

# Essay Comparison: Student #1 vs. Student #11

December 5, 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 #1's ESSAY]

Our presentation title is "Train Gap Filler", which statedly reveals our goal of designing new mechanisms. In our project, we first explained the significance of train gap: there is the possibility for the train to hit into the station. However, the gap still causes to some safety and efficiency issues. Therefore, we came up with two designs to fill the train gap and solve this problem; they apply different mechanisms. One used pivot, sliding, gear, and piston (giving three pivots, and would lay

down the platform); this one is comparatively more cost friendly and simpler. The other is formed with pneumatic cylinder (raising the platform) which is more expensive and complicated, yet more reliable and owns higher degrees of freedom. They both have pros and cons, but still aim for the same goal.

I also created four designs by myself, although it is not used in this presentation. Three of them are pretty similar (I actually developed two others based on my first design), which are composed of gears and rack rods. The other one applies fluid (hydraulic) pressure. In my first design, the rack rod is stucked on the door that, when door opens, will drive location fixed gear, location-fixed gear, and rack rod, making the rack rod extending out, so the platform stucked on it will show up and fill the train gap. This is similar to my second design: But the platforms move from vertical to horizontal instead of just move in and out horizontally, so it is no needed to create another space under the door to place the platform when it is kept in (this one just stand close to the wall /door). And my third design, also similar to the last two: But in this design, I added the mechanism of “tension and pulling”, so the platform is laid down and closed up by the wire. And my fourth design is much more different from the last three (I only drew the righthand-side half): You can think the two cylinders are connected syringes, so when one side is pushed in (e.g. door side), the other side (e.g. platform side) will be pushed out. Although my designs are not chosen to be presented, I still contributed some ideas and make innovations by myself which I found very reassured and interested.

For this project, I was firstly suggested the application of hydraulic pressure to drive the whole system. I think that kind of gave Takato some ideas of making his design (Design 2). As the result, I asked him if he needs any help with the final presentation, since I can thoroughly understand his design, but he himself is strong and smart to handle it. Anyways, I worked on my part only, which is the summary. I feel sad that I did not have enough time to summarize the whole project and our achievements during the presentation time, having most of my part being omitted. So I want to put it here. Overall, I looked back on all we have done during this quarter. In the very beginning, we learned the basics of Fusion 360, the software to draw designs, so we are able to create 2D sketches (side-view) and extend it into 3D models. Furthermore, I make our model to be movable. We took our first Fusion Homework and created a pivot (cylinder) overgoes the model, so the model can rotate on it. Although we were trying to make a motor, so it can rotate automatically, but due to the time limitation, we did not do that. And then, we discussed about the mechanisms used in our daily life, we each suggested one to two example(s), for instance bicycle, mechanical pen, wireless charging, and for me, I picked the key and mop. And finally, we voted for the “train gap” to be the topic of this final presentation. We aim to cover up the gap between the train and station to prevent people from being tripped on it or drop anything into the gap, and thus interrupt the whole process of train and people’s movement. After we decided our topic, we each created one to two designs, but we only chose two from all and extended on them (I originally want to show everyone’s works but some members lost their designs, so I did not do so). And in all, we want to minimize the cost and gap distance, and simplify the mechanism for our design to achieve the ideal state. Although we have not had the chance to discussed on it in deep.

In my perspective, I think this class have taught me a lot, including the aforementioned mechanisms, physics, and software application knowledge and also collaboration skills. Since we are in groups and required to work and present together, it is significant to have high efficiency of communication about everything, like choosing topics, deciding work distribution, exchanging and discussing ideas. At the beginning, we did not know each other well and felt awkward talking to each other, so most of the time we were in silence, needing the TA to guide the process. But now, we can discuss very smoothly, and the TA only need to assist us and answer some of our questions instead of talking all the time. Furthermore, we are not only discussing with our groupmates but also people from other groups. From these experiences, I also learned to talk to people I am unfamiliar with without awkwardness or shyness; this also gives improvement when I am doing presentation. In addition, I think the work of asking question, giving feedback, or summarizing the class has helped me a lot. Initially, to be honest,

I hate this work since I really feel uncomfortable talking in front of many people. Yet after several times of practice, I think I have more courage and can feel more relaxed doing so. On the other hand, giving feedback trains me to think critically by myself but not just listen to what others say. It also makes me develop my expression, so I can quickly, effectively, and precisely convey my idea to the presenter(s). So overall, I appreciate to have this class that teaches me the presenting, thinking, and collaborating skills.

[END of STUDENT #1's ESSAY]

[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]

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 evaluate the two student essays according to the specified rubric, I will compare them based on the three main criteria: Project Description, Role and Contribution, and Reflection and Insight.

### **1. Project Description**

- Student #1 (Train Gap Filler): The description is detailed, covering the problem, different solutions, and the design process. However, the essay lacks clarity in describing the final outcome or conclusion of the project.
- Student #11 (All Electric Airplane): This essay provides a clear overview of the project, including the problem, proposed solution, and specific details about the technology and challenges involved. It effectively summarizes the project's goal and findings.

Comparison: Student #11's essay is more structured and clearer in conveying the final outcome and implications of the project.

Score: Student #1: -1, Student #11: +1

### **2. Role and Contribution**

- Student #1: Clearly outlines their personal contributions, including designing mechanisms and assisting with the presentation. However, the focus is more on individual work rather than team contribution.
- Student #11: Describes their specific focus on the charging aspect of the project, demonstrating both individual contribution and its relevance to the team's goal.

Comparison: While both students detail their contributions, Student #11's essay better integrates their role within the team's collective effort.

Score: Student #1: -1, Student #11: +1

### **3. Reflection and Insight**

- Student #1: Offers a thoughtful reflection on personal growth, especially in terms of communication, collaboration, and overcoming challenges in public speaking.
- Student #11: Reflects on learning from the course and highlights the importance of staying aligned with the team's goals, acknowledging a lapse in this area.

Comparison: Both students show good self-awareness and learning. However, Student #1 provides a more in-depth analysis of their personal development, especially in overcoming specific challenges.

Score: Student #1: +1, Student #11: -1

### **Overall Comparison and Final Score**

- Student #1: Total Score = -1
- Student #11: Total Score = +1

**Conclusion:** While both essays have their strengths, Student #11's essay overall provides a clearer and more integrated understanding of the project, with a better alignment of individual contribution to the team's objectives. However, Student #1 shows a stronger personal reflection and growth. Therefore, Student #11's essay is slightly better overall.