

Principled Improvement in Science: Forces and proportional relations in early secondary-school teaching

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Abstract

In response to continuing concerns about student attainment and participation in science and mathematics, the epiSTEMe project took a novel approach to pedagogy in these two disciplines. Using principles identified as effective in the research literature (and combining these in a fashion not previously attempted), the project developed topic modules for early secondary-school teaching in the UK, arranged for their implementation in classrooms, and evaluated the results. This paper reports the development, implementation, and evaluation of one of the epiSTEMe science modules. Entitled Forces and Proportional Relations, the module covers standard curricular material in the domain of forces, while paying particular attention to the proportional nature of many key constructs. It was developed in collaboration with a small group of teachers; implemented subsequently in 16 classrooms, in all cases involving students from the first year of secondary school; and evaluated through comparison with first-year students in 13 control classrooms who were studying the topic using established methods. Evaluation addressed topic mastery and opinions about the topic and the manner in which it was taught. While further research is required before definite conclusions are warranted, results relating to topic mastery provide grounds for optimism about the epiSTEMe approach. Furthermore, student opinions about the module were positive..

Keywords

Science education, Early secondary-school, Dialogic teaching, Forces, Proportional reasoning.