This excerpt is from the project entitled "Extra Lure Safe" addressing an issue that exists with exposed fish hooks and personal injury.

Element K: Reflection on the design project

This entry would be likely to receive a score of 4, based on the EDPPSR (and was given that score by three engineering educators who independently reviewed the portfolio from which the entry is taken). The entry took the form of a systematic examination of the design project that addressed every part of the project (although one reviewer felt that some parts were addressed superficially). In the course of the entry, the designers provided a clear, insightful, and generally developed reflection on—and value judgment about—each of the major steps they followed. In addition, this reflection provides a good summary of the lessons learned in the process. One reviewer remarked that the reflection was fairly thorough, but thought that the lessons learned were not substantive.

Typically, in STEM-related contexts, reflection involves identifying and examining misconceptions and documenting changes in understanding and perspective. Reflections involve looking backward, in order to prepare to move forward. The way this entry was organized (with headings to identify each step in the process and reflections on that step) worked, but is by no means the only way that students can approach reflection.

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.

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?***

Reflection

XLS 2012 design project

Process: Research

The research conducted by the design team has indicated a need for a product that would provide fishermen with a safer fishing experience. The statistical evidence included the research that showed that 19% of the 34 million people that go fishing in the United States each year have been injured while fishing. Also, the surveys conducted indicated that the percentage of injures may actually be higher. The surveys showed that of the people surveyed 50% of them were injured while fishing and 75% of those people did not report the injury. Thus, indicating that injuries while fishing occur frequently.

Reflection: Research

It was important to conduct the research in order to determine that there is actually a need for the product. Without a need for a product there is no need to continue to development. Hence, the reason it was important to continue on with the design process. During the research, each team member independently worked on gathering information. It may have been more valuable for all team members to have been given specific areas to research in order to avoid duplication of research as well as saving time.

Process: Patent and Product Research

Patent and product research was also done in order to establish a basis for what has already been developed. While there were many products already designed and had patents, almost none of those designs had made it to the market. Therefore, there is a need for the product since it has been designed but not marketed. Therefore, it was important for us to continue the development of the XLS 2012.

Reflection: Patent and Product Research

It was important for our team to know what products were already developed in order to make certain that the team does not duplicate a similar product that has already been designed. It was also important to examine the patents to help stimulate ideas that we can expand on and possibly improve. Therefore, it was extremely important to make certain the team had a solid foundation of the products that have already been created.

Process: Design Specifications

It was important to develop the design specification for the product. In order to develop design constraints the team had to use the prior research to help determine what the design specifications should be. The team had a brainstorming session where each team member listed a number of design specifications. Then each team member shared their ideas. The design specifications were then developed. Some of the design constraints had to be re-worked in order to make them a testable constraint.

Reflection: Design Specifications

During the development of the design specifications, the initial design specifications needed to be re-done. Not all of the design specifications were testable. Therefore, it is important to make sure that all of the design specifications are testable before beginning the development of ideas.

Process: Brainstorming

The design team began brainstorming solution by each team member developing at least 3 ideas with sketches. The ideas were then share with every other team member. The team then used the post-it method of brainstorming where each team member writes down as many ideas on post-its. The ideas were then organized and discussed among team members.

Reflection: Brainstorming

While the team did develop many ideas to then be evaluated, each team member may have had a preconceived notion of the product outcome. It is important to make sure that in the development of the design, all team members are not pre-determining a solution. It is important to allow creativity in the developmental stages of the product.

Process: Decision Matrix

The design team developed a decision matrix in order to select the best design for the product. Six concept designs were placed into the decision matrix and each team member went through and evaluated each design in seven different areas. The matrix then determined the design we would pursue (XLS 2012).

Reflection: Decision Matrix

While the design team evaluated each design in all the areas set by the decision matrix, there was no formal rubric for the values of each attribute being evaluated. Therefore, while each team member did their best at evaluating each design, bias may have led to a specific design. Therefore, the development of a rubric for the decision matrix is very important.

Process: STEM Applications

The design team developed the mathematics, science and engineering concepts that may need to be addressed throughout the development of the product. These concepts included cost estimates, force analysis on product, survey analysis. All the calculations were then completed throughout the project design.

Reflection: STEM Applications

All of the mathematics, science and engineering principles used all had a solid foundation. However, the team may have wanted to pursue each of the areas (cost analysis, stress analysis, survey analysis) in more depth. For instance, the cost analysis could have examined the marketing aspect of the product, the stress analysis could have examined the stress on the connection to the fishing rod, and the survey could have been refined and then re-distributed. Therefore, it is important to continuously examine and refine all of the mathematics, science and engineering principles that need to be used in order to effectively design the best product.

Process: CAD, Prototype, Testing, Re-design

The design team developed the CAD drawings for the initial prototype. The drawings were then printed in a rapid prototype machine to produce a working prototype. The prototype was then tested and re-evaluated. After the testing and re-evaluation, the prototype was re-designed. The new prototype was then tested again. The testing indicated that there was an improvement in ease of use test while still meeting all other design specifications.

Reflection: CAD, Prototype, Testing, Re-design

Even though the team created a prototype, tested it, re-designed it, created a second prototype, and tested it; the design is not necessarily complete. It may be valuable for the team to re-evaluate and make improvements to the design before it would ever reach the market.

Overall Reflection:

The design process went fairly well. While there were aspects that could have been improved upon as seen in the previous reflections, the team was able to successfully design a product to increase the safety of fishermen dealing with fishing hooks.

Element L: Presentation of designer's recommendations

Designer's Recommendations

XLS 2012

The following are the designer recommendations for the XLS 2012 and how they may be initially implemented:

1. Reusable mounting method of the XLS 2012

Implementation: Research will need to be conducted in order to develop a mounting method that would be reusable.

2. Family of sizes for the XLS 2012 (Ranging from Fly Fishing to Deep Sea Fishing)

Implementation: Scaling the XLS 2012 will allow for a wide variety of lures.

3. Value added features (such as a bottle opener)

Implementation: Re-design of original mold to include value added features.