

# Mini-Symposium: Dual-Process Theory in Physics Education Research

10:45 am – 12:33 pm, Monday March 17 // Session APR-B15 // 📍 Anaheim Marriott, Grand Ballroom Salon C

**Chair:** Michael Loverude, California State University, Fullerton  
**Topics:** [Physics Education Research](#); [Education](#); [Friction](#); [Thermodynamics](#)  
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## Investigation of context dependence of students’ responses to thermodynamics problems and its potential application to dual-process theory research

12:21 pm – 12:33 pm

**Presenter:** David E Meltzer (Arizona State University)  
**Authors:** Mary Jane Brundage (Misericordia University), Chandralekha Singh (University of Pittsburgh)

Dual-process theory investigations in physics education research employ sets of physics problems posed in diverse physical contexts that are all focused on a single specific physics concept. Problems considered easier are used to determine whether students have a basic understanding of the targeted concept (that is, whether they have the requisite “mindware”), while more complex problems—and/or those with salient distracting features—are used to probe students’ ability to apply their basic conceptual understanding in a variety of problem settings. However, there have been few systematic studies of the relative challenges posed to students by diverse types of problems targeted on a single physics concept. Our recent investigation in the framework of introductory thermodynamics has explored students’ responses to a wide variety of problem types, designed such that 2-5 different problems all target the same physics concept; 13 different thermodynamics concepts serve as the targets. The problems differ from each other by using diverse physical settings and scenarios, as well as various types of potentially distracting features. (Examples: gas compressions and expansions; isothermal, adiabatic, and isochoric processes; with and without PV diagrams; diagrams that display or do not display temperatures or process types explicitly.) I will describe how our results may be applied directly in dual-process theory investigations and how they provide a model for further investigations of this type.

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### PRESENTATIONS (7)

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<b>10:45 am – 11:21 am</b> Dual-process theories of reasoning as a framework for investigating and supporting student reasoning in physics MacKenzie R Stetzer (presenter)	▲
<b>11:21 am – 11:33 am</b> Determining if context matters using a Dual Process Theory of Reasoning Framework Tyler Garcia (presenter), Mila Kryjevskaja	
<b>11:33 am – 11:45 am</b> Probing interactions between student knowledge, intuition, and reasoning Mila Kryjevskaja (presenter)	
<b>11:45 am – 11:57 am</b> Understanding the attention of a salient distracting feature in a friction force question Drew J Rosen (presenter), Ashley Brown	
<b>11:57 am – 12:09 pm</b> Insight into student reasoning using Online Reasoning Chain Construction Assessments (ORCCA) Beth A. Lindsey (presenter), Megan L Nagel	
<b>12:09 pm – 12:21 pm</b> Using metacognitive prompts to construct and examine student reasoning trajectories Em Sowles (presenter), Thomas Fittswood, MacKenzie R Stetzer	
<b>12:21 pm – 12:33 pm</b> Investigation of context dependence of students’ responses to thermodynamics problems and its potential application to dual-process theory research David E Meltzer (presenter), Mary Jane Brundage, Chandralekha Singh	▼