

## **Assessment Activities in Teaching First-year Engineering Mechanics**

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Shelley Lorimer is a Professor in Engineering (BSEN) Transfer Program at Grant MacEwan University. She is an instructor in the introductory engineering courses as well. The BSEN program at MacEwan has grown from forty students since it started more than twenty years ago, to the current 216 students. The majority of the students in the program transfer to second year engineering at the University of Alberta.

Shelley is a graduate of the University of Alberta in engineering and is a registered professional engineer with APEGA (Association of Professional Engineers, Geologists and Geophysicists of Alberta). Prior to her career at MacEwan, Shelley worked in industry as a research engineer and a consulting engineer for several years.

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Dr. Davis' research focuses on pedagogical topics such as student engagement, active learning, and cognitive development. Projects he is currently working on include "Development of a risk assessment model for the retention of students", "Development of Student Assessment Software", and "Improving Student Engagement through Active Learning".

## **GIFTS: Assessment Activities in Teaching First-year Engineering Mechanics**

Assessment activities play a significant role in teaching first-year engineering mechanics courses to ensure that accreditation standards are met. Traditionally, for in-person lecture-based course delivery, assessments involved a mix of problem-solving assignments, lab reports, and examinations. In terms of exams, they were often delivered in a time restricted in-person invigilated setting to uphold academic integrity and ensure that assessments demonstrate course learning outcomes. With the accelerated move to online delivery of lecture material during the Covid pandemic many instructors were required to rapidly transform to an online or blended mode of assessment. This paper speaks to that rapid transformation of first-year assessments and how prior teaching experiences in engineering education were used to ease the difficulty of this transition.

Prior to the pandemic, assessments were used to reinforce student learning through low-stakes assignments, and then through comparatively high-stakes exams to demonstrate competencies in course learning outcomes. To aid in course delivery, online resources were developed including quizzes, worksheets, problem databases, and content for automated assignment generation. Winter 2020 saw a rapid transition from in-person to an online or blended modality of teaching in the latter half of the course. However, as course outlines were already set, the grading distributions were not altered. Although this did not significantly affect low-stakes assessments, a negative effect was seen in the online, open book/notes exams.

To accommodate the change in modality, more frequent low-stakes assessments were developed for Fall 2020 / Winter 2021 to minimize stress for students and to address these concerns. Assignments, Seminars/Labs and Quizzes remained unchanged except for the submission format from physical to electronic submission. This was accommodated using an online grading platform, Crowdmark, through the learning management system which was complemented with a tablet. In addition, different types of exams were attempted including face-to-face, online problem solving, as well as a mix of multiple choice and short answer. For exams, online proctoring was not an option, however, in-person invigilated final lab assessments with small groups was possible. This was found to work well. Both students and faculty felt that these exams were more reflective of student learning and competency. To maintain a balance between academic integrity and the availability of resources, faculty felt it was necessary to design unique problems since solutions to many existing problems were readily available online. In addition, with reduced room capacities for in person exams, multiple exams needed to be created. This was accomplished by creating questions which were easily expandable to the development of new questions. Attempting various types of exams, it was found that the mix of multiple choice and short answer exams were not well received by students, in terms of both satisfaction and final grades as compared with more traditional problem-solving exams.

In summary, assessment activities changed from an in-person to online modality. It is important to address these changes to ensure the learning outcomes in courses are met. With the aid of previously developed resources for low-stakes assessments the need to alter these assessments was limited. It was found that when in-person assessments are not possible that a blended approach be taken for higher stake exams with traditional problem-solving question types. Finally, the move to online teaching has accelerated the need to explore different modes of assessments in an online environment when solutions are readily available or can be solved by others (individually or in groups or contracted resources) in real-time. This was achieved through the creation of problems designed to be modified.