UNIVERSITY OF LOUISVILLE — Louisville, KY

Product Name MyMathLab

Course Name Engineering Analysis I (Calculus I)

Course Format Hybrid: face-to-face and online on tablets in class

Key Results Frequent low-stakes assessments in MyMathLab in an ongoing calculus redesign is resulting in consistent course delivery across sections and semesters, plus increased opportunities for multimodal learning and mastery of course material.

Materials in Use

Custom text derived from *Thomas' Calculus* by Weir, Haas, Giordano; *Fundamentals of Differential Equations* by Nagle, Saff, Snider; and *Precalculus* by Blitzer

Implementation

University of Louisville engineering students are required to take a calculus sequence from the J.B. Speed School of Engineering's Department of Engineering Fundamentals. Engineering Analysis 1, the first course in the sequence offers an in-depth understanding of extensive problem solving in differential and integral calculus.

Class meets five times a week: Monday, Wednesday, and Friday for 50 minutes; Tuesday and Thursday for 75 minutes.

The implementation started in 2012 by transitioning from paper-and-pencil homework assignments to custom-created MyMathLab homework assignments managed by MyMathLab's coordinator course feature. Students have unlimited attempts on homework and all learning aids are available to them. They may continue to work on the homework after the due date but are assessed a two percent penalty per day. Each unit has a single set of homework problems.

The department recently began developing videos to replace parts of the traditional class lecture. For each unit, some material is covered in videos that students watch outside of class, thereby reducing the total number of class meeting hours per week by 40 minutes (Tuesday classes meet for 40 minutes). This material is not covered during lecture—it is the students' responsibility to watch the videos, which they access as MyMathLab media assignments within their homework assignments. Video assignments have a due date but may be reviewed later.

Once homework fully shifted to MyMathLab, the department began using MyMathLab for formal testing. Currently there is a MyMathLab test for each unit in the course. Tests are proctored and available for two days. Some sections have required students to earn at least 70 percent on the homework in order to take the associated unit test. Students have 40 minutes to complete each test, have one attempt, and no learning aids are available. The department uses MyMathLab's Lockdown Browser feature to ensure security.

Other ways to use MyMathLab for formal assessment are being evaluated, including unannounced, in-class pop-quizzes and a proctored, final exam in advance of the paper-and-pencil final exam.

The department uses MyMathLab's prerequisites feature to ensure mastery—students are required to earn at least 70 percent before moving to the next assignment. It also employs question pooling in quizzes and tests to help differentiate the questions each student receives.

Assessments

55 percent	Exams (13, paper-and-pencil, each covers two units)
25 percent	Final exam (paper-and-pencil)
15 percent	MyMathLab tests (13, each covers one unit)
5 percent	MyMathLab homework

Use of MyMathLab contributes 20 percent to each student's final course grade.

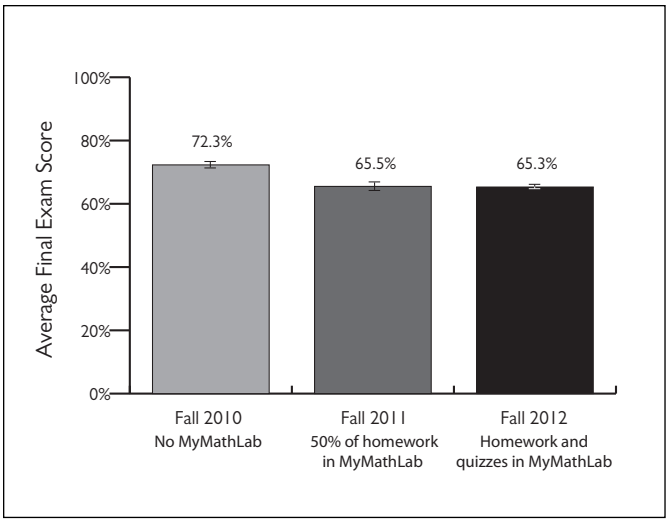

Figure 1. Average Final Exam Scores as Use of MyMathLab Increased, Fall 2010–Fall 2012 (*n*=736)

Results and Data

A primary benefit of the redesign lies in the data-collection capability of MyMathLab. Item analysis of MyMathLab unit tests helps identify areas of difficulty, often confirming what instructors have long suspected. Many instructors use this feature to prepare for review days. "A benefit that the department hopes to soon realize is creation of assessments in MyMathLab that can be reused each semester and compared across semesters," says Jeffrey Hieb, assistant professor of Engineering Fundamentals.

Hieb reports that the department has realized real benefits without a dip in student performance. After tracking and analyzing the average final exam scores of three cohorts throughout their calculus sequences, he found no significant negative impact (figure 1). "It may seem counter-intuitive to be pleased with 'doing no harm' to students, but in a short amount of time we have made substantial changes to the delivery of our calculus courses that saved money and time," says Hieb. "'Doing no harm' is a victory for us at this point. Students now have more accessible, high-quality resources at their disposal. Our latest objectives include adding components to the course that help students understand how to make use of these resources, and to use MyMathLab to hold students accountable for gaining proficiency on specific topics before taking their paper tests."

In addition, because student graders are no longer needed for homework and quizzes, the school has decreased its instructional costs.

The Student Experience

Hieb first employed MyMathLab to replace the paper homework assignments for his calculus III class. He recalls how positive students' reactions were to the change, "Students liked the fact that they could practice the homework as many times as they chose. Several asked if MyMathLab would be available next semester."

Since scaling the implementation, Hieb and his colleagues have realized that students' attitudes toward their assignments are critical to their success. "When students don't make the connection between the homework or quiz and the exam, they don't take the results seriously and they don't view their grade as an indicator of their comprehension, when in reality, it is a good indicator," says Hieb. "One of the areas we would like to improve is getting students to see the importance of taking the quiz results and using that to direct their learning. MyMathLab's Study Plan is one way to do this."

Conclusion

The Engineering Fundamentals Department has learned a variety of lessons, including the importance of change. "You can't just take what you used to do and replace it with MyMathLab," says Hieb. "You must change the way you've thought about your course and use MyMathLab to its fullest potential. That's why at the onset we invested time writing our own problems in MyMathLab—we wanted to ensure that students were receiving the engineering application problems we wanted them to have. They are receiving the same course students took in 2010, just more automated and with grade information more readily available. In addition, instructors are spending more time teaching and less time grading, and the department is realizing cost savings."

The department is pleased with the results they've seen since implementing MyMathLab—and they realize they're not finished yet. "We've got the homework portion figured out," says Heib. "Now it's time to get some more mileage from the testing." To that end, Hieb plans to employ the Personalized Homework feature in MyMathLab so that students have the opportunity to take the online exams, remediate, and show improvement on the paper exams. The department also has begun tracking and measuring the specific cost and time savings.

Submitted by Jeffrey Hieb, Ph.D., Assistant Professor
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