

# Framework of Data Analysis Chapter

Dr Anthony Yeong

BBA MBA DBA PMP AFAIM FIML

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# Data Analysis Chapter

The data analysis chapter is a pivotal section in a doctoral thesis. It's where researchers rigorously examine, interpret, and synthesise their collected research data. By employing statistical techniques, qualitative methods, or a combination of both, researchers uncover meaningful insights from the gathered information. The data analysis chapter presents these research findings in a clear, narrative format, supported by visual aids like tables, graphs, and charts. Any potential issues, such as outliers or unusual data points, are highlighted objectively. Most importantly, this chapter focuses on the raw facts, reserving subjective interpretation and discussion for a later chapter of the thesis.

# Data Analysis Chapter

<b>Chapter in Thesis</b>	<b>Topic</b>	<b>Percentage % in Thesis</b>	<b>No. of Pages in Thesis</b>	<b>Months required to write</b>
4	Data Analysis	22	35	5



# Data Analysis Chapter Content

Section	Content
4	Analysis of data (this chapter usually refers to the analysis of the major stage of the research project)
4.1	Introduction
4.2	Research Subjects
4.3	Patterns of data for each research issue or hypothesis
4.4	Conclusion

# Data Analysis Chapter Content

Chapter 4 presents the patterns of results and analyses their relevance to the research issues or hypotheses. Frequent summary tables and figures are essential to help readers easily identify patterns within the data. In quantitative research, tables of statistical data are used, while matrices are employed in qualitative research (Miles & Huberman, 1985).

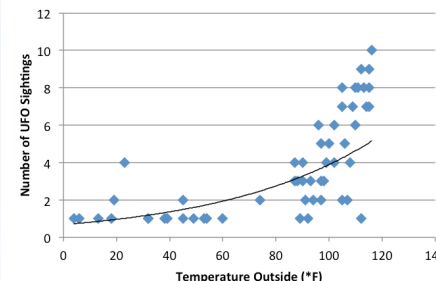
It is important that examiners can follow your arguments without needing to refer to tables and figures. If a table or figure contains a significant point, it must be incorporated into the text. Examiners should be able to pass the thesis without having to look at any tables or figures, especially if they are pressed for time.

Similarly, tables and figures should be somewhat independent of the text. Ensure that the titles of tables and figures are detailed and self-explanatory, and that any symbols used in a table are explained in a note. This way, a table can be understood even by someone who has not read the text. Remember, a table consists of rows and columns, whereas a figure does not.

Table 2. Column math mode in an observation log

UT start time <sup>a</sup> (YYYY-mm-dd)	MJD start time <sup>a</sup> (d)	Seeing (arcsec)	Filter	Inst.
2012-03-26	56012.997	~ 0."5	H $\alpha$	NOT
2012-03-27	56013.944	1."5	grism	SMARTS
2012-03-28	56014.984	...	F814M	HST
2012-03-30	56016.978	1."5 $\pm$ 0.25	B&C	Bok

<sup>a</sup>At exposure start.



Chad Perry 2012

# Data Analysis Chapter – Significance of Test Results

The Chapter 4 Data Analysis should be clearly organised. The introduction has the normal link to the previous chapter, chapter objective and outline, but often also has basic, justified assumptions like significance levels used and whether one or two tailed tests were used; for example: Significance of test results is reported in the three ways suggested by Coolican (1990, p. 174), based on  $p$  the probability level:

- `significant':  $0.05 > p < 0.01$ ;
- `highly significant':  $0.01 > p < 0.001$ ; and
- `very highly significant':  $0.001 > p$ .

All probabilities reported are based on two-tailed tests as each comparison had two possible directions.

# Data Analysis Chapter – Type I & II Error

Some statisticians prefer not to accept the null hypothesis simply because it is not rejected. This is due to the unknown Type II error associated with acceptance, whereas the Type I error involved in rejection is known. Therefore, the practical implications of a statistical test showing no significant difference between test statistics must be clearly stated. It is important not to confuse these implications with the statistical result itself.

A Type I error (false positive) occurs when a researcher rejects a null hypothesis that is actually true in the population. Conversely, a Type II error (false negative) occurs when the researcher fails to reject a null hypothesis that is actually false in the population.

		Reality	
		True	False
Research Outcome	True	Correct	Type I Error False Positive
	False	Type II Error False Negative	Correct

# Data Analysis Chapter – Linkage to other chapters

The introduction of Data Analysis Chapter may be different from introductions of other chapters because it refers to the following Conclusion chapter as well as the preceding Methodology chapter, for Conclusion Chapter will discuss the findings of Data Analysis Chapter within the context of the literature. Without this information, an examiner may wonder why some of the implications of the results are not drawn out in Data Analysis Chapter. The Chapter should be restricted to presentation and analysis of the collected data, without drawing general conclusions or comparing results to those of other researchers who were discussed in Literature Review Chapter. That is, although Data Analysis Chapter may contain references to the literature about methodologies, it should not contain references to other literature. If the chapter also includes references to other research, the more complete discussion of Conclusion Chapter will be undesirably repetitive and confused. In any case, it is traditional in research thesis to separate the results from the discussion of their significance, to preserve objectivity. 'To qualify each result, or group of results, with comments and comparisons gives the strong impression that you are trying to influence the objective judgment of the reader.' (Lindsay 1995, p. 17)



# Data Analysis Chapter – Linkage to other chapters

After the introduction, descriptive data about the subjects is usually provided, for example, their gender or industry in survey research, or a brief description of case study organisation in case study research. This description helps to assure the examiner that the student has a 'good feel' for the data, that is, they know good researchers must 'handle their own rats' (Frost & Stablein 1992, p. 271).



# Data Analysis Chapter – Linkage to other chapters

The data for each research issue or proposition is typically presented in the same order as in Literature Review Chapter (Chapter 2) and Methodology Chapter (Chapter 3), and will be discussed in Conclusion Chapter, Sections 5.2 (Conclusions about each research issue or proposition) and 5.3 (Conclusions about the research problem). Structuring the data analysis around the research issues, propositions, or hypotheses ensures that the student remains focused on solving the research problem, rather than becoming overly attached to the data itself (Brown, 1996). The analysis should address each research issue or hypothesis in turn. Sensitivity analyses should be included to account for potential errors in the data, such as using ordinal scales instead of assumed interval scales. For qualitative research, an additional section can be provided for data that does not fit into the research issue categories developed in the literature review of Chapter 2.

# Data Analysis Chapter – Linkage to other chapters

Please note that the suggested structure for Data Analysis Chapter does not include **tests for response bias** or **tests of the assumptions of regression** or similar statistical procedures. While some students may prefer to include these tests in Data Analysis Chapter, they are more appropriately discussed in Methodology Chapter, as they pertain primarily to the methodology rather than the data analysis used to test research issues or hypotheses.

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# Data Analysis Chapter – Interpretation of Data

In Data Analysis Chapter, the data should not be merely presented, leaving the examiner to analyse it. To ensure adequate analysis, students should use interpretive words to describe the data, followed by numbers in brackets. For example, “most survey respondents (69 percent)...” Similarly, test statistics, degrees of freedom, sample size (to allow the examiner to verify test statistics in tables if desired), and p-values should be explained in words that demonstrate the student’s understanding, followed by their values in brackets.

# Data Analysis Chapter – Interpretation of Data

An example of an appropriate analysis is as follows: Question 9 explored attitudes towards product quality, and respondents' answers are summarised in Table 4.6. Most respondents (59.2 percent) agreed that product quality was important, while a sizeable minority (27.8 percent) had no opinion on product quality. This somewhat surprising finding will be discussed in the context of the literature in Section 5.4.3 . A t-test was conducted to examine the relationship between attitudes towards product quality and price (Section 4.9), as both were measured on an interval scale. No significant difference was found between the means of attitudes towards the two variables ( $t = 1.56$ ,  $dof = 23, 25$ ;  $p = 0.35$ ). A practical implication of this finding is that shoppers considered product quality and price separately.

# Data Analysis Chapter – Interpretation of Data

Most researchers in reputable journals do not provide precise p-values when reporting their data analysis. Instead, they typically indicate whether the test statistic is significant at a certain level, such as 'p<0.05'. However, some researchers argue that this approach does not fully utilise the information provided by statistical programs and prefer to report the exact p-value, as demonstrated in the example above. A compromise between these two positions could be to state a specific significance level in the text, such as 'p<0.01', while listing the precise p-values in a table.

# Data Analysis Chapter – Discussion of Result

The discussion of results in previous was based on quantitative analysis. Reporting the analysis of qualitative data is slightly different. First, the overall patterns in the data are presented, along with the reasons for those patterns. There is no reference to the number of respondents or cases, as the sample will have been chosen purposively, and thus there can be no claim for statistical representativeness (Patton, 1992). Next, the reader can be referred to a matrix of the findings (Miles & Huberman, 1994) where more details can be found to support the claim that the pattern in the data exists. Finally, specific examples and quotations are presented to further corroborate the existence of the pattern in the data. A brief example of this presentation of qualitative findings is:

Most respondents thought shipping was not important because schedules were reliable (row 2 of Table 4.3). “Thank goodness the unions are tame” (A2). “No worries - we have good port agents and shipping lines” (B1).



# Data Analysis Chapter – Presenting Analyses

Presenting analyses of qualitative data can be challenging because patterns in the detailed data must be made clear without overlooking the specifics that provide the in-depth strength of qualitative research. The following paragraphs from the introduction to a data analysis chapter outline these two considerations and how they were addressed in the chapter:



# Data Analysis Chapter – Presenting Analyses

Two considerations made it challenging to blend qualitative details and synthesised patterns in the data within this chapter; that is, to blend the ‘wood’ and the ‘trees’. The patterns in the data that explain why and how the world operates represent the ‘wood’ and were the primary focus of this chapter. However, details of the ‘trees’ also had to be presented to confirm the trustworthiness of the patterns described. First, because this research was an in-depth investigation of a complex and under-researched area, the chapter had to be quite detailed in some parts of its analysis. For example, matrices for each type of finding (Miles and Huberman, 1994) show the results for each case. Second, the requirement for trustworthiness in qualitative research necessitated providing detailed quotations and other evidence for the patterns found in the data, along with the sources of the quotations. In brief, patterns had to be synthesized from the data without losing sight of the rich, qualitative sources on which they were based. To address these considerations, this chapter is clearly structured around the three research issues, with frequent summaries of the patterns of data being uncovered, supported by quotations. Tables and figures are critical for following the patterns in the data, as they provide an overall picture of the findings. Specifically, Figure 4.9 summarises the findings examined throughout the chapter and provides an overview of the entire chapter.

# Data Analysis Chapter – Patterns of the Results

Whether the data is qualitative or quantitative, all patterns of results in Data Analysis Chapter must be supported by the evidence unearthed through the procedures described in Methodology Chapter. Readers should be able to verify findings by referring to tables or figures. Therefore, each table or figure should be mentioned in the body of the chapter, along with the reason for its inclusion. As demonstrated in the previous paragraph, a topic should be introduced in words, followed by the main findings. Then, the relevant table or figure should be referenced, with evidence from it introduced in one or two sentences. The highlights of the table or figure should be discussed in more detail, along with a brief description of what the reader should look for when examining it. In other words, readers should not be expected to independently establish the connections between the text in Data Analysis Chapter and the tables or figures. Ideally, the reader should be able to understand the meaning by reading either the text or the figures without needing to refer to the other.

# Data Analysis Chapter – Tables and Figures

When figures are used, the table of data used to construct the figure should be included in an appendix. All tables and figures should have a number and title at the top, and their source at the bottom. For example, 'Source: analysis of survey data.' If no source is listed, the examiner will assume the researcher's mind is the source. However, a listing such as 'Source: developed for this research from Chapter 2' can reinforce the originality of the student's work. The title of a table or graph should contain enough information for its findings to be understood without referring to the text. For example, 'Relationship marketing propensity among Overseas Chinese and Australians: they are similar despite cultural differences.'

Example of a Table:

**Table 4.3: Comparative Demographics – National**

Demographics Variables	Cereal Purchaser	Pick n Pay Shoppers
<b>Gender (%)</b>		
Male	39.25	48.85
Female	60.75	51.15
<b>Age (Years)</b>		
Mean	39.96	37.63
Standard Deviation	15.39	15.89
<b>Household Income (Rand)</b>		
Mean	9 437.44	12 713.89
Standard Deviation *	8 972.74	127 330.26

Source: All Media and Product Survey (2013)

# Data Analysis Chapter – Statistical Methods

- Descriptive Statistics: Used to summarise and describe data.
- Correlation Analysis: Used to measure the strength and direction of the relationship between two variables.
- Regression Analysis: Used to predict the value of one variable based on the values of other variables.
- ANOVA (Analysis of Variance): Used to compare means across multiple groups.
- MANOVA (Multivariate Analysis of Variance): Extends the concept of ANOVA to analyse multiple dependent variables at once. It's especially valuable when these variables are correlated, as it can account for the interrelationships between them.
- Factor Analysis: Used to reduce the number of variables into a smaller set of underlying factors.

# Data Analysis Chapter – Quantitative Analysis Tools

Software Programs for Quantitative Data Analysis in Doctoral Research:

- SPSS
- R
- MATLAB
- SAS



# Data Analysis Chapter – Qualitative Data

## Qualitative Data Gathering Tools

- Interviews: Structured, semi-structured, or unstructured interviews can be conducted in person, over the phone, or online.
- Focus Groups: Small groups of participants are brought together to discuss a particular topic.
- Observations: Researchers observe participants in their natural settings or in controlled environments.
- Review of Documents: Analysing existing documents like letters, emails, or reports can provide valuable insights.
- Online Communities and Forums: Engaging with online communities and forums can provide access to a wide range of perspectives.

# Data Analysis Chapter – Qualitative Data Tools

- NVivo
- ATLAS.ti

Other notable qualitative data analysis tools include:

MaxQDA: a comprehensive tool for qualitative and mixed-methods research

Dedoose: a web-based tool for qualitative and mixed-methods research



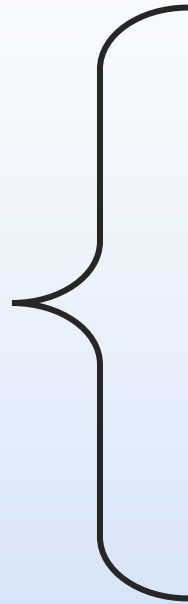


# References

- A STRUCTURED APPROACH TO PRESENTING THESES: NOTES FOR STUDENTS AND THEIR SUPERVISORS by Chad Perry (revised on 3.11.02)



**Thank you**



Dr Anthony Yeong

[anthony@anthonyyeong.com](mailto:anthony@anthonyyeong.com)