

# Comparing Two Student Essays

December 9, 2023

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 CO<sub>2</sub> emissions from airplanes. It involves researching the current challenges faced by the airline industry regarding CO<sub>2</sub> 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 #11's ESSAY]

Out of all topics related to Net Zero, our team decided to focus on transportation aspects. In specific, we picked an electric airplane. Our project was named, "All-electric airplane - CO<sub>2</sub> reduction". First, we redefined what is net-zero and what is an electric airplane. Our goal is to construct an airplane that runs with electricity and emits net-zero CO<sub>2</sub>. We calculated how much emissions will be reduced by replacing a current jet-fuel plane with an electric airplane and considered what we need to do to reach

net zero by utilizing it. Next, from the many problems and potentials of an electric airplane we detected, we chose some of the major ones and introduced them. For example, we found the airline industry's contribution to the emission issues. It provides 2.5% of global emissions, and that is 1.04 billion tons per year. However, if we succeed in constructing FEA (full electric airplane), 87% of CO<sub>2</sub> will be reduced. We can state that this electric airplane has great potential to contribute to reducing emissions. Based on this information, we divided our challenges into 3 parts, which are science, charging, and cost. With the science aspects, we tested multiple batteries to idealize the best suitable battery type. Currently, Lithium-ion battery shares a large part of electronic devices, such as a smartphone. However, all-solid-state battery might be more suitable for electric airplane because it provides high specific energy, more safety, and less weight. Next, with the charging aspect, we simulated building a new electric power plant. Also, we examined the multiple methods to recharge electricity during flight. Lastly, we researched costs we need to commercialize electric airplanes. Since part of fuel price and maintenance cost will be cut, we can assume that we have at least 50% low-priced ticket. In conclusion, as we simulated with an airplane with 180 passengers for an 800km flight, an all-solid-state battery is the most appropriate battery. It leads to reduce about 87% of CO<sub>2</sub>. This can also lower ticket prices by about 50-80%. Although the technology is not ready to commercialize planes yet, we believe more investigation will make it possible.

In this project, I mainly focused on the charging perspective, especially recharging during flights. Even if we use the most efficient battery, FEA still raises the cost and takes more time to charge compared to the current jet-fuel airplane. First, I focused on the regenerative brake. It is a technology that an airplane uses electricity for acceleration and propulsion, and charge electricity when it decelerates and level down. There is an airplane from JAXA, which succeeded with using regenerative soaring during a flight. I introduced a graph that shows the motor shaft output, which is basically how much energy it uses, and the remaining battery of the airplane. From the graph, we can observe that there is a moment that motor shaft output gets negative values. At the same time, the amount of remaining battery keeps constant or even increases. From this data, we can conclude that this airplane succeeded with regenerative soaring and recharging electricity. The minimum power we require for an airplane with 180 passengers' airplanes is calculated as about 6 MW. This is the potential energy we can convert to electricity. Although the specific values of efficiency to convert energy into electricity are not determined yet, I consider this technology will help to reduce the initial electricity we need. Next, I decided to work on solar power generation. This is the same technology we conduct on the ground, but for this situation, it is on the wing. I calculated the energy airplanes we can get from solar power with the equation  $E = TSI * A * E * \text{flight time}$ , where TSI is the total solar irradiance, A is the surface area wing, and E is the solar photovoltaic efficiency. As I calculated the percent of energy from solar power against total flight energy is about 0.07 to 0.7%. Although this does not contribute much to reduce the initial energy we need, I consider investigation on this field is still ongoing, so these values will be improved in the future.

From the lectures of this course, I learned a variety of methods evaluating the challenges we face. In the class time, we mainly use them to share the contents of research we did outside class. Also, we use it to divide work and research about the specific area each of us focused on. Overall, one of the most important things I learned through this course is to determine specific common goals initially, so that we can try to reach them with different perspectives. We considered having different perspective and works on individual tasks are important and useful methods. However, sometimes we lost the most important goals and concentrated into individual works too deeply. Therefore, we sometimes did calculations with different conditions. For example, I calculated the possible energy we can get with solar power generation during flight from papers I found. I tested with multiple situations, such as flight from Tokyo to San Francisco, Tokyo to Beijing, and Tokyo to Seoul. I was not aware that our goal is to create an airplane with 180 passengers with an 800km flight. Our group members discussed and decided within the class time, but I was too into my work and unaware about it. From this experience, I learned that it is important to share the information more often and check what is the final goal so that we do not lose.

[END of STUDENT #11'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 compare and evaluate the two student essays according to the specified rubric, we will assess each essay based on the three main criteria: Technical Knowledge and Application, Teamwork and Collaborative Skills, and Reflective Learning and Personal Growth.

#### **Technical Knowledge and Application**

- Student #11's Essay: This essay demonstrates a strong understanding of the technological concepts involved in designing an all-electric airplane. The student discusses specific technical aspects such as battery types, charging methods, and cost

considerations, showing a good grasp of practical applications. The approach to problem-solving and innovation is evident in the exploration of regenerative braking and solar power generation for the electric airplane.

- Student #14's Essay: This essay focuses on the design of a questionnaire to understand public perceptions of high-level radioactive waste disposal. The technical knowledge here is less about engineering concepts and more about social research methodologies. The student shows an understanding of questionnaire design and analysis, but the technical depth is not as pronounced as in #11's essay.

Score: Student #11's essay demonstrates a deeper and more technical application of knowledge. (+1 for #11, -1 for #14)

#### **Teamwork and Collaborative Skills**

- Student #11's Essay: The student clearly outlines their role in focusing on the charging aspects of the electric airplane project. However, there is less emphasis on how they interacted with the team or contributed to team dynamics.
- Student #14's Essay: The student describes their role as an idea giver, analyzer, and translator, indicating active involvement in various project phases. There is also mention of working on translations, suggesting effective collaboration within a diverse team.

Score: Student #14's essay shows a more rounded depiction of teamwork and collaborative skills. (+1 for #14, -1 for #11)

#### **Reflective Learning and Personal Growth**

- Student #11's Essay: There is substantial reflection on learning from the course, especially on the importance of aligning individual tasks with the team's overall goals. The student acknowledges an oversight in their work and how it impacted the project, showing personal growth and self-awareness.
- Student #14's Essay: This essay reflects on the importance of sharing ideas in a team setting and acknowledges the challenges of applying course learnings to a unique project type. The student shows an understanding of the importance of every team member's contributions to idea generation.

Score: Both essays show good levels of self-reflection and personal growth. (0 for both #11 and #14)

### **Summary and Overall Evaluation:**

- Student #11's Essay: Strong in technical knowledge and application, moderate in reflective learning, but less detailed in teamwork aspects.
- Student #14's Essay: Less technical but more balanced in teamwork and reflective learning.

Final Score:

- Student #11: +1 (Technical Knowledge and Application) - 1 (Teamwork and Collaborative Skills) + 0 (Reflective Learning and Personal Growth) = 0
- Student #14: -1 (Technical Knowledge and Application) + 1 (Teamwork and Collaborative Skills) + 0 (Reflective Learning and Personal Growth) = 0

Both essays have their strengths and weaknesses in different areas. Student #11 excels in technical application, while Student #14 shows better teamwork and collaboration skills. Their reflective learning is on par. Therefore, the overall evaluation results in a tie, with each essay scoring 0.