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The impact of instructor pedagogy on college calculus students' attitude toward mathematics.

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Summary: College calculus teaches students important mathematical concepts and skills. The course also has a substantial impact on students' attitude toward mathematics, affecting their career aspirations and desires to take more mathematics. This national US study of 3103 students at 123 colleges and universities tracks changes in students' attitudes toward mathematics during a 'mainstream' calculus course while controlling for student backgrounds. The attitude measure combines students' self-ratings of their mathematics confidence, interest in, and enjoyment of mathematics. Three major kinds of instructor pedagogy, identified through the factor analysis of 61 student-reported variables, are investigated for impact on student attitude as follows: (1) instructors who employ generally accepted 'good teaching' practices (e.g. clarity in presentation and answering questions, useful homework, fair exams, help outside of class) are found to have the most positive impact, particularly with students who began with a weaker initial attitude. (2) Use of educational 'technology' (e.g. graphing calculators, for demonstrations, in homework), on average, is found to have no impact on attitudes, except when used by graduate student instructors, which negatively affects students' attitudes towards mathematics. (3) 'Ambitious teaching' (e.g. group work, word problems, 'flipped' reading, student explanations of thinking) has a small negative impact on student attitudes, while being a relatively more constructive influence only on students who already enjoyed a positive attitude toward mathematics and in classrooms with a large number of students. This study provides support for efforts to improve calculus teaching through the training of faculty and graduate students to use traditional 'good teaching' practices through professional development workshops and courses. As currently implemented, technology and ambitious pedagogical practices, while no doubt effective in certain classrooms, do not appear to have a reliable, positive impact on student attitudes toward mathematics.

Classification: C25 D45 C75 U75 I15

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