

# Rubric-Based Evaluation: Student's Essay

November 16, 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. Kinematic Synthesis of Mechanisms <Say "NO" to Door Knobs>

This project develops a new mechanism for touchless doors, inspired by the widespread unease with touching door handles in public spaces like schools, hospitals, and restrooms during the Covid-19 pandemic. This design aims to eliminate the need for physical contact with door knobs.

3. Net Zero X <Carbon Dioxide Removal>

Given that emissions of CO<sub>2</sub> are produced by all sectors of society, identifying effective ways to capture CO<sub>2</sub> and store it safely is crucial. Create methods to extract CO<sub>2</sub> from the air and separate it into its constituent elements, carbon and oxygen, and explore how these elements can be repurposed effectively.

4. 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.

5. 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.

6. 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 six 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

Here is a student essay to be evaluated.

#### [STUDENT 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 sticked 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 sticked 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 in 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 ESSAY]

Please do the followings:

1. First, define a rubric that will serve as the evaluation criteria.
2. Explain the existing theory behind determining the above rubric.
3. Use the rubric to evaluate the student's reflection essay above on a scale of 30 points.
4. Explain the reason why you gave the above points.

To evaluate the student's reflection essay effectively, we will create a rubric based on three key criteria, each with a maximum score of 10 points, for a total of 30 points. The criteria are:

Project Description (10 points): This criterion evaluates the clarity, detail, and completeness of the project description, including the title, goal, conclusion, and the application of design thinking methods.

Contribution (10 points): This criterion assesses how well the student has articulated their role and contribution to the project. It includes the clarity of the student's self-assessment and the impact of their contributions.

Reflection (10 points): This focuses on the depth and insightfulness of the student's personal reflections. It includes how they have articulated what they learned from the workshops, both in terms of professional knowledge and skills, and in terms of soft skills like teamwork and communication.

The rubric is based on the educational theory of formative assessment, which emphasizes providing constructive feedback that helps students understand their strengths and areas for improvement. This approach encourages reflection and critical thinking, essential for learning and personal development.

Now, let's evaluate the student's essay:

Project Description: The student provides a detailed explanation of the "Train Gap Filler" project, including the problem, proposed solutions, and the mechanisms involved. However,

the description of the design thinking process and the conclusion of the project is less clear.

Score: 7/10

Contribution: The student outlines their individual contributions, including designing alternatives and assisting with the summary of the project. However, the impact of these contributions on the project's overall success is not deeply explored. Score: 7/10

Reflection: The student reflects on their personal growth, including improvements in communication, collaboration, and presentation skills. They also mention how their perspective has evolved through the course, demonstrating a good level of introspection and self-awareness. Score: 8/10

**Total Score: 22/30**

The student's essay demonstrates a good understanding of the project and a clear reflection of their learning experience. While the description of the project and personal contributions are well-articulated, there is room for improvement in detailing the impact of these contributions and in the depth of analysis regarding the design thinking process. The reflection part is well-handled, showing personal growth and learning, which is commendable.