

**How to write a report of an empirical study.** [Adapted from "Chapter 1: Content and Organization of a Manuscript" in the Publication Manual of the American Psychological Association (4th ed.).]

Although scientific writing differs in form from literary writing, it need not and should not lack in style or be dull. In describing your research, present the ideas and findings directly and concisely. Use a cool-headed, professional, non-combative style. However, write in an interesting and compelling way that reflects your involvement with your research area.

A report of an empirical study typically includes

- a title page,
- an abstract,
- an introduction,
- a methods section,
- a results section,
- a discussion section,
- a reference list, and
- (perhaps) one or more appendices.

I will discuss each of these sections and their subsections below.

## **Title Page**

***Title.*** The title should summarize the main idea of the paper simply, and if possible, with style. It should be a concise statement of the main topic, and it should identify the actual variables or theoretical issues under investigation and the relationship between them. An example of a good title is "Effect of Transformed Letters on Reading Speed." A title should be fully explanatory when it is standing alone. Its primary function is to inform readers about the study. Avoid words that do not serve a useful purpose. For example, words such as *method* and *results* should not appear in the title, nor should redundant phrases such as "A Study of" or "An Experimental Investigation of". Do not use abbreviations. The recommended length of a title is 10 to 12 words.

***Author's name and institutional affiliation.*** The title page should also include a byline that consists of your name and the institution where the study was conducted (do not include the words *by* or *from the*). The preferred form of an author's name is first name, middle initial and last name. For purposes of this course, the institutional affiliation is Western Connecticut State University.

***Running head.*** The running head is an abbreviated title that a journal would print at the top of the pages of your article if published. The running head should be no more than 50 characters, including letters, punctuation, and spaces between words.

## Abstract

An abstract is a brief, comprehensive summary of the contents of an article; it allows a reader to survey the contents of your article quickly and efficiently. A well-prepared abstract can be the most important paragraph in your article.

An abstract should describe in 100 to 120 words:

- the problem under investigation, in one sentence if possible;
- the subjects, specifying pertinent characteristics, such as number, type, age, and sex;
- the experimental method, including the apparatus, data-gathering procedures, and complete test names;
- the findings; and
- the conclusions, implications, or applications.

The abstract must be dense with information. However, it must also be readable, well organized, brief, and self-contained. A good abstract is

- **accurate:** Ensure that the abstract correctly reflects the purpose and content of your project. Do not include information that does not appear in the body of the paper. If the study extends or replicates previous research, note this in the abstract, and cite the author and year.
- **self-contained:** Define all abbreviations (with the exception of units of measurement) and acronyms. Spell out names of tests. Define unique terms. Paraphrase rather than quote. Include the names of authors and dates of publication in citations of other publications and instruments (and give a full bibliographic citation in the article's reference list).
- **concise and specific:** Make each sentence as informative as possible, especially the lead sentence. Be as brief as possible. Abstracts should not exceed 960 characters and spaces, which is approximately 120 words. Begin the abstract with the most important information. Do not waste space by repeating the title. Include no more than four or five of your study's most important ideas, implications, or findings.

*Ways to conserve characters:*

- ⇒ Use digits for all numbers, except those that begin a sentence (consider recasting a sentence that begins with a number).
  - ⇒ Abbreviate liberally (e.g., use *vs.* for *versus*), although all abbreviations that need to be explained in the text must be explained on first use in the abstract.
  - ⇒ Use the active voice (but without the personal pronouns *I* or *we*).
- **nonevaluative:** Report rather than evaluate; do not add to or comment on what is in the body of the manuscript.

- **coherent and readable:** Write in clear and vigorous prose. Use verbs rather than the noun equivalents and the active rather than the passive voice. Use the present tense to describe results with continuing applicability or conclusions drawn; use the past tense to describe the specific variables manipulated or tests applied. Use the third person rather than the first person. Avoid "boilerplate" sentences that contain no information (e.g., "Policy implications are discussed" or "It is concluded that").

## Introduction

***Introduce the problem.*** The body of a paper opens with an introduction that presents the specific problem under investigation and describes the research strategy. Because the introduction is clearly identified by its position in the article, it is not labeled with the word "Introduction". Before writing the introduction consider

- What is the point of the study?
- How do the hypotheses and the experimental design relate to the problem?
- What are the theoretical implications of the study, and how does the study relate to previous work in the area?
- What are the theoretical propositions tested, and how were they derived?

A good introduction answers these questions in a paragraph or two. By summarizing the relevant arguments and data, the introduction gives the reader a firm sense of what was done and why.

***Develop the background.*** Discuss the available literature, but do not include an exhaustive historical review. Assume that the reader has some knowledge in the field, and does not require a complete digest. A scholarly review of earlier work provides an appropriate history and recognizes the priority of the work of others. Citation of and specific credit to relevant earlier works is part of the author's scientific and scholarly responsibility, and it is essential for the growth of a cumulative science. However, *cite and reference only works that are pertinent to the specific issue at hand.* Do not cite works of only tangential or general significance. If you summarize earlier research, avoid nonessential details. Emphasize only relevant methodological issues, pertinent findings, and major conclusions. Refer the reader to general surveys or reviews of the topic if available.

Demonstrate the logical continuity between previous and present work. Develop the problem with enough breadth and clarity to make it generally understood by as wide a professional audience as possible. Do not let the goal of brevity lead you to write a paper that only a specialist could read.

Controversial issues, when relevant, should be treated fairly. Whatever your personal opinion may be, avoid negativity or animosity in describing the controversy. Never try to support your position or justify your research by citing established authorities out of context. If the controversy is complex, a simple statement that certain studies support one conclusion and others support another conclusion is better than an extensive and inconclusive discussion.

**State the purpose and rationale.** After you introduce the problem and develop the background material, you will be in a position to describe what you did in the study. Briefly describe your study in the closing paragraphs of the introduction. Define the variables, and make a formal statement of your hypotheses. Answer the following questions in closing the introduction:

- What variables did I plan to manipulate?
- What results did I expect and why did I expect them?

The logic behind "Why did I expect them?" should be made explicit. Clearly develop the rationale for each hypothesis.

## Method

The Method section is a detailed description of how the study was conducted. Such a description enables a reader to evaluate the appropriateness of your methods and the reliability and validity of your results. It also permits an experienced investigator to replicate the study.

**Identify subsections.** Divide the Method section into the following three subsections: *Participants*, *Apparatus* (or *Materials*), and *Procedure*. If the design of the study is very complex, or the stimuli require a detailed description, additional subsections may be needed. However, include only the information that is essential to comprehend and replicate the study. Insufficient detail leaves the reader with questions; too much detail burdens the reader with irrelevant information.

**Participants.** Appropriate identification of research participants is critical, particularly for assessing results, making comparisons across groups, generalizing the findings, and making comparisons in replications, literature reviews, or secondary analyses. Describe the sample carefully. The sample should represent the population to which you wish to generalize your results (if not, explain why). Conclusions and interpretations should not go beyond what the sample permits. Report the procedures used for selecting and assigning participants, and report whether or not participants were compensated, e.g., in terms of course credit or money. Report major demographic characteristics, such as sex and age. When a particular demographic characteristic is a variable in the study, or is important for interpreting the results, it may be necessary to be more specific--for example, by reporting variables such as racial and ethnic designation, national origin, level of education, health status, and so on. Give the total number of participants who participated in the study, and the number assigned to each experimental condition. If any participants failed to complete the experiment, state how many and the reason why these participants did not continue. Include a statement to the effect that the treatment of the participants in your study complied with the ethical standards of the American Psychological Association (unethical projects are not acceptable).

**Apparatus.** This subsection briefly describes the apparatus or materials used and their function in the experiment. Standard laboratory equipment, such as furniture, pencils, ordinary personal computers, lamps, or stopwatches can usually be mentioned without details. However, specialized equipment obtained from a commercial supplier should be identified by including the equipment's model number, and the supplier's name and location. Any professional personality inventories or surveys used in the study should be described in terms of the psychological construct(s) they were designed to measure, the number and type of questions they consist of, the type of response scale they use, and so on. Cite the author of the test and the year the test was published, and indicate the source by which you obtained the instrument. Convince the reader of the reliability and validity of the instruments you used.

**Procedure.** This subsection summarizes each step in the execution of the research. The Procedure section should tell the reader

- *what* you did, and
- *how* you did it,
- in sufficient detail so that a reader could reasonably replicate your study.

Include a discussion of the instructions you gave to participants, and of how the groups were formed, and describe the specific experimental manipulations. Describe randomization, counterbalancing, and any other control features used in your design. Usually, it is sufficient to paraphrase the instructions. However, if instructions were an experimental manipulation in your study, or if they are known to influence participants responses in the paradigm you used, the instructions should be presented exactly as they were in the study. State how long it took participants to complete your study.

## Results

The results section summarizes the data collected and the statistical treatment of them ("data" is plural for "datum," so the last word in this sentence is "them" not "it"). First, state the main results or findings. Then report the data in sufficient detail to justify the conclusions. It is not appropriate to discuss the implications of the results in the results section. Mention only relevant results, but include those that contradict the hypothesis. Do not include individual scores or raw data, unless you have a single-case designs, or you want to show an illustrative sample.

**Tables and figures.** To report the data, choose the medium that presents them clearly and economically. Tables provide exact values and they can illustrate means, standard deviations, and main effects. High quality figures attract the reader's eye, and illustrate interactions and comparisons directly. Summarizing results in tables or figures instead of in text might be helpful; for example, a table can enhance the readability of analysis of variance results. Avoid repeating the same data in several places and using tables for data that can be easily presented in a few sentences in the text. When you use tables or figures, make sure to mention them in the text. Refer to tables as *tables* and to graphs, pictures, or drawings as *figures*. Tables and figures supplement the text; they cannot do the entire job of

communication. Always tell the reader what to look for in tables and figures, and provide sufficient explanation to make them readily intelligible.

**Statistical presentation.** When reporting inferential statistics (e.g.,  $t$  tests,  $F$  tests, and chi-square), include information about (a) the obtained magnitude or value of the test, (b) the degrees of freedom, (c) the probability level, and (d) the direction of the effect. Include all relevant descriptive statistics, such as means, medians, and/or modes, and standard deviations, ranges, and/or semi-interquartile ranges. Assume your reader has a professional knowledge of statistics. Basic statistical procedures, such as the process of rejecting the null hypothesis, or how to calculate  $t$  or  $F$ , should not be reviewed in the results section. However, if there are technical questions about the appropriateness of a particular statistical test (e.g., Do the data meet the assumptions of the  $t$  test?), be sure to justify the use of that test.

**Sufficient statistics.** When reporting inferential statistics include sufficient information to help the reader corroborate the analyses conducted. For example, if your study is a single-group design, multiple-group design, or factorial design, include cell means, cell sample sizes, and a measure of variability (e.g., cell standard deviations). If your study is a correlational design, include the sample size, variances, and covariances of the variables, along with other information specific to the procedure used (e.g., the means of the variables, reliabilities, regression coefficients, standard errors, and so on). If you use nonparametric statistics (e.g., chi-square or rank-order statistics), summaries of the raw data should be included (e.g., the number of cases in each category, the sum of the ranks, and sample sizes in each cell). If your study has an extremely small sample size, consider providing the complete data in a table or figure.

**Statistical power.** Statistical power involves the likelihood of correctly rejecting the hypotheses, given a particular *alpha level*, *effect size*, *sample size*, and *variance*. You should show that your study has sufficient statistical power. A common error involves arguing that there are no differences, when the problem is a lack of power.

**Statistical significance.** Two types of probabilities associated with the significance of inferential statistical tests are reported. One, called the *alpha level* or the probability of a Type I error, is the *a priori* probability of rejecting a null hypothesis, *given that the null hypothesis is true*. The most commonly used alpha levels are .05 and .01. Before you report specific results, you should routinely state the alpha level you selected for the statistical tests you conducted, e.g.,

An alpha level of .05 was used for all statistical tests.

If you do not make a general statement about the alpha level, specify the alpha level when reporting each result.

The other kind of probability refers to the *a posteriori* likelihood of obtaining a result that is as extreme or more extreme than the actual value of the statistic you obtained, *assuming that the null hypothesis is true*. For example, if the null hypothesis is true, the probability of obtaining the particular value of the statistic you computed might be  $p = .008$ . Most statistics

packages now provide these exact values. You can report the value of  $p$  in addition to specifying whether you rejected or failed to reject the null hypothesis at the specified alpha level, e.g.,

With an alpha level of .05, the effect of age was statistically significant,  $F(1, 123) = 7.27$ ,  $p = .008$ .

*or*

The effect of age was not statistically significant,  $F(1, 123) = 2.45$ ,  $p = .12$ .

The second example should be used only if you have included a general statement about the alpha level earlier in your article.

If your statistical package does not provide information concerning the exact value of  $p$ , you can report the commonly used probability value that is nearest to it:

With an alpha level of .05, the effect of age was statistically significant,  $F(1, 123) = 7.27$ ,  $p < .01$ .

*or*

The effect of age was not statistically significant at the .05 alpha level,  $F(1, 123) = 2.45$ ,  $p > .05$ .

***Effect size and strength of relationship.*** You should provide information about the importance of an effect (i.e., its magnitude). Neither of the two types of probability values discussed above reflects the size or magnitude of an effect, or the strength of a relationship. This is because both probability values depend on the sample size. You can estimate the magnitude of an effect or the strength of a relationship with a number of measures that do not depend on sample size. Common measures are  $r^2$ ,  $\eta^2$ ,  $\omega^2$ ,  $R^2$ , and  $\phi^2$ . For example, for analysis of variance results,  $\eta^2$  can be calculated as follows:

$$\eta^2 = \frac{v_1 F}{v_1 F + v_2}$$

where  $v_1$  is the between groups degrees of freedom, and  $v_2$  is the within groups degrees of freedom.

## **Discussion**

After presenting the results, you are in a position to evaluate and interpret their implications, especially with respect to your original hypothesis. You are free to examine, interpret, and qualify the results, as well as to draw inferences from them. Emphasize theoretical

consequences of the results and the validity of your conclusions. (When the discussion is relatively brief and straightforward, some authors prefer to combine it with the previous results section, yielding Results and Conclusions or Results and Discussion.)

Open the discussion with a clear statement of the support or nonsupport for your original hypothesis. Similarities and differences between your results and the work of others should clarify and confirm your conclusions. Do not simply reformulate and repeat points that you already made; each new statement should contribute to your position and to the reader's understanding of the problem. You may remark on the most important shortcomings of the study, but do not dwell on every flaw. Negative results should be accepted as such without an undue attempt to explain them away.

## **References**

All citations in the paper must appear in the reference list, and all references must be cited in text. Provide sufficient references to support your research. Choose references judiciously, and cite them accurately. Whenever possible, support your statements by citing empirical work, such as the method and results of an empirical study or a review of empirical studies. If you cite nonempirical work, make this clear in your narrative:

Cho (1991) theorized that . . .  
Audeh (1997) argued that . . .  
. . . (see discussion in Ginsberg, 1993)

Similarly, when you want to direct the reader to background information, signal the reader with phrases such as "for a review, see . . ." and ". . . (e.g., see [author, year])."

## **Appendices**

An appendix is helpful when the detailed description of certain material (e.g., a complex mathematical proof) is distracting in the body of the paper. Include an appendix only if it helps readers to understand, evaluate, or replicate the study.

The following checklist might help you assess the quality of your paper.

- Is the introduction clear and complete?
- Does the statement of purpose adequately and logically orient the reader?
- Is the literature adequately reviewed?
- Are the citations appropriate and complete?
- Is the research question clearly identified, and is the hypothesis explicit?
- Are the conceptualization and rationale perfectly clear?
- Is the method clearly and adequately described? Can the study be replicated from the description provided in the paper?
- If observers were used to assess variables, is the inter-observer reliability reported?
- Are the techniques of data analysis appropriate, and is the analysis clear? Are the assumptions underlying the statistical procedures clearly met by the data to which they are applied?
- Are the results and conclusions unambiguous, valid, and meaningful?
- Is the discussion thorough? Does it stick to the point and confine itself to what can be concluded from the significant findings of the study?
- Is the paper concise?
- Is the manuscript prepared according to APA style?