

# WRITING THE REPORT

## *Organizing the report*

Most reports should be organized in the following manner. Sometime there is a valid reason to include extra chapters in within the body of the report.

1. Title page
2. Executive Summary or Abstract
3. Preface and/or Acknowledgements (optional)
4. Table of Contents
5. List of Tables (if appropriate)
6. List of Figures, or illustrations (if appropriate)
7. Notation or symbols (if appropriate)
8. Chapters
  1. Introduction
  2. Background and Literature Review
  3. Design
  4. Methodology
  5. Results
  6. Conclusion
9. References/Bibliography
10. Appendices (if appropriate)

APPLICATION OF AUTOLISP PROGRAMMING  
FOR PRINTED CIRCUIT BOARDS  
by  
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A Senior Project submitted  
in partial fulfillment  
of the requirements for the degree of  
Bachelor of Science in Industrial Engineering

California Polytechnic State University  
San Luis Obispo

Graded by: \_\_\_\_\_ Date of Submission: \_\_\_\_\_  
Checked by: \_\_\_\_\_ Approved by: \_\_\_\_\_

**Figure 1 - Title Page**

## **Title Page**

Title page must be of the same format as shown in the sample (Figure 1). The title must be the same in all the senior project related documents i.e. title page, abstract, senior project requirement form.

## **Table of Contents**

The table of contents should only contain the major divisions of the project, including the list of tables and list of figures, the chapters of the text and their headings exactly as in the text, the bibliography/references cited, the appendices, and their respective page numbers. See Figure 2 for a sample Table of Contents. Consider using the automatic Table of contents function within Word. It can be found under the “Insert” menu, “Reference” option, “Index

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**Figure 2 – Example Table of Contents**

and Tables” option, “Table of Contents” tab. This is a very useful method of organizing the document and updating tables, figure and the table of contents.

### ***Executive Summary (or Abstract)***

The executive summary is usually less than 500 words. It summarizes all the important points of the study: context, problem, objective, approach, conclusions, and recommendations. When writing this section, imagine that the reader is incredibly simple-minded, or has so little time to think about the report that only the most simple and direct statements are appropriate. Avoid technical vocabulary. Be sure to include the most important findings in your study, but be careful not to promise more than you actually found. Express results in quantifiable financial terms. Note an Executive Summary self-contained and is a substitute for the report itself. The executive summary will fulfill the Library’s need for an abstract. An abstract is also usually less than 500 words, is a guide to the report, but does not summarize the report content.

### ***Introduction***

This section should present the background/problem addressed by the study. The background/problem tells the reader WHY you performed the study, i.e., what problem you are attempting to solve. The progression is often from a very general background statement to a very specific and concise “problem statement.” Though much background may be needed to get the reader ready for the report, only a summary is presented here in the introduction. The rest is placed in the next section (see below).

State the objectives or purpose of the study, i.e., what you hope to accomplish with the project or hope to convey with the report. A set of two to eight objectives is often appropriate and should be listed with bullets. These objectives should clearly define the scope of the project so that the reader is not surprised later by information or is not expecting something that isn’t there. Any bulleted list of objectives (or any other list) must have 'parallel' structure; e.g., all starting with action verbs – study, design, investigate, select, etc.

Summarize the solution approach you will take to reach your objectives. If you will experiment, say so, and say why. List the key tasks you will accomplish as you solve the problem. At least some of these tasks must be related to engineering content found in your coursework or related activities and should be generally aligned with your major.

Regardless of the organization of the introduction section, it should answer the following questions:

- What is this report about?
- How did the idea for this project originate?
- What is the problem that needs to be solved?
- What needs to be accomplished to solve this problem?
- What do you intend to complete as part of this project?

- What deliverables will result from your work? Prototype, product design, process design, recommendations, etc.
- How will you meet each of your objectives?
- What will not be included in the scope of the project?
- What main tasks will you perform on the way to completing the project?

Make sure you include a few sentences telling the reader how the rest of the report is organized.

## **Background** (includes Literature Review)

The background should provide a context for the project and should describe any important information the reader needs to know in order to understand what you've done. This may include information concerning existing products, processes, systems, or organizations. Company literature, catalogue or manual information, advertising material, or other literature may be referenced here.

The background may also include important theory that has been developed by others (literature review). This is information the reader should know (or be reminded of) before reading the rest of the report. The theory is what is known (or believed) about the important concepts under study. It may describe a link between process/system inputs and outputs or define how quality, productivity, or cost is related to design decisions. The theory can usually be found in textbooks or landmark articles about the subject. Include references to give credit to the originators of the theory.

The background should also indicate what has been completed or attempted with regards to solving this or similar problems in the past (literature review). The published literature may include those that have attempted to solve the same problem as you, similar problems related to your work, or simply problems related to some of the methods you will use. References to recent works may include journal or magazine articles, theses or previous senior projects, conference proceedings, or other sources. Explain why your project is still necessary in the face of this prior work.

## **Literature Review**

Many students commit themselves to work on their senior project before they have done sufficient background reading on the topic, dismissing the literature search as completed after a few books and articles have been reviewed. Wide reading in the topic is strongly recommended as a means of discovering a suitable project and/or an appropriate approach to analyzing the selected problem. Often as result of such reading, an already selected senior project may be modified extensively or redefined.

A review of the related literature is an essential part of a senior project. The topic must relate to existing knowledge on the subject and must demonstrate an ability to locate, organize, and use the literature in the field. The literature search should be almost complete before proceeding with the project. This literature review will help in defining the problem, and provide insight into the methods and approaches used by others.

The review of the related literature involves locating, reading, and evaluating materials in your area of interest in the library and online. The library is, therefore, an indispensable resource for those engaged in project writing. The efficiency with which materials relevant to problem are located depends considerably on students' knowledge of the University Library and its various resources.

Generally you will need to have at least fifteen references; at least ten of them should be non-internet sources. There is much information online, but you must be diligent in evaluating the sources of the material. Cited material must be peer reviewed and published by a reputable source. Wikipedia is not an acceptable source in a literature review.

The methods of conducting the literature review differ to some extent from subject to subject. However, in most fields the first step consists of locating or identifying key

substantial change in response latency in the later portion of the test and a corresponding negative change in performance (Hadadi & Luecht, 1998). In a paper-and-pencil test, because the response times to individual items can not be recorded, only the performance can be examined. Secolsky (1989) examined scores on different sections of the Test of English as a Foreign Language (TOEFL) to see if there were sections of the test, especially at the end, that showed a pattern of random guessing.

words related to the topic under investigation. This is usually done by checking the main reference sources and

**Figure 3 - Reference by Author and Year**

references in the indexes and abstracts.

textbooks on the subject. These key words are needed to locate specific

During the search of indexes and abstracts a bibliography card should be prepared for each book title, report or article which might contain material pertinent to the project. The bibliography card should include all the information necessary to identify the reference, such as author, title, publisher, date, periodical title, volume number, and inclusive paging. PolyCat in the Library will provide this information. Libraries will also have facilities to search for references using key word search through database of current periodicals. Some of the needed materials may not be available in the library, but may be obtained on interlibrary loan.

The review of the literature should include those articles and other references that bear a valid relationship to the problem under study. They should provide the background information that is needed to understand the project's contribution to the field and a point of reference in discussing and interpreting the conclusions in the project.

When writing the Literature Review all sources must be cited within the report and in the reference list of the bibliography. One method of citing sources includes a reference to the source by author and year. An example

develop a new product in half the time. Also, it requires keeping far less than half the needed inventory on site, results in many fewer defects, and produces a greater and ever growing variety of products" [4].

Taiichi Ohno and Dr. Shigeo Shingo are credited as the founding fathers of the Toyota Production System. The Toyota Production System took over twenty years to develop, perfect, and implement. In a thorough investigation into the inner workings of the Ford production system, Ohno and Shingo were able to identify and create solutions to address the shortcomings of the mass-production assembly line while adapting techniques they found useful. Toyota Production System evolved in Japan in response to: lack of space, lack of money for inventory holding costs, and the need to build a large variety of vehicles for a small market [17]. The aspect of TPS that really makes it so successful is Dr. Shingo's SMED (Single Minute Exchange of Die) technique, which aided in reducing all changeover times to less than 10 minutes [16].

Lean manufacturing Principles evolved through a series of situational constraints Japan experienced in the 1940's and 1950's. It is very important to

is included in Figure 3. Another method is to reference the sources by number in the reference list. This is shown in figure 4. Anything reproduced from another source must be cited. Pictures taken by others or figures created by someone else must be referenced.

### ***Design*** (or Theory)

This is often the longest chapter and usually has subheadings that show the steps used in the design of the solution. For a product, process, or system design, describe the overall approach and the specific steps taken (calculations, reasoning, modeling, etc) to arrive at the initial design. This includes defining requirements, constraints, or user specifications and explaining the initial concept for the design solution and any alternative concepts. Justify each major decision by describing the theory or logic used. Justify any unusual or unique aspects of the design.

Present the original design in the form of drawings, process plans, or system specifications. Your initial cost, quality, or productivity estimates should be presented here. Refer to any drawings, tables, or diagrams in your text - whether these are embedded in the text or placed in an appendix.

If you have developed new theory for this project, derive it in detail in this section. You may change the title from Design to something more appropriate.

### ***Methods*** (or Experimentation)

In this section you will explain how you tested your design. If a virtual or physical prototype is produced for the product, process, or system design, explain how, including all equipment and methods. Include visual aids. If you ran experiments, indicate what you did, especially detailing your set-up. Describe all equipment and techniques used and conditions of the tests. Justify any non-standard methods. Describe any statistical tests or simulations used to evaluate the design. Include as much information as you feel is relevant. No results, however, should be included unless they are preliminary results used to justify a certain method.

### ***Results and Discussion***

In this section you will present the resulting data – whether numerical measurements or subjective observations. You should include only the important results in this section; the rest should be placed in an appendix (you should refer to them in the text). Any tables or figures should be referred to in the text.

**Figure 4 - Reference by Number**

Describe and explain the results. Answer the following questions:

- Were the results as expected? Why or why not?
- Did the theory hold?
- Is the design a good one?
- Were your cost, quality, or productivity estimates on track

- How should the design or theory be changed based on results? Your progression should be from facts to opinions.

Describe any problems or limitations with the methods or experiment. Answer the following questions:

- Were any unusual conditions present?
- Were any results difficult to interpret?
- Are there some questions that remain unanswered?

Interpret the results in terms of how successful you believe the actual implementation of the design will be. Answer the following:

- Based on the results, what do you predict for the future?
- Where might legitimate problems crop up?
- How should use of the design or theory be limited?

Describe the impacts of implementing the design:

- What are the economic impacts?
- What are the ethical, societal, and environmental impacts?

## **Conclusions** (or Summary and Conclusions)

In this section you will summarize the project: problem, objectives, and solution approach.

List a set of conclusions as bullets. Summarize the results by answering the following:

- What were your most important results?
- What can you say about the theory or the topic in general based on your experimental results?
- Did you accomplish each objective listed in the introduction?

What did you learn in the project? How would you do the project differently next time or what would you try next? What do you recommend based on your findings?

Explicitly include the social and environmental impact of the project. This includes a systems view of our design including a thorough exploration of the consequences, both intended and unintended.

## **Bibliography**

All published literature referred to by the student to carry out any of the project tasks must be listed in the bibliography. MLA or APA should be used to format the bibliography. There are several books and online resources that can help in this formatting. The following essential information must be included in the listing: authors,

literature title, journal name or publisher's name, volume, number and year of publication, and page numbers referred.

## ***Appendices***

Appendices include materials that cannot be presented in the text (due to length, form, or complexity) without interrupting its continuity, but which are helpful in clarifying the meaning of the text. Materials that are valuable in providing supporting evidence, (i.e. summary tabulations, forms, documents, letters, manuals and questionnaires) may also be provided in the appendix.

## ***General Writing Guidelines***

Use this as a guide only. Each project has unique elements and may require a different structure or different sections for the report.

- Write the Introduction first, the Executive Summary last.
- Do not use first person in the senior project write up.
- Headings and subheadings should mean something.
- Start each major section with a short explanation of what will be covered.
- Keep in mind who you're writing for and what you want to say. Most senior projects should target a general audience (not your advisor!). Imagine that the most likely people that will read it are a future boss or a future student who wants to know what you did.
- Use headings, subheadings, bulleted lists, tables and figures whenever possible. Refer to all tables and figures in the text (same for Appendices).
- Be honest, cite others, and don't conclude more than your results tell you.
- You don't have to sound like an encyclopedia, but technical writing is meant to inform, not entertain. Shorter sentences often work better.
- Spell-check. It's easy. Consult a resource on grammar and word usage if unsure. Have a friend or colleague read over your work to catch mistakes and suggest changes.

Note: See Senior Project Template posted at PolyLearn.