

Student Essay Evaluation: Competent (24/30)

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 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]

The project that I contributed on titled “Monster Truck”. As it was named, the monster truck project focused on how vehicles can damage the infrastructure in societies. Both over-height and over-weight vehicles can damage the structure when they have already exceed the maximum capacity. Some cases often occurred with over- height vehicles by striking the top part of the bridge, while bridge collapsing often caused by over-weight loads carried by the vehicle. Repairing the infrastructures cost lots of money and blocking the other road users from accessing the road. It also can not be denied that some accidents happened when an infrastructure collapsed. Currently, some countermeasures have already been used to prevent and minimize the use of the oversized vehicle. Height clearance barrier, axle scale, road signs, and manual checking by the highway staff and police are some of the countermeasures applied. However, some of them are still less effectively used. Manual checking by police can cause a traffic jam, while there are some cases where the height clearance barrier is still struck by the over-height vehicle. More than that, road signs are also still neglected by the road user. The monster truck project aims to tackle these whole problems of damaging infrastructure by observing and researching more detail about how oversized vehicles affect the infrastructure, and finally applying creativity through ideas by using or inventing technologies that are applicable to be used and introduced to society.

The final target for the monster truck project is to design a new countermeasure or developing the countermeasures that are applied in societies. The design method is based on analyzing the optimization of the current countermeasures. When a person wants to design a new technology countermeasure, the process of having a deeper analysis of the effectiveness of the current countermeasures is important, as it can help to find the weaknesses of the countermeasures that have already exist. Then, the weaknesses can be the reference on how to design a new countermeasure with more advanced technology and more efficient to be used in the society.

In the monster truck project, we work on 3 innovative ideas, which are a UAV recognition system, smart toll gates, and transport ID. At the beginning of the class, I present my idea about applying an automatic sensor to detect the height and using Weigh-in Motion(WIM) to scale the weight simultaneously, which was further developed as smart toll gates. Briefly, smart toll gates are an innovation to measure over-height and over-weight vehicles simultaneously. It is using an infrared sensor to detect the height exceed and a WIM to scale the overloaded vehicles. My role in this project is to work together with Hana-san to develop smart toll gates. During the process, I took charge to design how the smart toll gate looks like and make sure about the feasibility on it. Each week, I did a presentation on the development of the design which always changes simultaneously as the professor always provided feedbacks and asked for more detailed information about it. During the presentation, I and Hana san also needed to answer all the questions given by the other students to make sure that they fully understand about our presentation. I do realize that teamwork is essential to produce the best innovative idea to present. As result, I always talked to Hana san about my new ideas to answer the professor’s feedback and discussed it together with her. More than that, giving feedback and questions to the other group presentation also important as it can help them to criticize more and create better innovation.

Some technologies contributed to the design of smart toll gates, which are sensors, antenna, transport ID, and Weigh-In-Motion(WIM). When innovating smart toll gates, the most important thing is to know how these technologies work and can support the design. Along the process, I researched topics on how sensors and WIM work. As transport ID also an innovation from the other group in the monster truck project, we try to combine these two innovations to maximize usage. By doing a discussion with the other group’s members and professors, I finally figured out how to make transport ID as support to deduct the fines for the driver who drives the oversized vehicle. In the final design, I

suggest using the transport ID as a card that will always be brought by the driver. Then, there will be a camera that will capture the car plate number of the overweight vehicle. When the infrared sensor detects the exceed the height, the antenna will transfer the signal to the transport ID. The transport ID carries the driver's data. As result, it can be used to charge the driver. The final design is more approachable and applicable to be used in society, also tackling the problems stated by contributing some advanced technologies.

During the project, I learn that being proactive is needed during a workshop to establish a better environment to study. Especially in the large meeting with the other group's project, the professor still needs to wait for questions. As we divided into three m groups, I also learned how to give good advice to the other group to develop more about their idea. Moreover, I also found how to develop an idea from a civil engineering perspective, where we need to concern about the environmental effects and how it can ease society by not damaging the infrastructure facilities. For creating an innovation, there is a lot of research that needs to do and I feel it helps me to learn how to present a great innovation with details, and also did a nice presentation that easier to understand by the listeners.

During the workshop, the professor and TA help a lot to gain more understanding about the problem given. They explained well from the background of the problem until how to innovate new ideas based on the current countermeasures. They also always asked us to be active and ask questions. I hope it can be maintained for the next workshop next year.

[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 rubric, here's the evaluation of the student's reflection essay:

1. Technical Knowledge and Application (10 Points)

- **Understanding of Concepts:** The student demonstrates a good understanding of the technical and theoretical concepts relevant to the project. They explain the problem of infrastructure damage by oversized vehicles and discuss existing countermeasures, highlighting their inadequacies.
- **Practical Application:** They effectively apply technical knowledge in designing the smart toll gates, incorporating sensors and Weigh-In-Motion technology.
- **Innovation and Problem Solving:** The student displays creativity in addressing the challenge, proposing the integration of smart toll gates with transport ID for more efficient enforcement.

Evaluation: Highly Competent (8 Points)

The student shows a strong grasp of concepts and practical application, with a high level of creativity and problem-solving skills.

2. Teamwork and Collaborative Skills (10 Points)

- **Individual Role and Contribution:** The student clearly defines their role in the project, focusing on the design and development of the smart toll gates.

- **Team Interaction and Communication:** They mention working closely with a teammate, indicating effective collaboration. Additionally, they actively participate in group discussions and presentations.
- **Peer Engagement:** The student engages with other groups, offering feedback and ideas, demonstrating a good level of peer engagement and contribution to team dynamics.

Evaluation: Highly Competent (8 Points)

The student exhibits effective teamwork and collaboration skills, clearly contributing to and interacting with the team.

3. Reflective Learning and Personal Growth (10 Points)

- **Self-Reflection and Insights:** The student reflects on the importance of being proactive and engaging in workshops. They also recognize the value of research and presentation skills.
- **Design Thinking and Process:** There's evidence of applying design thinking, particularly in iterating the design based on feedback and integrating technologies.
- **Skill and Attitude Development:** The student acknowledges learning about civil engineering perspectives, environmental considerations, and the importance of detailed research and clear presentations.

Evaluation: Highly Competent (8 Points)

The student shows considerable self-reflection and insight into personal growth, effectively applying design thinking and demonstrating skill development.

Total Score: 24/30 Points

The student's performance is consistently 'Highly Competent' across all main items, reflecting a strong understanding, application, teamwork, and personal growth through the project.