

Rubric for Student's Evaluation

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 CO₂ are produced by all sectors of society, identifying effective ways to capture CO₂ and store it safely is crucial. Create methods to extract CO₂ 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 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.

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]

I was in the Monster group for this course, SHIP Research Planning and Skill A. Monster truck refer to oversized vehicles that have excessive weight and height. Our group focused on how these vehicles damage the infrastructure. I learned that over-weight vehicles can affect both bridges and roads. For instance, cracks at the structure of the bottom part of the bridge can be caused when an overweight vehicle repeatedly drives over. After studying the accidents caused by the Monster trucks and the current countermeasures for them, we decided that our goal was to generate solutions that would help maintain safe and secure infrastructure while having these types of vehicles.

I started thinking about my solutions by researching current solutions that are available. When researching I did not specify a region or a country as I wanted to collect different kinds of solutions. Also, because different regions will have varying environments with different traffic standards, I assumed that I could encounter solutions that I would not usually see or come up with. One of the existing solutions that I found interesting was the idea of using a monitoring device only for oversized trucks. The reason I focused on this solution is that it seemed to work in almost any road environment. Studying existing solutions is effective as it allows the solution to be more feasible. The fact that it is already being used in real life indicates that this solution is more doable than those that are not.

After choosing an existing solution I combined the solution with my ideas. This was how I invented my solution, Transport ID. It was necessary to generate new ideas so that it is an improved version of the solution. The improved idea would have new features that would solve the problems of the current solution. For instance, I added a data encryption feature to the Transport ID. I thought that this feature is necessary to prevent other parties such as the drivers from falsely inputting the data and cheat their way into unpermitted roads.

The Monster Truck group was divided into three subgroups each in charge of one solution so that we would have three solutions in total. I was in the Transport ID group as I was very involved in generating the solution. Hence, one of my roles in the Monster Truck group was to develop Transport ID as one of the solutions for our goal to maintain a safe and secure infrastructure. As the inventor of the Transport ID, I came up with its design. When creating the design diagram for the Transport ID I made sure that it was easy to understand. I avoided adding too many details to avoid confusion but enough information to show what the ID could do. In addition, I generated features that would solve the problem of current solutions, and finally, I considered and proposed the feasibility of this invention.

I also contributed to the group by asking questions to other group members. By asking questions and commenting on some of the details, I feel that they were able to reflect on their solution that they generated. I was able to go through the same process. When I was asked questions, I would add more details to the presentation so that it was more easily understood. In addition, I would also speak to the other groups about our group. I would often briefly talk about the solutions that we generated and the improvements we realized that we need to make the solutions more effective and feasible. This allowed me to summarize the things we have done that day so that we can acknowledge the progress of our project.

One of the important things I learned while participating in this workshop is the importance of asking questions to my group members and to other groups in the workshop. When I was asked a question by other people I noticed some aspects that need to be improved which I would have not noticed if they did not ask about it. When they pointed out these aspects, I was able to make improvements on it so that my solution became more efficient and feasible. Not only the questions but I learned that comments from other people during a workshop are helpful. The comments were often new ideas that could be added to the solutions I generated. More comments meant that more features were added to the inventions and they would solve more issues related to the pre-existing solutions.

Another procedure I realized was important was frequently having short meetings while working on the presentation. Often times, I would have a meeting with the group members in the very beginning to divide the work. After working on the presentation, we would have our second and final meeting to make sure that all parts of the project are complete. Nonetheless, I noticed that having frequent meetings, more than twice is more helpful. During this project, I received more comments that significantly made my solution more effective and feasible due to the more frequent meetings we had. [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 can define a rubric based on three primary criteria, each with a maximum of 10 points, leading to a total of 30 points. The criteria are:

Content and Clarity (10 points): Assessing how well the student explains the project, their role, and their contributions. This includes the clarity of the project description, the explanation of the student's role and contributions, and the relevance and depth of the reflection.

Critical Thinking and Problem-Solving (10 points): Evaluating the student's ability to demonstrate critical thinking and problem-solving skills. This includes how they approached challenges, their creativity in developing solutions, and their ability to reflect on and learn from the experience.

Communication and Collaboration (10 points): Measuring the student's ability to articulate their experiences in group dynamics, including how they communicated and collaborated with others, the effectiveness of their team interactions, and their reflection on these aspects.

The existing theory behind this rubric is derived from educational assessment principles. Rubrics are widely used in education for evaluating student work because they provide a clear, structured, and fair method for assessment. They help in assessing not just the final product but also the process and learning that occurred. This rubric is designed to evaluate both the tangible outcomes of the student's work (like the project contribution) and intangible aspects (like teamwork and personal reflection).

Now, let's evaluate the student's reflection essay using this rubric:

Content and Clarity (7/10): The essay provides a clear description of the project and the student's role in it. However, while the project's goals and conclusions are mentioned, they could be more explicitly articulated. The process of the project and the application of design thinking methods are somewhat implicit rather than explicitly detailed.

Critical Thinking and Problem-Solving (8/10): The student demonstrates good critical thinking skills, particularly in how they approached the problem of oversized vehicles affecting infrastructure. They researched existing solutions and innovatively combined them with their ideas, showing problem-solving abilities. However, more detailed reflection on the

challenges faced and how they were overcome would enhance this aspect.

Communication and Collaboration (6/10): The student mentions their contribution to group discussions and their interactions with other groups. However, the reflection on teamwork and collaboration is somewhat superficial. More depth in describing how they facilitated or contributed to effective teamwork would strengthen this aspect.

Total Score: 21/30

The student's essay shows strengths in critical thinking and a clear understanding of their project, but it lacks depth in reflecting on the collaborative process and could benefit from more detailed exploration of their learning journey.