

## **UC Merced**

# **Proceedings of the Annual Meeting of the Cognitive Science Society**

### **Title**

Modeling Across the Curriculum: Scaling up Modeling using Technology

### **Permalink**

<https://escholarship.org/uc/item/5pn0q81f>

### **Journal**

Proceedings of the Annual Meeting of the Cognitive Science Society, 25(25)

### **ISSN**

1069-7977

### **Authors**

Gobert, Janice  
Horwitz, Paul  
Tinker, Bob  
et al.

### **Publication Date**

2003

Peer reviewed

# Modeling Across the Curriculum: Scaling up Modeling using Technology

**Janice Gobert, Paul Horwitz, Bob Tinker & Barbara Buckley**

The Concord Consortium  
10 Concord Crossing Suite 300, Concord MA 01775

**Uri Wilensky & Sharona Levy**

Center for Connected Learning and Computer-Based Modeling  
Annenberg Hall 335, 2120 Campus Drive, Northwestern University, Evanston IL 60208

**Chris Dede**

Graduate School of Education, Harvard University  
Longfellow Hall Room 323, Appian Way, Cambridge MA 01238

Modeling environments, we believe, can make the most significant contribution of information technologies to improved science learning. A partnership of the Concord Consortium, Harvard and Northwestern Universities, with the help of the Josiah Quincy Upper School and the Fitchburg and Lowell Public Schools, is studying the impact of modeling on secondary science learning.

The project uses tools we call CIE models: environments that incorporate core science content that students learn through inquiry and exploration. Increased learning is expected from a curriculum focused on a few core science concepts that students learn primarily through guided exploration of CIE models. The project goal is to test this expectation in real schools as students encounter a representative set of CIE models over three years in sequential physical science, chemistry, and biology courses. The tools that are used in these courses are Dynamica (Horwitz et al, 2001), Connected Chemistry (Stieff, M & Wilensky, in press) and BioLogica™ (Horwitz & Christie, 1999), respectively.

The project uses a powerful tool, Pedagogica, developed at The Concord Consortium that provides online lessons with embedded guidance and assessment. Pedagogica controls all aspects of the learners' interactions with the software tools by changing the available options, the nature of the scaffolding, the instructions, and the assessments. Pedagogica can automatically report student progress through these lessons via the Internet, providing real-time, fine-grained, educationally significant data on student learning.

The project consists of a series of studies using as outcome measures, gains in content knowledge, modeling skills, epistemological understanding, and motivation. The first group of studies focuses on improving the instructional design through individual interviews of students and teachers. The classroom-based studies evaluate the impact of variation in at least two important pedagogical dimensions: degree of constructivism and the type and amount of scaffolding. The design involves randomly assigning the *same* science content, but different

scaffolding, to different students within a class, thereby limiting the problems of bias and self-selection that often confound in-school research. At the same time, Pedagogica will automatically document how students interact with the material and the pedagogy, and track their learning during treatment. We are also conducting a longitudinal study of three-year implementations of project materials in the Partner Schools and, during the latter years, in ten Member Schools. Cumulative gains in the content areas, transfer to other topics, modeling skills, epistemological understanding, and attitudes about science are being measured. All data are collected from Pedagogica, annual administration of a project-generated assessment, extensive interviews, and standardized tests. With this, we are addressing how this can be adapted in order to scale up to serve large numbers of students across the country.

## Acknowledgments

Funded by the National Science Foundation and the U.S. Dept. of Education under a grant awarded to the Concord Consortium (IERI #0115699). Any opinions, findings, and conclusions expressed are those of the presenters and do not necessarily reflect the views of the funding agencies.

## References

- Horwitz, P., Tinker, R., Gobert, J., Dede, C., Wilensky, U. (2001). *Modeling Across The Curriculum*. Proposal #0115699 Funded by the Intra-Agency Education Research Initiative.
- Horwitz, P. and Christie, M. (1999). Hypermodels: Embedding Curriculum and Assessment in Computer-Based Manipulatives, *Journal of Education*, 181(2), pp. 1-23
- Stieff, M & Wilensky, U. (in press). The Connected Chemistry Modeling Environment: Incorporating Interactive Simulations into the Chemistry Classroom. *Journal of Science Education and Technology*.