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Published on *IVT Network* (http://www.ivtnetwork.com)

Critical Thinking #4: Presenting Scientific Data Clearly and With Purpose

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Mar 10, 2022 8:00 am EST

INTRODUCTION

In science and technology, we need to use written communication in order to record what has happened; to review previous events; to plan project developments; and to create a complete picture. In doing so, the author may seek to inform others about facts, findings, and decisions or to theorize to enable the discussion of ideas. There may also be a desire to persuade and convince or possibly to justify past, present, or future activities.
This article looks at some best practice points concerning the presentation of data in terms of a report. Reports are often supplemented by tables, charts, or through the use of figures. Data needs to be presented well in order to make a reasoned argument and hence the report plays an important role in the critical thinking approach.
This article is associated with three others in the series:

1. Critical Thinking #1: Why Pharmaceuticals and Healthcare Needs More Critical Thinkers: https://www.ivtnetwork.com/article/critical-thinking-1-why-pharmaceuticals-and-healthcare-needs-more-critical-thinkers
2. Critical Thinking #2: Reading Research Papers: https://www.ivtnetwork.com/article/critical-thinking-2-reading-research-papers
3. Critical Thinking #3: Developing Questions to Achieve the Optimal Outcome: https://www.ivtnetwork.com/article/critical-thinking-3-developing-questions-achieve-optimal-outcome

OBSERVANT READING

When examining a text to determine if it is suitable for issuing, the following questions can prove useful in deciding whether the document is ready for release or whether further review and editing is required (1):

- Does the first sentence entice the reader to continue reading?
- Do the ideas follow each other logically?
- Does the text flow easily?
- Is the overall message clear?
- Is the document aimed appropriately for the intended readership?

PRESENTING DATA

When presenting data, either in a document or as a presentation, the following should be considered:

- What is the message?

- Which form of presentation is the clearest? (Such as charts compared with tables or text)
- Which form is the easiest to produce?

It is additionally important to check:

- If data is presented in both a table and a chart, to ensure the data is consistent.
- When plotting data, ensure the scale is appropriate; that all axes are labelled; and that each set of data has a key
- When describing a table or a figure, does the text complement the presented table?

DOCUMENTING DATA

In terms of putting data together, as a written communication, the oft repeated scholastic lessons of 'beginning,' 'middle' and 'end' apply (2). In other words:

Beginning

A short introduction, providing the necessary background, the reason for the communication and the core finding. As well as 'setting the scene,' the introduction should engage the reader and provide a reason to read on.

Main Body (Or Middle)

This will always be the longest part of any report. It is recommended that the body is divided into sections using headings and, where necessary, subheadings. Ideally each heading contains a key point. Where key points are long or complicated, breaking these down into bullet points assists with the clarity of the presentation.

Further good practices involve presenting facts and arguments in a logical order, making each point separately and building up the total picture. Providing a summary at the end is also useful and allows the reader to recap. Where a longer report is required, a good document will periodically sign-post where the paper leads.

End

The end will either be summary or a conclusion. Where arguments have been made or conflicting views have been contrasted, a conclusion is necessary. Where further activity is required, each recommended action should be stated. An effective conclusion will link the points made with the statement made in the introduction.

WRITING PROTOCOLS

When preparing protocols (or project briefs), the following should be considered:

Planning

- What is needed?
- Why is it needed?
- How will the project be approached?
- When should the project start?
- Where should the project start?
- How long will the project take?
- When will the project be delivered?
- When can the final report be expected?

Motivation

If the aim is to convince others that the project is worthy of executing, the text should be sufficiently clear as to why the project is a good idea. This may also need to include sufficient detail of the cost and resources.

WRITING UP EXPERIMENTS

For experimental data, the format will be similar, although the main body section will comprise of materials and methods and a presentation of the results (3).

Another way of thinking about the flow within the document for an experimental write-up is:

- *Why did you start?* (the introduction, placing the study in context)
- *What did you do?* (materials and methods)
    - The level of detail should be sufficient for the study to be repeated by the reader.
    - The reader should be able to assess whether the study design was valid.
    - The methodology should be easy to follow.
    - Standard techniques (such as those stated within pharmacopeia) can be referenced, rather than described in full.
    - To keep this section concise, unnecessary details should be omitted.
    - No results should appear within the materials and methods section.
- *What did you find?* (results)
    - Before writing up the results:
        - Review the data.
        - Assess what will be the major findings.
        - Think about the message that needs to be conveyed.

        - Make sure the order will be logical.
        - Figure out the means of presentation.
- *What does it mean?* (discussion)
    - o
      For the discussion:

        - Consider the key points in turn.
        - Interpret each of the key points ('the findings').
        - Acknowledge any study limitations.
        - State what should be performed next, in terms of further research.
- *Return to the study objectives* (conclusion).

Generally, experimental write-ups should be brief. Where elaboration is required, the discussion is the best place to expand upon the text.

USE OF TABLES

Where tables are used in the main body of the document, some useful pointers are (4):

- Compare across columns (not down rows).
- Avoid blank spaces or dashes (use '0' or 'N/A'),
- Use actual figures.
- Do not put units in the main body of the table (place units in column headings).
- Ensure the table has a title.
- When tables begin to appear complicated, consider:
    - The use of two tables.
    - Replacing a table with a figure.

Avoid unnecessary tables and figures, it is always worth asking:

- Do they aid understanding by the reader?
- Are they all necessary?
- Does each figure or table save or waste space?
- Is the table unnecessarily repeating information conveyed in the text?
- Is the table comprehensible?
- Is the point being made obvious?

Often, judicious editing can reduce the length of the first draft of a repot down by 20%. However, in reducing the length it is important to ensure that the message remains clear, and the findings are not open to misinterpretation.

EFFECTIVE WRITING

There are various aspects to consider when developing effective writing, including punctuation, structure, and style.

Punctuation And Structure

For effective writing, excessively long sentences should be avoided and, where absolutely necessary, they should appear sparingly and be broken by the use of the semi-colon (the semi-colon is an effective way to link two independent, but closely related clauses; stylistically, the semi-colon can help avoid repetition). Ideally most sentences are 'short,' that is typically formed of between 5 and 20 words. Writing that flow well will contain sentences that vary in length and will have the correct use of punctuation. The use of commas can also give structures to sentences, especially longer ones to help make the meaning clear. Another stylistic approach is the use of colons, which can help to point the way forwards in the text, such as:

"The results were not easy to interpret there was an apparent discrepancy between the two batches."

The use of brackets helps to enclose additional information or comments (for information that is not essential to the text). However, the use of dashes (single or paired) should be avoided in scientific text. This is because the dash is used to represent a pause and it is associated with more causal forms of writing.

In terms of putting sentences together to form a paragraph, the paragraph should contain one idea or concept per paragraph. This approach helps to organize information an aid logical sequencing. In addition, the one concept approach provides both a mental and visual break for the reader. It may be necessary to break long passages into more than one paragraph.

Style

In terms of the overall style, some effective pointers include:

1. Write in an impersonal way.
2. Avoid ambiguity, for this only serves to confuse the reader.
3. Avoid verbosity. It is preferable to use a single word instead of engaging in circumlocution. The over-use of words not only makes text hard to read for the busy reader it can either appear vague or elusive.
4. While an appropriate and varied vocabulary helps the text to flow, long and esoteric words should be avoided.
5. Abbreviations should always be explained in full upon first use.
6. Where jargon is necessary, it should also be explained otherwise it will exclude readers unfamiliar with the subject.
7. Technical dressing that seeks to impress instead invariably annoys the reader.
8. Cliches should be avoided.
9. The incorrect use of words or tenses will only serve to reduce the fluency of the text.
10. Tautology should be avoided (that is saying of the same thing twice over in different words).

REVIEW

Every draft document should be reviewed at least once, considering if there is any danger of misinterpretation at any stage and to assess whether any important findings have been overlooked. A useful piece of advice here is read what you have written rather than what you think you have written (5).

A useful consideration to keep in mind is ‘what does the reader need to know and does the document, in its present form, tell they reader what needs to be conveyed?’ the draft review should also assess grammar, overall fluency and how well different sections of the report are linked to each other.

CONCLUSION

This article has taken the critical thinking approach and applied this to scientific writing, both for protocols, reports, and experimental write-ups. Every document is a form of communication and to be effective it should be:

- Easy to read
- Easy to understand
- Easy to assimilate

Whichever format is used once the document has been completed the ‘draft’ should be reviewed and an attempt made to improve and polish it through editing. The focus of the editing should include revisiting some of the points made in this article, checking whether each section of the document is sufficiently clear.

REFERENCES

1. Gennaro, S. (2016) Why write?’, The Journal of Nursing Scholarship, 48 (2): https://doi.org/10.1111/jnu.12200
2. Gregory MW. (1992) The infectiousness of pompous prose.*Nature*. 5;360(6399):11-2. doi: 10.1038/360011a0. PMID: 1436065
3. Bredan AS, van Roy F. (2006) Writing readable prose: when planning a scientific manuscript, following a few simple rules has a large impact.*EMBO Rep.* 7(9):846-9. doi: 10.1038/sj.embor.7400800
4. Goodman NW. (1993) Paradigm, parameter, paralysis of mind.*BMJ*. 307(6919):1627-9. doi: 10.1136/bmj.307.6919.1627
5. Ludbrook J. (2007) Writing intelligible English prose for biomedical journals.*Clin Exp Pharmacol Physiol* . 34(5-6):508-14. doi: 10.1111/j.1440-1681.2007.04603.x

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