American Journal of Physics -- June 2003 -- Volume 71, Issue 6, pp. 630-638

Initial understanding of vector concepts among students in introductory physics courses

Ngoc-Loan Nguyen and David E. Meltzer
Department of Physics and Astronomy, Iowa State University, Ames, Iowa 50011

(Received 8 February 2002; accepted 12 March 2003)

We report the results of an investigation into physics students' understanding of vector addition, magnitude, and direction for problems presented in graphical form. A seven-item quiz, including free-response problems, was administered in all introductory general physics courses during the 2000/2001 academic year at Iowa State. Responses were obtained from 2031 students during the first week of class. We found that more than one quarter of students beginning their second semester of study in the calculus-based physics course, and more than half of those beginning the second semester of the algebra-based sequence, were unable to carry out two-dimensional vector addition. Although the total scores on the seven-item quiz were somewhat better for students in their second semester of physics in comparison to students in their first semester, many students retained significant conceptual difficulties regarding vector methods that are heavily employed throughout the physics curriculum.