

2004 Summer Conference

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- [Invited Speakers](#)
- [Schedule of Events](#)

Integrating Science and Mathematics Education Research into Teaching

The University of Maine
Orono, Maine

Investigation of Students' Reasoning in Thermodynamics and the Development of Improved Curricula

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In collaboration with the Iowa State Chemistry Education Research Group, we have carried out a series of investigations into student learning of thermodynamics in both physical and chemical contexts. We analyzed a wide range of data including student answers on free-response exams, students' written explanations of their reasoning, and extended one-on-one interviews with students. We have found significant learning difficulties related to fundamental concepts including the first and second laws of thermodynamics, behavior of systems undergoing cyclic processes, and the origin of heat transfer in chemical reactions. We have begun development and testing of curricular materials based on this research, aimed at helping students resolve some of these learning difficulties. We are also extending both the research and the curriculum development to more advanced topics typically covered in junior- and senior-level courses, such as statistical thermodynamics and analysis of free energies.

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