

Rethinking the role of challenge through problem-based learning

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A problem-based learning approach was adopted in two classes to address issues with knowledge retention from introductory courses. To this end, course content was revised for a graduate course (Multibody Dynamics) and an elective undergraduate course (Dynamics of Mechanisms). Both courses are in the field of dynamics and rely on introductory courses such as undergraduate Dynamics, Kinematics, Numerical Analysis, and Programming, with which the students typically struggle. Prior to redesign, the courses followed a traditional model of instructor-provided theory, problems, and solutions with assignments providing minor variations on the problems discussed in lecture. Handing algorithms and theories to students without giving them any chance to develop their own interpretation of topics adversely influenced learning outcomes. In this model, the students were unintentionally trained to pattern match; as a result, they “memorized” the lessons rather than “internalized” them. The problem-based approach instead presented students with challenges intended to achieve sustained learning. The new course content relied heavily on assignments and projects: each course involved approximately five homework and peer-assessments, four comprehensive programming (MATLAB) assignments that were designed to apply the course concepts to a broader range of problems, three software assignments (ADAMS), two pre-defined mid-semester projects, a final project whose topic would be defined individually by each student, and traditional midterm and final examinations. The programming and software assignments and projects were interdependent and were designed, in most cases, to build upon each other toward a practical application. Overall, the new teaching model incurred a challenge and significant amount of coursework to students. Contrary to this model, many instructors take into account students off-campus responsibilities and take a different approach by reducing students’ coursework outside the class time. This poster is intended to provide supporting evidence, through a set of surveys on course outcomes, to support the effectiveness of problem-based learning and demonstrate that students do indeed like challenges given that those challenges are purposeful and support learning outcomes.