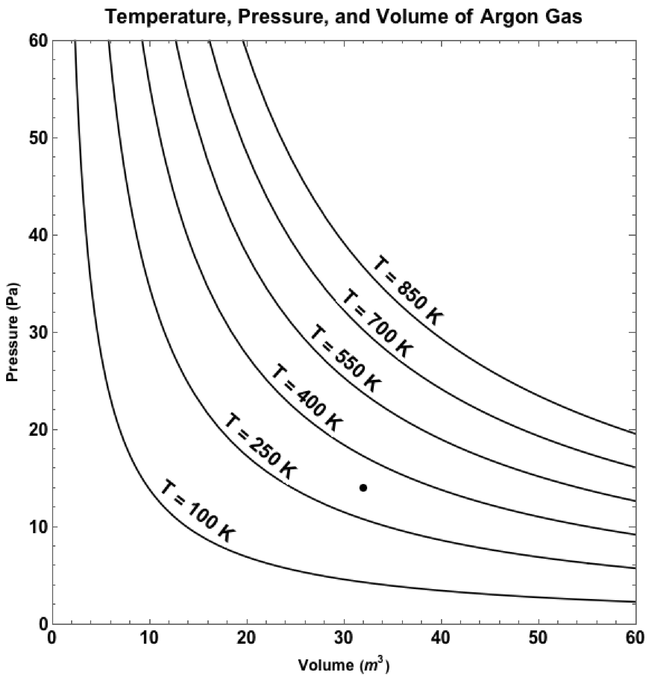
Students **do not** consider all **possible changes** when reasoning about thermodynamic variables.

Student Reasoning about Multivariable Covariation in Thermodynamics

Paul J. Emigh, Reese R. Siegel, Jonathan W. Alfson, & Elizabeth Gire



Pretest Questions

1. At the indicated point, suppose p increases by 15 Pa. What can you say about the change in T? Explain your reasoning.
2. At the same point, as you increase V, how might T change? Explain your reasoning.

Covariational Reasoning

"The cognitive activities involved in coordinating two varying quantities while attending to the ways in which they change in relation to each other." [1]

Multivariable Reasoning

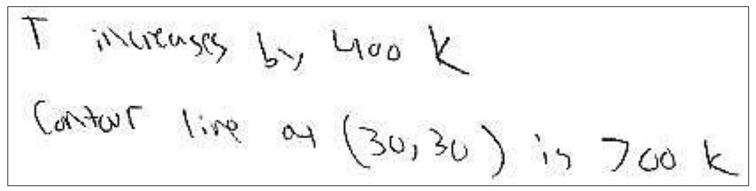
Many students relate 2 variables directly, ignore possible changes in a 3rd variable, or hold variables constant incorrectly [6-7].

Background and Methods

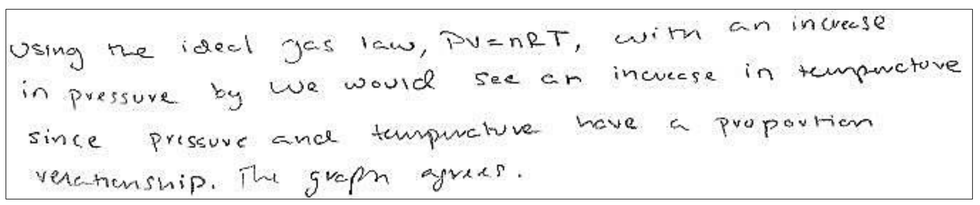
- Junior-level thermo students (N = 45)
- No prior thermo in a physics course
- Iterative Thematic Analysis [12,13] focused on distinct steps in student reasoning

Categories of Student Reasoning

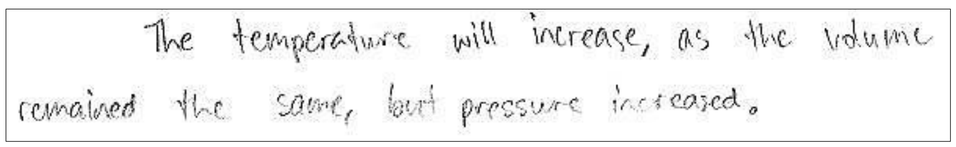
Referencing features of the graph (60%)



Using physical knowledge about the gas (49%)



Specifying a change in the 3rd variable (40%)



Implications for Instruction

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We suggest giving students the opportunity to examine tacit assumptions about what can be held constant.

Find out more

Oregon State University