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Student performance and attitudes in a collaborative and flipped linear algebra course.

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Summary: Flipped learning is gaining traction in K–12 for enhancing students' problem-solving skills at an early age; however, there is relatively little large-scale research showing its effectiveness in promoting better learning outcomes in higher education, especially in mathematics classes. In this study, we examined the data compiled from both quantitative and qualitative measures such as item scores on a common final and attitude survey results between a flipped and a traditional Introductory Linear Algebra class taught by two individual instructors at a state university in California in Fall 2013. Students in the flipped class were asked to watch short video lectures made by the instructor and complete a short online quiz prior to each class attendance. The class time was completely devoted to problem solving in group settings where students were prompted to communicate their reasoning with proper mathematical terms and structured sentences verbally and in writing. Examination of the quality and depth of student responses from the common final exam showed that students in the flipped class produced more comprehensive and well-explained responses to the questions that required reasoning, creating examples, and more complex use of mathematical objects. Furthermore, students in the flipped class performed superiorly in the overall comprehension of the content with a 21% increase in the median final exam score. Overall, students felt more confident about their ability to learn mathematics independently, showed better retention of materials over time, and enjoyed the flipped experience.

Classification: D40 C20 H60
Keywords: flipped learning; linear algebra; student attitudes towards mathematics; inverted learning; collaborative learning; higher education
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