

Cardboard Chair Design and Construction



Objectives:

This project provides an opportunity to apply the first key steps in the engineering design process (concept to first prototype) as teams design and build a functional chair....with unique constraints!

The chair design must be:

1. Load bearing per design needs. The chair must support at least 180 pounds.
2. Built of only three materials: Cardboard (any type, corrugated, single sheet, etc.), paper and water-based glue. No added materials can be used that would make the chair non-recyclable.

Additional guidelines include:

- Ergonomically appropriate
- Aesthetically pleasing
- Safe (does not wobble, teeter, or collapse in catastrophic ways)

Motivation:

Architects and engineers have the potential to design wonderful, innovative products that meet all of the needs of the users and do no harm to the larger community of life, both now and in the future. In fact, we are starting to envision ways of providing for the needs of present generations while improving the state of the world. These ideas are reflections of the concept of sustainability, meeting the needs of the present without diminishing the ability of future generations to meet their needs.

Engineering activities can be unsustainable in several ways. They can use up valuable resources that are nonrenewable. They can produce byproducts that are harmful to life. In the course of this project, you'll learn some of the ways that engineers can account for these factors. You should also feel some satisfaction in creating a piece of furniture that is both useful and attractive for someone living in a home such as a Solar Decathlon home. Sustainability is important, but function and beauty are also necessary for a successful design.

This experience should also improve skills associated with working in teams and familiarize you with the engineering product development process and program management tools. You will also have an opportunity to put some of your newly developed CAD skills to use.

Outline:

To accomplish this project tasks will include:

1. Clearly define the problem or need
2. Survey students potential buyers or users (develop the survey, poll students, analyze data) on what type of furniture is needed or could be of interest
3. Do research on product design, ergonomics, aesthetics, and construction
4. Develop several ideas for product design and document with sketches
5. Narrow down design options
6. Develop product selection criteria and analyze survey results
7. Develop a plan of obtaining materials... for free!

8. Do detailed design and weight-bearing analysis
9. Develop detailed drawings
10. Build a prototype
11. Reflect on process

Steps for this project:

Task 1: Gather chair ideas....

Each student asks four people for their chair/seat ideas they would like to have or think would sell; KEEP A LIST! Asking different people for their furniture design ideas is very effective (male, female, different majors, ages, from different hometowns/countries). We will collect all ideas in class.

Task 2: Start making ideas reality....

Look at the on-line resources about cardboard furniture products, designs, examples. Each student can sketch out their ideas.

Task 3: Narrow down your ideas...

- Look at team member's sketches.
- Discuss design ideas, construction techniques that work and don't work.
- Develop **product selection criteria**
- Do additional research on product design and construction, as needed.
- Based on new ideas and chair models, develop more specific ideas for the chair/seat design. Do preliminary development of at least 3 different concepts and document with sketches.

Task 4: Look at strength of materials...

In your teams ask yourselves questions such as "What method of layering or bending corrugated cardboard provides best strength for least amount of material?" Try testing out some ideas.

Task 5: Do some drawings...

Draw out your chair idea so you have a plan on what you will build and can create "templates".

Task 6: Plan out what you need and where you will get the materials.

Teams should prepare estimates of the amount of materials needed. Plan on approaching local stores to gather cardboard. Show them your designs.

Task 7:

Cardboard Chair construction!

Task 8:

Complete a product positioning statement.

Product Positioning Statement: Cardboard Furniture Design Project

Team Name: _____

Product Name: _____

Product Positioning Statement:

Sentence #1: **For** (*target customer*) **who** (*statement of need or opportunity*), **the** (*product name*) **is a** (*product category*) **that** (*statement of benefit*).

Sentence #2: **Unlike** (*primary competitive alternative*), **our product** (*statement of primary differentiation.*)

Key design features: *List the big selling points on your design!*

Goals in the Design: *Low cost? Easy to use? Safety? Greenness? Effectiveness? Durability?*

Estimated selling price for the (Product Name): \$ _____and describe how you came up with this price estimate.

Courtesy of Penn State University