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Areas, anti-derivatives, and adding up pieces: definite integrals in pure mathematics and applied science contexts.

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Summary: Research in mathematics and science education reveals a disconnect for students as they attempt to apply their mathematical knowledge to science and engineering. With this conclusion in mind, this paper investigates a particular calculus topic that is used frequently in science and engineering: the definite integral. The results of this study demonstrate that certain conceptualizations of the definite integral, including the area under a curve and the values of an anti-derivative, are limited in their ability to help students make sense of contextualized integrals. In contrast, the Riemann sum-based “adding up pieces” conception of the definite integral (renamed in this paper as the “multiplicatively-based summation” conception) is helpful and useful in making sense of a variety of applied integral expressions and equations. Implications for curriculum and instruction are discussed.

Classification: I55 M55

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