

# Engineering Energy Efficiency

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## Learning Engineering with CAD/CAM: Enhance or Inhibit?

Concord Consortium / Tufts University

This project explores how computer tools can enhance engineering education. Students are challenged with a sequence of engineering tasks to design their own model houses and improve their energy efficiency, in which computer tools can be used to support scientific inquiry and engineering design. A comparison study is being conducted to test the efficacy of the computer-based intervention.

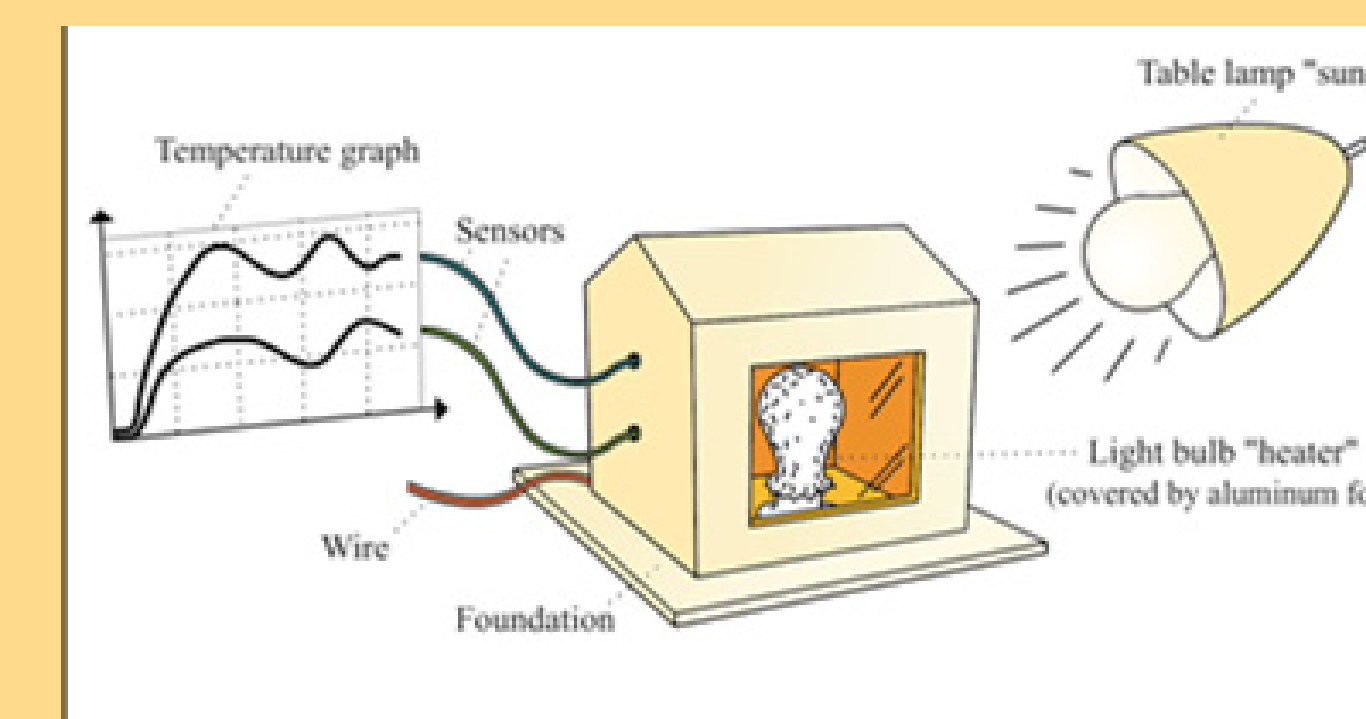


Design

Build

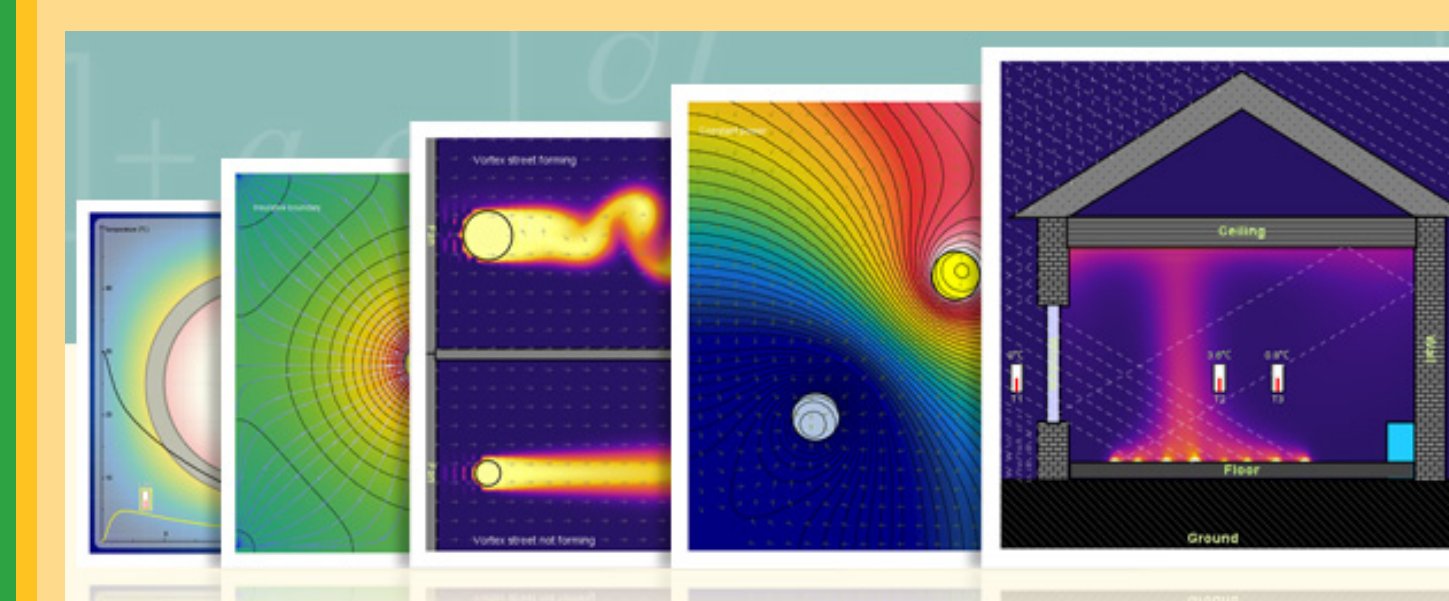


Test



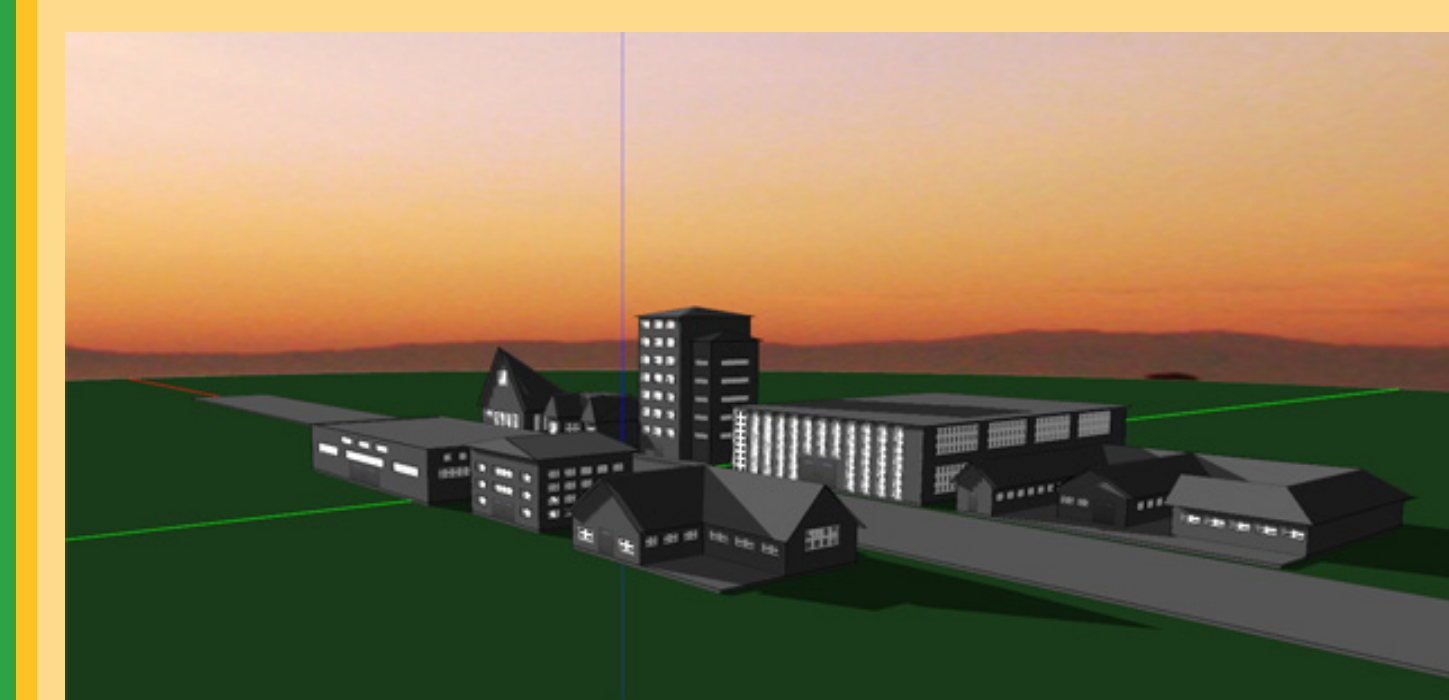
## The Intervention

\* Energy2D



"I liked watching the simulations, you could see what actually happens — you can't see it like that in a book." - Student

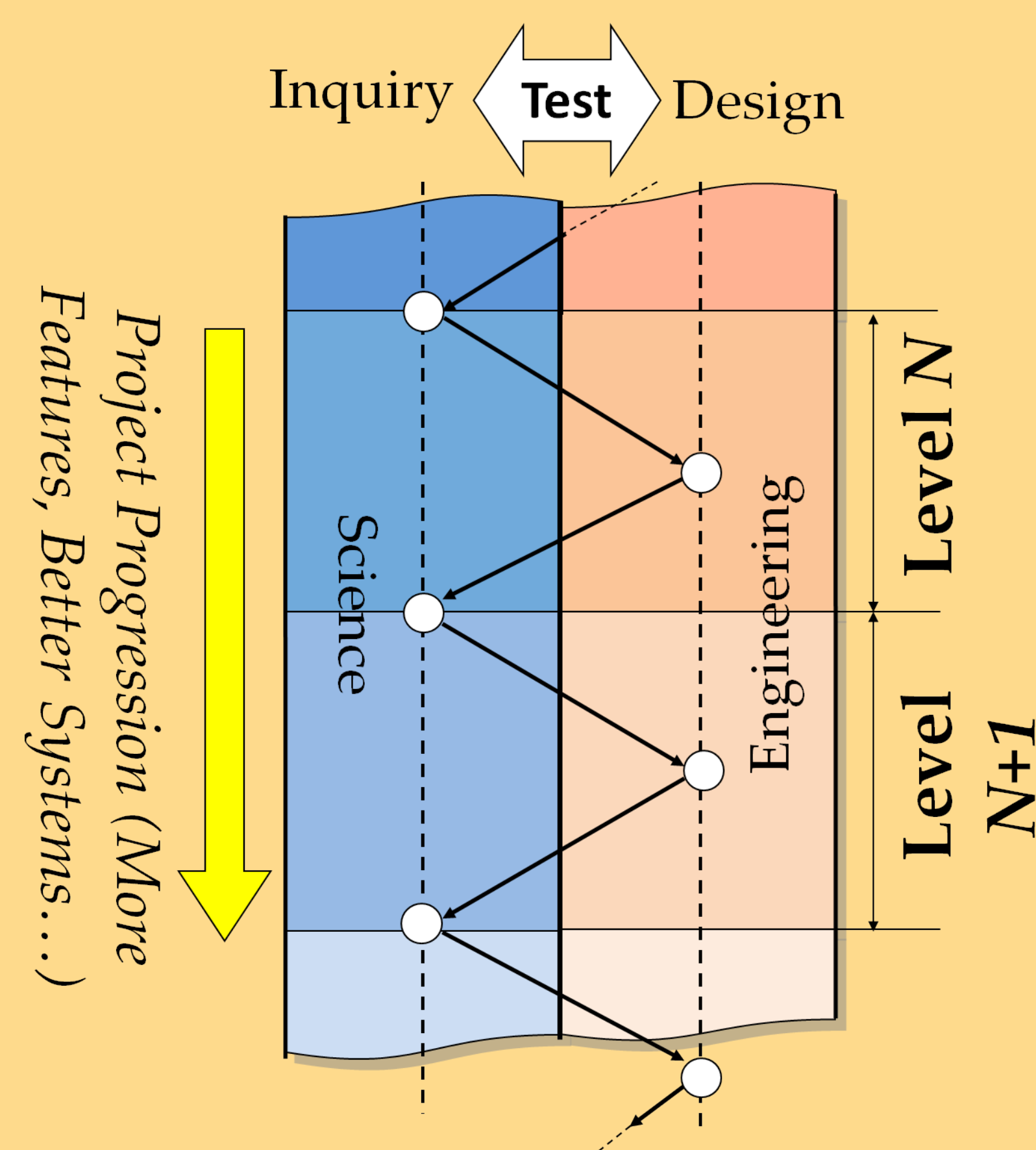
§ Energy3D



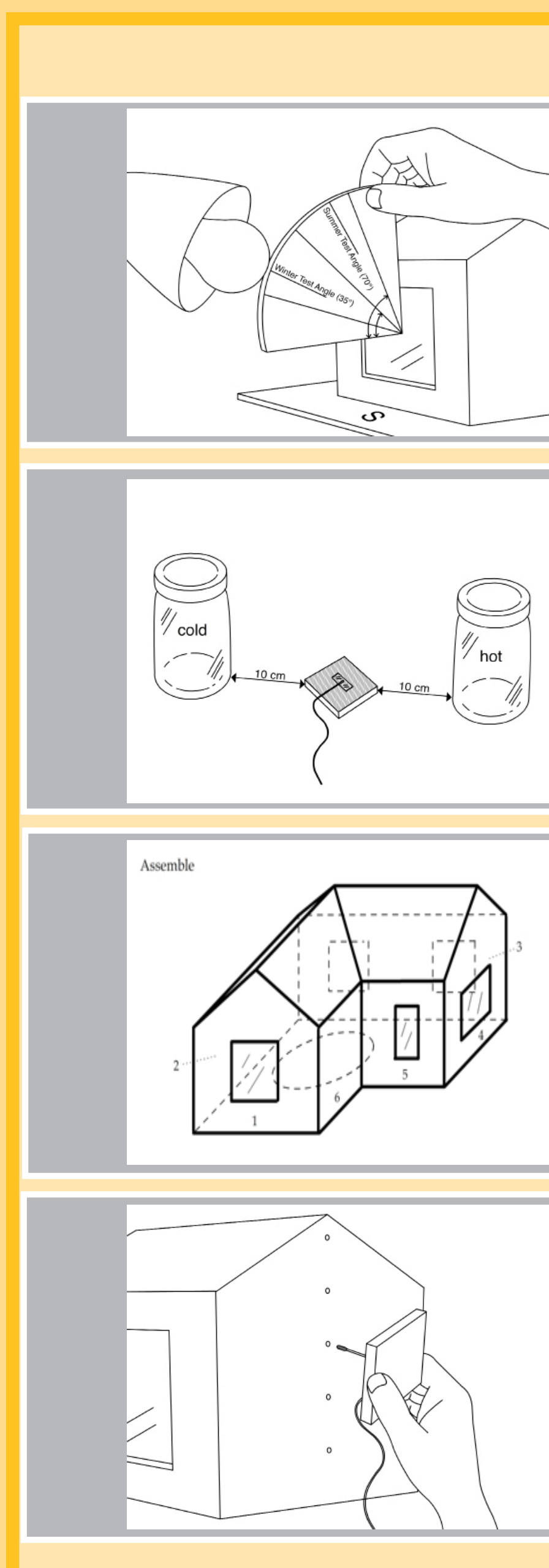
"The 3D designing was very helpful as we could customize the house as we wanted to or as we needed to." - Student

## Research Context: The EEE Curriculum

Design Principle: "Knitting"  
Science & Engineering in  
Project-Based Learning



"I would have to say the part of the Engineering Energy Efficiency Project I enjoyed the most was seeing the drastic change in temperature minor modifications made." - Student



Chapter One: Build and  
Test a Standard House

Chapter Two: Heat  
Transfer Basics \*

Chapter Three: Design  
and Build Your Own  
House §

Chapter Four: Modify  
Your Own House



## CAD/CAM: Pros & Cons

Interactive visualization to help 3D reasoning (seeing before making, etc.)  
Rapid iterative design (easy to undo, virtual testing, etc.)  
Computer-assisted fabrication  
Extra time to learn the tool

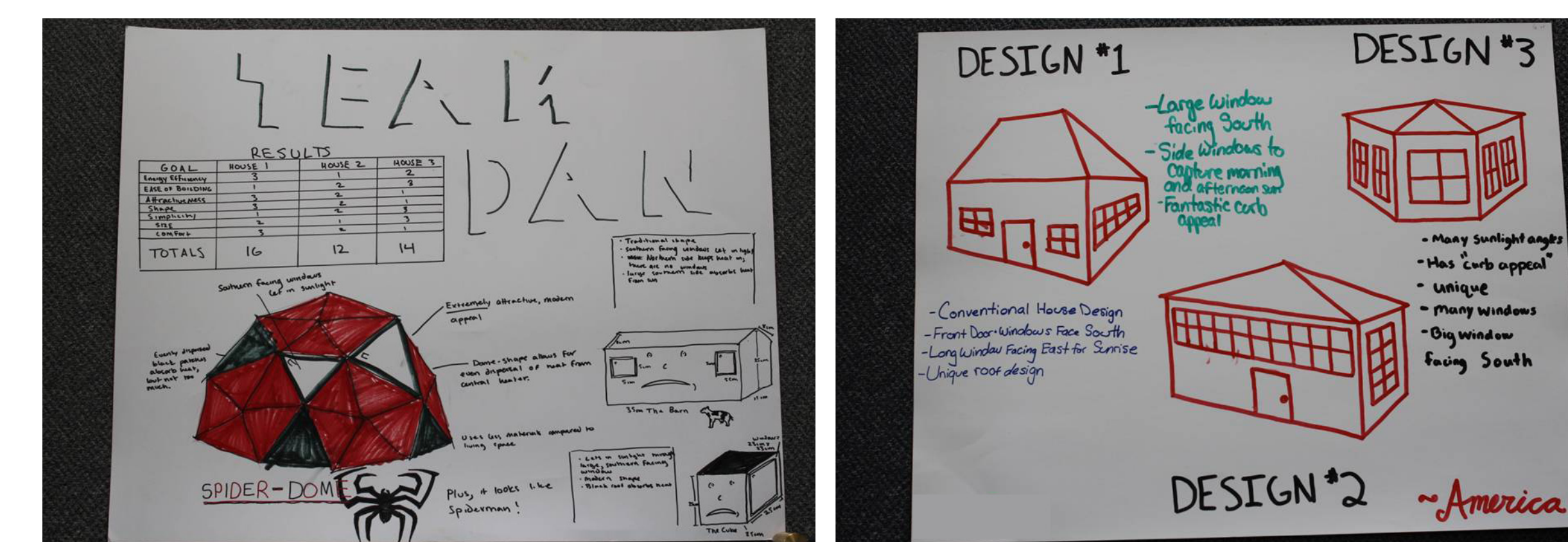
## Student Products (Spring 2012)



176 students  
from 8 classes  
(one school)

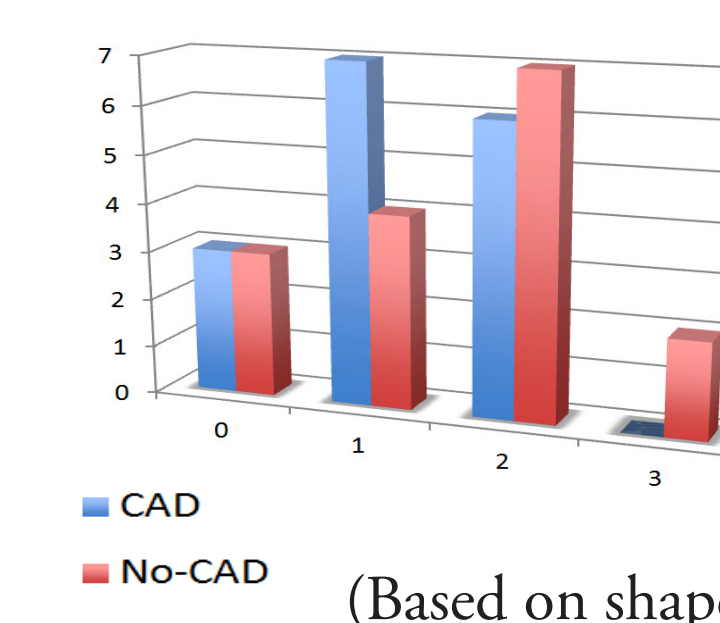


## Design Rationales



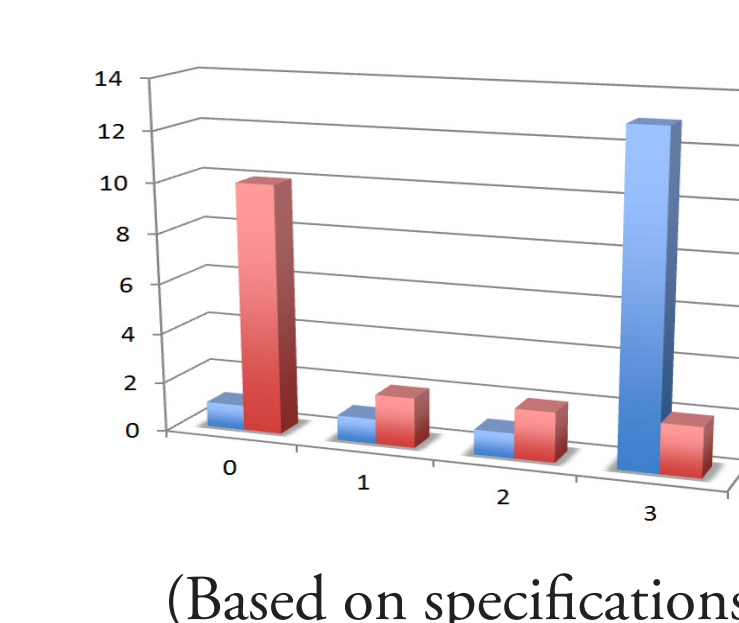
## Preliminary Findings

Design space  
exploration



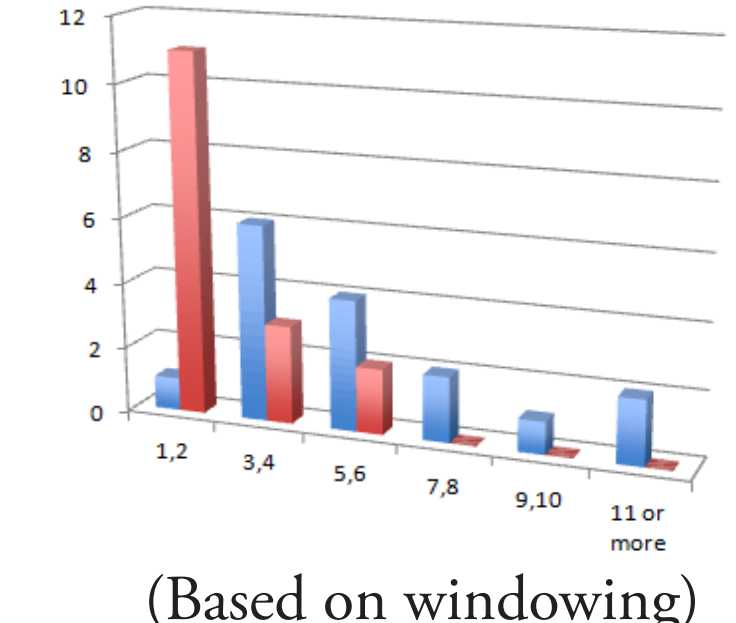
(Based on shapes)

Design step  
scaffolding



(Based on specifications)

Design tool  
stimulation



(Based on windowing)

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