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Pre-instruction diagnostic tests can predict grade probabilities in introductory physics

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We have investigated the probabilities of earning high (top-quartile) and low (bottom-quartile) course grades in introductory university physics courses for students in two different groups: one, those who scored in the top quartile of their class on one of three diagnostic pretests, and the other composed of those who scored in the bottom quartile on the same test. The tests employed were the Force Concept Inventory (a physics concept test), the Lawson Test of Scientific Reasoning, and a newly developed mathematics test that includes only pre-college mathematics questions; all pretests were administered before or near the beginning of the course. Our investigation includes over 2000 students enrolled in 31 introductory physics classes taught by eight instructors at four universities. We found with 97% consistency that top-quartile scorers on any of the pretests were more likely to get high (top-quartile) grades and less likely to get low (bottom-quartile) grades than were bottom-quartile scorers on the same pretest. Top-quartile scorers on the pretests were, on average, four to six times as likely to receive high grades, and one-third to one-fifth as likely to receive low grades, compared to bottom-quartile scorers on the same pretests. These results are consistent with mathematical models of empirical data published by Salehi *et al.* [Phys. Rev. Phys. Educ. Res. **15**(2), 020114 (2019)] and with their cautions regarding the potentially serious implications of these findings for the careers of poorly prepared college physics students.

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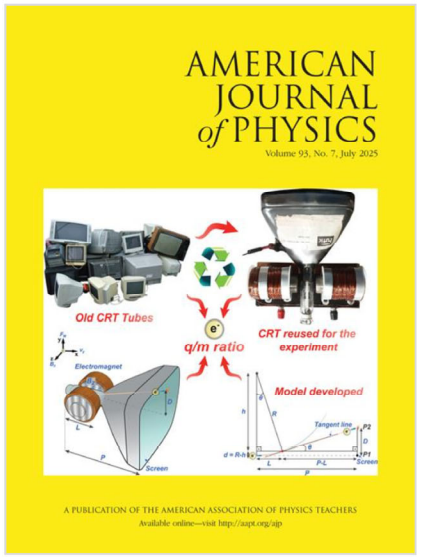

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