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The prevalence of area-under-a-curve and anti-derivative conceptions over Riemann sum-based conceptions in students' explanations of definite integrals.

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Summary: This study aims to broadly examine how commonly various conceptualizations of the definite integral are drawn on by students as they attempt to explain the meaning of integral expressions. Previous studies have shown that certain conceptualizations, such as the area under a curve or the values of an anti-derivative, may be less productive in making sense of contextualized integrals. On the other hand, interpreting the integral using Riemann sum-based conceptions proves much more productive for understanding contextualized integrals. This study investigates how frequently students from a US calculus population drew on these three conceptualizations (as well as others) to interpret the meaning of definite integrals. The results were achieved by asking a large sample of students from two US colleges ($n = 150$) four open-ended questions regarding the underlying meaning of definite integrals. Data from the student responses show a high prevalence of area and anti-derivative ideas and a relatively low occurrence of multiplicatively based summation ideas for interpreting these integrals. Possible reasons for and implications of the results are discussed.

Classification: I55

Keywords: calculus; definite integral; Riemann sum; area; anti-derivative

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