Relation between students' problem-solving performance and representational format

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An analysis is presented of data on students' problem-solving performance on similar problems posed in diverse representations. Five years of classroom data on 400 students collected in a second-semester algebra-based general physics course are presented. Two very similar Newton's third-law questions, one posed in a verbal representation and one in a diagrammatic representation using vector diagrams, were given to students at the beginning of the course. The proportion of correct responses on the verbal question was consistently higher than on the diagrammatic question, and the pattern of incorrect responses on the two questions also differed consistently. Two additional four-question quizzes were given to students during the semester; each quiz had four very similar questions posed in the four representations: verbal, diagrammatic, mathematical/symbolic, and graphical. In general, the error rates for the four representations were very similar, but there was substantial evidence that females had a slightly higher error rate on the graphical questions relative to the other representations, whereas the evidence for male students was more ambiguous. There also was evidence that females had higher error rates on circuit-diagram problems in comparison with males, although both males and females had received identical instruction.

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