Notes on the Literature Review

Final Year Research Project - Notes on the Literature Review

Purpose of the Literature Review Process
In the context of the research project, the Literature Review provides
- an introduction to the study under consideration
- a justification for the research, in particular for the specific approach adopted
- essential background material (initially for the benefit of the researcher; ultimately, for that of the reader)

A Literature Review is not simply a list of pertinent references, each considered in isolation. In addition to conveying an understanding of the topic, a good Literature Review critically evaluates key ideas and observations while making meaningful comparisons between the works of various authors. In reviewing the work that has been performed on a particular topic to date, it should be possible to identify knowledge gaps or inconsistencies, which may form the basis for future experimental work.

In preparing for and producing the Literature review, the researcher should develop a number of skills which are of relevance in almost any discipline or professional activity, including the ability to
- locate and retrieve relevant (scientific) information from a variety of sources, including books, journals and the Internet
- organise information in a logically-structured and coherent fashion, with reference to specified objectives
- critically evaluate and compare information
- present information in a clear and concise manner, while adhering to the conventions of scientific writing

Preparing for the Literature Review
- Firstly, identify the relevant area(s) of interest (e.g. fermentation system: bacterial, fungal, plant or animal) and then focus on the specific aspect(s) under consideration (e.g. product formation, growth optimisation, morphological characterisation). An exploratory trawl of the available information sources may be useful at this stage.
- If you are unsure of how to use the relevant Abstracts or Indices (in particular, the Science Citation Index/Web of Science (SCI/WOS), Engineering Index (Compendex), ScienceDirect, etc.) or how to locate books or periodicals in the Library, arrange to attend a training session in the Library. Remember that many of the computerised databases only contain information on recently published material (e.g. SCI only references material produced since 1990). Accordingly, it may be necessary to extend your search to more traditional 'paper' sources.
- On the basis of your preliminary search, become familiar with the main journals of interest to you.

Sources of Information
- Original, peer-reviewed research articles (in, for example, journals such as Biotechnology and Bioengineering, Chemical Engineering Science, AIChe Journal, etc.) are known as 'primary sources' of information, while review articles are termed 'secondary sources'. Secondary sources (e.g. reviews in Advances in Biochemical Engineering/Biotechnology, Trends in Biotechnology, Journal of Biotechnology, Enzyme and Microbial Technology, Critical Reviews in Biotechnology or chapters in scientific encyclopaedia including Biotechnology, Comprehensive Biotechnology) are very useful for providing an overview of a subject and can serve as a starting point for relevant references. However, for the Literature Review, primary sources are of greater importance.
- While UCD has a well-stocked library and excellent information dealing systems, not all journals or books of interest to you may be available on-campus. If this is the case, ascertain (through the Internet or SHiRL) whether or not the material is held in any other Library in Dublin. The UCD Librarian can provide a letter of admission to other University-based libraries. Books and articles may also be ordered on Inter-Library Loan (ILL), from the UK. Order forms are available at the ILL. However, as a charge is levied for each item ordered, this service should be used sparingly; moreover, items may take several weeks to arrive in UCD.
- Relevant information may also be available on the Internet. However, as this material is generally not peer-reviewed, it should be treated with caution.
- Check the OPAC for M.Sc. or Ph.D. theses on relevant work performed in UCD. (See what a Literature Review looks like!)
- Patents (European Patent Office http://ie.espacenet.com/) may also be a valuable source of information.

Handling Information
Because the time available for this exercise is limited, it is essential to develop a rigorous, consistent and efficient approach to information retrieval and management.
- Having identified the key area(s) of interest, undertake a more thorough search of the literature. But be selective in your search. Use keywords judiciously.
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- Make a preliminary decision on the relevance of an article on the basis of the title, keywords and source journal; read the abstract to ascertain its significance. Subsequently, compile a list of articles for retrieval. Resist the temptation to photocopy every article unearthed in your initial search. This is a costly and time-consuming exercise, which typically yields poor returns.

- In photocopying materials, check the quality of the copies as you proceed. Reducing from A3 to A4R (71%) may reduce costs, but is effective only if the copy is legible. When you have retrieved a document, scan it quickly to ensure that you have copied the entire article, including the title page, the head and footer, and all references and appendices. Staple the pages securely together.

- Read the articles soon after copying them. Read the Abstract for pointers to the objective, methods and main observations. Check the Introduction for useful references. In the Materials and Methods sections, make a note of experimental techniques or conditions which may be of relevance to your work. From the Results and Discussion sections, form a clear picture of the experiment under consideration (e.g. hypothesis, independent variable, results, explanation). If you have read other articles dealing with the same subject, consider how the results are corroborated or contradicted by this work.

- You may find it helpful to maintain a summary card, sheet or file for each useful article, containing the full reference source (in a consistent, comprehensive format (see UCD Library (2007) or Kieran & Stubenrauch (2007)) and details, in your own words, of the objective, experimental system and main findings. File the original articles and corresponding cards/sheets in alphabetical order (by first author surname). Include notes on the card/sheet of where in the Literature Review a particular article might be referenced (e.g. background material, methods similar to current project, results supporting/contradicting those of A.N. Other, etc.)

Writing the Literature Review

- As early as possible, establish a structure for the Review. This may, of course, be modified, as you become more familiar with the subject, but it is useful for arranging material into coherent and manageable units. Decide on the main theme(s) for the Review, which will ultimately be contained, in sequentially numbered sections and sub-sections, between an Introduction and a Conclusion.

- Do not wait until you have read (and re-read) every reference in your possession before beginning to write. Using your proposed structure as a starting point, make sub-heading for each section. Allocate ideas and substantiating references to each. Reorganise these sections into a logical order as the structure develops.

- Take particular care in referencing material. Ensure accuracy in conveying the ideas or results of other workers. Use a consistent, comprehensive referencing system, allowing the reader to easily access the original source material. Remember that tables and figures must be referenced, as well as text.

- Consciously avoid plagiarism, which is defined (Dartmouth College Committee on Sources, 1988) as
  - '...direct quotation or word-for-word transcription'
  - '...mosaic or mixing paraphrase and unacknowledged quotation'
  - '...(unacknowledged) paraphrase and/or use of ideas'

  In student works, plagiarism often results from either ignorance or carelessness. By familiarising yourself with both the letter and spirit of the definitions provided above, carefully documenting all reference sources and taking the time to summarise material in your own words (as well as subsequently verifying the accuracy of your summary), plagiarism can be avoided.

- In presenting the Literature Review, take care to make the material accessible to the reader. Careful use of tables and figures may avoid lengthy and confusing lists of facts; sub-sections, each addressing a single theme or idea, are preferable to one, uninterrupted chapter.

Technical Matters

Poor presentation, faulty syntax, typographical errors and inconsistencies of style all detract from the reader's appreciation of any paper, however scientifically strong.

- Use a spell-checker!
- Avoid slang or colloquialisms.
- It's ~ It is; Its ~ possessive.
- Reread sentences (aloud, if necessary) for structure and sense.
- Where possible, use short, concise sentences. Use paragraphs to separate ideas.
- Re-read the Chemical Engineering guidelines for writing technical reports.
- Typesetting is a well-established art. Do not use the Literature Review as a vehicle for new trends in presentation! Consult standard texts and peer-reviewed journals for style and presentation guidelines.
- However reluctant you may be to do so, it is essential that you carefully reread the entire document before submitting it for assessment.

Committee on Sources (1988). Sources: Their Use and acknowledgement. Dartmouth College, Hanover, NH, USA