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Introductory student understanding of signed quantities: an example of Physics Quantitative Literacy

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An objective of introductory physics courses is for students to develop quantitative reasoning skills in the context of physics, which includes the ability to quantify physical phenomena. *Quantification* is characterized by the use of established mathematics to invent and apply novel quantities to describe natural phenomena. An important aspect of quantification in physics is making sense of the sign of a quantity. Mathematics education research suggests that students have difficulty developing the flexibility necessary to make sense of the ways negative numbers are used in algebra courses. We extend that work to physics, where the negative sign takes on different meanings depending on the context. I will describe some preliminary results from studies conducted at Rutgers University, the University of Washington, and Western Washington University that suggest that physics students also have difficulty making sense of the negative sign in a variety of physical contexts. I will suggest changes to the way we talk about signed quantities that can provide more clarity for students as they learn to reason.