

# Student's Reflection Essay Evaluation

November 17, 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 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 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]

Scoring of students' essays should be done based on the following rubric.

#### [SCORING RUBRIC]

Comprehensive Evaluation of Workshop Course (Total: 30 Points)

##### 1. Technical Knowledge and Application (10 Points)

- 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 (10 Points)

- 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 (10 Points)

- 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.

#### Performance Levels and Point Allocation:

- Outstanding (10 Points): The student not only fulfills but also significantly surpasses all set criteria. Their work demonstrates exceptional understanding, creativity, teamwork, and introspection. They exhibit mastery in applying theoretical knowledge to practical scenarios and show remarkable initiative and innovation.
- Highly Competent (8 Points): The student consistently meets all expectations and often goes beyond them. Their work reflects a thorough understanding and application of concepts, effective

collaboration, and thoughtful reflection. They demonstrate a strong ability to integrate knowledge with practical skills and show considerable proficiency in problem-solving and innovation.

- **Competent (6 Points):** The student meets the standard expectations in all evaluated areas. Their work shows adequacy in understanding and applying concepts, collaborating with the team, and reflective thinking. While they demonstrate basic competency, there may be a need for further development in depth, consistency, or innovation.
- **Needs Improvement (4 Points):** The student's work falls short of meeting the standard expectations in several key areas. There is a noticeable lack of depth or understanding in technical application, collaboration skills, or reflective thinking. This level indicates that the student needs considerable improvement and guidance to reach the expected level of competency.

Application:

Each main item in the rubric is worth up to 10 points, making the total possible score 30 points. The students' performance in each area is assessed against the four performance levels: Outstanding=10 Points, Highly Competent=8 Points, Competent=6 Points, and Needs Improvement=4 Points, accordingly. This approach ensures a comprehensive and nuanced evaluation of the students' work, reflecting their technical abilities, teamwork skills, and personal growth through the workshop course. [END of SCORING RUBRIC]

Use the rubric to evaluate the student's reflection essay above on a scale of 30 points. Perform Holistic Scoring for each main item. This approach treats each main item (Technical Knowledge and Application, Teamwork and Collaborative Skills, Reflective Learning and Personal Growth) as a whole, evaluating the student's overall performance in that area. In Holistic Scoring, the three subitems for each main item serve as critical guiding parameters rather than direct scoring elements.

Based on the provided scoring rubric and the student's essay, here is the evaluation:

### **1. Technical Knowledge and Application (10 Points)**

- **Understanding of Concepts:** The student shows a good grasp of the technical and theoretical concepts relevant to the project, as evidenced by their detailed description of various designs for the Train Gap Filler project. They mention specific mechanisms like pivot, sliding, gear, piston, and hydraulic pressure, indicating an understanding of the technical aspects.
- **Practical Application:** The student demonstrates the application of technical knowledge in practical situations, especially in the design process. However, there is less focus on the development and real-world implementation of these designs.
- **Innovation and Problem Solving:** The student exhibits creativity, particularly in developing multiple designs for the project. However, there is a lack of detail on how these designs address the specific challenge or their effectiveness in solving the problem.

Score: Highly Competent (8 Points)

### **2. Teamwork and Collaborative Skills (10 Points)**

- **Individual Role and Contribution:** The student clearly defines their role in the project, particularly in creating designs and contributing ideas. However, their actual contribution to the final project seems limited.
- **Team Interaction and Communication:** The student mentions their interactions with the team and offers help to team members. They also reflect on the team dynamics and communication, indicating effective collaboration.

- Peer Engagement: The student demonstrates participation in peer learning and supporting team members, but there is limited evidence of significant contribution to the team's dynamics beyond their individual work.

Score: Competent (6 Points)

### **3. Reflective Learning and Personal Growth (10 Points)**

- Self-Reflection and Insights: The student shows depth in self-reflection, especially regarding their learning process and how they overcame challenges in presentation and communication.
- Design Thinking and Process: The student reflects on the process, including the initial awkwardness in team discussions and their evolution to more effective communication. However, there is less focus on the application of design thinking methods in their project work.
- Skill and Attitude Development: The student demonstrates growth in professional skills, such as software use and mechanism design, and soft skills like communication and critical thinking. They also show adaptability and improvement in public speaking and feedback giving.

Score: Highly Competent (8 Points)

### **Total Score: 22 Points (Out of 30)**

This score reflects the student's solid understanding of technical concepts and personal growth, with competent teamwork skills. There is room for improvement in deeper integration of technical knowledge with practical application and more active engagement in the team's collective efforts.