

## Element K: Reflection on the design project

This entry would be likely to receive a **score of 3**, based on the EDPPSR. Although the entry was not explicitly organized according to the elements of the EDPPSR (aspects of the engineering design process), contents could be easily connected to many of the major steps in the project. The reflection is generally clear and adequately developed. One strength of the entry is that the lessons learned that were included would be likely to be useful to others attempting the same or similar project. It should be noted that the engineering educators who reviewed this portfolio did debate the appropriate score for this entry (whether it should be assigned a 2 or a 3), based on the fact that the detailed discussion focused on phases of the project rather than the rubric elements. Acceptance of this entry as an example of 3-level work hinges on recognition that major steps in the project are addressed. The fact of the reviewers' initial score disagreement should be taken as a reminder that the EDPPSR should be students' and teachers' starting point rather than something to refer to after the fact, to ensure that key aspects of the element are addressed.

**Engineering Design Process Portfolio Scoring Rubric  
Component and Element Titles****Component I: Presenting and Justifying a Problem and Solution Requirements**

- Element A: Presentation and justification of the problem
- Element B: Documentation and analysis of prior solution attempts
- Element C: Presentation and justification of solution design requirements

**Component II: Generating and Defending an Original Solution**

- Element D: Design concept generation, analysis, and selection
- Element E: Application of STEM principles and practices
- Element F: Consideration of design viability

**Component III: Constructing and Testing a Prototype**

- Element G: Construction of a testable prototype
- Element H: Prototype testing and data collection plan
- Element I: Testing, data collection and analysis

**Component IV: Evaluation, Reflection, and Recommendations**

- Element J: Documentation of external evaluation
- **Element K: Reflection on the design project**
- Element L: Presentation of designer's recommendations

**Component V: Documenting and Presenting the Project**

- Element M: Presentation of the project portfolio
- Element N: Writing like an Engineer

**Please Note: Elements M and N require no submission from the portfolio author(s) and are intended to be scored based on the portfolio work as a whole from what has been submitted from Elements A through L**

## ***Element K: Reflection on the design project***

- 5** The project designer provides a consistently clear, insightful, and comprehensive reflection on, and value judgment of, each major step in the project; the reflection includes a substantive summary of lessons learned that would be clearly useful to others attempting the same or similar project.
- 4** The project designer provides a clear, insightful and well-developed reflection on, and value judgment of, each major step in the project; the reflection includes a summary of lessons learned that would be clearly useful to others attempting the same or similar project.
- 3** The project designer provides a generally clear and insightful, adequately-developed reflection on, and value judgment of, major steps in the project, although one or two steps may be addressed in a more cursory manner; the reflection includes a summary of lessons learned, at least most of which would be useful to others attempting the same or similar project.
- 2** The project designer provides a generally clear, at least somewhat insightful, and partially developed reflection on, and value judgment of, most if not all of the major steps in the project; the reflection includes some lessons learned which would be useful to others attempting the same or similar project.
- 1** The project designer provides a reflection on, and value judgment of, at least some of the major steps in the project, although the reflection may be partial, overly-general and/or superficial; the reflection includes a few lessons learned of which at least one would be useful to others attempting the same or similar project.
- 0** The project designer attempts a reflection on, and value judgment of, at least one or two of the major steps in the project, although the reflection may be minimal, unclear, and/or extremely superficial; any lessons learned are unclear and/or of no likely use to others attempting the same or similar project; OR there is no evidence of a reflection and/or lessons learned.

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Reflective Questions for Element K;

***- If I/we were going to do this project over, what should be done differently during the design process to improve the project and how would those recommendations make the project better overall?***

## Door Speed Control Device

REFLECTION ON THE DESIGN PROJECT K

Along the way our team has faced many challenges to accomplish our goal. We began our current project after we found a currently manufactured solution to our previous problem statement approximately halfway through the year. With this setback in mind we set out with a renewed, determined attitude to find a new problem. The idea for our current problem stemmed from a student last year who did his project on slamming vehicle doors, it was then that it occurred to us that there was no solution to prevent vehicle doors from behaving in volatile manners during opening.

The largest problem we faced was proving that our problem was indeed an issue. Though many have been victims of door dings very few are reported. Proving who the offender was in these cases is an almost impossible issue, and if reported to insurance companies a patron would need to pay a deductible, on most policies, for any repairs. These deductibles can range from only \$50.00-\$300.00 or higher therefore most would rather not report these incidences. This problem proved arduous and we were only able to find current insurance rates, even calling our own insurance providers for door ding statistics proved useless.

3 We then set out to create a viable design where we encountered more problems on an increasingly nearing deadline. Current solutions such as the Ford Edge and DoorShox provided to a minimal degree what we sought after. We needed to create a design that was non-intrusive to the user but provided enough force to accomplish the task. Our first two designs, the wire break and gearbox, would both accomplish the task however they would potentially harm the user by either tripping over the wire or hitting their heads on the box. Finally setting on the microcontroller/sensor design utilizing a pneumatic cylinder it was time to construct our prototype.

The most difficult part of the prototype was the programming involved. Though both of us had previous experience with Java-based coding we were completely new to the C++ based Arduino language, leaving us to teach ourselves. After countless hours and sleepless nights we gained a level of familiarity with the language and set out to complete our task at hand. Problems with utilizing the accelerometer forced us to reorder the part for a working one. Once everything was soldered and wired we encountered a problem with reading the ultrasonic data and the accelerometer data while also controlling the valve. Since the Microcontroller we chose, like all affordable ones, is a single processor unit it ran the program in a linear function. The delays needed to send out pulses to the ultrasonic and the delays needed for the pneumatic valve were compiling together, slowing down the overall performance. Creating sub-loops helped to aid this

but for the system to function as smoothly as possible a multi-processor unit would need to be utilized.

All things considered our project came together nicely. Though we were not as diligent about recording data in our Engineer's Notebooks the collaboration of our group and the class helped us find a viable problem with a viable solution. In addition to this we now have a better understanding of the design process and the difficulties associated with embarking on overwhelming projects without having enough time money or expertise, and this is similar to the real world experience that we will have during our careers.