Laser Danger Report

Intro to Engineering Problem Solving

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INTRODUCTION

The aim of this project is to create a game that would teach kids about science, technology, engineering, or math (S.T.E.M.) in a fun and educational way while still allowing for a flow of creativity. Laser Danger is a children's, S.T.E.M. focused board game that uses a laser and mirrored game pieces to hit a target end piece. To play, the player puts the target end piece anywhere on the board and the goal is to have the laser's light hit the target. This can be done by using the mirrored game pieces to bounce the laser's light around the maze. For an extra challenge, it is encouraged that kids time themselves and play against friends. This showcases the S.T.E.M. concepts of science, by teaching the ideas of light and reflection, and engineering as it allows kids to identify and design a plan to complete the maze.

The safety of the consumers while playing Laser Danger is our biggest priority. Thus, it has been determined that children ages eight and up is the most appropriate age range. Children ages eight and up can safely handle the laser as well as the glass on the game pieces. When compared to our competitors, the same age range was determined for their games, therefore, we feel comfortable setting that age range.

When we first began our design process, we were tasked with having to make a fun and appealing board game to attract the consumers. Thus, we decided to make Laser Danger have a 3-D maze board, mirrored game pieces, and a box to hold the laser. While one group member finalized the prototype, the task of creating the poster was left up to the rest of the group. Quickly, some constraints began to arise. The biggest constraint was price. In order to keep Laser Danger at a competitive market price, we did not want to go over the twenty-dollar budget we had set. Secondly, the laser used was quite weak. Although the laser was not as strong as we hoped, it worked out for the better. The weaker laser is more suitable for children, and although not advised, if a child were to shine the laser in their eyes it would not cause any eye damage. Finally, the last constraint we faced was the lack of materials. We did not have any excess products for our prototype, so if there were to be any design change or something was messed up, we would not have the budget nor materials to rebuild it.

MATERIALS & METHODS

When beginning our brainstorming, we immediately knew that we wanted to utilize a laser in our game and teach the S.T.E.M. concepts of light and reflection, as well as aiding an engineering mindset of identifying a problem, learning how to solve it, and then carrying out a solution. From the get-go we brainstormed creating a 3-D maze board game that would use a laser to hit a target that would signal completing the maze and winning the game.

As we began building, we started out with a wooden sixteen by twenty-inch board and then cut out strips of cardboard to create the maze walls. We cut out cardboard strips ranging from twenty-inches to three-inches to build our maze. From there, we hot glued the cardboard strips onto the board in a maze formation and spray painted the newly created game board with a flat, black spray paint, as seen in Figure 1. Soon after, the design of the game pieces became a newly found problem. With our original design, we were to make rectangular game pieces with a mirror tile glued onto the front of them, but upon building it, the design was too bulky to angle within the maze, and we needed something much smaller and thinner, as seen in Figure 2. Thus, we bought thin, plastic game pieces and hot glued the mirror tiles to them. As for the laser, we cut up a red, rectangular box and placed the laser inside so it would be in line with the mirrors on the game pieces, as seen in Figure 3. Finally, we bought a glass prism to be the end target. With the prism, it would be much easier for children to know when they have hit the target and won the game. For our final prototype, in total, we used a wooden sixteen by twenty-inch board, cardboard, a laser, twelve plastic game pieces, twelve mirror tiles, a glass prism, and one rectangular box to hold the laser.

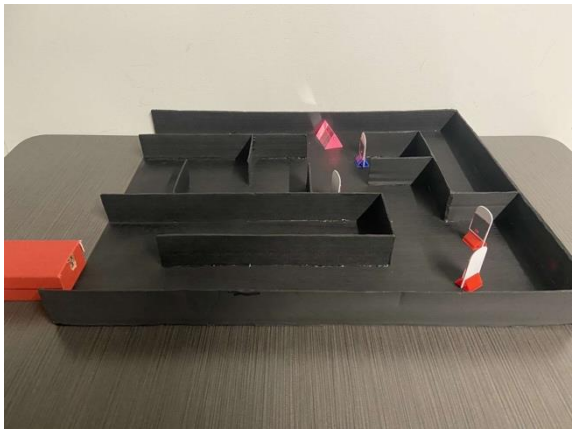

Figure 1: Final prototype of Laser Danger when in play and set-up

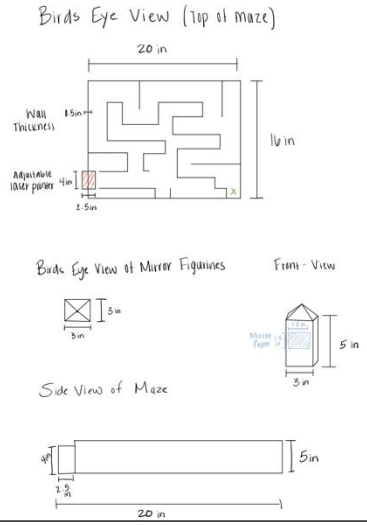

Figure 2: Initial design and schematics for Laser Danger

Figure 3: Final prototype of game pieces along with the target piece

Determining the age range and safety precautions for our product became our next task. When comparing our game to our competitors, we concluded that Laser Danger is best for ages eight and up because of small game pieces, the use of glass, and the laser. To ensure the right safety precautions are taken when playing the game, we presented a caution label on our prototype detailing the dangers of shining a laser pointer in the eyes, as seen in Figure 4.

Figure 4: Presenting the cautions of Laser Danger as well as the appropriate age range

Laser Danger has a variety of ways to play. The first way to play is to set the target piece in your desired end spot, turn on the laser, and begin setting up the game pieces to complete the maze. To make it more challenging, you can time yourself and compete against friends. Another

way to play is to set the target piece for your opponent and time how long it takes them to complete the maze. Laser Danger is a great game for kids to spin their creativity on.

Although our prototype of Laser Danger generally has everything we designed, there are still a few tweaks we would like to make before our product hits the market. First, we would like to make the game board have detachable maze walls to allow for more variability and to easily change the difficulty of the game, as seen in Figure 5. Secondly, we would like to install a track for the laser box so it can glide along the edge of the board and remain attached to the board, as seen in Figure 5. Finally, as for the game pieces, we would like for them to be wider and be bendable, as seen in Figure 6. This would allow for an angled game piece and teach children about angles in light reflection.

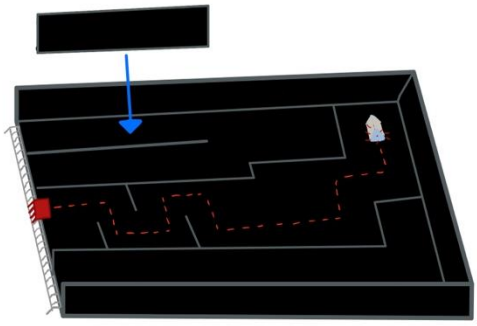

Figure 5: Moveable walls and laser track for final design of Laser Danger

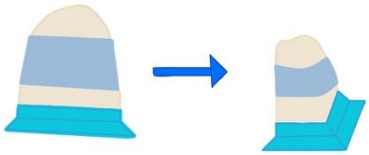

Figure 6: Angled game pieces for final design of Laser Danger

RESULTS & DISCUSSION

Laser Danger is a successful game as a prototype, but it did come with a few problems. To start off, we had problems with our individual game pieces. Each piece was a plastic game piece with a mirror glued onto it and the mirror was not always perfectly level. With any slight tilt to the mirror, either up or down, caused the laser to change levels and not work with hitting the other game pieces. Ultimately, the laser would then be too high to hit the target end piece. We found this to happen to some of our pieces, so we had to only use the ones that worked when presenting our prototype. Another problem that we faced while building the prototype was that the laser that we used didn't shine through the prism as well as we would have wanted it to. As seen in Figure 7, the prism was not as lit up as we would have wanted. We could have used a

different laser like a green one instead of a red one, which would have allowed for a better ending when the laser contacted the prism.

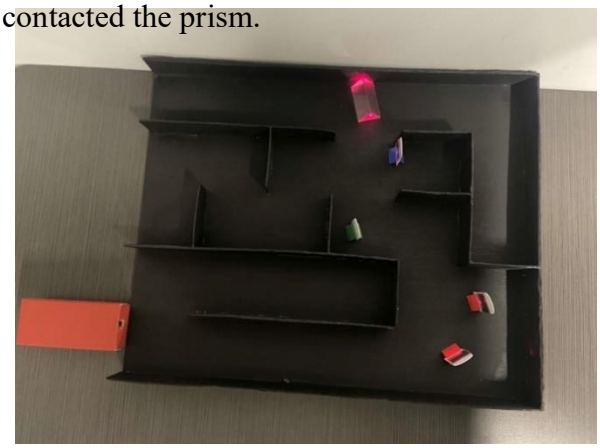

Figure 7: Birds eye view of game when setup and in play

Our project may have had a few problems when working with the prototype, but still did a great job when it came to building a toy that relates to S.T.E.M. Our game involves two different aspects of S.T.E.M., science and engineering. Science is brought up when we look at the laser and what it does. The laser teaches kids about reflection of mirrors, and when we make a laser that can work better with the prism, it can teach the kids about wavelength. Engineering is also taught to kids from our game. Engineering is involved when we look at the building aspect. The player of the game must put pieces in the correct place to win the game and build a solution to the maze. When we create our final model, we would like to add moveable walls to the final product, which would allow for even more creative building and designs by the kids.

S.T.E.M. games tend to have an older age range due to the difficulty and skills required to play. Laser Danger had a hard time deciding what age range this game should be played in. You must keep in mind things like the safety of children when playing with the laser, as mentioned in the Materials and Methods section, and how it can be a hard game for very young kids to understand and grasp. Laser Danger was decided to be made for children ages eight and up. This is the same age group that similar games, like our competitor Laser Maze and Laser Chess, allow to play. Laser Danger is a game that is targeted at kids, and a good reason that kids would want to play it is because it is a versatile board game that allows for kids to put their own spin on it. Board games are very interesting for kids because they can have a hands-on experience and physically see what is happening.

We decided that the game should be sold through Amazon or Walmart because these are very popular destinations for parents and children to view board games, especially because of their online presence. Before bringing this game to the market, it must be able to compete versus our competitors in the market. In Figure 8, Laser Danger is being compared to two similar games: Laser Maze and Laser Chess. Not only did we find Laser Danger comparable to them, but overall, it is a better product for the consumers to buy. The price of our game is only $26.99 compared to the much higher prices of the other games. Due to the lower cost, our game is able to reach a larger consumer base that our competitors cannot reach. Additionally, Laser Danger is much more versatile than our competitors. When hitting the market, our brand will include additional content that you could purchase to further change how the game looks. For example, you could have a thief as the target end piece and have the laser hit that. Finally, our game is more acceptable to adding your own twist onto it.

	Price	Versatility	Additional Content
Laser Danger	$26.99	✓	✓
Laser Maze 	$32.99	✗	✗
Laser Chess 	$45.99	✗	✗

Figure 8: This table shows Laser Danger compared to two similar products

Our game has more things that make it better other than the things mentioned before. Our game is a lot bigger than the other ones. The bigger board allows for more space to play the game on, and more space means more creative options to play. Our game is also made of more durable, better materials. While games like Laser Chess and Laser Maze are made of cheap plastic, our game takes a more natural feel to it. It consists of a wooden base which helps to make it more durable and last longer. As a parent you would never want a game to break and then buy again, so when you have the option of getting a game with more sturdy materials, it is

more appealing. Laser Danger also has the visual aspect that the other games don't have. Ours looks like an actual maze with real walls that are painted black to bring out the color of the laser and prism when they make contact, whereas the other games are just plain white.

Laser Danger does have to consider some safety considerations. One of them is that the laser could be dangerous if used directly in someone's eyes. We took this into account for our target audience, but it is still important to note down what it could do. The laser is weak and will not do any damage, so it is safe for most people to use when playing this game. Other than that, our game is safe for kids ages eight and up so they should not have to worry about anything else while playing our game.

CONCLUSIONS

Laser Danger is a very creative and intriguing S.T.E.M. game for kids and teaches them science and engineering aspects. It is overall a better option than some of its competitors and still has improvements that could be made to make the final product even better. It is cheap and hits all the criteria that we were given and the criteria we set for ourselves. Bottom line is that Laser Danger is a success.

When it comes to further action on the project, I do not feel like it should be done for this project. The next step would be creating a final prototype and then building the company.

This project has really taught us about competition across the market and how to optimize our own products. This project was a good learning experience in regards to project design, management, and how to present.

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