

11-21-17

ELO Reflection

### **Reflection Paper:**

As a way to enhance my understanding of the design process used by engineers and the organizational skills involved in tracking my progress, I decided to work on redesigning a project, a ping-pong ball ballistic launcher, that I had made in a group of three during my sophomore year in an engineering class. My teacher for this class, Mr. Gosselin, agreed to work with me on this, allowing me to use the various resources and machines in his room and to ask him for advice. After researching, designing, and building the launcher, I used various physics calculations, with the help of Mr. Edgar and some from Mr. Myers, to predict how far a ball would launch at a certain angle, and account for the impact of air resistance on the launching distance. I then tested the launcher, and then used my predicted and actual distances at each angle to run a statistical analysis, with the help of Mr. Myers, to determine if my predictions could be considered accurate. Finally, I presented my findings to Mr. Gosselin's Design, Create, Innovate class. The duration of my project was most of first trimester, or from the beginning of September through the middle of November.

My goals included the following: How can I effectively construct and predict the performance of a ballistic launcher? Do the results of the performance of this launcher differ at a statistically significant level from my predictions for them? Based on my results, how reliable and accurate is my product? What revisions need to be made, if any? For the first goal, while I built an effective launcher, I did not successfully predict the launch distances. So, this goal was only partially met. For the second goal, I was able to conduct a significance test, and reached a

conclusion, so this goal was met. For the third goal, my product did launch straight consistently, but due to the power source did not provide consistent/reliable data. So, this goal was not satisfactorily met.

At first, I expected this project to be a nice break in my day, and a good way to decompress and do something I enjoy amidst my other difficult classes. This was true for awhile - I was very relaxed during the initial research and concept design phases of my project. However, I soon realized that my work load was about to dramatically increase, as I would have to do much work outside of the classroom to build my launcher and make up time as I had missed some deadlines. While the workload changed from beginning to end, the fact that working on the project was a nice break in my day did not change.

For most of my ELO, I worked in Mr. Gosselin's room during Block 4. He had another class - Design, Create, Innovate - at the same time, so I worked independently and asked him for help when he was available. I had access to the drills, saws, machines, and other resources in his room, which were useful when I was building my launcher. However, I had to wait until Mr. Gosselin's class did not need the machines, so that I wasn't interfering with their work. For about a week I spent time working between Mr. Edgar's room and Mr. Myer's room when I needed their help and advice.

I worked most closely with Mr. Gosselin throughout the duration of my project. He was never on top of me and asking me if I had met my deadlines exactly, but this allowed me the freedom to learn from my own mistakes and figure out how to fix my own problems. He did make sure I was headed down the right path, and would remind me that I should be moving on to the next phase of my project soon. When needed, I would ask Mr. Gosselin about the design of

my launcher and for tips on how to properly go about building a part of my launcher. He was always helpful, never turned any of my questions away, and gave me enough feedback to help me figure out my problems.

What I liked most about my experience was being able to work with my teachers on something that wasn't directly tied to a class I had/have with them. I also enjoyed being able to make improvements to a project I liked a lot when I originally created it, and being able to spend more time on it. Additionally, I liked having the opportunity to build something and do something with my hands during school, rather than the traditional alternative of taking notes and tests. What I liked least was the workload that it added onto my already high amount, and the stress that this caused as a result. But, there wasn't much else that I did not enjoy.

I did not have too much trouble maintaining my other commitments while working on this project. However, I had more trouble balancing work for this class with work from my other classes. I didn't anticipate how much the workload at home would be when building the launcher, and often times put work for other classes ahead of work for this one.

One thing I felt I did well was adhering to the design process throughout my project. Doing this made it much easier for me to track my progress and get work done, even when I fell behind at points. I also feel that I did a good job designing and refining my launcher. With the help of Mr. Gosselin and my dad, I was able to get the launcher to launch straight, as it launched consistently to the side at first, and measure correctly where the various angles the launcher would be launched at, which was not done correctly at first. On the other hand, I feel that I could've used improvement with my time management. I fell behind early on in my project, which was caused by spending too much time working on phases that didn't need as much work,

like the research and design analysis, rather than on phases that needed more work, like the construction of my launcher, predictions, and testing. I also should have spent more time working outside of class once I realized that I was behind. Additionally, I feel that I could have done a better job presenting my project. I feel that I could've been more prepared for my presentation, done a better demonstration, and explained the reasons behind why I did this project and exactly what I did better.

This experience has impacted my education and career goals in that it has made me solve problems on my own and figure out how to meet deadlines I set for myself. It also helped me experience another real world application of math through statistics, which was by analyzing the data for the predicted and actual launch distances. Furthermore, the experience challenged me to take what I learned last year in physics and extend this knowledge beyond what I was taught when calculating my predictions. Additionally, being able to experiment with the computer software that Mr. Edgar let me use enhanced my understanding of air resistance. Overall, this experience has exposed me to topics that I am interested in possibly pursuing for a career, which was very beneficial to have been able to do at this stage in my high school career.

One of the skills I learned and/or improved on from this experience is my problem-solving, and being able to do this mostly on my own rather than seeking help from an instructor. I also learned more about the impact of air resistance on a projectile, and how to take the simple physics formulas I learned last year to apply them to more advanced concepts and calculations with this project. Additionally, I was able to enhance my ability to visualize the applications of math (statistics) in real life through using the content I learned in statistics last year. I was very

happy to have been able to gain these skills, not all of which I expected to have gained going into the project.

One thing Mr. Gosselin suggested I do differently is to adjust my deadlines as needed when I fall behind. Instead of keeping the same deadlines throughout when I fall behind, and then add to my stress trying to make up time later on, I should shift my deadlines accordingly if I find that a certain phase needs more time than initially planned. Specifically, I think I should have allowed myself more time for building my launcher and doing the calculations I did, since I was crunched for time when I did these and could have obtained higher-quality results were I to spend more time on it. Other things that I would work on were I to do this again include finding a way to account for air resistance more in my calculations, since most of my predictions were higher than the actual distances the ball traveled. Along with this, I would think about using a different power source instead of the two 9V batteries I used to power my launcher. I found the batteries quickly wore out, but it was too expensive to constantly be replacing them, so some of my data was skewed as a result. So, I would try to find a method of launching that is more consistent if I did this project again. Furthermore, I would also consider collecting more data at each angle for how far the ball actually went, so that I could conduct a stronger statistical analysis to determine if my predictions were accurate. Finally, I would do more work outside of class early on, because part of why I had trouble meeting deadlines was because I did most of the work in class at first. Over time, I did more work outside of class, but I should've started this habit from the beginning.

My initial research included looking up various designs of possible ballistic ping-pong ball launchers and what materials would be used for them. I also talked to both Mr. Myers and

Mr. Edgar, who gave me invaluable advice on how to predict the launching distances of my launcher, and whether or not these predictions were considered statistically accurate. Without their help, I likely would not have been able to figure these things out on my own, so I greatly appreciate their help and efforts taken to assist me.