Engineering Energy Efficiency

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Learning Engineering with CAD/CAM: Enhance or Inhibit?

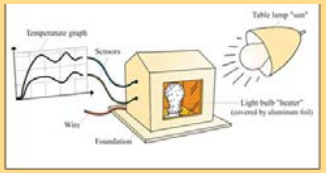
Concord Consortium / Tufts University

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

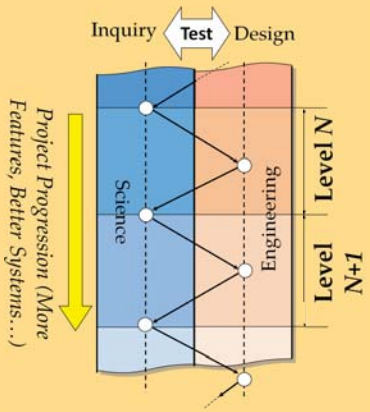
Build

Test

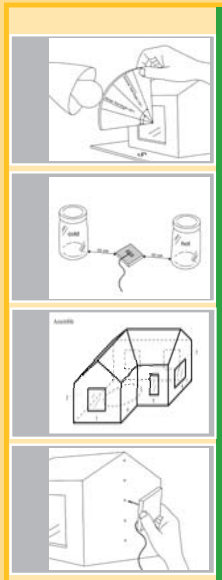


Research Context: The EEE Curriculum

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

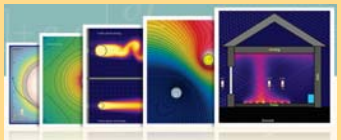
Chapter Two: Heat Transfer Basics *

Chapter Three: Design and Build Your Own House §

Chapter Four: Modify Your Own House

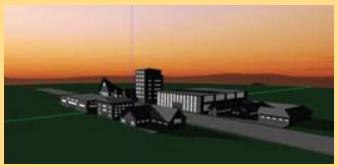
The Intervention

* 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

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

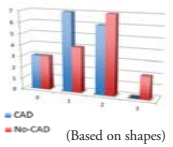
Student Products (Spring 2012)

176 students from 8 classes (one school)

Design Rationales

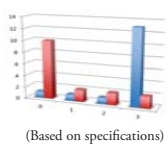
Preliminary Findings

Design space exploration



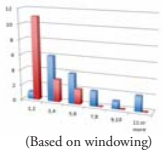
(Based on shapes)

Design step scaffolding



(Based on specifications)

Design tool stimulation



(Based on windowing)

This material is based upon work supported by the National Science Foundation under Grant No. DRL-0918449. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

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