Element H – Score 1
Reinventing The Lifejacket

Element H: Prototype testing and data collection

The project for which this is one entry was conducted before the current version of the EDPPSR could be used as a resource, and this entry was intended to address an element of the design process that focused on sufficiency of testing that had actually been conducted. However, much of the content of the entry aligns best with new element H, and so it can serve as a useful example. Based on the current version of the EDPPSR, this entry would be likely to receive a score of 1.

The assigned score would be at the lower end of the scale for several reasons. Although the test described is a feasible way to address one of the design requirements, there is almost no information to address others of the requirements identified earlier in the entry for Element C (or alluded to again in the entry for Element G). The lack of confirmation by even one field expert is also characteristic of entries at this score point level.

One way that the entry could easily be strengthened (besides the addition of evidence of confirmation of the testing plan by field experts) would have been to provide more specific detail about plans for the “full scale testing” that was actually conducted. The description of this testing was very superficial and vague (e.g., “we…recorded what happened,” “we would test it again”). With specific detail on the planned for conduct of testing to evaluate those requirements tested operationally in the pool—comfort, adjustable size, and safety—and an explanation of how such testing would yield objective data, this entry would receive a much higher score.

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 H: Prototype testing and data collection plan

5 The testing plan addresses all or nearly all of the high priority design requirements by effectively describing the conduct (through physical and/or mathematical modeling) of those tests that are feasible based on the instructional context and providing for others a logical and well-developed explanation confirmed by one or more field experts of how testing would yield objective data regarding the effectiveness of the design.

4 The testing plan addresses many of the high priority design requirements by describing in a generally effective way the conduct (through physical and/or mathematical modeling) of those tests that are feasible based on the instructional context and providing for others a logical and generally developed explanation confirmed by one or more field experts of how testing would yield objective data regarding the effectiveness of the design.

3 The testing plan addresses some of the high priority design requirements by adequately describing the conduct (through physical and/or mathematical modeling) of those tests that are feasible based on the instructional context and providing for others a generally logical and adequately developed explanation confirmed by one or more field experts of how testing would yield objective data regarding the effectiveness of the design.

2 The testing plan addresses a few of the high priority design requirements by at least partially describing the conduct (through physical and/or mathematical modeling) of those tests that are feasible based on the instructional context and providing for others an only somewhat logical and/or partially developed explanation confirmed by one or more field experts of how testing would yield objective data regarding the effectiveness of the design.

1 The testing plan addresses one of the high priority design requirements by describing at least minimally the conduct (through physical and/or mathematical modeling) of a test that is feasible based on the instructional context and/or providing for an at least generally logical and/or partially developed explanation of how testing would yield objective data regarding the effectiveness of the design; confirmation of that explanation by even one field expert may be missing.

0 Any testing plan included fails to address at least one of the high priority design requirements by describing at least minimally the conduct (through physical and/or mathematical modeling) of a test that is feasible based on the instructional context and/or providing for an at least generally logical and/or partially developed explanation of how testing would yield objective data regarding the effectiveness of the design; OR a testing plan is missing altogether.

Excerpt from the "Reflective Questions for Students" Document regarding Element F from the Innovation Portal Resources files;

"What is the plan to test the prototype design and how can I show others that the testing plan for each design requirement is a well thought out test and would yield believable /valid data?"

Testing

The first tests we did were small scale on the foam we took from the traditional life jacket. Basically we attached a net to one of the pieces of foam and put masses in the net till the foam sank. When the foam sank we added another sheet and found the weight the combined sheets could hold. We did that for four sheets. Later when we ordered the closed cell polyethylene we did the same test on that foam. The bulk of our full scale testing was done informally. Mostly we took our design to the pool jumped in and recorded what happened. Than we would discuss what we needed to be changed, change it the next day and test it again. We went through that cycle for about two weeks until we ended with our second prototype. Most of the changes were taking foam from the back and adding it to the front. We did not do any full scale testing on our final design but everything we wanted to add to our second prototype but could not because we did not have the necessary materials we put in our final prototype.

Prototype One and Two

Purpose

The purpose of this test is to determine how much weight (in grams) a sheet(s) of the traditional life jacket material could hold until it sinks. Dimensions of 1 sheet: 29.8cm X 15.3cm X .5cm.

Pass/Fail Criteria

- **Pass: There is no pass or fail criteria, this is a test for information.**

Materials

- **Sheets of traditional life jacket material 1/4 inch thickness**
- **Large bucket of water**
- **Gram weights**

Stepwise Procedure

1. **All materials are on hand.**
2. **Place 1 sheet of the traditional life jacket in the large bucket of water.**
3. **Start to place the weights in the middle of the sheet. Place the heaviest weights on first until the sheet sinks.**
4. **Take the last weight that was put onto the sheet so the sheet can float again.**
5. **Place the next less heavy weight on until the sheet sinks.**
6. **Repeat step 4**
7. **Repeat steps 3-6 with different weights until the max weight it can hold is found.**

Final Prototype

Purpose

- **The purpose of this test is to determine how much weight (in grams) a sheet(s) could hold until it sinks. Dimensions of 1 sheet: 30.5cm X 15.5cm X .5cm.**

Pass/Fail Criteria

- **Pass: There is no pass or fail criteria, this is a test for information.**

Materials

- **Sheets of Closed Cell Polyethylene 1/2 inch thickness**
- **Large bucket of water**
- **Gram weights**

Stepwise Procedure

1. **All materials are on hand.**
2. **Place 1 sheet of the traditional life jacket in the large bucket of water.**
3. **Start to place the weights in the middle of the sheet. Place the heaviest weights on first until the sheet sinks.**
4. **Take the last weight that was put onto the sheet so the sheet can float again.**
5. **Place the next less heavy weight on until the sheet sinks.**
6. **Repeat step 4**
7. **Repeat steps 3-6 with different weights until the max weight it can hold is found.**
8. **Record data.**

8. Record data.
9. Repeat steps 3-8 stacking 1 more sheet of material at a time.

Data:
- 1 sheet of the tradition could hold 360 grams
- 2 sheets could hold 700 grams
- 3 sheets could hold 980 grams
- 4 sheets could hold 1220 grams

9. Repeat steps 3-8 stacking 1 more sheet of material at a time.

Data:
- 1 sheet of the tradition could hold 800 grams
- 2 sheets could hold 1620 grams
- 3 sheets could hold 2400 grams
- 4 sheets could hold 3240 grams