Student understanding of calorimetry in introductory calculus-based physics

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Abstract

We report on students' thinking regarding calorimetry concepts in an introductory calculus-based physics course. We analyzed student responses to a variety of questions in diverse contexts and found that despite overall good performance (> 60% correct responses), only about half of all students were able to provide correct answers with satisfactory explanations. A number of persistent student difficulties were found to affect up to 40% of the student population even after instruction, including apparent confusion about the meaning of specific heat and misunderstanding of the nature of thermal energy exchange. Student response patterns varied significantly depending on the context of the question and often reasoning did not appear to be consistent among contexts, instead seeming to favor algorithmic or "rule-based" reasoning. Interviews with students suggested that difficulty with algebraic manipulations was a significant contributor to incorrect responses on calorimetry questions.

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