

ZMATH 2012e.00693

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Reasoning about variation in the intensity of change in covarying quantities involved in rate of change.

J. Math. Behav. 31, No. 3, 313-330 (2012).

Summary: This paper extends work in the area of quantitative reasoning related to rate of change by investigating numerical and nonnumerical reasoning about covarying quantities involved in rate of change via tasks involving multiple representations of covarying quantities. The findings suggest that by systematically varying one quantity, an individual could simultaneously attend to variation in the intensity of change in a quantity indicating a relationship between covarying quantities. The results document how a secondary student, prior to formal instruction in calculus, reasoned numerically and nonnumerically about covarying quantities involved in rate of change in a way that was mathematically powerful and yet not ratio-based. I discuss how coordinating covariational and transformational reasoning supports attending to variation in the intensity of change in quantities involved in rate of change.

Classification: I44 C34 E44

Keywords: calculus; quantitative reasoning; rate of change; covariational reasoning; transformational reasoning; secondary school mathematics; secondary school students; cognitive processes; mathematical concepts; interviews; educational research
doi:10.1016/j.jmathb.2012.01.001