

Evaluation Rubric: 21/30 Points

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 belonged to the Monster Truck group for the SHIP course this semester. Monster Trucks refer to over-height or over-weight vehicles that cause a great deal of damage to infrastructures. Recent cases of problems due to Monster Trucks include how over-height vehicles crashing into bridges crossing overhead, or the constant load of over-weight vehicles causing cracks and failures on roads over time. The goal of our team was to develop a creative solution that will prevent these accidents from happening in the future.

In order to accomplish this goal, first, each team member did a background research on current countermeasures. From this research, we found different countermeasures in different countries, including the placement of height clearance barriers, vehicle weight measuring checkpoints, and height measuring checkpoints. However, accidents by oversized vehicles repeatedly happen, and they are still a critical issue to the safety of road. Considering this reality, our team critically re-evaluated the current countermeasures. This evaluation helped our team to find key points such as limitations of current countermeasures, and what can be improved.

Based on this knowledge that we gained, our team moved on to our key mission, which was to tackle the issue of Monster Trucks. Individual brainstorming and research about possible new solutions were done, and was presented to the whole team during sessions. In this process, our team succeeded in coming up with several ideas, including using drones to detect oversized vehicles, implanting sensors to existing measuring checkpoints, and making ID cards that detect which vehicle is violating the height limits. Ideas which were similar or used the same technology were combined.

Finally, our team decided on approaching the Monster Truck issue from 3 solutions; UAV recognition system, Transport ID, and the Smart Toll Gate. From this point, our group broke up into 3 pairs, each in role of one solution. Within the pairs, each solution was developed further. Pairs decided the design, evaluated the feasibility, checked the technology required for the solution they were in charge of. By this way, the solutions were specified. In the sessions on Friday, each pair gave presentations of their achievements of improving their solution and gave feedback to each other. In the last few sessions, presentations of each solution were combined and edited to construct the final presentation from the Monster Truck group as a whole.

Each member of the Monster Truck team played an important role and contributed to the team throughout the project. My greatest contributions were finding the technology of WIM, and developing the design of Smart Toll Gate.

In the process of background research about our project, each member was assigned a country to do research on. I was in role of searching countermeasures taken in the United States of America, due to my personal background living there as a child. In order to tackle the issue of Monster Trucks, USA was using height clearance barriers which were bar like structures that notified the height limit to the drivers. Moreover, certain routes were designated only for large sized vehicles to prevent large vehicles from causing issue on regular roads. Additionally, what was the most interesting was the system called WIM. WIM stands for Weigh-In-Motion, and this system weighs the vehicle as it passes over a section on the road with sensors implanted underneath. In one of the classes, I introduced these solutions to my team, as examples of ideas we could build up on for our own creative solution.

Next, in the process of developing our original creative solutions, my largest contribution to the team was insisting the usage of a new version of WIM. Here, there were still several concepts to consider, such as the cost and feasibility. I contributed to the team by suggesting using a simple design to cut costs, or constructing WIM in key points like toll gates, where several oversized vehicles pass by. Due to the fact that another team member was thinking of a plan of measuring height with sensors at the toll gates, we decided to combine our ideas. This innovated version of a toll gate, which our group decided to name the Smart Toll Gate, aims to efficiently measure height and weight simultaneously. However, at this point, our idea was nothing more than a general imagination. Therefore, we spent

much time discussing about the specific design, and researched what kind of technology will be required. I insisted to place the WIM before the toll gate and the height sensors inside the toll gate. Additionally, using the same sensors used in the toll gate, we decided to place them before structures including bridges or tunnels, to prevent oversized vehicles from entering areas where height is limited. Throughout the workshops in SHIP course, I acquired several skills and also gained knowledge from fields in Civil Engineering and Mechanical Engineering.

In the group discussions held each week, I improved my skill on discussing, thinking creatively, and presenting. In some of the earlier discussions, it was in fact somewhat difficult for me to discuss due to my lack of background knowledge in Monster Trucks, and uncomfortableness in group work. However, as the course moved on, my research ability improved, and I was able to get more involved in group discussions. I became more confident in discussing with my group, which lead to myself making better individual presentation. Additionally, with the help of my group members, I improved on thinking more creatively. Some ideas seemed impossible at first, but with thorough research and planning, we were able to develop it to the level of using the solution on site.

Moreover, from the weekly presentations from other groups, I learned several facts related to fields in Civil and Mechanical Engineering. I never knew the how surveys on radioactive power were imperative. Presentations from the Mechanical Engineering taught me that creativity in their field is the key to solving daily issues such as the gap between train and platform, making automatic doors, and so on. Groups working on stopping CO₂ emission especially surprised me with the idea of using electric planes.

Overall, from SHIP, I was stimulated in several ways. Many of the international students amazed me and acted as role models in how to facilitate discussions, make questions, and present in a way that will improve each other. Interaction with different majors also let me learn topics I was unfamiliar before.

[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.

1. Evaluation Rubric Definition

The rubric for evaluating the student's reflection essay will be based on three main criteria, each with a maximum of 10 points, for a total of 30 points:

A. Project Description and Application of Design Thinking (10 Points)

- Clarity and Detail (4 Points): Clear description of the project, including title, goal, and conclusion.
- Process and Application (4 Points): How the design thinking methods were applied in the project.
- Relevance and Insight (2 Points): Insightful connection of the project to the broader context of engineering and problem-solving.

B. Contribution to the Project (10 Points)

- Role Definition (3 Points): Clear explanation of the student's specific role in the project.
- Contribution Detail (4 Points): Specific examples of how the student contributed to the project.

- Impact and Value (3 Points): Assessment of the value and impact of the student's contribution to the overall project.

C. Reflection and Learning (10 Points)

- Depth of Reflection (4 Points): Insightfulness and depth in reflecting on the learning experience.
- Professional and Personal Growth (3 Points): Evidence of professional knowledge and skills gained, and how it contributed to personal development.
- Workshop Contribution and Interaction (3 Points): Reflection on how the student contributed to and facilitated the workshops, including interaction with peers.

2. Theory Behind the Rubric

The rubric is grounded in educational theory focusing on reflective learning and project-based assessment. Key theories include:

- Reflective Learning Theory: Emphasizes the importance of reflecting on experiences to derive meaning and learning. This theory underpins the evaluation of the reflection and learning component.
- Bloom's Taxonomy: Provides a framework for evaluating cognitive skills, from basic knowledge recall to higher-order thinking. This framework is used to assess the depth and complexity of the student's understanding and reflection.
- Project-Based Learning (PBL) Assessment: Focuses on assessing skills like collaboration, problem-solving, and application of knowledge in real-world scenarios, which are crucial in the context of the workshop course.

3. Evaluation of the Student's Reflection Essay

A. Project Description and Application of Design Thinking: 7/10

- Clarity and Detail: 3/4. The project is described with adequate clarity, including goals and methodologies.
- Process and Application: 3/4. The essay demonstrates the application of design thinking, but could benefit from more detailed examples.
- Relevance and Insight: 1/2. There's some insight, but the connection to broader engineering challenges could be more explicit.

B. Contribution to the Project: 8/10

- Role Definition: 3/3. The student clearly defines their role.
- Contribution Detail: 4/4. Specific contributions, like the WIM technology suggestion, are well detailed.
- Impact and Value: 1/3. The essay describes contributions but lacks depth in assessing their impact on the overall project.

C. Reflection and Learning: 6/10

- Depth of Reflection: 3/4. The student reflects on their learning process, showing some depth.
- Professional and Personal Growth: 2/3. They discuss their skill development, but more detail on personal growth could be included.
- Workshop Contribution and Interaction: 1/3. There's some mention of group interaction, but more insight into how they facilitated or contributed to the workshop dynamics is needed.

Total Score: 21/30

4. Reasoning for the Score

The student's essay shows a good understanding of the project and their role within it, as well as a decent level of reflection on their learning. However, there are areas for improvement:

- **Project Description:** While the project's goals and methods are clear, the essay could better articulate how these fit into the broader engineering context.
- **Contribution:** The student's contributions are well-articulated, but the impact of these contributions on the overall project is not deeply explored.
- **Reflection:** The student reflects on their learning and growth but lacks depth in discussing how they enhanced the workshop experience and interacted with their peers.

Overall, the essay is strong in describing the project and the student's role, but it could benefit from deeper reflection and analysis, particularly in understanding the broader implications of their work and their impact on the group dynamics.