

# Student Essays Comparison - #8 vs #14

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The workshop course is provided by technology-oriented engineering department. The goal is to understand technologies but also to foster motivation and active involvement of groupwork. The assignment given to the students was as follows:

1. Kinematic Synthesis of Mechanisms <Train Gap Filler>

The gap between the train and the platform at train stations is a significant safety hazard, often leading to accidents. This risk is especially high for children, the elderly, and individuals with physical disabilities with wheelchairs. The challenge is to devise a mechanism that effectively mitigates this danger.

2. Net Zero X <All Electric Airplane>

The objective of this project is to develop a strategy for reducing CO2 emissions from airplanes. It involves researching the current challenges faced by the airline industry regarding CO2 emissions and conceptualizing an all-electric airplane as a viable solution to significantly lower these emissions.

3. Radioactive <Science Communication on High-Level Radioactive Waste>

High-level radioactive waste (HLW) is created by the reprocessing of spent nuclear fuel. Storage cannot provide the permanent isolation of the wastes from human's environment. This workshop aims to reveal the current conditions and possible disposal methods of HLW, and understand ways of dealing with real social issues.

4. Monster Track <Damages on Infrastructures by Oversized Vehicles>

The oversized loading induced an excessive external load which exceeds load-carrying capacity of bridges, resulted in collapse incidents. Clarify the common challenges in protection of infrastructures during their life cycle from oversized vehicles and come up with initiatives and solutions to this issue.

Around six students formed groups and challenged one of the above problems in seven 3-hour workshops: ideation, interim report, prototyping, final report, and a reflection essay at the end. Each student is requested to create an individual reflection essay including the following descriptions.

- Project description (300-400 words)

Title, goal and conclusion of the project

Process of the project: how you applied design thinking methods

- Contribution (300-400 words)

Your role in the project

Your contribution to the project

- Reflection (200-300 words)

Write freely but we are interested in what you learned from the series of workshops not only professional knowledge and skills but also how to contribute to and facilitate the workshops

The following two essays were prepared by students according to the above instructions.

## [STUDENT #8's ESSAY]

I was in the Net-Zero transportation group and our project was based on the reduction of the CO2. We mainly focused on the aircraft industry. The rate of emission of CO2 in the total global CO2 emission is small comparing to other industries. However, this is because aircraft travels around the world, and

the international emission is not included in each country's emission. Therefore, it is important for the airplane industry to work to solve the problem of the emission of the CO<sub>2</sub>.

To solve the problem, we focused on introducing the electric airplane in normal flights. Electric airplane uses only electricity to fly. If we have enough electricity to use for normal flights, the emission of the CO<sub>2</sub> from aviation is said to be reduced by 87%. However, there are many problems that stops the electric airplane to be normalized. In our project, we pointed out some of the most important problems and tackled them. The problems that we investigated were battery efficiency, weight of the battery and the charging electricity. To tackle the problems, we divided the problems into three big sections, which are science, charging and cost.

In the science section, we compared two types of batteries which are lithium-ion battery and solid-state battery. Lithium-ion battery is a common battery that is being used in our society like the electric cars. Solid-state battery is a battery that has many advantages. Since they don't use liquid, we do not have to worry for leakage during flights. Adding to this, the charging is faster for solid-state battery than Lithium-ion.

In the charging section, we mainly focused on the way of recharging the plane. We considered to recharge the electric plane during the flight since charging a battery from an empty battery is hard. Adding to this, we tried to work on with where we are going to afford all the electricity.

In the last section, cost, we lastly combined our ideas and summarize the cost that it will totally take to create and use all-electric plane. We considered the amount of cost we can offer the airplane ticket due to the maintenance, electricity, cabin fee and other supplies. We compared this value with the current cost for jet fuel airplane and we summarized that the fuel price and the maintenance in electric plane can be reduced from approximately 3.1M\$ to 2000\$.

During the project, I mainly worked on with the cost of the electricity. First, I only considered about the cost of the electricity itself and looked at the current price. However, as class went on, I noticed that considering only about the current price does not help our project. This is because our project cannot be started immediately. Electric airplane is an important project should be considered immediately. However, there are still many problems that needs to be considered. Therefore, electric airplane is a project that needs to be experimented in a long term.

In our project, we considered electric airplane to be achieved to be used in normal market by 2035. Therefore, I needed to consider the price of electricity at that time. Adding to this, I noticed that the price of the electricity will be affected by the amount of electricity we need. The need of electricity is rising time by time and if we ask for more electricity to the powerplants that we have right now, it is obvious that the electricity price will rise. Adding to this, the trend of producing electricity is tilting to be eco-friendly. This means that we need to also depend more on renewable sources. Due to the aim, made me possible to think to add an option about creating a new powerplant to afford all the electricity we need.

The cost needed for creating a new powerplant is called Levelized Cost of Electricity and found out that LCOE is the summation of two costs, which are Capital expenditure and Operation expenditure. Capital expenditure is the initial price for building the facility. The operation expenditure is the cost that we need to run the facility in the future. I looked for the LCOE price for Solar power and Wind power. These were chosen because the CO<sub>2</sub> emission was smaller than other technologies. I created a graph that shows the change of the price of the LCOE cost during time and read the trend of the cost through it. I have also calculated the jet fuel price for reference. At the end I summarized that Solar power photovoltaic utility showed to be the most reliable technology we could in our project. My part helped our project to be lower cost, since fuel is the largest part that is included in the cost of the price of the seat for airplanes now.

The workshop we did just after the mid term presentation was fun. The workshop was about giving new and unique ideas for a group that we are not mainly working on. I went to the Monster truck group and gave an idea that changes the height of the floor and not the bridge, tunnel, or the pole. It is simply fun for people who is not in the main group to give unique ideas to other groups even though it is not achievable. Adding to this, doing the workshop in small groups made me understand the topics of other groups more and made me feel more interested about the project, than just listening to the presentation they give to the whole class. This is because smaller groups helped us to ask more

questions. However, I think that giving new ideas widen the way of thinking for the main group. When people focus on one idea, it is hard for them to notice other people's perspectives that might help them make their idea more interesting and achievable.

I was also able to learn how to ask questions after the presentations. I found it hard to ask questions to other groups but the frequent question section and listening to other people asking question helped and taught me how to ask a good question.

[END of STUDENT #8's ESSAY]

[STUDENT #14's ESSAY]

The goal of this project is to design a questionnaire to understand the public's thoughts and concerns about the disposal of high-level radioactive waste, and one which can at the same time give the respondents some information and a general idea about the disposal of high-level radioactive waste. Then by gathering the results and by analyzing the results we aim to understand the public and at the same time assess the questions in the questionnaire to see if the questions are able to earn the information or results that our group wants and to modify any questions. The importance to understand the public's thought and concerns about the disposal of high-level radioactive waste all lies in the point that the disposal of high-level radioactive waste is not carried out because of the lack of public approval. So, by understanding about the public, we could think of ways to earn the approval by the public.

Through the two months working in this project, we were able to design and analyze two questionnaires. One questionnaire was designed for the people in the SHIP class, there were 40 responses and through the analysis we concluded that the questionnaire had confusing wording and there was a need to modify the words. The other questionnaire was designed for the public, there were 133 responses and through the analysis we concluded that the public only has a little knowledge about high-level radioactive waste, does not know the details of the disposal of high-level radioactive waste and that most accept thinks that the waste should be disposed in their own countries.

Throughout the project what we have done was to design questions. When doing so, we first thought of what specifically we had to know about the public, then after that we thought of the type of format that is suitable for what we want to know and after that we chose the appropriate choices for the question. Finally, we shape it up and make it into a question and modify the wording so it would fit the target respondent.

I thought that my role in this project was an idea giver, analyzer, and translator. I thought that I was an idea giver as I thought that I have contributed to the project by thinking of new ideas for the question of the questionnaire. For example, I have thought of the idea for the question number 11 which asked the closest radius that the respondents can accept the disposal site of high-level radioactive waste, this question intends to find an image of a specific distance that the public can accept, by knowing a distance that the public can accept it could be used for the consideration of the disposal site of high-level radioactive waste.

I thought that I was an analyzer as I had contributed in the analysis of the results. When talking about the analysis, I have contributed especially on the analysis to divide the respondents of the Japanese questionnaire into public and experts. When dividing the respondents we had to analyze many of the technical issue related questions and free answer questions, so as one of the native Japanese speakers I had to analyze the peoples answers and see if there were any respondents that could be classified as "experts". For example, although we gave an overall classification by seeing whether the respondents answered that they have done any scientific research related to the disposal of high-level radioactive waste, some respondents who was not classified as experts was then classified as an expert as their response to the free answer question was an answer which a person with expert knowledge could only answer. I thought that I was a translator as I have contributed in the creation of the Japanese questionnaire. Like I have previously explained, as I was one of the native Japanese speakers in our group, after the English questionnaire was made, I have done the translation of the questionnaire into Japanese.

As our groups project was different to other groups, I thought that it was very hard but interesting to do the project. On the other hand, as our groups project was different to other groups, many of the

things that we learnt in the SHIP lecture was hard to apply into the project. I thought so because our groups project aimed to design a questionnaire to understand the public, while for the other groups project they aimed to find, or think of a solution to a problem that they found, which is very different and as the previous SHIP workshop and this SHIP workshop both focused on trying to find a problem and then think of a solution, it was hard to apply.

From the series of workshops, I thought that I have learnt the importance of sharing each person's idea no matter how small or boring it might look. Through out the SHIP workshops each group had to think, or find a problem and a solution to it and in this process all the members in the project had to think of some ideas, but when thinking of ideas there would always be some ideas that may seem very small or meaningless for the person and the person usually won't present that. On the other hand I learnt that it is important to present any small idea as these ideas could then be a trigger for other members or even yourself to think of new ideas.

[END of STUDENT #14's ESSAY]

Compare and evaluate the above two essays according to the rubric specified below.

#### [SCORING RUBRIC]

##### Comprehensive Evaluation of Workshop Course

##### 1. Technical Knowledge and Application (1/3)

- Understanding of Concepts: Evaluates how well the student grasps the technological and theoretical concepts relevant to the project.
- Practical Application: Assesses the effectiveness of applying technical knowledge in practical situations, specifically in project design and development.
- Innovation and Problem Solving: Measures the creativity and innovation in addressing project challenges and proposing effective solutions.

##### 2. Teamwork and Collaborative Skills (1/3)

- Individual Role and Contribution: Looks at how clearly the student defines and fulfills their role within the team, and their contribution to the project.
- Team Interaction and Communication: Evaluates the student's ability to communicate and collaborate effectively within the team.
- Peer Engagement: Considers the student's participation in peer learning, support to team members, and contribution to the team's dynamics.

##### 3. Reflective Learning and Personal Growth (1/3)

- Self-Reflection and Insights: Assesses the depth of the student's self-reflection on personal learning and development throughout the project.
- Design Thinking and Process: Measures how well the student demonstrates the application of design thinking methods and management of the project process.
- Skill and Attitude Development: Evaluates the growth in the student's professional and soft skills, like critical thinking, adaptability, and communication.

[END of SCORING RUBRIC]

Compare and evaluate two essays based on the three main criteria in the above rubric: Project Description, Role and Contribution, and Reflection and Insight. Summarize the comparison of the three main criteria and then determine which essay is better overall.

The final score should be as follows. If one is superior to the other even slightly, award +1 point to the superior essay, and -1 point to the other. If one is clearly superior to the other, award +2 points to the clearly superior essay, and -2 point to the other. If both are the same, give each a score of 0.

To effectively evaluate and compare the two student essays (#8 and #14) based on the provided rubric, let's break down the analysis according to the three main criteria: Technical Knowledge and Application, Teamwork and Collaborative Skills, and Reflective Learning and Personal Growth.

## **1. Technical Knowledge and Application**

Student #8:

- Understanding of Concepts: #8 shows a good understanding of the technical aspects of electric airplanes, including battery types and their efficiencies.
- Practical Application: The student demonstrates the application of this knowledge by discussing the feasibility of electric planes in terms of battery technology and recharging methods.
- Innovation and Problem Solving: There's evidence of innovative thinking in proposing solid-state batteries and recharging during flight, though details on problem-solving are not extensively covered.

Student #14:

- Understanding of Concepts: #14's understanding of the technical aspects of high-level radioactive waste disposal is less evident. The focus is more on public perception than on the technicalities of waste disposal.
- Practical Application: The practical application is centered around questionnaire design and analysis, rather than direct technological application.
- Innovation and Problem Solving: The student shows some innovation in questionnaire design and problem-solving in modifying the questionnaire based on feedback.

Comparison: #8 demonstrates a stronger grasp of technical concepts and their practical applications, showing more depth in technological understanding and innovation.

*Score: #8 +1, #14 -1*

## **2. Teamwork and Collaborative Skills**

Student #8:

- Individual Role and Contribution: Clearly defined role focusing on the cost analysis of electric airplane implementation.
- Team Interaction and Communication: Describes the division of work but less detail on interaction and communication within the team.
- Peer Engagement: Shows engagement with other groups during workshops, contributing ideas outside their primary project.

Student #14:

- Individual Role and Contribution: Acted as an idea giver, analyzer, and translator, showing diverse roles.

- Team Interaction and Communication: Less emphasis on team dynamics but indicates collaboration in questionnaire development.
- Peer Engagement: Focuses more on individual contribution than on peer learning or support.

Comparison: Both students show good team involvement but #8 shows more engagement in collaborative learning and providing support to other groups.

Score: #8 +1, #14 -1

### 3. Reflective Learning and Personal Growth

Student #8:

- Self-Reflection and Insights: Reflects on the learning process, understanding the importance of future-oriented thinking.
- Design Thinking and Process: Details the process of problem-solving and design thinking in their project.
- Skill and Attitude Development: Demonstrates development in critical thinking, particularly in cost analysis and future projections.

Student #14:

- Self-Reflection and Insights: Reflects on the importance of sharing ideas and learning from feedback.
- Design Thinking and Process: Discusses the design and iterative process of the questionnaire.
- Skill and Attitude Development: Shows growth in analysis skills and the importance of considering public opinion.

**Comparison:** Both students show good reflective learning, but #8's reflection indicates a deeper understanding of the complexities and future-oriented thinking in their project.

Score: #8 +1, #14 -1

### Overall Evaluation

- Technical Knowledge and Application: #8 +1, #14 -1
- Teamwork and Collaborative Skills: #8 +1, #14 -1
- Reflective Learning and Personal Growth: #8 +1, #14 -1

**Total Score: #8: +3, #14: -3**

Conclusion: Based on the scoring rubric, Student #8's essay is superior, demonstrating a better understanding of technical knowledge, effective teamwork and collaboration, and deeper reflective learning and personal growth.