

2003-01-01

## Crafting a Research Paper

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### Recommended Citation

Fitzpatrick, R. & O'Donnell, K. (2003). Crafting a research paper. doi:10.21427/aqhm-6435

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# Crafting a research paper

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## Abstract

*Writing research papers presents numerous different challenges, which vary from how to layout the various pages and format the text to what to include in the different sections that make up the paper. In order to clarify these issues this paper sets out guidelines and best practice approaches and demonstrates their use in the style of this paper.*

**Keywords:** research paper, report, structure, format, style and content.

## 1 Introduction

There are many, many models for how to write a paper or research report that will hold your readers attention. The secret of a successful approach is to write such that readers have confidence in what you are writing about, they are satisfied from your vocabulary, tone and style that what they are reading is authoritative and scholarly and that they want to keep reading because your content is of interest to them.

The purpose of this paper is to provide some guidelines on how to structure the paper and to suggest some essential content so that your writing will be interesting for your readers. The structure guidelines and suggested content are illustrated by the manner in which this paper is written. In other words, if you're stuck as to what to do next, check to see how it's done in this paper and try to replicate in your own work, the solution that is shown here. The paper is intended for undergraduate students writing course reports and for postgraduate students who are writing up their research so that a minimum standard of research paper writing can be achieved. The paper will also be of interest to researchers seeking to secure publication of research work and to business report writers in general. The paper draws on experience gained since 1995 during research paper writing for the MSc programme at the DIT School of Computing and the model suggested has been successful to the extent that many papers which use it have had easy passage to publication. Section 2 recommends paper or report structure and format and Section 3 sets out some good practice guidelines for content.

## 2 Structure and format

This section addresses the structure of a paper or report and also addresses the appearance or presentation. The first of these is important in order to comply with convention (table of contents comes early in a report and references come at the back). Appearance and presentation are important to assure your readers of the scholarly or professional effort that has been applied to the paper writing process. Guidelines for these are now explained in detail.

## 2.1 Structure

Your paper or report should include sections that will establish the structure of your work. If you are writing a report you will need to include a cover page and a Table of Contents. Position these before the Abstract. All of this is set out in Figure 1.

Paper	Report
<ul style="list-style-type: none"> <li>• Title and author details</li> <li>• Abstract</li> <li>• Acknowledgements</li> <li>• Introduction</li> <li>• Various Level 1 sections of the paper</li> <li>• Conclusion</li> <li>• References.</li> </ul>	<ul style="list-style-type: none"> <li>• Cover page</li> <li>• Title and author details</li> <li>• Table of Contents</li> <li>• Abstract</li> <li>• Acknowledgements</li> <li>• Introduction</li> <li>• Various Level 1 sections of the report</li> <li>• Conclusion</li> <li>• References.</li> </ul>

**Figure 1** – Level 1 section headings

What you are reading now is a paper so, there is no cover sheet nor is there a Table of Contents, but the other section headings are all included.

So, when you start to write up your research you already have a general outline of the structure of your paper. For example, you know that you will have an Abstract and you know you will have a Reference section and you know where in the paper these are positioned. What you don't know is what the various level 1 sections will be about and it is helpful to think about these in advance and then to tailor your write up to suit your chosen headings. So, having decided on structure you now have to adhere to a format and style for page layout, text, numbering and similar presentation issues.

## 2.2 Format

The page layout and text format of your paper is extremely important. You will notice as you read other papers how a consistent style adds that element of authority, scholarship and professionalism to your paper. This section suggests a style for your paper. You should know that Microsoft Word automatically generated all of the formatting in the paper that you are now reading. Your word processor will automatically generated Table of Contents, Section headings to many levels and Section numbering to match those levels. Once you become familiar with using this automatic formatting you will find it a great time-saving tool. If you don't know how to use it, ask.

### 2.2.1 Margins

Using A4 paper, use a left margin of 3.17cm (1.5 inches) and right, top and bottom margins of 2.54cm (one inch).

### 2.2.2 Main text

Type your main text in 12-point Times New Roman, single-spaced, fully justified.

### 2.2.3 Cover page

If your assignment requires that you are to include a cover sheet you should format this as instructed or as shown in the attachment to this paper.

#### **2.2.4 Title and author details**

The main title (on page 1) should be centred, and in Times New Roman 18-point, boldface type. Capitalise the first letter of the title only. Leave one blank 18-point line after the title. Author names are to be centred beneath the title in Times New Roman 12-point, boldface type. Affiliations and contact details are to be centred beneath the Author names in Times New Roman 12-point, non-boldface type.

#### **2.2.5 Table of Contents**

Use the Index and Tables facility of your word processor to include a Table of Contents on a page of its own.

#### **2.2.6 Abstract format**

Type the word Abstract in 16-point, Times New Roman, bold, single-spaced, left justified and unnumbered. Use italics font in the abstract text. Otherwise format the abstract as per main text.

#### **2.2.7 Acknowledgements**

A paragraph of acknowledgements may optionally be included after the Abstract. For best presentation this looks best if confined to a page of its own. Type the heading Acknowledgements in 16-point, Times New Roman, bold, single-spaced, left justified and unnumbered. Use main text.

#### **2.2.8 Section headings**

Section headings start with a capital letter and unless the proper use of English requires it, all other characters in the section headings are lower case. All headings should be formatted to have a 6-point spacing before and 3-point spacing after. If you don't know how to do that, ask.

#### **2.2.9 Section numbering**

The Abstract and Acknowledgements sections are unnumbered (and are formatted in Times New Roman, 16-point, bold). Numbering begins with the Introduction section, which is a level 1 heading and numbered 1. Level 1 headings are Times New Roman, 16-point, bold and numbered. Typical level 1 headings are the Introduction, Principal section headings in the paper, Conclusion and References. Level 2 headings are Times New Roman, 14-point, bold and numbered. Level 3 headings are Times New Roman, 12-point, bold and numbered. Level 4 headings should be avoided, but on the rare occasion that you must use one format it in Times New Roman, bold and leave it unnumbered.

#### **2.2.10 Page header**

It is very useful to include the title of the paper as a header throughout the paper. This header should be right aligned. Use Times New Roman, 10-point, italics and include an underline the full width of the page. Because the paper title is already on page 1 it is not necessary to include this header on page 1.

#### **2.2.11 Page numbering**

The cover sheet is unnumbered. Pages between the cover sheet and page 1 are numbered using Roman numerals (e.g., i, ii, iii, iv, v) in Times New Roman font. The page with the Introduction paragraph is page 1 and from this point to the last page, pages are numbered using decimal digits (1, 2, 3, 4, 5) in Times New Roman font. Page numbers should be centered in the page footer.

### 2.2.12 Footnotes

The following extract from the guidelines for an SMEF 2004 conference paper offers excellent advice on the use of footnotes.

*“Use footnotes sparingly (or not at all!) and place them at the bottom of the page on which they are referenced. Use Times 10-point type, single-spaced. To help your readers, avoid using footnotes altogether and include necessary peripheral observations in the text (within parentheses, if you prefer, as in this sentence)”* (Kusters *et al.*, 2003).

### 2.2.13 Citations and References

In order to demonstrate to your readers that your work is research you must cite references for your sources in the body of your text. If you don't include these citations your readers might simply regard your work as your own opinion and not based on research at all. You might also be accused of plagiarism. There are many international styles for doing this, the Harvard Publishing Style being one that is often quoted (DIT, 2000). So, we suggest a simplified version of this style for our papers. Including citations and creating a Reference section are explained in the next sub-sections.

#### Citations

Cite an appropriate balance of original sources from academic journals, conference proceedings, standards documents, whitepapers and similar authoritative sources. While undergraduate textbooks are appropriate, for research, you should be citing the original publications of recognised world experts. Be careful when citing the WWW as a source. Some publications on the WWW are by acknowledged authors and there is no difficulty with including these as references in your work. Others have no authority at all yet they can alert researchers to the very latest and state of the art developments. However, a large proportion of WWW postings have no place in research papers. At all times try to start a WWW reference with an author's name and then follow the normal citation and reference style. You will soon get to know the type of Web publications that are best avoided.

Citations in the text should be enclosed in round brackets and should use the author's surname and year of publication as in (Robson, 1997). Note that there is a comma between the surname and the year. Where there are two authors, both surnames are given divided by an ampersand as in (Porter & Millar, 1985). Where there are multiple authors, the surname of the first author is used with the Latin abbreviation *et al.* and year of publication, as in (McCall *et al.*, 1977) – note the comma. The *et al.* is always in italics and is followed immediately by a full stop. Where two or more citations are included the format is (McCall *et al.*, 1977; Robson, 1997), that is, the older publication is listed first and a semi-colon separates the citations. Page numbers (e.g., Robson, 1997:199) are included as appropriate for the benefit of future researchers. Page numbers must be included when text is quoted verbatim from another author's work and the verbatim text *“must be in italics and contained within double quotation marks”*. When citing multiple publications by the same author in the same year, add a, b, c, and so on to the year of publication as in (Brown, 2000a or Brown, 2000c). Citations from the Internet should comply with these standards. Best practice dictates that citations should not appear in the Abstract or the Conclusion. A word of caution about quoting paragraphs of text verbatim from other authors. If you over engage in this practice your paper could have too much verbatim text and you could be accused of ‘stringing quotations together’ and that's not appropriate for a research paper. So, consciously limit your use of verbatim quotes. How much is appropriate? Well, definitions are appropriate and perhaps one or two key quotations that underpin your work will suffice.

## Reference listing

All citations in the body of the paper must be included in the Reference section at the end of your paper and only citations in the body of the paper should appear in the Reference. Cited references should be set out in alphabetical order. Each reference should be left aligned on a new line with subsequent lines indented by 1cm from the left margin (i.e., a hanging indent of 1cm). There should be a ½-line spacing between listings, i.e., 6-point before. References and citations should use the main text format. Begin with the author's surname followed by a comma and the author's initial(s) followed by full stops. Next is the year of publication within round brackets. This is followed by the title of the work being cited (paper title if appropriate) book or journal title, publisher, city of publication, country, and if appropriate, volume number, part number in round brackets followed by page numbers - see the examples at the end of this guidance note. For an Internet publication the same format is used and, so that future researchers can find it, add the full URL where the publication is posted and the date when you accessed it. An optional style is to format the author's names SMALL CAPITALS. Note that when naming a paper or book the preferred style is to use a capital letter only for the start of a title (or sub-title) and proper nouns. Also, the *Title of a book* should be in italics and the "Title of a Journal article" should be in inverted double commas. You can use the Styles and Formatting... option in your word processor to help with the easy formatting of entries in your Reference.

### 2.2.14 Tables and figures

In order to improve the appearance of your written work, illustrations (figures, tables, photographs or other images) should be used throughout your work.

- Each illustration must have a caption consisting of a figure number and a title. Decide on a suitable caption format and use it consistently throughout your work. Use the caption facility in MSWord.
- The figure number in the text of the work should explicitly reference each illustration. Avoid expressions like "in the figure overleaf" or "in the table below".
- The illustration should be positioned as close as possible to where it is first mentioned in the text.
- Each illustration must be commented on and if necessary explained.
- For a professional presentation all illustrations should have a consistent look about them. This can be achieved by
  - Using a box or frame to surround it
  - Using a different text font to that used in the body of the work (Arial)
  - Using small caps (*Format... Font...*) when formatting headings
  - Avoiding fancy fonts
- Use the Borders and Shading ...Options... to position the border such that it is not touching the text.
- Some standards require a figure to have its caption below it while a table has its caption above.
- If the work in an illustration is your own creation, say so. Otherwise, you must cite a source for it.
- In order to consistently position the caption relative to the illustration itself, write the caption on the line immediately following the illustration and then set the "Spacing Before: " on the caption text to 6-point (Select the text and *Format... Paragraph*).
- It is sometimes useful to have two separate lists at the start of your work. One, a List of Figures and the other a List of Tables.

**Figure 2** – Guidelines for figures and tables in a research paper or report.

It is essential that these illustrations should be presented with a consistent and highly professional appearance. Figure 2 sets out a list of guidelines, which should be followed in order to achieve this professional appearance.

That concludes the section on structure and format. If there is some aspect relating to structure and format that is not covered in this section let your own best practice guide you. At all times let your objective be to achieve the highest standard for your readers.

### **3 Content**

For beginning researchers and report writers it is always an issue as to what to include in the various sections of their paper or report. Typically, these issues include, what goes in the Abstract? or, what goes in the Introduction? or, what goes in the Conclusion? This section sets out good practice guidelines that you can apply.

#### **3.1 Abstract content**

This is an overview of the paper, which is intended to convince others that the content is significant and that their understanding of the subject matter is incomplete if they have not read your paper through. Weave the keywords of your text into a summary of about 200 words. It is often useful to consider that the Abstract is what a librarian might write as an overview of the paper so that researchers visiting the library can read the Abstract and decide if the content is sufficiently important for them to want to read the full paper. There should be no citations in the Abstract. This is because Abstracts are published as stand alone documents, which are generally no more than one page in length. If citations are included when publishing the Abstract it then becomes necessary to also publish the full reference to those citations.

Include a final paragraph of six to eight keywords

#### **3.2 Introduction content**

The guidance advice for your Introduction section is to provide a two or three paragraph overview of your paper, which sets the scene and context for your readers. Do not write these paragraphs in any great detail. Just gently introduce the topic(s) to your readers and keep detailed explanations for later in the paper. Next, make certain that you state the **aim** of the paper, **who** your audience is, **why** you are writing this paper (the problem or challenge to be addressed) and **how** you went about the research (the research methods like literature review, expert interview, observation or perhaps a questionnaire). If appropriate, use the Introduction to alert your readers of any deliverable from the paper. Especially emphasise if it is a new deliverable and if it is your contribution. All of this sets the scene for your readers and begins to instill in them that sense of confidence that they need. To end your Introduction section (and as a link to the rest of the paper) provide signposting for the readers by indicating section content.

The structure and style of the Introduction section has already been illustrated in Section 1 of this paper. For completeness, the topics that are addressed in the Introduction are overview paragraphs, aim, audience, challenge, research method, deliverables and signposting.

#### **3.3 General section content**

The general sections of the body of your paper are specific to the research topic that you have chosen and consequently it is impossible to include in this paper specific detail as to

what should be addressed. One important practice though is to include a short introductory paragraph immediately following a Level 1 section heading and at the end of that section have a few lines of conclusion. The remainder of this section sets out some good practice content guidelines that have proven successful in the past. Another important practice is to use definitions early in your paper in order to clarify for your readers, exactly what you are writing about.

### **3.3.1 Coverage of sources content**

You need to reassure your readers about the completeness of your research and that you have researched the entire subject area but that you concentrated only on those sections specific to your research. Try not to cite second-hand from text in other author's papers. Instead, locate the work of the original author of a topic and cite that author's seminal paper. The debate between dated and modern sources will never end. Some authorities might insist that publications before a certain date are of no value to your research while others will advocate the value of early thinking. For this work the guideline is include old and new to your preference.

### **3.3.2 Breadth and depth**

It is important that your research addresses sufficient breadth of topics otherwise the concentration might be too narrow or too focused to be really meaningful. Equally, your explanations need to be sufficiently detail to enable readers to understand your writing without being too simplistic.

The breadth of your paper needs to be sufficient to assure your readers that your research is aware of the entire subject area but that you concentrated only on those sections specific to your research.

Make certain that you have researched a broad section of internationally recognised experts of the subject area. Also, be conscious of how dated a selected publication might be and its relevance to your research. For example, it is not unusual for a beginning researcher to write, "*The Internet has the potential to become a significant medium for commerce (Bloggs, 1982)*". This kind of reporting is now meaningless as the Internet is well established as the foundation of e-commerce.

The depth or level of detail in your paper is critical to the readability of the paper and, for this reason, you should only include three levels. Typically these will be numbered 1., 1.1 and 1.1.1 and anything deeper than this should be carefully considered.

### **3.3.3 Examples**

When you are explaining something it is often appropriate (in order to clarify what you are explaining) to include an example of what you are writing about. This is a very powerful method of clarifying you point for your readers. So, include examples regularly. If you don't include them, will your readers understand the points you make? And, more importantly, if you are unable to give examples, is it that you don't understand things yourself?

### **3.3.4 Conclusion section content**

The Conclusion often causes some confusion as to how the word conclusion should be interpreted. One interpretation is to conclude or end by summarising the content of the paper. An alternative is to end by listing out the conclusions (that is the findings and deductions that can be made from those findings). The guidance suggested in this paper

is that you include both. So, remind your readers of the key topics that you address in your paper and clearly identify any deductions you make as a result of completing the research. The conclusion should not contain any new content and consequently should not include any citations. Remind your readers again of your original perspective and if your paper includes an original contribution or deliverable then remind your readers of that contribution too. Emphasise the value of the paper in general and your deliverable in particular, remembering to suggest how others might apply or use it. It might also be appropriate to include a critique of your work which might include some suggestions for future research in this area. The clarity of your summary and the conclusions you make should help to convince your readers of the publishable standard of your paper.

### **3.3.5 Language and proof-reading**

Write with an authoritative style so that your readers know that you fully understand what you are writing about. Your writing should also have a scholarly bias about it. Write in the active voice using best English grammar, syntax and semantics in properly structured paragraphs. Avoid slang and colloquialisms. Remember to write gender-free text (use the plural instead of the singular) and remember too that “*one does not use one or etc. in one’s papers, dissertations, etc., etc., etc.*”. What are your readers to understand by these expressions?

Reading through your written work which has been left aside for some time (even one week would show evidence of this) will identify many opportunities to enhance it. Sometimes these opportunities will relate to structure and format while other will relate to content. Sometimes these might be simple spellings errors while others may have serious flaws resulting from incorrect vocabulary. Whatever the cause, re-visiting your work will almost always improve it.

So, proofread, run spell-checkers and proofread again. Then, if possible, have a colleague read it for you. Strive to “get it right” and do yourself justice. Then read it again. Then, when it’s finished, it’s finished.

### **3.3.6 Argument & critique**

As you write up your paper you should not simply report what your research discovered. If your research disagrees with some of the main research sources you might want to make an argument for or against some points. Don’t be afraid to do that. It introduces that element of authority and scholarship that converts a typical paper into a valuable research source. You should also include aspects of comments, recommendations and observations. If you are finding ambiguity in the research sources, say so, and perhaps suggest how this might be resolved. However, it is easy to formulate comments and observations to have a negative bias. Avoid that, and where you do have these types of criticisms try to have positive comments and observations by way of balance.

### **3.3.7 Contribution to the body of knowledge**

Depending on the requirements of the paper that you are writing there might be a need to produce a publishable paper containing a new contribution to the Body of Knowledge. So think about what your contribution might be. For example, it might be a new set of guidelines or a new framework or a new model or something new that is your own work. Be aware of the limitations of your original contribution so that you can comment on these in the concluding section.

That concludes the section on content guidelines. When you have your paper written, you might find it useful to return to this paper and to crosscheck that you are properly applying the style guides and content advice.

## 4 Conclusion

This paper presents guidelines on how to structure and format a research paper or report and suggests some best practice regarding content and presentation. The structure topics addressed essential sections that must be included and their sequence and also set out text formatting requirements. The content section addressed essential topics that need to be included in various sections in order to support your readers. All of this is illustrated by example in that the manner in which this paper is written follows the guidelines and practice recommendations.

Reading through different journals, conference proceedings and other publications it is obvious that there are many different styles for how a research paper should be presented and if the intention is to be have a paper published in a selected publication then the paper must be prepared in the required format.

Finally, if you notice any inconsistencies or would like to suggest corrections that we should make in this paper we would welcome hearing from you. Meanwhile, success and good luck with your writing.

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