

# Engineering Energy Efficiency

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

Concord Consortium / Tufts University



### 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

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.

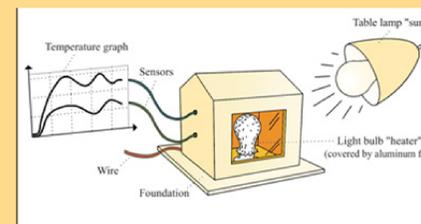


Design



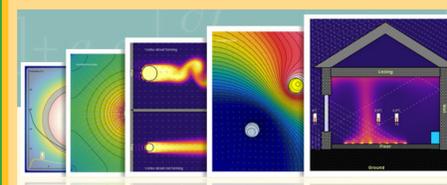
Build

Test



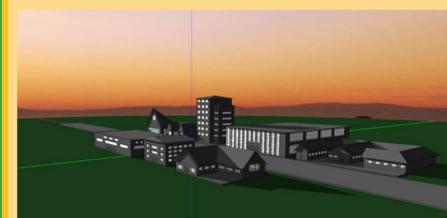
## The Intervention

\* Energy2D



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

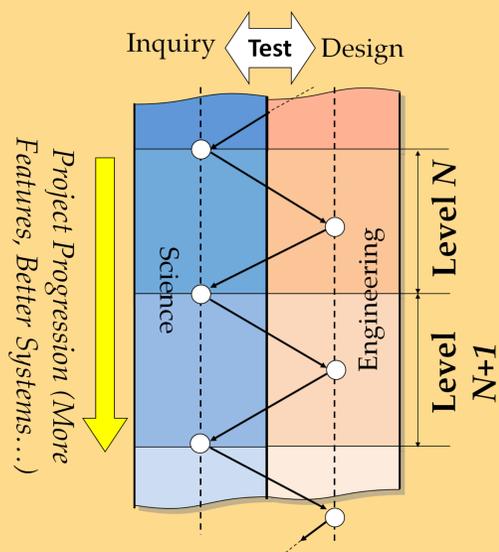
§ Energy3D



"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

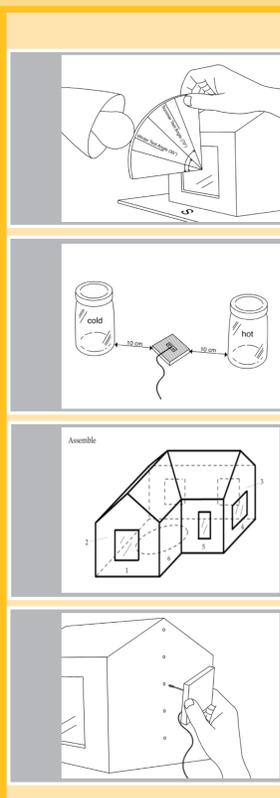


Chapter One: Build and Test a Standard House

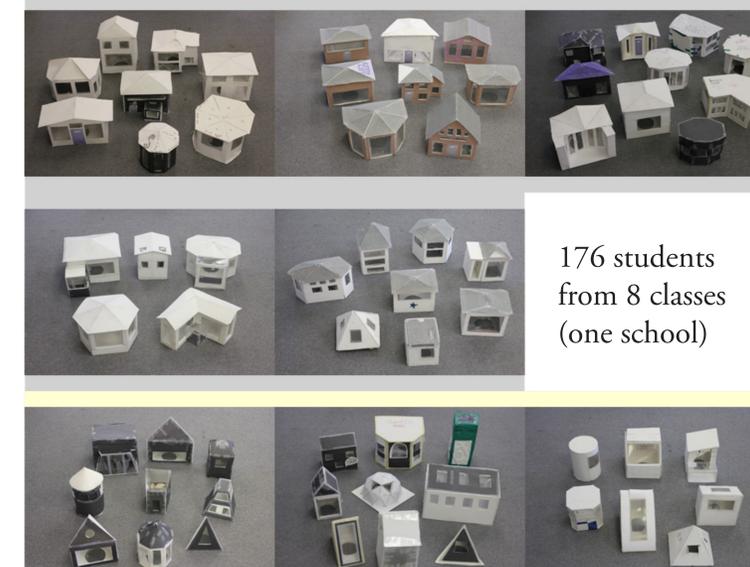
Chapter Two: Heat Transfer Basics \*

Chapter Three: Design and Build Your Own House §

Chapter Four: Modify Your Own House

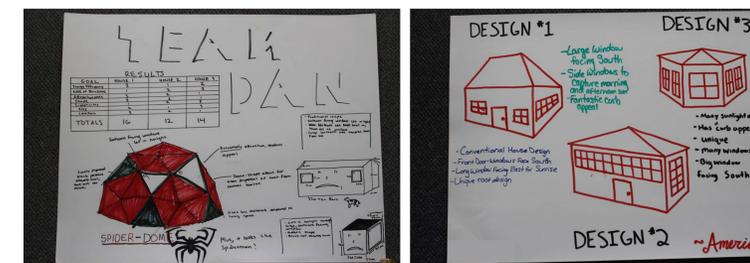


## Student Products (Spring 2012)



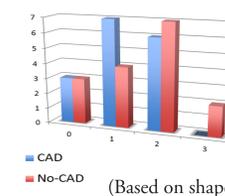
176 students from 8 classes (one school)

## Design Rationales

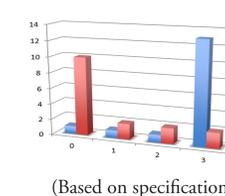


## Preliminary Findings

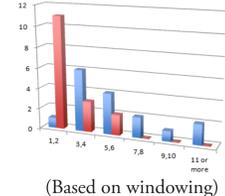
Design space exploration



Design step scaffolding



Design tool stimulation



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The Concord Consortium

"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