Scientific writing and Results writing

1. Scientific writing

Writing style guides

Publication of research results is the global measure used by all disciplines to gauge a scientist's level of success. Different fields have different conventions for writing style, and individual journals within a field usually have their own style guides. Some issues of scientific writing style include:

- Some style guides for scientific writing recommend against use of the passive voice, while some encourage it.
- Some journals prefer using "we" rather than "I" as personal pronoun or a first-person pronoun. The word "we" can sometimes include the reader. The acceptability of passive voice in scientific writing is inconsistent. It is not always wanted, but is sometimes encouraged. One reason that passive voice is used in scientific writing is that it is beneficial in avoiding first-person pronouns, which are not formally accepted in science. It can be hard to make claims in active voice, that is, without the words, I" and "we". The reason that passive voice is sometimes discouraged is that it can be confusing, unless used carefully.

These two simplistic "rules" are not sufficient for effective scientific writing. In practice, scientific writing is much more complex and shifts of tense and person reflect subtle changes in the section of the scientific journal article. Additionally, the use of passive voice allows the writer to focus on the subject being studied (the focus of the communication in science) rather than the author. Similarly, some use of first-person pronouns is acceptable (such as "we" or "I," which depends on the number of authors). The best thing to do is to look at recent examples of published articles in the field.

Scientific report

The stages of the *scientific method* are often incorporated into sections of scientific reports. The first section is typically the *abstract*, followed by the *introduction*, *methods*, *results*, *conclusions*, and *acknowledgments*. The introduction discusses the issue studied and discloses the hypothesis tested in the experiment. The step-by-step procedure, notable observations, and relevant data collected are all included in methods and results. The discussion section consists of the author's analysis and interpretations of the data. Additionally, the author may choose to discuss any discrepancies with the experiment that could have altered the results. The conclusion summarizes the experiment and will make inferences about the outcomes. The paper will typically end with an acknowledgments section, giving proper attribution to any other contributors besides the main author(s). In order to get published, papers must go through peer review by experts with significant knowledge in the field. During this process, papers may get rejected or edited with adequate justification.

Scientific literature comprises scholarly publications that report original empirical and theoretical work in the natural and social sciences. Within an academic field, scientific literature is often referred to as **the literature**. Academic publishing is the process of contributing the results of one's research into the literature, which often requires a peer-review process. Original scientific research published for the first time in scientific journals is called the primary literature. Patents and technical reports, for minor research results and engineering and design work (including computer software), can also be considered primary literature. Secondary sources include review articles (which summarize the findings of published studies to highlight advances and new lines of research) and books (for large projects or broad arguments, including compilations of articles). Tertiary sources might include encyclopedias and similar works intended for broad public consumption.

Types of scientific publications

Scientific literature can include the following kinds of publications:[1]

- Scientific articles published in scientific journals
- Patents in the relevant subject (for example, biological patents and chemical patents)
- Books wholly written by one author or a few co-authors
- Edited volumes, where each chapter is the responsibility of a different author or group of authors, while the editor is responsible for determining the scope of the project, keeping the work on schedule, and ensuring consistency of style and content
- presentations at academic conferences, especially those organized by learned societies
- Government reports such as a forensic investigation conducted by a government agency.
- Scientific publications on the World Wide Web (although e.g. scientific journals are now commonly published on the web)
- Books, technical reports, pamphlets, and working papers issued by individual researchers or research organizations on their own initiative; these are sometimes organized into a series.

Literature may also be published in areas considered to be "grey", as they are published outside of traditional channels. This material is customarily not indexed by major databases and can include manuals, theses and dissertations, or newsletters and bulletins. The significance of different types of the scientific publications can vary between disciplines and change over time.

Scientific papers and articles

Scientific papers have been categorised into ten types. Eight of these carry specific objectives, while the other two can vary depending on the style and the intended goal.

Papers that carry specific objectives are:

- **An original article** provides new information from original research supported by evidence.
- **Case reports** are unique events that researchers read to obtain information on the subject.
- A **technical note** is a description of a technique or piece of equipment that has been modified from an existing one to be new and more effective.
- A **pictorial essay** is a series of high-quality images published for teaching purposes.
- A **review** is a detailed analysis of recent developments on a topic.
- A **commentary** is a short summary of an author's personal experience.
- **Editorials** are short reviews or critiques of original articles.
- **Letters to the editor** are communications directed to the editor of an article to ask questions and provide constructive criticism.

The following two categories are variable, including for example historical articles and speeches:

- "**Nonscientific material**" This type of material comes from the result of an article being published. It does not advance an article scientifically but instead contributes to its reputation as a scientific article.
- "**Other**": Other types of papers not listed under non-scientific material or in any of the above eight categories. They can vary depending on the objective and style of the article.

Scientific article

Preparation

The actual day-to-day records of scientific information are kept in research notebooks or logbooks. These are usually kept indefinitely as the basic evidence of the work, and are often kept in duplicate, signed, notarized, and archived. The purpose is to preserve the evidence for scientific priority, and in particular for priority for obtaining patents. They have also been used in scientific disputes. Since the availability of computers, the notebooks in some data-intensive fields have been kept as database records, and appropriate software is commercially available. The work on a project is typically published as one or more technical reports, or articles. In some fields both are used, with preliminary reports, working papers, or preprints followed by a formal article. Articles are usually prepared at the end of a project, or at the end of components of a particularly large one. In preparing such an article vigorous rules for scientific writing have to be followed.

Language

Often, career advancement depends upon publishing in high-impact journals, which, especially in hard and applied sciences, are usually published in English. Consequently, scientists with poor English writing skills are at a disadvantage when trying to publish in

these journals, regardless of the quality of the scientific study itself. Yet many international universities require publication in these high-impact journals by both their students and faculty. One way that some international authors are beginning to overcome this problem is by contracting with freelance medical copy editors who are native speakers of English and specialize in ESL (English as a second language) editing to polish their manuscripts' English to a level that high-impact journals will accept.

Structure and style

Although the content of an article is more important than the format, it is customary for scientific articles to follow a standard structure, which varies only slightly in different subjects. Although the IMRAD (Introduction, Methods, Results, and Discussion) structure emphasizes the organization of content, and in scientific journal articles, each section (Introduction, Methods, Results, and Discussion) has unique conventions for scientific writing style. The following are key guidelines for formatting, although each journal etc will to some extent have its own house style:

- The **title** attracts readers' attention and informs them about the contents of the article. Titles are distinguished into three main types: declarative titles (state the main conclusion), descriptive titles (describe a paper's content), and interrogative titles (challenge readers with a question that is answered in the text). Some journals indicate, in their instructions to authors, the type (and length) of permitted titles.
- The names and affiliations of all **authors** are given. In the wake of some scientific misconduct cases, publishers often require that all co-authors know and agree on the content of the article.
- An **abstract** summarizes the work (in a single paragraph or in several short paragraphs) and is intended to represent the article in bibliographic databases and to furnish subject metadata for indexing services.
- The **context** of previous scientific investigations should be presented, by citation of relevant documents in the existing literature, usually in a section called an "Introduction".
- **Empirical techniques**, laid out in a section usually called "Materials and Methods", should be described in such a way that a subsequent scientist, with appropriate knowledge of and experience in the relevant field, should be able to repeat the observations and know whether he or she has obtained the same result. This naturally varies between subjects, and does not apply to mathematics and related subjects.
- Similarly, the **results** of the investigation, in a section usually called "Results", should be presented in tabular or graphic form (image, chart, schematic, diagram or drawing). These display elements should be accompanied by a caption and should be discussed in the text of the article.
- **Interpretation** of the meaning of the results is usually addressed in a "Discussion" or "Conclusions" section. The conclusions drawn should be based on the new empirical results while taking established knowledge into consideration, in such a way that any reader with knowledge of the field can follow the argument and confirm that the

conclusions are sound. That is, acceptance of the conclusions must not depend on personal authority, rhetorical skill, or faith.
- Finally, a "References" or "Literature Cited" section lists the **sources** cited by the authors.

Ethics

The transfer of copyright from author to publisher, used by some journals, can be controversial because many authors want to propagate their ideas more widely and re-use their material elsewhere without the need for permission. Usually, an author or authors circumvent that problem by rewriting an article and using other pictures. Some publishers may also want publicity for their journal so will approve facsimile reproduction unconditionally; other publishers are more resistant.

In terms of research publications, a number of key issues include and are not restricted to:

- Honesty. Honesty and integrity is a duty of each author and person, expert-reviewer and member of journal editorial boards.
- Review process. The peer-review process contributes to the quality control and it is an essential step to ascertain the standing and originality of the research.
    - Redundant Publications. Publications that contain copyrighted and new unpublished material.
    - Data Fabrications. Is the process of purposefully changing data to make the information more in the favour of the author?
- Ethical standards. Recent journal editorials presented some experience of unscrupulous activities.
- Authorship. Who may claim a right to authorship? In which order should the authors be listed?
    - Conflicts of Interests. This is referring to the biased assumption due to private interest. It can be done knowingly or not. This is unethical because it makes data inaccurate.
    - Authors Disputes. The authorship of an article is simply the author of the article. The ethical issue with this is when there are two people that believe to be the author, but there is only one true author. There are guidelines to help pick which get authorship of the writing. The one that does not get authorship is put in the acknowledgments.

2. Result writing

What is the Results section and what does it do?

The Results section of a scientific research paper represents the core findings of a study derived from the methods applied to gather and analyze information. It presents these

findings in a logical sequence without bias or interpretation from the author, setting up the reader for later interpretation and evaluation in the Discussion section. A major purpose of the Results section is to break down the data into sentences that show its significance to the research question(s). The Results section appears third in the section sequence in most scientific papers. It follows the presentation of the Methods and Materials and is presented before the Discussion section—although the Results and Discussion are presented together in many journals. This section answers the basic question "What did you find in your research?"

What is included in the Results?

The Results section should include the findings of your study and ONLY the findings of your study. The findings include:

- Data presented in tables, charts, graphs, and other figures (may be placed among research text or on a separate page)
- A contextual analysis of this data explaining its meaning in sentence form
- Report on data collection, recruitment, and/or participants
- Data that corresponds to the central research question(s)
- Secondary findings (secondary outcomes, subgroup analyses, etc.)

If the scope of the study is broad or has many variables, or if the methodology used yields a wide range of different results, the author should state only those results that are most relevant to the research question stated in the Introduction section. As a general rule, any information that does not present the direct findings or outcome of the study should be left out of this section.

How are the results organized?

The best way to organize your Results section is "logically." One logical and clear method of organizing the results is to provide them alongside the research questions—within each research question, present the type of data that addresses that research question.

Captioning and Referencing Tables and Figures

As the hard data yielded by your study, tables and figures are central components of your Results section. Therefore, it is crucial to know how to caption the figures and refer to them within the text of the Results section. The most important advice one can give here as well as throughout the paper is to check the requirements and standards of the journal to which you are submitting your work. Every journal has its own design and layout standards; perusing a journal's articles will give you an idea of the proper number, size, and complexity of your figures. Regardless of which format you use, the figures should be placed in the order they are referenced in the Results section and be as clear and easy to understand as possible. If there are multiple variables being considered (within one or more research questions), it can be a good idea to split these up into separate figures. Subsequently, these can be referenced and analysed under separate headings and paragraphs in the text.

Steps for Composing the Results Section

Because each study is unique, there is no one-size-fits-all approach when it comes to designing a strategy for structuring and writing the section of a research paper where findings are presented. The content and layout of this section will be determined by the specific area of research, the design of the study and its particular methodologies, and the guidelines of the target journal and its editors. However, the following steps can be used to compose the results of most scientific research studies and are essential for researchers who are new to preparing a manuscript for publication or who need a reminder of how to construct the Results section.

Reference

The Science of Scientific Writing by George D. Gopen and Judith A. Swan (1990)

Scientific writing by Ken Hyland

From Research to Manuscript: A Guide to Scientific Writing By Michael Jay Katz

The making of meaning : metaphors, models, and maxims for writing teachers by Ann E. Berthoff