

Engineering Design Research Plan

Name(s):

Grade:

School:

County:

Working Title:

This doesn't have to be your final title, but should identify your topic and general plan.

Statement of Technical / Engineering Design Problem to Solve:

It may require up to one paragraph. Engineering Design Projects are projects which address a clear, focused engineering design problem or need; where criteria for success are identified; preliminary designs prepared; at least one prototype is created and tested with results clearly communicated.

Relevant Background Research Report:

- Write 3-5 pages, double-spaced.
- MUST use references! Use APA style for in-text citations and references. Must also credit sources of any photos, diagrams, tables or graphs used. Products related to your design are appropriate to reference.
- Think of the background research section as if you were writing a report on your subject. Give enough relevant information and organize it logically so that when the audience reads your design approach at the end of the section, they'll think, "Oh, that makes sense".
- See the suggestions below to help organize. (This is only one of the many ways to write a background research section.) Pay attention to engineering, technical design, or journal articles in your topic area to see how they're written.

1st paragraph suggestions/ options/ examples:

Give context of why your problem is important. Using statistics or describing the problem is often one way to do this. Engineering designs are often targeted at improving efficiency: a better way to do something to save cost, save time, make something easier for your customer, or reduce complication. Give an introduction as to how your design will be an improvement on the current state of the art. A good explanation here serves two purposes: it informs the reader who might not know as much about the subject as you do, and it shows an expert that you have done the necessary work to understand to topic.

Middle paragraphs:

This is bulk of your background research. Go into more depth about your problem and other designs that you find have been tried or are currently being investigated. Try to set it up logically to lead your reader to see how your design fits into the big picture while giving them enough information to understand your study. Define criteria for success as well as challenges and constraints impacting the design. Be sure to tie the different pieces together to make a single story.

Last paragraph:

Close the research section with a summary paragraph. Tie together the problem you are addressing, your design to solve it, and the main points of the research.

Procedure / Design Process:

How do you plan to address the problem? Procedure should be written step-by-step and also include

a list of all of the materials and/or equipment you will use so that you could give someone else the steps and he/she could conduct your experiment. Most engineering design is iterative- you will improve the design and retest based on what you learn from earlier tests. While you won't know exactly how this will go until you try it, you can describe how you will build an initial prototype, test it, and analyze the data before making improvements. Often designs are tested in smaller parts- you may test different pieces separately before putting them together and testing (this is often the best approach if your design allows it). Software development is especially well-suited to this approach. Also think about how you will analyze or plot the data to better understand what your tests mean and how the results can be used to improve your design.

Engineering Design Notebook:

In addition to your research paper, you must create and maintain an engineering design notebook throughout the duration of your project. In this notebook (journal) you should document your designs concepts. This can be simple line drawings or computer models. Enough detail should be included such that someone unfamiliar with the design can understand the design elements, the function of component parts, as well as the function of the complete assembly / mechanism. Basic sizes (dimensions) and a list of materials should also be documented.

A series of prototypes, iterative design evolutions, are expected to be built and tested by you. You should test and document, in your Engineering Design Notebook, why and how the prototype can be improved. Include performance or test data from each iteration; examples may include weights, speeds, strength limits, percent success and percent failure, measures of efficiency, failure modes, human interactions (both

expected and unexpected) with the design, etc. It is important to document your learnings and discoveries. Pictures of your design in-action should be included in the notebook.

Presentation of materials:

You should prepare a display board which describes your project. It should include: project title, statement of the technical / engineering design problem being solves, a summary of background research, sketches, drawings or pictures of your design. Data tables, charts or other visual aids summarizing the performance of your design should also be included on your project board. Of course, multiple visual aids may be used, but don't over-crown your display board. In a corner of your display board include your name, school grade, school name.

Don't forget, your Research Report and your Engineering Design Notebook must also be available to the judges for review.

References

Use APA-style formatting for your reference list and in-text citations.

<https://owl.english.purdue.edu/owl/resource/560/01/>