

Puzzle Design Challenge Brief

Client

Fine Office Furniture, Inc.

Target Consumer

Ages: High school aged

Designer _____

Problem Statement

A local office furniture manufacturing company throws away tens of thousands of scrap $\frac{3}{4}$ " hardwood cubes that result from its furniture construction processes. The material is expensive, and the scrap represents a sizeable loss of profit.

Design Statement

Fine Office Furniture, Inc. would like to return value to its waste product by using it as the raw material for desktop novelty items that will be sold on the showroom floor. Design, build, test, document, and present a three-dimensional puzzle system that is made from the scrap hardwood cubes. The puzzle system must provide an appropriate degree of challenge to high school students.

Criteria

1. The puzzle must be fabricated from 27 – $\frac{3}{4}$ " hardwood cubes.
2. The puzzle system must contain exactly five puzzle parts.
3. Each individual puzzle part must consist of at least four, but no more than six hardwood cubes that are permanently attached to each other.
4. No two puzzle parts can be the same.
5. The five puzzle parts must assemble to form a $2\frac{1}{4}$ " cube.
6. Some puzzle parts should interlock.
7. The puzzle should require high school students an average of _____ minutes/seconds to solve. (Fill in your target solution time.)

Submittal

View the **Portfolio** presentation. Create a project portfolio to include the following:

- Design Process Description. Summarize your work during each step of the design process. Include documentation (written work, sketches, CAD drawings, images, etc.) to support your discussion. Your documentation must include the following information located in the appropriate Design Process step:
 - Title page
 - Brief autobiography and your picture

- Puzzle Design Challenge Brief
- Brainstorming Possible Part Combinations (Activity 4.1a Puzzle Part Combinations)
- Isometric sketches of two possible complete Puzzle Cube designs
- Justification of your chosen Puzzle Cube design solution
- Multi-view sketch, fully dimensioned of each of the five puzzle parts in your chosen design (Activity 4.1b Engineering Graphics)
- CAD drawing(s) displaying a fully dimensioned multi-view of each puzzle part and two different isometric views of the assembled puzzle.
- Drawing review comments from a classmate.
- Image(s) of your building process and puzzle prototype.
- Physical model of your puzzle.
- Statistics related to the solution time of your puzzle as required above.
- A written summary of your puzzle test results and a discussion of the validity of your design. Does your design meet the design criteria? Does your design “provide an appropriate degree of challenge to high school students” (as stated in the design statement)?
- A discussion of possible changes to your puzzle cube that would improve the design.

Conclusion

1. Why is it important to model an idea before making a final prototype?

2. Which assembly constraint(s) did you use to constrain the parts of the puzzle to the assembly such that it did not move? Describe each of the constraint types used and explain the degrees of freedom that are removed when each is applied between two parts. You may wish to create a sketch to help explain your description.



3. Based on your experiences during the completion of the Puzzle Design Challenge, what is meant when someone says, “I used a design process to solve the problem at hand”? Explain your answer using the work that you completed for this project.