

CC12 10:45 a.m. Are There “Hidden Variables” in Students’ Initial Knowledge State Which Correlate with Learning Gains?

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The most common measure of student learning gain currently used for conceptual diagnostic exams in PER is Hake’s normalized “ g ,” where $g = [\text{posttest score} - \text{pretest score}] / [\text{maximum possible score} - \text{pretest score}]$. Hake¹ has shown that class-averaged g values are uncorrelated with average pretest score and are apparently instructor independent for traditionally taught courses, but are significantly higher for courses taught with interactive-engagement instructional methods. However, even in the same course with the same instructor, students with nearly identical pretest scores manifest a broad range of overall learning gains as measured by widely varied individual g ’s. This suggests that students’ initial knowledge state may be only incompletely specified by their pretest score, and that “hidden variables” such as mathematics knowledge² or specific patterns of incorrect responses³ may be statistically linked to individual learning gains. I will present preliminary data which, though inconclusive, serve to illustrate the issues involved.

1. Hake, Richard R. “Interactive engagement versus traditional methods: A 6,000-student survey of mechanics test data for introductory physics courses.” *Am. J. Phys.* **66**, 64 (1998).
2. Halloun, I. and D. Hestenes. “The initial knowledge state of college physics students.” *Am. J. Phys.* **53**, 1043 (1985).
3. Thornton, Ronald K. *Conceptual Dynamics: Following changing student views of force and motion*, in : *Proceedings of the International Conference on Undergraduate Physics Education*, E.F. Redish and J.S. Rigden, eds., American Institute of Physics, Woodbury, N.Y., Part One: pp. 241-266.