



This handout will explain the “problem-based approach” before focusing on three important differences between the *design project* and the *research paper*.

Background: the “Problem-Based Approach”



ENGR 110 (the *Communication* part) asks students to take a “problem-based approach”—what does this mean? It means that the problem description (what is the *unsatisfactory situation*?) is the starting point for the analysis.

There is almost always more than one way to address a problem. For example, the claim that “The only way to reduce the number of cars on campus is to increase the number of bike lanes on routes leading to the university” is not necessarily true (one might also improve bus routes, promote carpooling programs, and so on). Unsatisfactory situations can usually be approached in multiple ways—there is rarely just one choice.

When deciding which option will most effectively address the problem, students will need to consider a variety of constraints (e.g. budget, timeline, environmental concerns, laws and regulations, etc.). All of these considerations will not only help students develop their design projects, but this preliminary thinking might also spark an idea for an interesting angle for the final research paper.

★ 3 KEY DIFFERENCES BETWEEN THE DESIGN PROJECT AND THE RESEARCH PAPER ★



This section will focus on three important differences between the *design project* and the *research paper*. Although these are *not the only differences*, the three items listed below are key to a successful research paper.

★ 1 of 3: Developing a Thesis

The research paper needs a “thesis,” which is usually a *one-sentence statement of the argument in the paper*, and it normally appears at the *end* of the introduction. Here are a few possibilities to provide some ideas:

Propose a solution—suggest how we should address the problem and why.

This option would likely involve advocating for the solution you pursued in your design project.



Compare solutions—analyze the similarities and differences between competing approaches.

Perhaps you want to revisit and reevaluate the top two options you brainstormed for your design project.

Critique a solution—explain why a popular solution is actually misguided.

This option could even include critiquing your own design if you have changed your mind.

Challenge the problem formulation—argue why this is not the problem we should be focusing on.



Sometimes Engineers are encouraged to go back and re-think the initial problem formulation.

Highlighting the importance of a particular constraint, and arguing why it should not be overlooked.

This option might include arguing why a specific constraint should be the most important deciding factor.

Remember: a strong thesis statement is *controversial* (in order to be an *argument* there must be possible disagreement), and *specific* (it must respond to a particular problem and provide reasons for this position).





★ 2 of 3: Beginning with an Introduction Paragraph

Research papers should start with an introduction paragraph. For the ENGR 110 assignment, the introduction should probably begin with the “problem-based approach.” That is, students should set up their papers by explaining the “unsatisfactory situation” that needs to be addressed.



Example 1st sentence: University of Victoria administrators are concerned about the increasing number of cars on campus.

Next, students should elaborate on the problem, assuming that readers lack information about the situation (i.e. provide more details and context about the problem).

Finally, students should finish the introduction with their thesis statement (see examples on previous page). ☺

★ 3 of 3: Ending with a Conclusion Paragraph



The conclusion usually starts by restating the main argument, but using different words than the original thesis statement (try to explain the same argument in a new way).

The conclusion often ends with a brief reflection on why it is important to think about, and try to improve, the particular problem addressed in the paper (remember to keep the tone academic—no personal rants!). Also, be careful not to start a whole new argument here—just extend your thinking *a little bit* to suggest why this topic is important.

Example ending to the conclusion paragraph: It is important to think about reducing the number of cars on campus because if left unaddressed, this problem might lead to the construction of undesirable parking garages, and cause further environmental damage. Engineers and university administrators need to work together in order to protect the present campus landscape.

SO WHAT? WHY RESEARCH PAPERS ARE IMPORTANT IN ENGINEERING



Engineers are frequently tasked with the challenge of finding a way to improve a problem or unsatisfactory situation. While doing so, they will likely encounter numerous obstacles and constraints. Ultimately, they will strive to propose the best design plan among all of the competing possibilities.

Engineers cannot simply claim that one design is better than others without providing proof. They must compare rival design plans across multiple criteria, determine which one to propose, develop a convincing argument, and *communicate this argument to an audience* (instructors, employers, team members, etc.). Often there is more than one “right” answer; the challenge is learning how to justify your decision and convince others.

Additionally, as Engineers focus on answering one question (“Why is this the best plan to address this problem?”), additional questions may emerge, such as: “Why is this the problem we should be focusing on to begin with?” Ideally, being able to think critically and ask better questions will lead to a richer analysis of the situation, resulting in a more persuasive final argument that is nuanced, sophisticated, and well thought out.

