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MyLab educator study examines the impact of Interactive Assignments on student success in Intermediate Algebra at College of Southern Nevada

Key Findings

- Students who earned higher scores on Interactive Assignments also earned higher scores on quizzes and homework assignments.
- Data show a strong correlation between MyLab Interactive Assignments and final course scores.
- Students who earned at least 80% on Interactive Assignments in MyLab Math scored an average of 22 percentage points higher on other course assessments.

Study Specifics

School: College of Southern Nevada**,** Las Vegas, NV
Course name: Intermediate Algebra
Course format: Face to face
Course materials: MyLab Math for *Interactive Developmental Mathematics* by Rockswold and Krieger

Timeframe: Fall 2017–Spring 2018
Educator: James Lee
Results reported by: Julie Rebert, Pearson Results Manager

Setting

- Locale: The College of Southern Nevada (CSN) is a large, two-year college, offering over 180 degrees and certificates in more than 70 academic programs.
- Enrollment: approximately 70,000 credit students
- Part-time students: 73%
- Female students: 58%
- Online students: 27%
- Average student age: 26
- Student/faculty ratio: 23:1

About the Course

Intermediate Algebra at CSN is a three-credit course that does not satisfy the math component of any degree or certificate at the college. Topics include factoring polynomials, rational expressions and equations, radical expressions and equations, quadratic equations, graphs, and applications. The prerequisite is a C or better in Elementary Algebra, or a satisfactory ACT/SAT placement test score.

Challenges and Goals

Professor James Lee has been teaching mathematics at the college level since 2007 and joined CSN in 2012. After using different Pearson texts and an alternate digital product for his Intermediate Algebra course, Lee was looking for a solution that would support a flipped classroom model. He learned of the Rockswold and Krieger *Interactive Developmental Mathematics* eText in MyLab™ Math at the AMATYC conference in 2016 and thought it might work well in improving student performance and engagement in his course.

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Implementation

Flipped classroom model

Lee delivers the Intermediate Algebra course in a flipped format. Classes meet twice per week for 80 minutes each period, with Lee utilizing a MyLab Math interactive course in conjunction with in-class activities. Students are expected to review each day's material prior to class using the *Interactive Developmental Mathematics* eText and workbook in MyLab, with active learning taking place in the classroom to extend the students' online learning.

> "There were many assignments that were conducted on a weekly basis that contributed to my learning this semester. The consistent assignments were the most helpful as they allowed me to practice the ideas."
> —Student

Interactive Assignments lay the foundation

Lee provides a variety of assignments, each designed to bring students to success. The MyLab Interactive Assignment is the main learning tool, providing lectures and examples. Once students have finished the Interactive Assignment, they move on to a MyLab quiz on the corresponding section of the text. A personalized homework is then generated in MyLab based on the student's performance on that quiz. Lee only counts the Interactive Assignment and the personalized homework score; the quiz score is not counted because it is simply used to assess a student's knowledge and build the personalized homework. Students are expected to complete all three assessments on their own time prior to coming to class so that they are prepared to participate in the in-class assignment for the day.

While his syllabus reminds his students that the better they do on the quiz, the less homework problems they will see in the personalized homework, he says that in the Fall 2017 semester, he had several students who chose to bypass the ungraded quiz altogether, opting instead to just complete the full homework set. Lee says that he had not anticipated students taking this route and felt that, by skipping the quiz, those students were missing out on an opportunity to challenge their knowledge without learning aids, which he makes available on the personalized homework. In response to students bypassing quizzes, Lee modified his grading policy for Spring 2018, using MyLab prerequisites to require students to earn at least 50% on each quiz before being able to access their personalized homework.

A course pacing guide is embedded in the syllabus, so students are immediately aware of schedules and due dates from the first day of class. Personalized homework has fixed due dates and Lee does not grant extensions. Students can attempt each problem a maximum of three times, using learning aids as needed.

In-class assignments deepen the understanding

Each class period, with the exception of testing days, begins with a short, four-to-five question paper-and-pencil quiz covering what was learned in MyLab. The quizzes are graded for correctness only — one point for a correct answer and zero points for an incorrect answer. Lee quickly scans the quizzes for accuracy just after they are taken. This allows him to immediately assess how well the students synthesized the required daily material from the Interactive Assignments and directs him on how to proceed with the in-class activities for the day. Quiz performance counts as extra credit at the end of the term.

Following the daily quiz, Lee first responds to questions or delivers mini-lectures to fill knowledge gaps on the objectives for the day. He then provides students with an in-class assignment to solidify the concepts they just learned. These assignments generally take the form of worksheets or small group activities. Lee shares that in the Fall semester, he expected students to do many of these assignments independently and submit them for a grade, but he noticed that the students were more challenged with this format and weren't performing as well as he had hoped. He shifted his model to include more group work and collaboration on the in-class assignments, with Lee serving as facilitator, guiding students through some of the questions and grading for completion. Accordingly, he adjusted the contribution of the in-class assignments to the overall grade for Spring 2018.

Lee offers guidance and support to his students throughout the course, beginning with his syllabus where he encourages them to attend class daily, take good notes, and pay attention. He advises that they keep an organized notebook and attempt every homework problem, asking for assistance for any answers that are unclear. He says, "If you get stuck on a problem for more than ten minutes, move on to the next problem. Review material every day and don't fall behind."

Three chapter exams are given during the semester, with a comprehensive final exam at the end. All four exams are pencil-and-paper tests, and the final exam is standardized across the department. Calculators are not allowed in class for any quizzes or exams. Lee provides sample chapter tests in MyLab for students to use in preparation for exams. He also reminds students, "Exams are meant to assess your knowledge of the material, but also within the time allowed. Make sure you can solve each problem within four to five minutes." No makeups are allowed on exams or the final exam.

Assessments

- 15% MyLab Interactive Assignments & MyLab homework assignments
- 15%* In-class assignments
- 45%* Chapter exams (3)
- 25% Final exam

*Weights shown represent the Fall 2017 semester distribution. For Spring 2018, Lee adjusted the in-class assignment and chapter exam weights to better reflect the changes in the in-class assignment implementation. Weights for Spring 2018 were: 10% In-class assignments and 50% Chapter exams.

Grades are assigned using the following scale: **A** 90–100% | **B** 80–89% | **C** 70–79% | **D** 60–69% | **F** 0–59%

Results and Data

Analysis centered on the MyLab Interactive Assignments and their impact on student outcomes and results throughout the course. A correlation measures the strength of a relationship between two variables, where r is the correlation coefficient. The closer a positive r-value is to 1.0, the stronger the correlation. The corresponding p-value measures the statistical significance or strength of the correlation, where a p-value <0.05 shows the existence of a positive correlation between these two variables. Note that correlation does not imply causation; it is simply a measure of the strength of the relationship.

When considering only assessments completely contained within MyLab Math, data show very strong correlations between student performance on MyLab Interactive Assignments and both the subsequent MyLab quizzes [$r(48)=0.81$] and MyLab homework assignments [$r(48)=0.86$], illustrated in figure 1.

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Correlations between Interactive Assignments, quizzes, and homework assignments

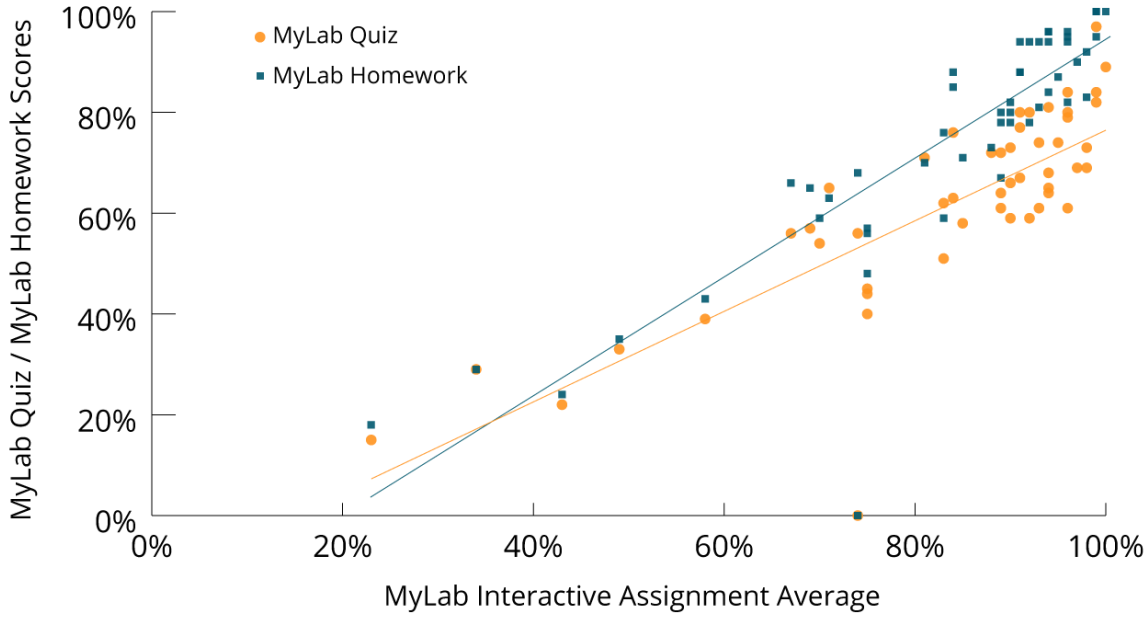

Figure 1. Correlations between MyLab Interactive Assignments and MyLab Quizzes and MyLab Homework Assignments, Fall 2017 (*n*=25) and Spring 2018 (*n*=25)

Lee's hope was that combining MyLab assignments with assessments outside of MyLab would have a positive impact on students' course outcomes. He shares that he really wanted to be able to continue his in-class assignments, because they allow him to actively work with his students, but hoped that students would find the MyLab assignments to be a beneficial tool in preparing them for the in-class work and exams. Figure 2 explores the relationship between student performance in the MyLab Interactive Assignments and final course scores. Data show a strong correlation between these two assessments, $r(48)=0.62$.

Correlation between Interactive Assignments and final course scores

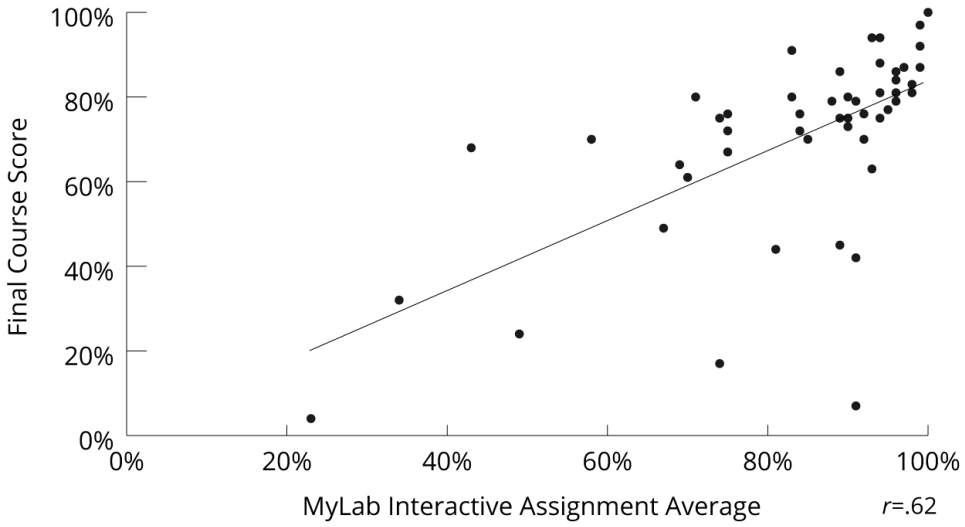

Figure 2. Correlation between Interactive Assignments and Final Course Scores, Fall 2017 (*n*=25) and Spring 2018 (*n*=25)

To explore the impact of the MyLab Interactive Assignments more deeply, students were grouped into two categories: those earning at least 80% on Interactive Assignments and those earning less than 80%. When quiz, homework assignment, in-class assignment, average chapter exam, final exam, and final course scores were analyzed for these two groups, data show that students who earned at least 80% on homework scored:

- 27 percentage points higher on quizzes[1], $t(48)=6.61$, $p<0.05$
- 35 percentage points higher on homework assignments[2], $t(48)=7.72$, $p<0.05$
- 19 percentage points higher on in-class assignments[3], $t(48)=2.8$, $p<0.05$
- 16 percentage points higher on chapter exams[4], $t(31)=2.55$, $p<0.05$
- 16 percentage points higher on the final exam[5], $t(32)=1.78$, $p<0.05$
- 19 percentage points higher on the final course score[6], $t(31)=2.83$, $p<0.05$

These results were statistically significant for each course assessment, as well as for the final course score (figure 3). Note that the MyLab Interactive Assignments do count towards a student's final course score.

Interactive Assignment impact

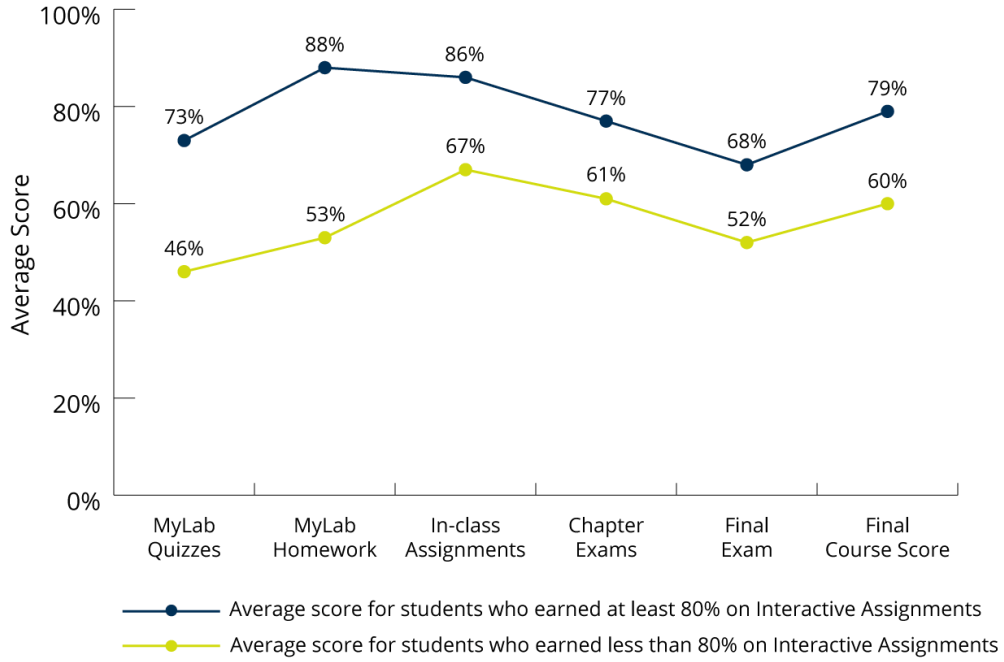

Figure 3. Average Scores for Students Earning at Least 80% (n=31) or Below 80% (n=19) on MyLab Interactive Assignments in Fall 2017 and Spring 2018.

The Student Experience

Combining Interactive Assignments found in MyLab with in-class worksheets and activities allows students a wide range of resources for their learning experience. In an anonymous, voluntary survey administered by Lee (69% response rate), one student shared, "There were many assignments that were conducted on a weekly basis that contributed to my learning this semester. The consistent assignments were the most helpful, as they allowed me to practice the ideas."

Students shared their views on the various initiatives incorporated into the course. When asked which assignments, projects, and learning opportunities most contributed to their learning, students shared:

- *"The way the class is setup - doing homework first then going over things in class - was beneficial to me."*
- *"The strengths of this class come from the practice questions that are given. There are many opportunities to practice the topics."*
- *"The online homework has helped me understand the topics more because it provides lots of information and examples."*

Results from the survey also showed:

- On average, students spent between seven and nine hours study time on the course.
- 70% of students indicated that they always or usually actively participated in the learning opportunities available in the class.
- 97% of students agreed that the instructor presented information in an understandable manner.

Conclusion

James Lee wanted to create a flipped classroom setting that would benefit students, offering the opportunity for independent learning via MyLab Math and an interactive textbook, combined with in-class discussion and active assignments. The MyLab Interactive Assignments and exercise feedback allow students to master objectives prior to attending class, where Lee then solidifies that understanding with active in-class assignments. Data show that students who perform better on the Interactive Assignments perform better on other class assessments, both within and outside of MyLab.

For other faculty interested in trying a flipped classroom model, Lee advises, "Make sure the students are aware of the flipped expectations up front," sharing that when the students are aware of what is happening and when, and their roles, the day-to-day course activities run much more smoothly. He notes that he finds MyLab great for a flipped class, saying, "It does a good job of providing examples and giving feedback when students struggle with a problem." Lee continues to refine the class to determine the best mix of MyLab work, in-class work, and grading weight.

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[1]Quiz score *t*-test results: Students with average MyLab Interactive Assignment scores of 80% or higher (M=73%, SD=10%, N=31) had significantly higher quiz scores than students with MyLab Interactive Assignment scores less than 80% (M=46%, SD=19%, N=19), $t(48) = 6.61$, $p<0.05$.
[2]Homework score *t*-test results: Students with average MyLab Interactive Assignment scores of 80% or higher (M=88%, SD=9%, N=31) had significantly higher homework scores than students with MyLab Interactive Assignment scores less than 80% (M=53%, SD=23%, N=19), $t(48) = 7.72$, $p<0.05$.
[3]In-class assignment score *t*-test results: Students with average MyLab Interactive Assignment scores of 80% or higher (M=86%, SD=19%, N=31) had significantly higher in-class assignment scores than students with MyLab Interactive Assignment scores less than 80% (M=67%, SD=30%, N=19), $t(48) = 2.8$, $p<0.05$.
[4]Chapter exam score *t*-test results: Students with average MyLab Interactive Assignment scores of 80% or higher (M=77%, SD=19%, N=31) had significantly higher chapter exam scores than students with MyLab Interactive Assignment scores less than 80% (M=61%, SD=24%, N=19), $t(31) = 2.55$, $p<0.05$.
[5]Final exam score *t*-test results: Students with average MyLab Interactive Assignment scores of 80% or higher (M=68%, SD=26%, N=31) had significantly higher final exam scores than students with MyLab Interactive Assignment scores less than 80% (M=52%, SD=33%, N=19), $t(32) = 1.78$, $p<0.05$.
[6]Final course score *t*-test results: Students with average MyLab Interactive Assignment scores of 80% or higher (M=79%, SD=19%, N=31) had significantly higher final course scores than students with MyLab Interactive Assignment scores less than 80% (M=60%, SD=25%, N=19), $t(31) = 2.83$, $p<0.05$.