

SmartCAD

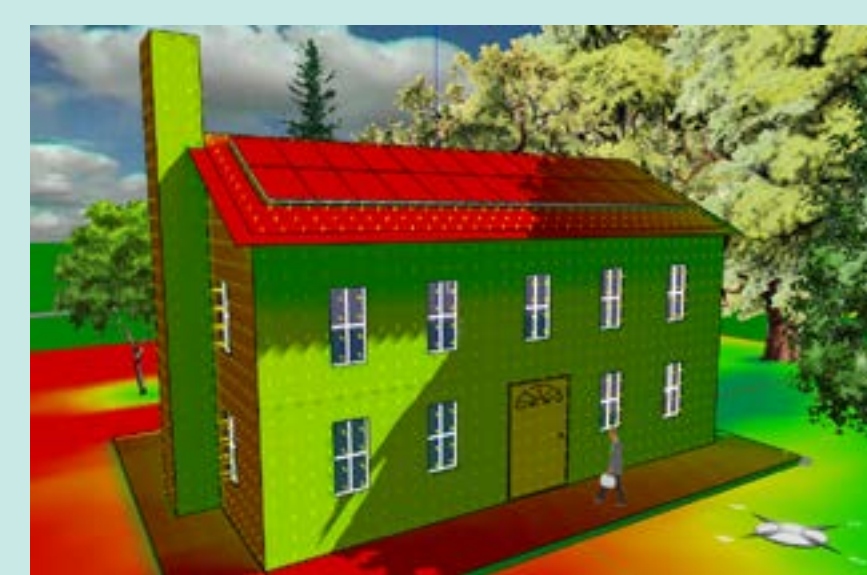
Guiding Engineering Design with Scientific Simulations

This project explores the educational value of science simulations for guiding secondary students through complex, authentic engineering design aided by "smart" CAD tool in classrooms. The research hypothesis is that such an approach can result in three learning outcomes: 1) Science knowledge gains; 2) Design competency gains; and 3) Design performance improvements. The project also investigates two research questions: 1) Feedback types: What types of feedback from simulations to students are effective in helping them attain the outcomes?; 2) Feedback conditions: Under what conditions do these types of feedback help students attain the outcomes?

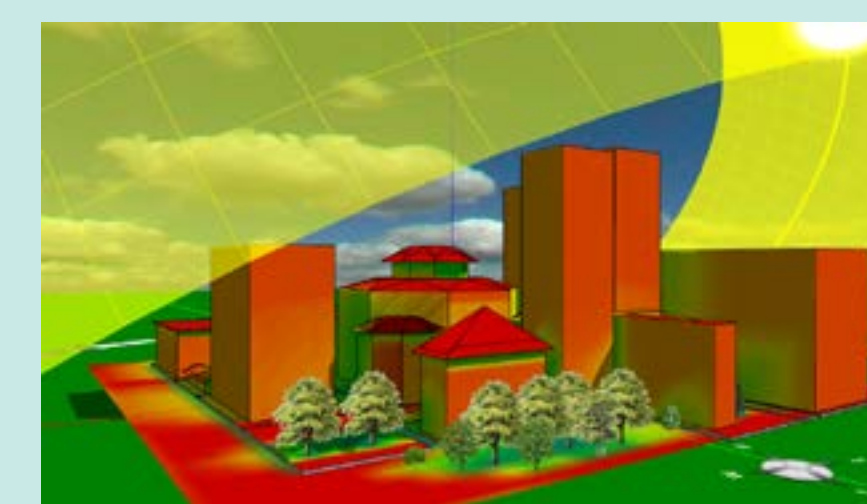
Student design challenges



Solarize your home
Students design solar panel arrays for their own homes for best cost-effectiveness.



Design an energy-plus home
Students design a new home that consumes less energy than it produces over a year.

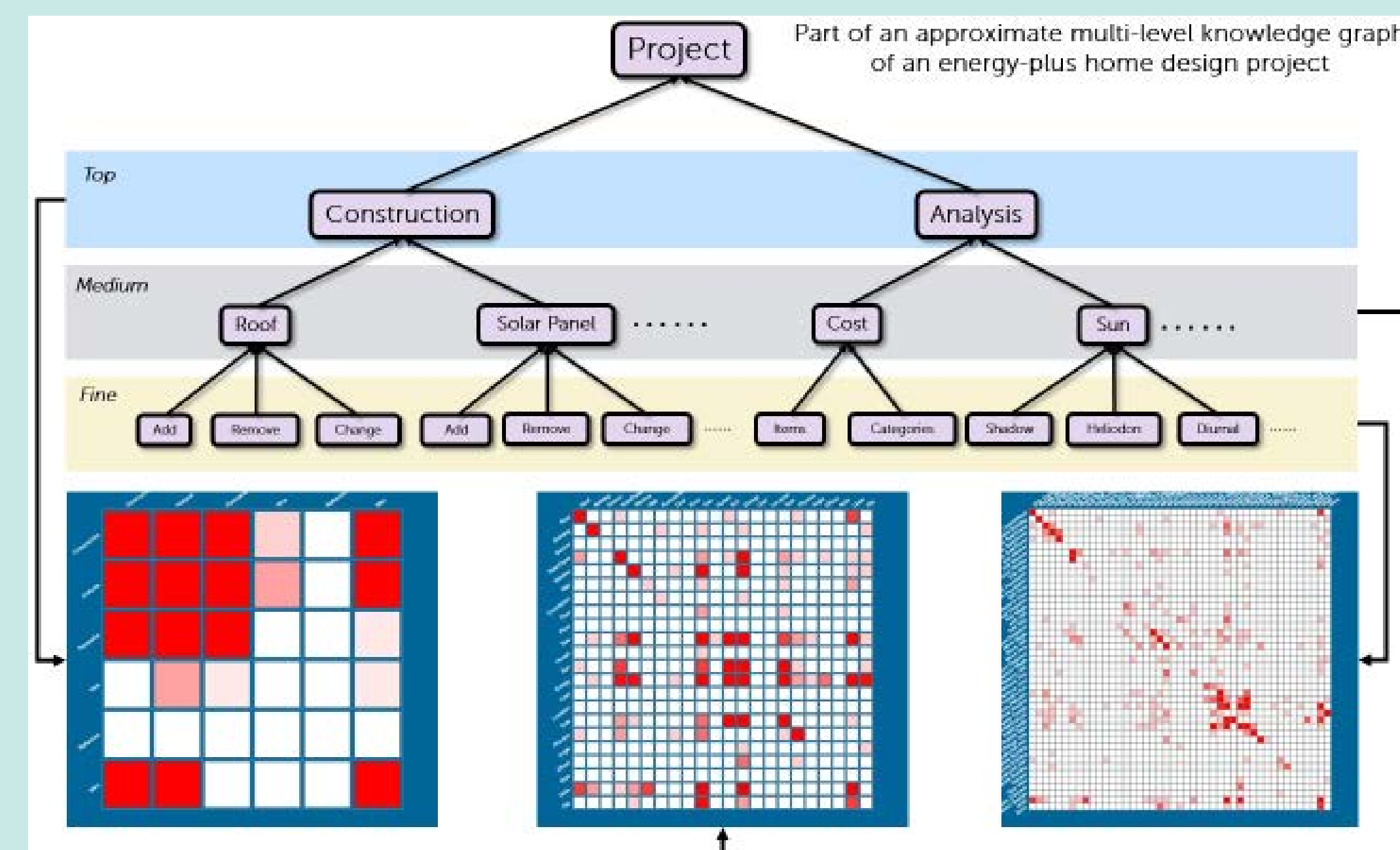


Plan an urban block
Students design a city block that provides fair and optimal solar access for the community.

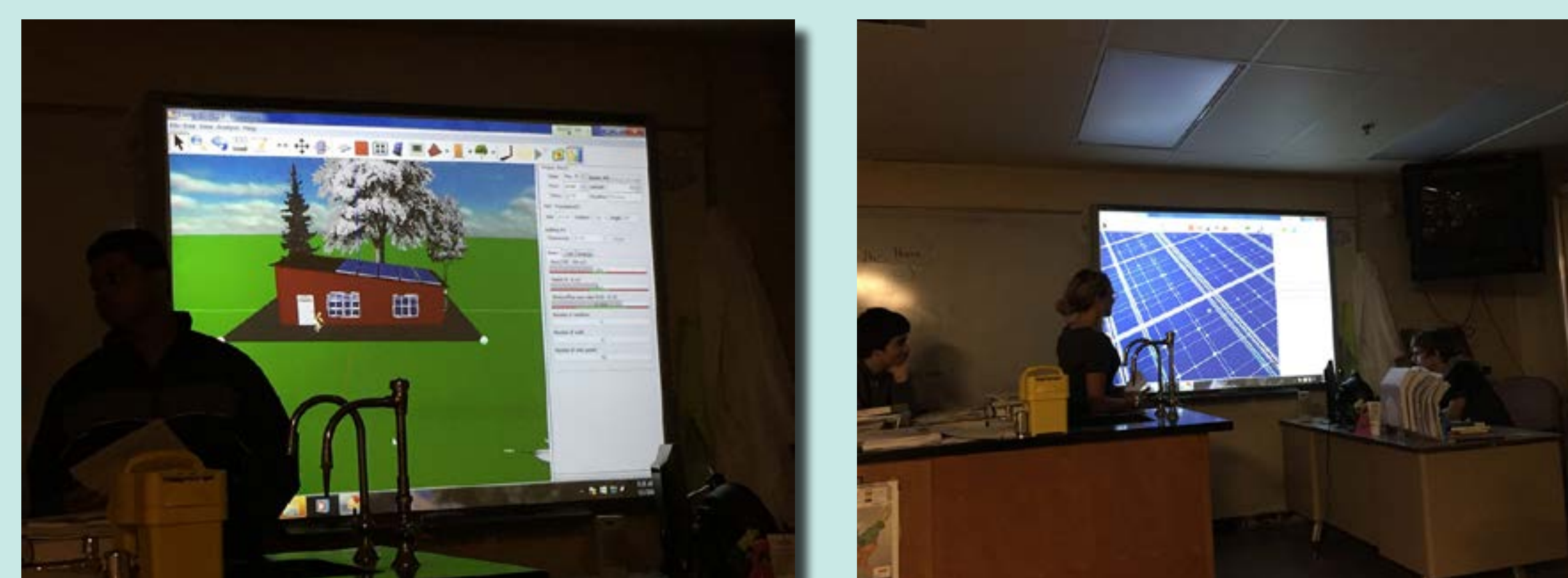
Energy3D designs



Data mining & design modeling



Spring pilot tests in Massachusetts and Indiana



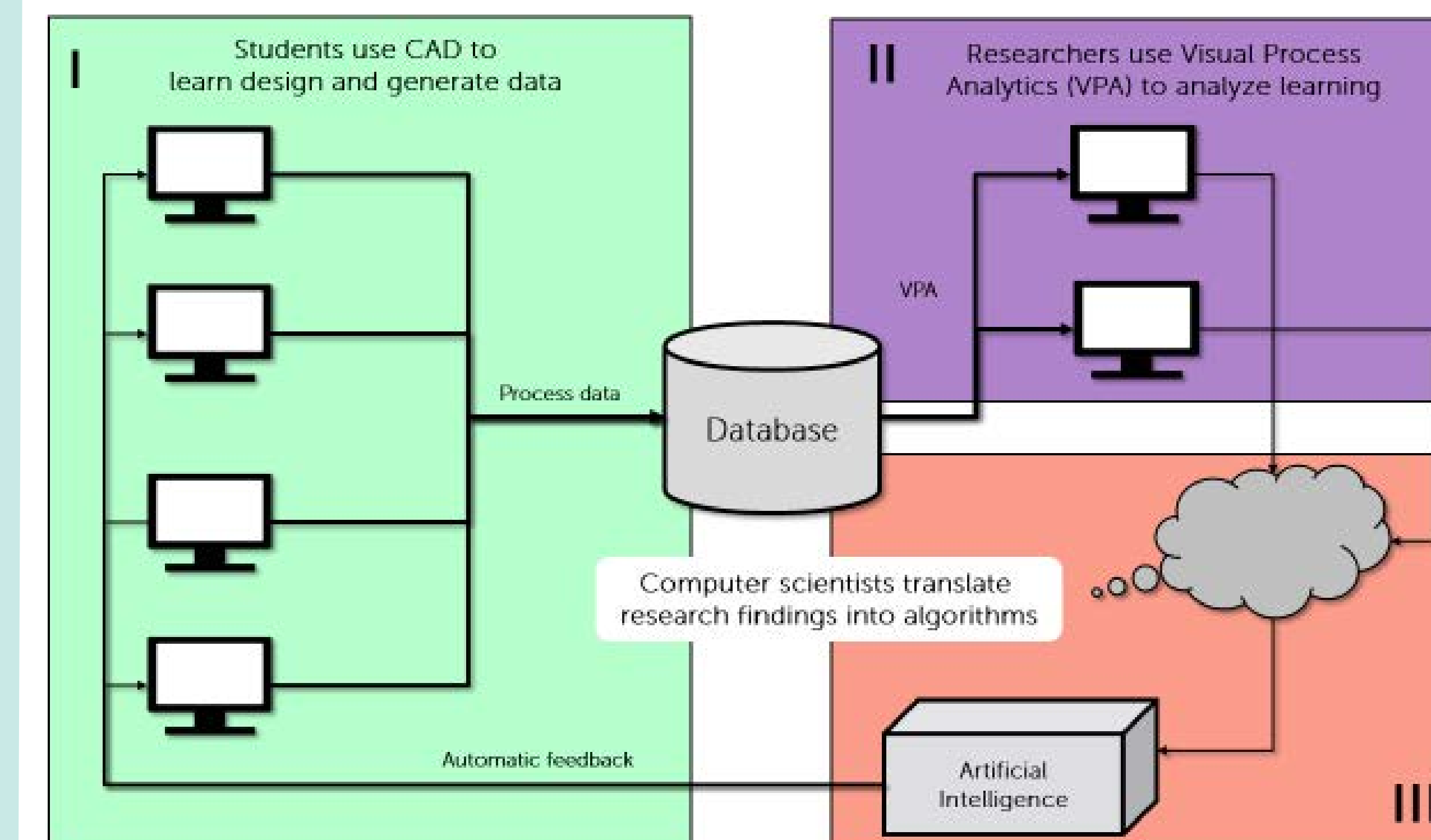
About 120 high school students and 500 middle school students from earth science and physics classes

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Technology roadmap



Rationale

Engineering design is a complex process. Summative assessment based on analyzing final products is too little too late. We must help students while they are on tasks. SmartCAD aims to provide automatic formative feedback on an ongoing basis to guide student design processes based on computationally analyzing student design actions and artifacts.

Engaging students to solve real-world problems



Visit us: energy.concord.org/energy3d



* Created by students