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Minneapolis, Minnesota (Apr 15-18)
Virtual (Apr 24-26); Time Zone: Central Time

Session H17: Research on Mathematical Reasoning in Physics

1:30 PM–3:18 PM, Sunday, April 16, 2023
Room: Marquette VIII - 2nd Floor

Sponsoring Unit: GPER
Chair: Eric Kuo, University of Illinois Urbana-Champaign

Abstract: H17.00002 : Investigation into the mathematical preparation of introductory physics students*

1:42 PM–1:54 PM

← Abstract →

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We summarize key findings of our six-year investigation into the mathematical preparation of students in introductory physics courses. After administering written and online diagnostic tests to over 7000 students at five campuses of four universities, and carrying out about 90 individual interviews, we find several consistent themes: (1) difficulties with basic pre-college operations involving trigonometry, algebra, and graphing are widespread; (2) replacing numbers with algebraic symbols significantly decreases students' problem-solving success rate; (3) most students lack familiarity with physical units or appreciation for their essential role in physics problems; (4) most students attempt to "arithmetize" algebraic operations by premature substitution of numerical values, decreasing their ability to check physical units or individual steps; (5) difficulties with different types of operations are highly correlated, in that difficulties with trigonometry imply difficulties with algebra, etc.; (6) evidence suggests that students' success on the mathematics diagnostic is closely linked to overall course success.

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