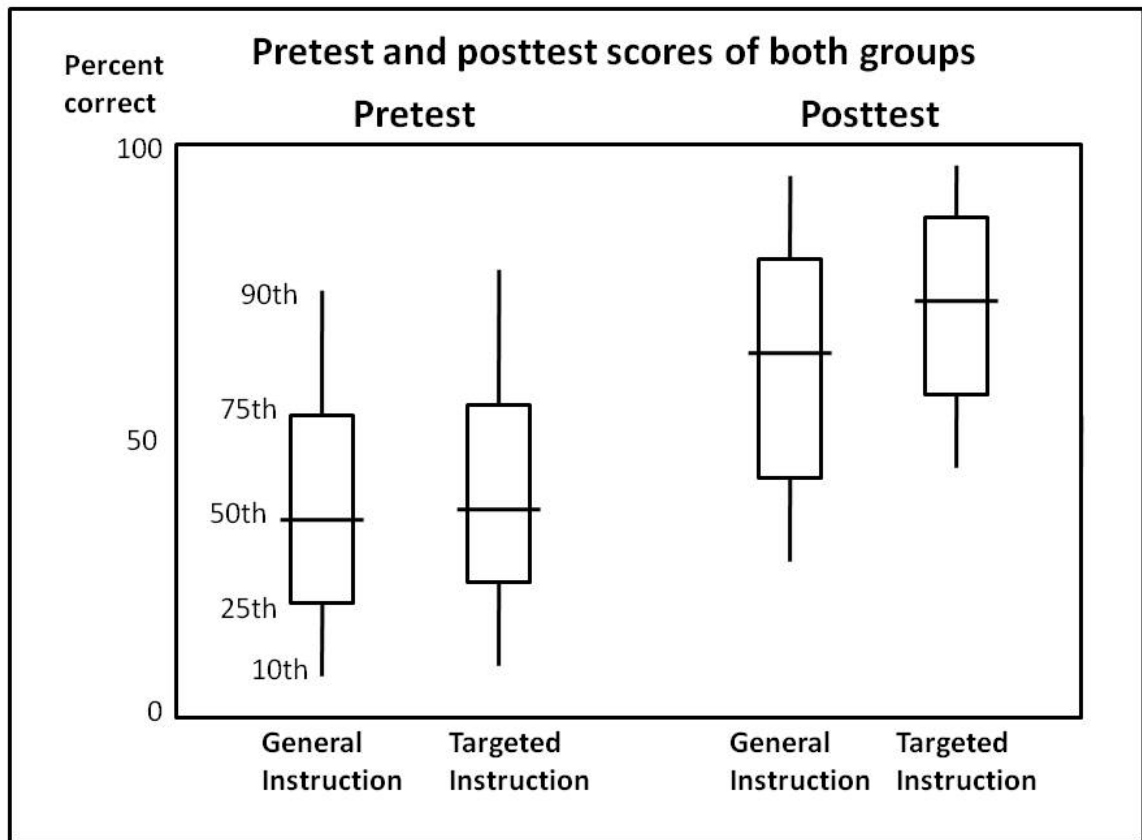
**Figure A6. A scatterplot.**

Plotting individual data points is also a good way to show two or more distributions in the same graph, when the number of observations in each distribution is small. (See Figure A7.) The distributions to be compared could be distributions of the same variable in different groups, or they could be distributions of different *but comparable* variables in the same group. You can make such a plot by creating a scatterplot in which one of the variables (usually the  $x$ -variable) simply identifies the distribution; for example,  $x = 1$  for the first distribution,  $x = 2$  for the second distribution, and so on. You can control the spacing in the graph by selecting the  $x$ -values; in Figure A7, the  $x$ -values of the four distributions are 1, 2, 4, and 5. If two or more observations in the same distribution have exactly the same  $y$ -value, make their  $x$ -values slightly different, so that all the data points will be visible on the graph. For example, if two observations in Group 1 have exactly the same  $y$ -value, you can change their  $x$ -values to 0.98 and 1.02.



**Figure A7.** A plot of individual data points for comparing distributions.

A box-and-whisker plot (see Figure A8) is a good way to compare two or more distributions when the number of observations in each distribution is too large to show individual data points. Again, the distributions to be compared could be distributions of the same variable in different groups, or they could be distributions of different *but comparable* variables in the same group. Each distribution is represented by a rectangular box extending from the 25th percentile to the 75th percentile, with a line crossing the box at the 50th percentile. The “whiskers” are lines extending from the ends of the box to the 10th and 90th percentiles. The height of the box shows the overall level of the scores. The length of the box and the whiskers show the variation within the distribution.



**Figure A8.** A box-and-whisker plot.



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