

Assessment Design Promotes Peer Learning in a Calculus Course for Engineering Students

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This study reports on how students experience peer learning in a first-year engineering mathematics course with portfolio assessment. The course has recently changed the assessment form from a high stake, closed book exam at the end of the semester, to a portfolio exam. An analysis of the traditional approach to teaching mathematics, with large lectures, problem solving sessions, and a high stake, closed book exam at the end of the semester, shows that students participate passively in their own learning (Zakariya et al., 2022). Students reports that they receive little feedback, and the course suffers a high failure rate (up to 40%). Several studies, such as Freeman et al. (2014) claims that students in STEM subjects perform better in classes with active learning methods compared to traditional lectures. Biggs et al. (2007) argue that all types of students will benefit from active learning methods. It is what activities the students do that is important for their learning. The term “active learning” can describe many learning activities. Here we will define peer learning as active learning. Peer learning is when students form study groups and work together with mutual engagement and shared responsibility for learning. We describe these groups using Community of Practice (CoP) framework from Wenger (1998).

This study analyzes data collected from the course's midterm evaluation, a standardized survey administered and anonymized by the university. The survey comprises 17 Likert-scale questions (5-point scale) and 4 open-ended questions. Of the 447 students enrolled in the course, 194 (43.4%) completed the survey. The analysis incorporates mixed approaches.

The course assessment consists of 4 digital tests and a written assignment. The digital tests were closed-book exams, utilized the STACK assessment tool (STACK, 2024) to generate randomized questions. Students could attempt each test up to four times, with their highest score contributing to their final grade. During these tests, students solved problems manually on paper and submitted answers digitally, receiving immediate feedback on correctness.

After the test we observe that students gathered in groups to discuss their solutions, suggesting that peer learning played a significant role in their preparation for subsequent attempts. On the 5-point Likert question “Academic collaboration among students (in groups or study circles) contributes to a good learning environment” 117 (60%) of the students answered, “Strongly agree” (5) and 59 (30%) students answered “agree” (4). While the course retains traditional instructional components, such as large lectures and problem-solving sessions, we suggest that the new assessment format foster peer learning. Students report frequently using the university’s mathematics support center, further indicating a strong reliance on peer and institutional support networks. Peer learning is particularly valued for its contributions to understanding complex concepts, maintaining motivation, and building a collaborative learning culture. Observations suggest that students naturally form Communities of Practice because of the digital tests, using these interactions to enhance their learning outcomes.

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