

Comparing Two Student Essays

December 7, 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 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 CO₂.

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 CO₂ 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 CO₂ 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 #13's ESSAY]

As a group, we constructed a project named science communication on high-level radioactive waste, based on the reason that there may exist some misconceptions or knowledge gap between the general public and the organizations dealing with nuclear activities. The main objective of our project is to find out the public's concerns and understanding of high-level radioactive waste. Since our topic is about communicating on the high-level radioactive waste, we decided to have a questionnaire as a way of communication. Our project includes two questionnaires and results analysis on the responses from the questionnaires trying to identify the major considerations of the general public towards the management and disposal of high-level radioactive waste.

After receiving a general image of what is high-level radioactive waste from our facilitator professor, the students discussed on what kind of questions will be sent to the public and designed suitable questions that involve critical thinking for the respondents. The first questionnaire was a trial targeted mainly to the students and facilitator from the SHIP course, whereas the second questionnaire will be sent to a wider range of audience. Since the topic of radioactive is quite sensitive, we spent time considering the information provided in each question and ensure all the answer choices are appropriate for every possible participant of our questionnaire. After receiving enough responses from the first questionnaire, we started analyzing the choices made by the respondents to find out why he/she has chosen that particular option.

Based on the reflections from the first questionnaire and midterm presentation, we constructed the second questionnaire with improvements. We kept a few questions from the first questionnaire which had given us positive feedback and edited/removed those which was not very helpful. Furthermore, we added questions with the explicit implication of identifying the public's general understanding and concerns based on two major investigations, 1) public and political considerations, and 2) scientific-technical issues, which could better fit our objective of this project. Similar to the first result analysis, we group up each choice made by the respondents in the second questionnaire and provide explanations for each group. From the analysis, we concluded that more than 60% of the respondents have limited understanding of high-level radioactive waste, the organizations of nuclear energy should provide information with educating purpose to the general public to fill up the knowledge gap and avoid misconceptions in dealing with high-level radioactive waste.

Since our project involves question designing and result analysis, my main role was just like other group members, which was to brainstorm ideas on the type of questions to be given to the public in order to obtain the necessary information to support the objective of our project. Before the second questionnaire was sent out, I and 2 other group members worked together with our professor in finalizing the questions for English version. After getting the results from the questionnaire, the whole group worked together in identifying the possible trend of choices from the result of the two questionnaires and I took the role in analyzing the results from the English version of the second questionnaire while those who are bilingual focused on both the Japanese and English version.

For the midterm presentation, I was assigned to present the material section, which I needed to explain the results we obtained for the questions relating to the type of material that is the most suitable for the storing of high-level radioactive waste. Not surprisingly, all the questions from the other groups were material-related, which means the section about the material is the most intriguing topic and caught the most attention. The same happens to the final presentation where more questions were asked on the material section of the presentation. For the final presentation, I volunteered to present the introduction and objective of our project, and it was much harder than I thought. Since each group was given 10 minutes to present, I have only roughly 2 minutes to explain the background of

high-level radioactive waste and the objective of the project, while the same section took a total of 4 minutes in the midterm presentation.

Although this was the first time I worked with my classmates from the same major as a group, I tried my best to remove any barriers between each of us. Despite the amount of time spent together during the classes was not plenty enough, I always try to give my opinion and thoughts both during the meeting each week and outside in the line group we made. Furthermore, I participated in answering questions from other groups without being shy or having concerns because I know my group members will support and add-on to what I said if some information is missing.

I believe one of the most important aspects of the series of workshops is about teamwork and collaboration, which is also the reason why the students are in groups of 5 or 6 and not in individuals or groups of 2 only. What I learned from the workshops is not only about the knowledge of high-level radioactive waste, but moreover, I learned how to support my group members and work together with them at the same pace. The question designing part of the project required brainstorming and considerations in all forms (political, emotional, etc.) due to the sensitivity of the topic, and this is when collaborations between the group members, TA, and facilitator become extremely critical. Each of us gives our personal opinion and comes together to decide on the final layout of the questions, during this stage, we learned how to design questions with reference to an explicit objective while taking the sensitive information into consideration.

One possible improvement for our project can be using another type of communication. Due to time constraints, we were not able to contrast an interview to some of the respondents of the questionnaire, by having an interview can also be helpful in understanding the public's concerns and level of knowledge on the high-level radioactive waste. In my opinion, we can have the second questionnaire as an interview while the first questionnaire could be sent to a wider range of public.

[END of STUDENT #13'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 essays of Students #8 and #13 according to the specified rubric, I'll break down the comparison into 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 (Net Zero X Project)

- Understanding of Concepts: Demonstrates a good understanding of the challenges in the aviation industry regarding CO2 emissions and the potential of electric airplanes.
- Practical Application: Effectively applies this knowledge to the project, exploring different types of batteries and recharging methods.
- Innovation and Problem Solving: Shows creativity in addressing problems like battery efficiency and the costs associated with electric airplanes.

Student #13 (Radioactive Project)

- Understanding of Concepts: Exhibits a comprehensive grasp of issues surrounding high-level radioactive waste and the public's perception of it.
- Practical Application: Utilizes this understanding in designing questionnaires to gauge public opinion and awareness.
- Innovation and Problem Solving: Less focus on technical problem-solving compared to #8, more on communication and data analysis.

Score: #8: +1, #13: -1

2. Teamwork and Collaborative Skills

Student #8

- Individual Role and Contribution: Clearly outlines their role in researching the cost of electricity and its impact on the project.
- Team Interaction and Communication: Mentions collaboration but focuses more on individual contribution.
- Peer Engagement: Engages in cross-group idea sharing, demonstrating a broader perspective.

Student #13

- Individual Role and Contribution: Participates in question designing and result analysis, working closely with the team and professor.
- Team Interaction and Communication: Actively collaborates in group discussions and finalizing questionnaire content.

- Peer Engagement: Shows strong group integration and peer support, reflecting more on team dynamics.

Score: #8: -1, #13: +1

3. Reflective Learning and Personal Growth

Student #8

- Self-Reflection and Insights: Shows a clear understanding of the learning process and how the project influenced their perception of electric airplanes.
- Design Thinking and Process: Demonstrates the application of design thinking in tackling the electricity cost issue.
- Skill and Attitude Development: Reflects on the evolution of their thinking process and the importance of long-term planning.

Student #13

- Self-Reflection and Insights: Reflects on the importance of teamwork and understanding public perception.
- Design Thinking and Process: Shows application in questionnaire design and analysis.
- Skill and Attitude Development: Focuses on team collaboration, communication skills, and adapting to project requirements.

Score: #8: 0, #13: 0

Overall Comparison and Final Score

- Technical Knowledge and Application: #8 demonstrates stronger technical application and problem-solving skills.
- Teamwork and Collaborative Skills: #13 shows greater depth in team interaction and peer engagement.
- Reflective Learning and Personal Growth: Both students show good reflective learning and personal growth, but with different focuses.

Final Score:

- Student #8: 0 (1 - 1 + 0)
- Student #13: 0 (-1 + 1 + 0)

Conclusion

Both essays are strong in their respective areas, with #8 excelling in technical knowledge and application, and #13 showing greater strength in teamwork and collaborative skills. Reflective learning and personal growth are well-demonstrated by both students. Therefore, I would conclude that both essays are equally commendable, each showcasing different strengths.