228797
RESEARCH METHODS IN ENGINEERING

ACADEMIC WRITING

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Based on the lecture course by Prof. Henry Wu, School of Electrical

Academic Writing

1. Academic and Technical Writing

2. Research/Project Proposal

3. Thesis Structure

4. Referencing

5. Thesis Conclusion

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1. Academic and Technical Writing

- Pay attention to differences between the spoken language and the written language
    - Learn from reading and
    - Practice makes perfect

- Technical writing (research based or technology related)
    - Technical briefing/literature survey
    - Research proposal
    - Technical report
    - Conference paper
    - Correspondence or express letters or comments
    - Full journal or transaction paper
    - Book chapter
    - Thesis
    - Book

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2. Research/Project Proposal

- Structure of research/project proposal
  - Introduction
    - o indentify your field of research (or FoR)
    - o research problem definition (or problem statement)
    - o aims and objectives, and
    - o research performance criteria and outcomes specification
  - Literature review
    - o tracing the origin of ideas
    - o critical assessment of the *state-of-the-art*
    - o establishing significance (scientific, social, cultural, economical and environmental) and innovation of the proposed research
  - Research approach, methodology and planning
    - o approach-routine, modified/improved, novel/new
    - o detailed formulation/techniques-description, math, figures/tables
    - o facilities required for the conduct of the proposed research
    - o workplan, Gantt chart
  - Justification or evidence for a successful outcome of the proposed research project, e.g., preliminary investigation results or findings
  - References

3. Thesis Structure

A general thesis template[3]

- **Cover page**
  - Thesis title
  - Name of the course/degree
  - Author's name
  - Year
- **Abstract**
- **Acknowledgements**
- **Contents**
- **Abbreviations, Acronyms and Symbols**
- **Lists of Figures and Tables**
- **Chapter 1** Introduction
- **Chapter 2** Literature Review
- **Chapter 3** Research Methods, Fundamentals, Frameworks
- **Chapter 4** Research Findings
  - Theoretical work
  - Experimental design, implementation or simulation
    - system level
    - hardware
    - software
    - system integration
  - Performance evaluation, analysis, benchmarking against the state-of-the-art
- **Chapter 5** Conclusion
- **References**
- **Appendices**

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Thesis Format[6]

The thesis shall contain the following, in the following order:

a) a title page setting out the:

  i. full title of the thesis,

  ii. full name and degrees of the candidate,

  iii. name of the School and College associated with the work,

  iv. month and year when the thesis is submitted for the degree.

b) a declaration by the candidate (see Section 6 for required format);

c) acknowledgements, if any;

d) a table of the contents of the thesis and, where applicable, lists of diagrams, tables, etc., contained therein;

e) a summary of the research in not more than 1,000 words;

f) the main text of the thesis ;

g) a list of references conforming to a recognised international standard.

Writing abstract[3]

- Abstract:
  - a synopsis of the thesis' work
  - should be informative (compared with descriptive)
    - a summary of the work carried out by the reported research and its significance/importance, major contributions/findings and recommendations.

- Elements of an abstract
  - problem statement including the need for research
  - research approach/methods
  - research results/findings/contributions
  - conclusion(s) and recommendation(s)

An abstract template[3]

"Abstract:

The focus of this research is in the area of ...**Such a study is important in order to** ...**The research approach adopted** in this dissertation **includes...The findings from this research** provide evidence **that...The main conclusions drawn** from this study are...**This dissertation recommends that**..."

—John Biggam, 2008

Writing introduction[3]

General structure of an introduction

- Background

- Research focus

- Research aims and individual research objectives

- Value/significance/benefits of this research

  - scientific

  - technological, social, economical and environmental impacts

- Thesis organisation/structure

- Contributions and achievements made*

*optional

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Problem statement[8]

"A problem statement is expressed as an interrogative sentence, a declarative sentence, or an imperative sentence that summarizes a question, complaint, or requirement, respectively."

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Literature review

- Components of a literature review
  - tracing the origin of ideas
    - when and where the original discovery was made and concepts defined
    - to show appreciation of fundamental issues, principles, methods and techniques which influenced the development of the field
  - critical assessment of the state-of-the-art
    - establishing the state-of-the-art in the field
      - approach and methodology (means of discovery as accepted or established by the research community)
      - pros and cons in terms of a set of performance criteria
      - remaining issues and new challenges
    - identifying current benchmarks for performance evaluation
  - establishing significance (scientific and social) and innovation of the proposed research

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Key points of literature review[3]

- Introduction to the literature review
  - objectives and topics of the review relevant to your research
- Referencing
- Quotations
  - appropriate with comments
- Demonstrate basic understand skill when describing published work
  - with critical evaluation consisting of description and your views of a relevant work, and reasons to support your views
- Useful verbs such as "accepts", "expresses", "speculates", etc. [3, Appendix I]
- Demonstrate high level of cognitive skills, i.e., analysis, evaluating and creating
- Conclude with your findings linking to your research objectives and methods

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What is a Literature Review?

- A review of the writings/literature on a particular subject / topic

- A review of the most relevant, recent and scholarly work in the subject / topic area

- A piece of writing that supports, evaluates and critiques your research topic.

What a Literature Review is NOT?

- Just a summary of articles, texts or journals
- Opinionative or argumentative essay

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Why is Literature Review Needed?

- To justify choice of research question, theoretical or conceptual framework, and method;

- To provide background information needed to understand the study;

- To define key terms, definitions and terminology;

- To show reader that the writer are familiar with significant and/or latest research relevant to the topic.

What Makes a Good Literature Review?

- The selection of literature chosen for review;

- The criticism of the literature;

- The interpretation of the literature.

How is a Literature Review Different from a Research Paper?

- Literature reviews discuss available information in a specific area, and sometimes information in a particular subject area within a certain time period.

- In contrast, the focal point of an academic research paper is to develop a NEW question, and a research paper will contain a literature review as one of its parts.

- In a **research paper literature review**, the literature is used as a **foundation and as support** for a new insight that is contributed

- Good reference sources for the Literature Review are:
  - Journal Article
  - Computerized Databases
  - Dissertations
  - Government reports
  - Historical records
  - Technical White paper
  - Monographs
  - Conferences proceedings
  - Empirical studies
  - Reports from other bodies
  - Statistical handbooks

How about Wikipedia ?

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Wikipedia

- URL: http://www.wikipedia.org
- Wikipedia is:
  - Free;
  - Web-based;
  - Collaborative;
  - Multilingual

  encyclopedia project.
- More than 3.5 million articles in English
- More than 270 language
- More than 91,000 active contributors.
  - You can register your own account and edit Wikipedia
- Is Wikipedia a right source for referencing / literature review?
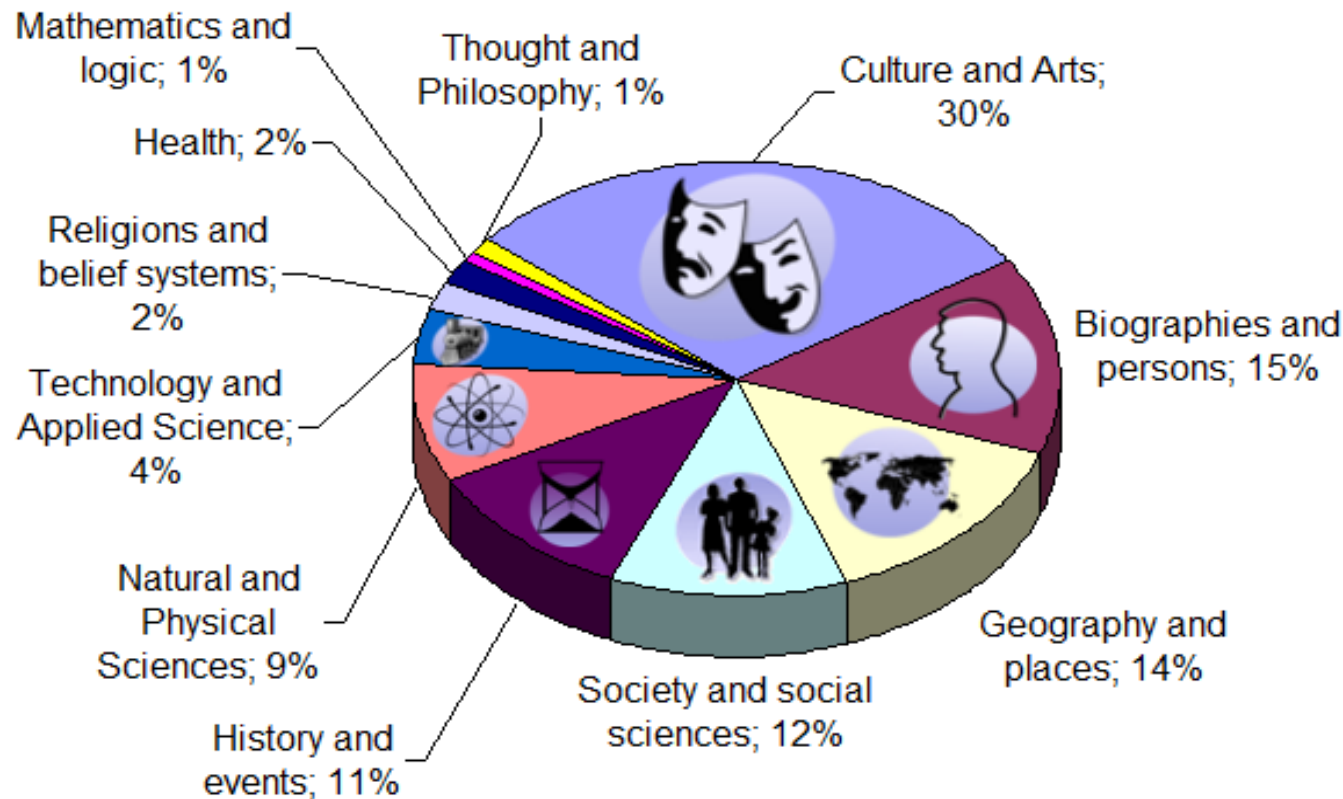 - **NO!!!!**

Why is Wikipedia not a good source?

- Everyone can edit Wikipedia
  - The qualities of editors
    - Wikipedia joker eats humble pie (http://news.bbc.co.uk/2/hi/technology/4520678.stm)
    - A false Wikipedia 'biography' (http://www.usatoday.com/news/opinion/editorials/2005-11-29-wikipedia-edit_x.htm)
  - Some users just edit it to spread rumor
    - Comedian Sinbad Fights Back Over Internet Death Rumor (http://www.foxnews.com/story/0,2933,259047,00.html)
  - "Paid Editor"
    - http://www.elance.com/j/wikipedia-editor/20193303/
    - *"Looking for an experienced Wikipedia editor. The organization I work for has an entry where a paid editor has ruined our reputation. We would like an experienced editor to replace it with an accurate and objective entry. We have a draft of the copy complete with reputable 3rd party sources. Every time we have changed the entry, the paid editor has changed it back so we need someone that is an established Wikipedia editor to change it back and monitor it for reversions."*

Should I still use Wikipedia for my Research?

- Answer: Yes! But be careful!
- Universities/College or conference/journals may not allow to use Wikipedia as your source / reference
- It is still a good place to start with some basic idea (but do **NOT** trust it 100%)
- Look for the reference link in the Wikipedia to find the further information

Mathematics and logic; 1%
Thought and Philosophy; 1%
Culture and Arts; 30%
Health; 2%
Religions and belief systems; 2%
Biographies and persons; 15%
Technology and Applied Science; 4%
Natural and Physical Sciences; 9%
Geography and places; 14%
History and events; 11%
Society and social sciences; 12%

Pie chart of Wikipedia content by subject as of January 2008

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Primary Source vs. Secondary Source

- Primary Source
  - "[A] document or record containing first-hand information or original data on a topic…"

    The Online Dictionary for Library and Information Science

  - is contemporary accounts for an event, written by someone who experienced or witness the event in question.

- Secondary Source
  - "Any published or unpublished work that is one step removed from the original source, usually describing, summarizing, analyzing, evaluating, derived from, or based on primary source materials..."

    The Online Dictionary for Library and Information Science

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Check List: Selection of Literature

- Have you read widely?
- Is the purpose of the review clearly identified?
- Does your writing include clear definitions and identify the limits of the research?
- Does the review focus on the most recent developments/research for the topics?
- Does the review make use of primary sources?

Avoid in the Literature Review

- Just reading!
  - Not only reading, but also writing;

- Not keeping bibliographic information;

- Incomplete Reference;

Introduction of the Literature Review

- What you are going to cover in the review

- The scope of your research

- How the review ties in with your own research topic.

Topic sentence - identifies five major themes as the scope of this review

Many theories have been proposed to explain what motivates human behaviour. Although the literature covers a wide variety of such theories, this review will focus on five major themes which emerge repeatedly throughout the literature reviewed. These themes are: incorporation of the self-concept into traditional theories of motivation, the influence of rewards on motivation, the increasing importance of internal forces of motivation, autonomy and self-control as sources of motivation, and narcissism as an essential component of motivation. Although the literature presents these themes in a variety of contexts, this paper will primarily focus on their application to self-motivation.

5 major themes to be covered

Concluding sentence - specific focus

Paragraph

- A main statement / idea that you are putting forward, i.e., topic sentence ;

- Evidence from research to support / argue your idea, showing where the writers agree and / or disagree

- Student analysis of the research literature where appropriate

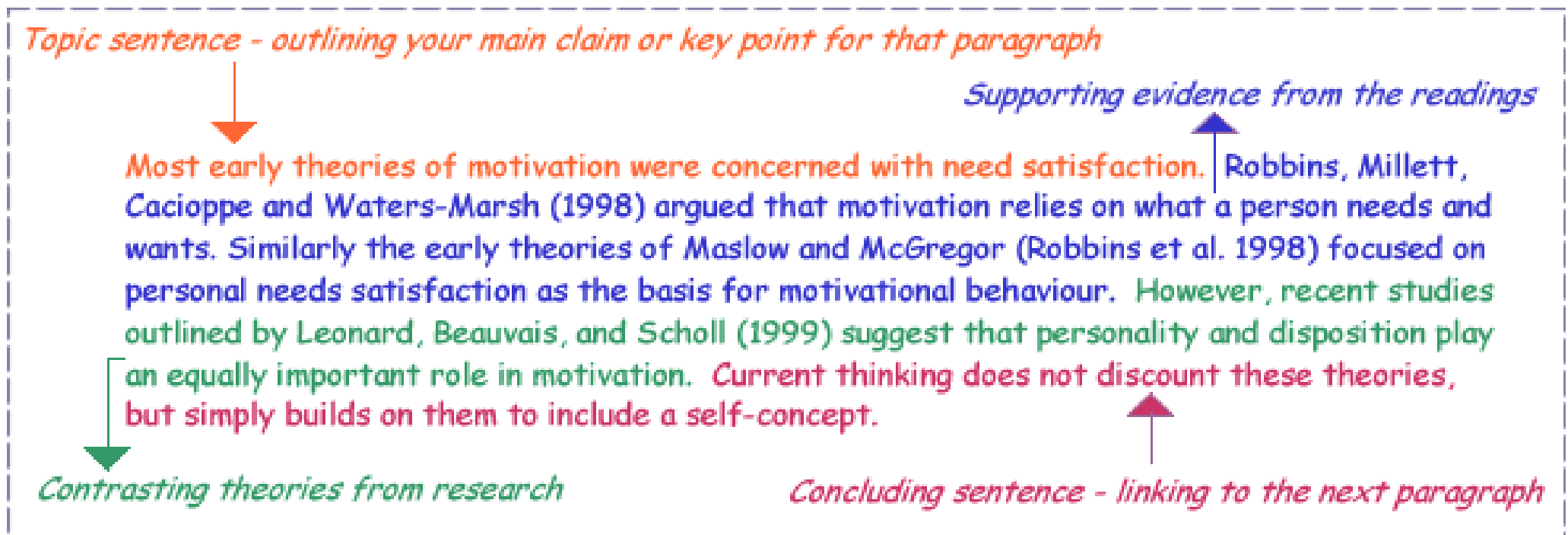- Summing up and linking to the next idea (paragraph).

Citing Previous Research

- There are two way to cite the work of other authors:

  - **Information Prominent** focuses on the *Information* provided by an author, e.g.:

    - *"For viscoelastic fluids, the behaviour of the time-dependent stresses in the transient shear flows is also very important (Boger et al., 1974)."*

  - **Author-prominent** focuses on the *author him- or herself, e.g.:*

    - *"McClose (1983) developed a simplified theory using an analogy between heat and mass transfer and the equivalent heat transfer only case." (strong)*

    - *"Several authors have suggested that automated testing should be more readily accepted (Balcer, 1989; Stahl, 1989; Carver and Tai, 1991)." (weak)*
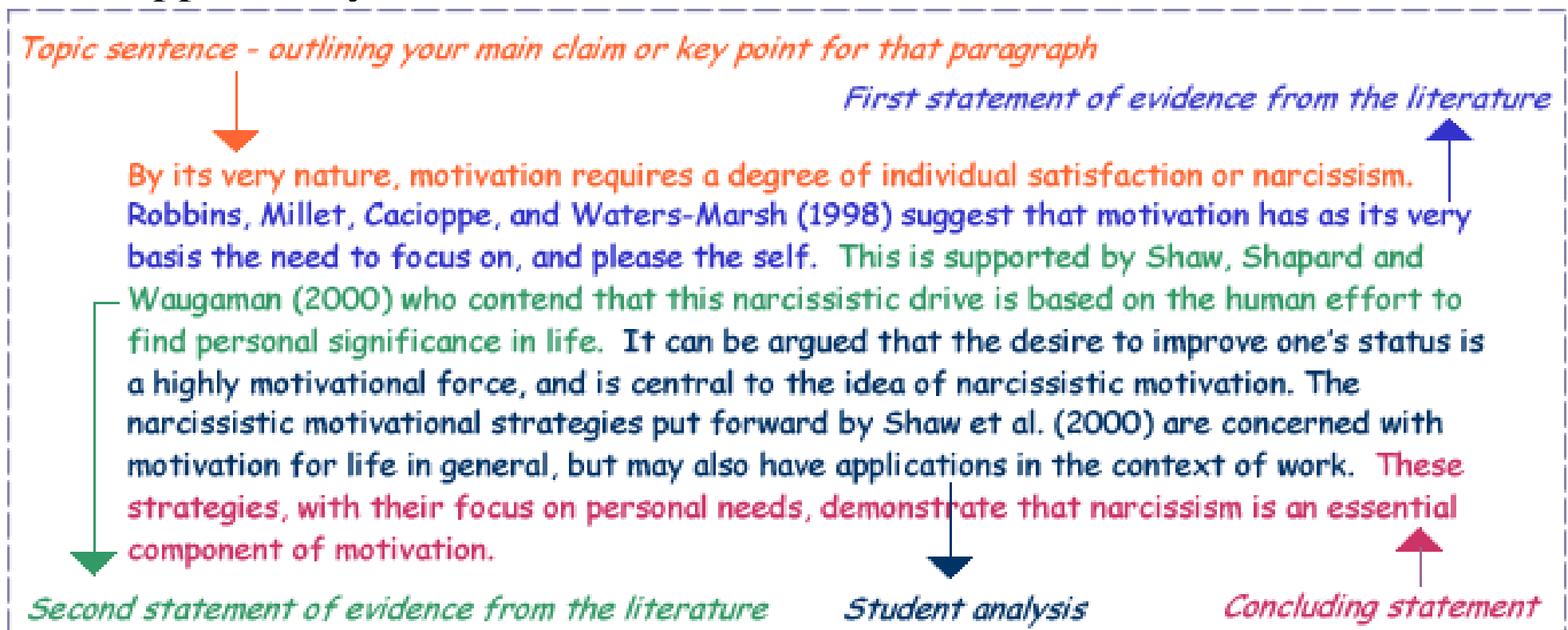
Integrating Arguments in Paragraphs

- Integration of multiple sources
  - To develop an integrated argument from multiple sources, you need to link your arguments together. The model below is a guide.

Integrating Arguments in Paragraphs

- Integration of student analysis
  - It is important to integrate your analysis and interpretation of the literature in your literature review. Read the following paragraph and see how the arguments have been integrated into the paragraph along with student analysis. Analysis is not just student opinion, it needs to be supported by the literature.

Topic sentence - outlining your main claim or key point for that paragraph

First statement of evidence from the literature

By its very nature, motivation requires a degree of individual satisfaction or narcissism. Robbins, Millet, Cacioppe, and Waters-Marsh (1998) suggest that motivation has as its very basis the need to focus on, and please the self. This is supported by Shaw, Shapard and Waugaman (2000) who contend that this narcissistic drive is based on the human effort to find personal significance in life. It can be argued that the desire to improve one's status is a highly motivational force, and is central to the idea of narcissistic motivation. The narcissistic motivational strategies put forward by Shaw et al. (2000) are concerned with motivation for life in general, but may also have applications in the context of work. These strategies, with their focus on personal needs, demonstrate that narcissism is an essential component of motivation.

Second statement of evidence from the literature

Student analysis

Concluding statement

Poor Writing in a Literature Review

- Poor writing in a literature review is often the result of failing to integrate arguments into the review. Many people make the mistake of simply summarising their readings. Look at the following example of poor writing.

Example - poor writing

Avoid using words like 'are reported' . These types of words often lead to descriptive writing.

During the past decade, many researchers have shown interest in motivation. Their findings are reported here. Smith (1995) developed a model investigation conducted on ... *(next paragraph describes Smith 's model). ..* Jones (1998) asserts *that ... (following paragraph says what Jones asserted). ..* Hoey (1998) makes a clear distinction *between ... (following paragraph states what Hoey says) ...*

- **All this does is leads to paragraphs that just describe, not critically synthesise and evaluate**

- This example is just simply reported each author's theory without any analysis or integration

- Remember !!!! Literature review is NOT:
  – Just a summary or articles, texts or journals.

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Good Writing in Literature Review

- The following information is an example of good writing in a literature review because:
  - it integrates the research of various authors ;
  - it shows similarities and differences of ideas ;
  - it shows wide reading;
  - it shows analysis and critical evaluation of what the student has read.

Shows ability to connect two author's ideas

Shows further reading

Student voice

This paper brings together work in two areas of motivation. According to Robbins, Millett, Cacioppe and Waters-Marsh (1998) the early theories of motivation were concerned with need satisfaction. Current thinking however, does not discount these theories, but simply builds upon them, to include a self concept. Leonard, Beauvais and Scholl (1999) argue that there are three elements to self-perception. They propose that... These three elements can be seen as a further development of Eunson's original concept of 'money as motivator'.

Deeper development of analysis

Research Methods, Fundamentals, Frameworks

- Present fundamentals to anchor discussions
  - basic definitions, concepts, principles
    - set ground work and define "common language"
    - show mastery and understand of knowledge in the field
- Define or describe theoretical and/or experimental framework(s) to be employed by the thesis work
  - consistent mathematical representation, symbol system
  - systematic process and procedures
- Provide detailed information and discussions on research methods adopted by the thesis work
  - where they stand
  - how they compare with alternative methods
  - your reasoning and justification of choosing such methods

6.4. Referencing

- Compile your sources of information and references as you proceed
- Style of referencing[7]
  - IEEE
  - Harvard
  - Vancouver
  - Chicago, etc.
- Difference between references and bibliographies
  - References or works cited
  - Bibliography or works consulted
    - sources consulted but not directly cited
    - references directly cited

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When to reference[4]?

- When to reference
  - To inform the reader of source of materials presented
    - o statistics, diagrams, tables etc.
  - When describing theory, model and work by others
  - To give weight or credibility to an argument support by you
  - To inform the source of quotation used
  - When paraphrase work by others of significance or subject to debate
- When you do not need to reference
  - when presenting historical overviews
  - when presenting your own experiences
  - in conclusions, when you are repeating ideas previously referenced
  - when summarising what is regarded as "common knowledge" or axiom (a self-evident or universally recognised truth, etc.)

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6.5. Thesis Conclusion

- Components of concluding chapter
  - Introduction
  - Research objectives as delivered, including summary of findings and conclusions
  - Contribution to knowledge
  - Limitations
  - Self-reflection

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References and useful information on the subject

1. Evans D., How to write a better thesis or report, Melbourne University Press, 1995.

2. Leedy Paul D., Practical Research: Planning and Design, 4th Edition, McMillan, New York, 1989.

3. Biggam J., Succeeding with your Master's Dissertation-A step-by-step handbook, McGraw Hill, 2008.

4. Neville C., The Complete Guide to Referencing & Avoiding Plagiarism, 2nd ed., McGraw Hill, 2010.

5. Sample research papers and references available in course documents via RMIT Learning Hub.

6. RMIT, Thesis policy - higher degrees by research , URL: http://www.rmit.net.au/browse;ID=jsnvw021y33g1;STATUS=A;STYPE=ENTIRE;PAGE_AUTHOR=Michael%20Walsh;QRY=Phd%20thesis%20format;SECTION=1; 2011

7. RMIT Library, Referencing Guides, http://www.rmit.edu.au/browse;ID=8rwjnkcmfoeez;STATUS=A;PAGE_AUTHOR=Karen%20Macvean;SECTION=1; 2011

8. P. Bock, *Getting It Right-R&D methods for science and engineering*, Academic Press, 2001.

9. Literature Review, Study & Learning Centre, RMIT University http://www.dlsweb.rmit.edu.au/lsu/ content/2_AssessmentTasks/assess_tuts/lit_review_LL/index.html

10. Writing Literature Review, Language & Learning Online, Monash University http://www.monash.edu.au/lls/llonline/writing/general/lit-reviews/index.xml

11. Primary vs. Secondary Source, University of Victoria Libraries http://library.uvic.ca/site/lib/instruction/research/primvsec.html

12. UNCW Fast Facts Guide: Identifying Primary, Secondary, and Tertiary Sources http://library.uncwil.edu/is/infocycle.htm

13. Primary, Secondary and Tertiary Sources, University of Maryland Libraries http://www.lib.umd.edu/UMCP/UES/primary-sources.html

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