# Structuring a Laboratory Report

## A Student Guide

Murdoch University

**Laboratory reports** (or simply, lab reports) are common assignments that students complete within disciplines that tend to rely on scientific methods. They are also commonly **called scientific reports.** Lab reports are used widely by researchers to communicate key theories, methodologies and findings to a wider audience. A lab report is a structured piece of writing divided into several sections: title, abstract, introduction, method, results, discussion and references. It is important to understand the purpose of each section to produce a good report.

Before writing your report, identify whether it is a quantitative or qualitative report. Most undergraduate reports will use a **quantitative research design**, which uses numbers to measure variables, such as the dose of an antidepressant medication, the level of anxious symptoms, or the number of hours conducted in an intensive exercise program. In contrast, a **qualitative research design** uses words, categories and/or themes as 'data' rather than numerical values.

### Title Page

The *title page* lists the main details about the report. The title of the paper comes first, and should be bolded. Below, include a blank line, followed by the rest of the report details, including: the author (a.k.a. your name); the University at which it was produced; the unit for which it was submitted; the course instructor (i.e., Unit Coordinator), as well as the date. Everything on the page needs to be centered. An example is shown below.

**Neurological Dysfunctions Associated with Cluster B Personality Disorders**

Jonathan P. Smith

Murdoch University

PSY141: Introduction to Psychological Science

Dr. Sigmund Freud

January 30, 2021

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### Title

A good *title* is usually around 12 words and should be both informative and engaging – in other words, it should succinctly summarise the content of the report while also sparking the reader's interest.

Some examples of titles from published journal articles are highlighted below:

Ashida, S., Goodman, M., Pandya, C., Koehly, L. M., Lachance, C., Stafford, J., & Kaphingst, K. A. (2011). Age differences in genetic knowledge, health literacy and causal beliefs for health conditions. *Public Health Genomics*, 14(4), 307-316. https://doi.org/10.1159/000316234

Bennett-Levy, J., Wilson, S., Nelson, J., Stirling, J., Ryan, K., Rotumah, D., Budden, W., & Beale, D. (2014). Can CBT be effective for Aboriginal Australians? Perspectives of Aboriginal practitioners trained in CBT. *Australian Psychologist*, 49(1), 1-7. https://doi.org/10.1111/ap.12025

De Moor, M. H. M., Beem, A. L., Stubbe, J. H., Boomsma, D. I., & De Geus, E. J. C. (2006). Regular exercise, anxiety, depression and personality: A population-based study. *Preventive Medicine*, 42(4), 273-279. https://doi.org/10.1016/j.ypmed.2005.12.002

Gao, J., Zheng, P., Jia, Y., Chen, H., Mao, Y., Chen, S., Wang, Y., Fu, H., & Dai, J. (2020). Mental health problems and social media exposure during COVID-19 outbreak. *PLoS One*, 15(4), Article e0231924. https://doi.org/10.1371/journal.pone.0231924

Larison, B., & Pritchard, M. (2019). The effects of internalized shame and self-blame on disordered eating and drive for muscularity in collegiate men. *Eating and Weight Disorders*, 24(4), 653-660. https://doi.org/10.1007/s40519-019-00700-0

Lavallee, K., Zhang, X. C., Michalak, J., Schneider, S., & Margraf, J. (2019). Vegetarian diet and mental health: Cross-sectional and longitudinal analyses in culturally diverse samples. *Journal of Affective Disorders*, 248, 147-154. https://doi.org/10.1016/j.jad.2019.01.035

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### Abstract

The *abstract* is the first section of the lab report that the reader of your report will see. However, it is typically the section of the report that you will write last, because you will need to know the contents of your report before being able to summarise it in the abstract. This section summarises the report to someone who may not have the time to read the full report, or who would first like to confirm if it is relevant for their research. The abstract is shown on its own separate page after the title page.

The purpose of the abstract is to very briefly summarise all of the sections of the report, with approximately 1-2 sentences for each section. An example of an abstract from a published study is shown below, with the colours used to indicate which section of the report is being summarised: introduction (including background & study aim/s), method, results and discussion/conclusion.

Burnout is an inherent risk for those working as mental health professionals, given the nature of their work. Due to recent Medicare changes in Australia, private practice psychologists were suspected to face similar burnout risks as non-private practitioners. The aim of the present study was to investigate the relationships among burnout in Australian psychologists, work-setting and years of experience in that setting, mindfulness and career-sustaining behaviours (CSBs). 145 females and 22 male Australian registered psychologists, with a mean age of 42.47 years (SD = 11.64, range 24-68), were surveyed to determine work-setting, mindfulness, burnout and preferences for CSBs. High levels of burnout were reported among Australian psychologists. No significant difference in burnout between psychologists working in private-practice and non-private-practice settings was found. There was a strong negative relationship between mindfulness and burnout and there was a low but significant negative relationship between years of experience in current work-setting and burnout levels. CSB preferences only had weak relationships with burnout, which decreased after controlling for mindfulness. Several CSBs that had a detrimental relationship with burnout were identified and may be worthy of further investigation. Developing strategies to increase mindfulness may prevent burnout in Australian psychologists.

Di Benedetto, M., & Swadling, M. (2013). Burnout in Australian psychologists: Correlations with work-setting, mindfulness and self-care behaviours. *Psychology, Health & Medicine, 19(6), 705-715. https://doi.org/10.1080/13548506.2013.861602*

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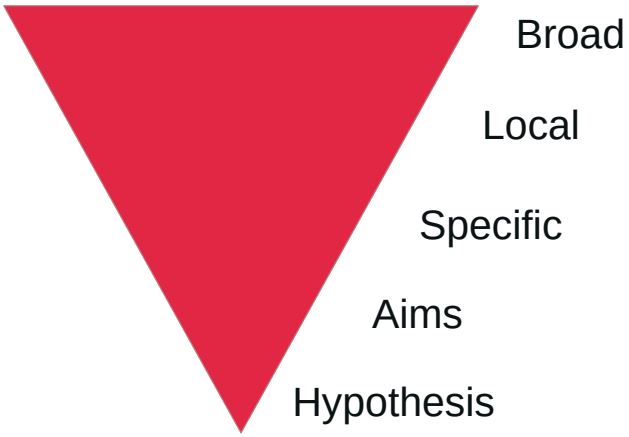
### Introduction

The *introduction* should bring the readers' attention to the current state of the literature (i.e., what is already known) and highlight the aims of your own research (i.e., what is unknown). The introduction should begin with very broad information about your topic to orient your reader to your topic, then be placed in a local context (e.g., the culture in which the study is being conducted or the specific phenomenon of interest). Then, you must introduce the specific approach of your study and provide a rationale for your study that leads into your aims and hypothesis.




Laboratory reports should always begin by defining **key terms**, which can be *italicised* to signpost to the reader where the terms were first defined. Always use the full names for terms when first introducing them; thereafter, you may rely on the acronym (e.g., PTSD for post-traumatic stress disorder).

The introduction should delve into the key theories and findings of the current research literature. Conduct a **literature search** by reading through journal articles on your topic, then outline the theory or theories proposed to explain the phenomenon of interest, and describe the available research evidence that supports (or refutes) the theories. Journal articles should be **peer-reviewed**, which means that researchers have reviewed the work of their peers before the articles have been published. The introduction should clarify whether there is consensus or disagreement among researchers in your chosen area.

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### Introduction Cont.

It is important to highlight the key variables, aims and hypotheses of your own research. Make sure to clearly define your variables. In an experiment, you will need to define your **independent** and **dependent variable(s)**.

The **aim** is the purpose behind the research being conducted, while your **hypotheses** should state your predictions regarding the outcomes of your study. An example of a hypothesis could be: "It was predicted that increasing levels of daily exercise would be associated with a reduction in depressive symptoms, as measured using the Beck Depression Inventory."

A hypothesis is a prediction about the results of your study derived from your theory of interest. Testing the hypothesis should provide feedback about whether the proposed theoretical explanation of the phenomenon is correct or incorrect.

### Method

The *method* section of a lab report describes the way in which the researcher conducted the study. Typically, this section is split into a few subsections:

a) participants,
b) measures,
c) materials,
d) procedure.

Usually researchers will select between Measures or Materials, rather than including both subsections. "Measures" is typically used in survey studies; "Materials" is used if the study employs physical objects (e.g., sorting cards). "Apparatus" is used for high-tech computers, EEG machines, etc. "Stimuli" is also a useful header in lab experiments (e.g., the words flashed on the computer screen in various conditions). A researcher will typically choose one of Measures, Materials or Apparatus to suit their specific study. "Stimuli" would most likely accompany Apparatus.

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### Method Cont.

It is important to show the similarities and differences in your method compared to those employed in past studies. If you are basing your method on a past article, make sure to cite and explain this method. You cannot assume that the reader will know how the study was conducted – everything that is relevant must be discussed in detail and made clear to the reader. Your study needs to be **replicable**, in the sense that another researcher could easily repeat the procedure employed.

***Participants***

The *participants* section should explain who the participants were in the study and how they were recruited. This includes information such as:

a) the *sampling method* in your study, e.g. convenience or random sampling,
b) the major *demographic characteristics* of participants, such as age, gender, socioeconomic status and health status,
c) any *incentives* that were offered to them to participate.

Information should not be included that would be likely to personally identify individuals. The letter 'n' is used to state the number of participants. Capitalise *N* when referring to the whole sample (e.g., *N* = 70); use lower case *n* when referring to subgroups (e.g., control *n* = 35, experimental *n* = 35).

***Measures***

In the *measures* section, researchers describe any specific measures they utilised (e.g., the WAIS or depression scales), which need to be cited and referenced. Typically, this will include a discussion of the reliability and validity of the measures employed and the structure of the measure, such as its item construction and subtests. The measures should also be linked to the specific variable(s) that they measure and how they are scored. However, do not discuss the specific uses of the measure at this point. Think of this subsection as being like the ingredients section in a recipe rather than the method (i.e., the "what", not the "how").

***Materials***

Within the *materials* section, describe any tools or materials that were needed for the study, how they work and their uses. This may include any specific psychometric instruments or physical items such as computers that were utilised.

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## Method Cont.

***Procedure***

Finally, in the *procedure*, explain how the study was conducted, such as the administration and scoring of measures and any treatment interventions that were utilised. The information should be written in a way that is clear to follow, in a chronological, step-by-step fashion.

However, it is important that we do NOT number the steps (e.g., do not use bullet or number points or write sentences like: "Step 1 was to obtain ethical approval and Step 2 was to post the survey online"). Instead, detail the steps using full sentences (e.g., "After ethical approval was obtained from the Murdoch University Human Research Ethics Committee, the survey was posted online to recruit participants"). Make sure the steps include any important details that other researchers will need if they decide to replicate the procedure.

***Data Analysis Method***

In some quantitative reports and most qualitative reports, there may also be a subsection in the Method section titled *Data Analysis Method*. This section outlines the way in which the data has been analysed for the selected aim(s) of the study. For example, a researcher using a thematic analysis method will describe in detail how this process was carried out.

## Results

The *results* section is where all of the findings are reported. This may include statistics or categories and themes, depending on the research design. The purpose of the results section is simply to report and *describe* the key findings, *not* to dissect their meaning (this process of unpacking the meaning of the results will occur within the Discussion).

Results need to be presented in a sensible order that makes sense to the reader (e.g., if presenting raw data, this should be included before more complex statistics are shown). The kinds of results presented will vary according to research design and the stated aim(s) of your study.

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### Results Cont.

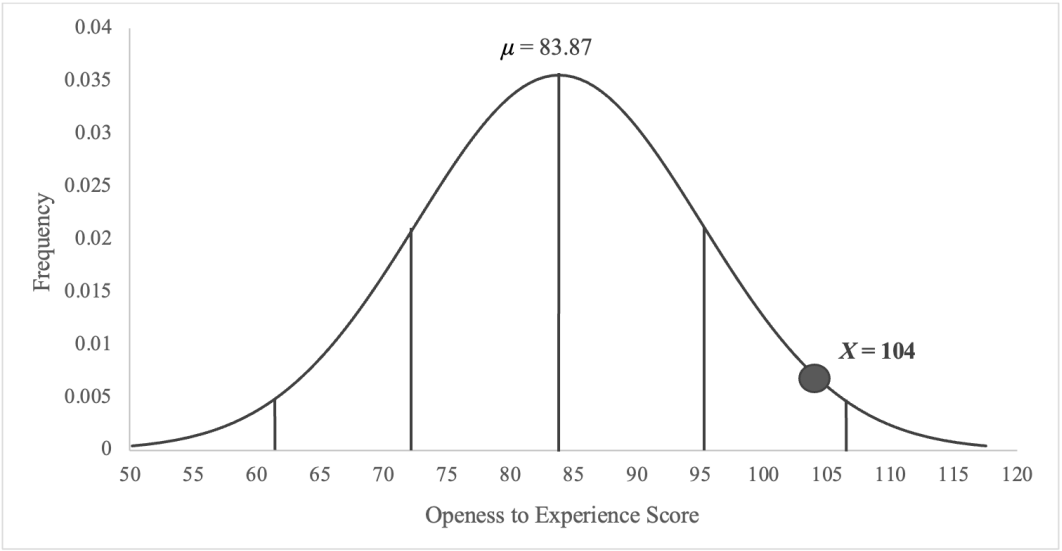
If you are writing a quantitative report, begin with the **descriptive statistics**, which *describe* the raw data (e.g., mean, SD, correlation coefficient, etc.).

Then, bring in any **inferential statistics** (such as *p* values, ANOVA, etc.). These statistics *infer* what the results mean – usually whether our sample results are likely to reflect a genuine pattern in the population. The *p* value is typically set at the alpha level = .05, where any value above this ($p > .05$) is deemed *statistically non-significant*, and any value below this ($p < .05$) is deemed *statistically significant*.

Make sure to follow a style and formatting guide in the reporting of the statistics. It is usually a good idea to include a figure or a table to aid in the reporting of the results. However, try not to 'double-up' with the same results by putting results in a table and then re-reporting all the same results in writing.

A *figure* is any graph or image that is presented within the report. In APA 7th edition, all figures need to be labelled at the top with a short statement about what the figure depicts. An example of a figure is shown below.

*Figure 1.1.* Distribution of scores on Openness to Experience domain, with vertical lines indicating *SD*s from the mean and marked circle indicating personal score.

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### Results Cont.

A *table* can also be useful when presenting statistics and again needs to follow the relevant style conventions. Tables should NOT re-present statistics that have already been discussed in the written text. Tables need to have a title at the top, not below.
An example of a table is shown below.

Table 1

*Error Rates of Older and Younger Groups*

| Level of difficulty | Mean error rate | | Standard deviation | | Sample size | |
|---|---|---|---|---|---|---|
| | Younger | Older | Younger | Older | Younger | Older |
| Low | .05 | .14 | .08 | .15 | 12 | 18 |
| Moderate | .05 | .17 | .07 | .15 | 15 | 12 |
| High | .11 | .26 | .10 | .21 | 16 | 14 |

If you are using a *qualitative design*, which uses words and categories as 'data', your results will not involve the reporting of any statistics (perhaps other than descriptive statistics, which are sometimes reported). Instead, the results may include key themes or findings from the study described in words or categories, which are generally reported under their own subheadings.

Examples of qualitative designs include thematic analysis, discourse analysis, analysis of case studies or written survey responses. Qualitative reports will often combine the results and discussion into one section titled 'Analysis and Discussion'. However, the title for this section will depend on the method of data analysis used in your research.

The following article explains the process of conducting a thematic analysis:

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology, 3, 77-101. https://doi.org/10.1191/1478088706qp063oa*

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### Discussion

In the final section, your *discussion* allows you space as a researcher to interpret why you obtained these particular findings in your study and reflect on the research process. The discussion will first need to explain whether a particular hypothesis was supported or not supported based on the results. You will need to answer the following question: *Does this new evidence support or falsify the theory being examined?*

Then, we need to discuss *why* the theory was supported or falsified and why our results were similar or different to those found in other studies. The Discussion must link to the past research conducted in your area of interest to provide a comparison of results.

It is important to discuss the *contributions* of your research to the scientific and wider community by highlighting the relevance of your findings. Think about why your results are important and how they may be of use to others, such as researchers, clinicians, policymakers and society at large.

You will also need to discuss the *limitations* of your study, including any areas of improvement, challenges in conducting the study and generalising its findings to other populations. Make sure you go beyond basic discussions of the sample size - e.g., think about the potential limits of the methods, design and measures used and other variables that may not have been controlled for within your research due to financial, practical or ethical constraints. For example, a limitation of the correlational research design is that correlation cannot imply causation – therefore we cannot reasonably make any claims about there being a cause-and-effect relationship based on our results (this would require us to conduct an experiment).

A good report will also note *future directions* to provide suggestions as to how other researchers may seek to improve or build upon your work. Think about:

- What knowledge is still missing in this area
- Any areas of inconsistency or mixed findings
- Any variables that have not been controlled for or investigated thus far
- What needs to be done to improve the methodology in your chosen area
- Other areas of application for your findings

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### References

The *References* section lists all of the sources of material that were cited within your research. This section needs to be presented in alphabetical order (e.g., an author with the surname "Sloan" should be placed before an author with the surname "Smith") as you move down the list (because, in this case, the second letter "l" comes before the letter "m" in the alphabet).

Referencing is very important because it shows where the information in the lab report is derived from and allows other researchers to read more about your topic from other sources. It is also important because of intellectual property rights and the need to respect other theoreticians' or researchers' academic and/or scientific contributions to your work. The scientific process demands that we can support our claims with sufficient evidence, which can only be achieved through referencing.

In a typical lab report, *almost every sentence should have a citation*!

There is a list of referencing examples using all material types on the Murdoch Library APA Referencing Guide website (https://libguides.murdoch.edu.au/APA/all). Research will usually involve journal articles or e-journals but may also include other sources such as books, videos or websites.

References typically include information about who wrote or produced the work; the time the work was produced; the title of the specific piece of work; the location of this piece of work (e.g., the book title or journal title); and how to access the work.

An example of an online journal article as a reference is shown below:

Else-Quest, N., LoConte, N. K., Schiller, J. H., & Hyde, J. S. (2009). Perceived stigma, self-blame, and adjustment among lung, breast and prostate cancer patients. *Psychology and Health, 24(8), 949-964. https://doi.org/10.1080/08870440802074664*

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### References Cont.

Every reference begins with the **author's names**: in particular, the surname written in full, and then the first letter of their first name and any middle names (e.g., "Smith, J. P." for a person named Jonathan Percy Smith). All of the authors' names need to be included. The only exception is where there are more than 20 authors for one text – in this case, include the first 19 authors' names then insert three ellipses (…) and follow with the final author's name. An example is shown below:

Jankovic, N., Geelen, A., Streppel, M. T., de Groot, L. C. P. G. M., Orfanos, P., van den Hooven, E. H., Pikhart, H., Boffetta, P., Trichopoulo, A., Bobak, M., Bueno-de-Mesquita, H. B., Kee, F., Franco, O. H., Park, Y., Hallmans, G., Tjønneland, A., May, A. M., Pajak, A., Malyutina, S., … & Feskens, E. J. (2014). Adherence to a healthy diet according to the World Health Organisation guidelines and all-cause mortality in elderly adults from Europe and the United States. *American Journal of Epidemiology, 180*(10), 978-988. https://doi.org/10.1093/aje/kwu229

The **article title** will tell you about its contents (e.g., the one above examined the relationship between diet and mortality), while the **journal title** is the name of the journal where the article is published (e.g., in this reference, it is the American Journal of Epidemiology that published the article). The **volume** is the first number presented in the reference, and the **issue** is the second number shown in brackets (so, this for article, it is Volume 180, Issue 10). **Page numbers** are then included after the journal title, volume and issue numbers.

The *DOI*, which is an acronym standing for ***'Digital Object Identifier'***, is a short code that can be identified on most journal articles and then placed into a URL link to access the articles much more quickly. The beginning of this link is always https://doi.org/ and the rest of the link is the unique DOI code for that article.

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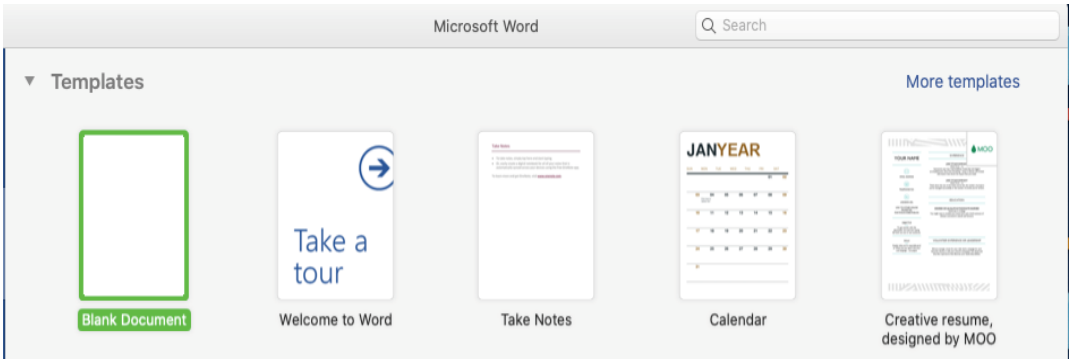
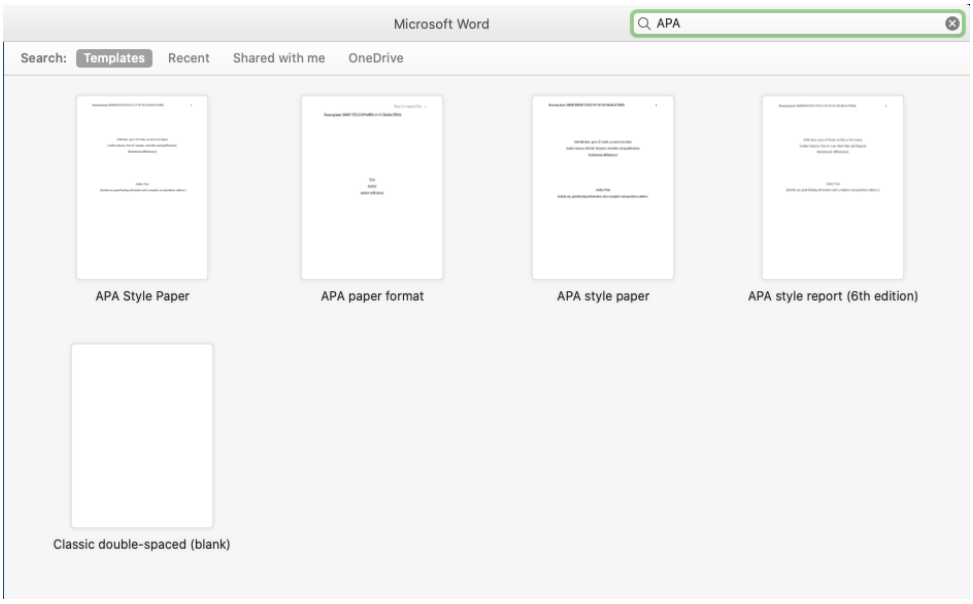
### Organising the Report in APA Style

Microsoft Word has a great APA style template for lab reports. However, it is not updated to APA 7th edition, so it is important to update small stylistic features that are still aligned with APA 6th edition (e.g., removing the running header, which is not needed in APA 7). To access this template, open the Word application and wait until the opening screen appears. The 'Templates' section should appear at the top of your screen.




Look up 'APA' in the search bar and select the 'APA Style Paper' template.
It will then be possible to edit the headings and text in your documents.

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### Report Examples

Examples of laboratory reports in APA 7th edition are shown below. Note the information presented about formatting for different levels of headings and indenting.

- https://apastyle.apa.org/style-grammar-guidelines/paper-format/student-annotated.pdf
- https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_formatting_and_style_guide/documents/APA%207%20Student%20Sample%20Paper.pdf
- https://www.antioch.edu/wp-content/uploads/2019/12/APA-7-Writing-in-APA-7th-Ed-Example-Paper.pdf

It is also advisable to read through the lab report 'good examples' included in the following text:

Burton, L. J. (2020). *An interactive approach to writing essays and research reports in psychology, 5th ed. Wiley.*

Please note that this student guide does not cover all of the APA 7th edition style requirements and that certain assignments you complete throughout your degree may have very specific instructions for completion. Therefore, it is always important to check the above text (or the online APA Blog) for style requirements, make sure to follow the individual requirements of the assignment and compare your work to the marking rubric.

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