Blackstone Valley Regional Vocational Technical High School
Student Portfolio- Project Reflection

Date	**1-14-22**
Student Name	**Om Patel**
Subject	**Intro to Engineering and Design**
Instructor's Name	**Mr. Rhodes**
Instructor's Signature	

For this project I was challenged to design and build a puzzle cube using scrap hardwood provided by Fine Office Furniture Inc. The goal was to take leftover material and transform it into a functional novelty item that was challenging, visually appealing, and able to be sold as a small product. From the start I had to work within strict constraints. The cube had to measure exactly two and one quarter inches when assembled, be made of five unique pieces, and each piece needed to consist of four to six smaller hardwood cubes. Every piece also had to interlock correctly so the puzzle would stay together once completed.

The first step was measurement. I used a dial caliper to carefully check the size of each individual hardwood cube, which ranged between .74 and .76 inches. This step was important because even small errors in measurement could throw off the final design. With accurate data recorded, I began sketching potential puzzle parts. I drew twenty different variations on paper, experimenting with different arrangements of four, five, and six cube combinations. From those sketches I built a small prototype out of plastic cubes to test how the pieces might fit together. The prototype stage helped me visualize the interactions between parts before committing to the final wooden version.

After selecting my final design, I moved to Inventor where I created digital models of each puzzle piece. This allowed me to check clearances and confirm that the five parts would form a perfect cube when assembled. In Inventor I also generated drawings for each part and a presentation that showed how to solve the cube step by step. These drawings were an important part of the project because they documented my design in a way that others could reproduce or understand without needing the physical puzzle.

Once the digital design was finalized, I built the wooden version by cutting, coloring, and gluing together the hardwood cubes. Each part had to dry and cure properly to make sure the puzzle held together under repeated use. After assembling the five pieces into a full cube, I turned to the final stage of the project, which was packaging. This step required me to think beyond engineering and into marketing. My package included a company name, a UPC code, warnings, cost, the country of manufacture, a clear viewing window, and an isometric sketch of the cube. The packaging not only protected the puzzle but also made it look like a professional product that could be sold in a store.

Looking back, this project taught me much more than how to design a puzzle. It pushed me to balance creativity with strict rules, since every piece had to fit within narrow size limits. It also introduced me to the importance of prototyping. Building a small plastic model first saved me from mistakes that would have wasted time and material later. I also strengthened my CAD skills by modeling complex interlocking parts and creating professional drawings. Even something as simple as making the packaging gave me an appreciation for how engineers often have to think about not just the function of a product but also how it will be presented to customers.

Overall, the puzzle cube project was one of my first real experiences with the complete design cycle, from concept sketches and digital models to physical prototypes and a finished product. It showed me that good design is about details, patience, and documentation, but it is also about creativity and problem solving. Those lessons have carried forward into the larger projects I do now, where the same design process is applied on a bigger scale.

Technical competencies and academic skills demonstrated by completing this assignment.

Framework Standard	Description
2.D.02.06	Create and edit a solid model using a 3-D modeling program, based upon design sketches. Utilize appropriate materials, measurements, fits, appearances, processes and functions.
2.D.02.07	Combine model parts into working assembly, manipulate and animate assembly using a 3-D modeling program.
2.B.01.02	Brainstorm ideas; develop and evaluate solutions; create documentation; build and test prototype; and present design.
2.B.05.02	Create specifications (or follow if given) for a project or product.
Embedded Academics	**Description**
2.B.01.2.1	Identify and explain the steps of the engineering design process, i.e., identify the need or problem, research the problem, develop possible solutions, select the best possible solution(s),
2.B.09.02.3	Apply geometric methods to solve design problems (e.g.,, designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).
2.B.01.2.2	Demonstrate methods of representing solutions to a design problem, e.g.,, sketches, orthographic projections, multiview drawings.
2.B.01.2.4	Identify appropriate materials, tools, and machines needed to construct a prototype of a given engineering design.