

CASE STUDY

The background of the top half of the page is a photograph of a classroom. The image is heavily tinted with a red color. In the foreground, a young woman is seen in profile, looking towards the right. She has her hand near her face, holding a pair of glasses. In the background, other students are seated at desks, some looking towards the front of the room. The overall atmosphere is that of a focused learning environment.

Arizona State University Phoenix, Arizona

In 2013, Arizona State University (ASU) identified two alarming trends regarding students enrolled in their college-level algebra classes. First, faculty noticed that an increasing number of students placed into the institution's lower-level, non-credit bearing mathematics course, Freshman Enhanced Mathematics (MAT 110). Second, pass rates for the standard beginning math course, College Algebra (MAT 117), were stalling at approximately 60%. Faculty had become concerned; not only were more students required to take additional lower-level math courses, but even those who successfully passed appeared unprepared for the rigors of further college algebra classes.

ASU had identified a major stumbling block for student success in college: an increasing number of students weren't successfully moving through lower-level mathematics courses. Once placed into a lower-level course, students would struggle to pass and move on to higher-level credit bearing courses. The cycle was difficult, if not impossible, for some students to break and one that can be

a stumbling block in student success and college completion. ASU faculty decided to tackle the problem head on and change their entire course structure to help more of their students succeed in math.

Evaluating Adaptive Technology

To support the students and increase math success rates, ASU started to explore different technological solutions that could more accurately place students into the appropriate level math classes and better prepare them to pass the courses once placement had occurred.

This was not ASU's first time trying to find a technological solution to the problem. Over the years, many attempts to improve student performance in the Freshman Enhanced Mathematics and College Algebra courses had been piloted and subsequently abandoned. Regardless of approach, all of the tested systems failed to improve students' success rates on final exams. Faculty realized that a more targeted and tailored solution was needed to engage students in new ways and drive improved student outcomes in College Algebra.

Douglas Williams was brought on to the project in 2012 as the Adaptive Learning Coordinator for ASU's College Algebra and College Math Courses. Originally hired as a professor in 2000, he had the opportunity to teach various undergraduate math, math education, and statistics courses using traditional, hybrid, online, and adaptive designs. Williams assisted with many of the previous College Algebra pilot programs, and, having observed the pros and cons of each approach, he formed a team to finally find a lasting solution.

By the summer of 2016, after evaluating several courseware options and pedagogical considerations, Williams' team was preparing to pilot the McGraw-Hill Education software, ALEKS, during the College Algebra summer class session. Prior to the pilot, faculty decided to try an unconventional approach. They enrolled in the program as students in order to experience firsthand how the adaptive technology works. The hope was that ALEKS would prove to be sophisticated enough to use each student's existing math knowledge and alter the course content to fit the needs of each individual. Moving through the course as students, faculty quickly understood the benefits of ALEKS' adaptive approach, which included built-in motivational cues and a student-centric, personalized approach to learning. When the classroom pilot began shortly after, faculty and students traded lecture-style classes for the system's built-in reasoning and adaptive nature.

Making a Radical Change

In the fall of 2016, after the success of the ALEKS pilot, ASU faculty made two bold decisions. First, the school eliminated Freshman Enhanced Mathematics entirely and enrolled all students into the College Algebra course. Secondly, ASU implemented ALEKS in the College Algebra course. Williams' team believed that ALEKS could help remediate students lacking the prerequisite College Algebra skills without forcing them to take an extra class beforehand.

In terms of course redesigns strategies, the approach was fairly dramatic. Students that previously would have placed into the non-credit-bearing, lower-level Freshman Enhanced Mathematics were now enrolled directly in an appropriate credit-bearing mathematics course. ALEKS became the primary instructional tool, with an eye on providing extra practice and support to the students who would have previously been placed in the lower-level math course. Because the technology was adaptive, these students received the opportunity to complete College Algebra in just one semester, versus the two semesters it would have taken previously.

“WE FIND THAT STUDENTS ARE BEING PLACED MORE APPROPRIATELY INTO MATH COURSES AFTER IMPLEMENTING ALEKS.”

– Dale Johnson, Director of Adaptive Learning Initiatives at ASU

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ALEKS been transformational for ASU. It's opened opportunities for students to learn at their own pace and created a more personalized learning experience. When you think of all the classes that we teach to large groups of students, they're all based on one learning standard. Now we're using a learning solution that is personalized for each student.

– Dale Johnson, Director of Adaptive Learning Initiatives at ASU

Implementing at Scale

Educational technology is only ever as good as its implementation. Having been through the process before, Williams' vision was to fully realize a ALEKS-blended College Algebra course that truly supported student learning. To make this a scalable reality, several tactics were implemented.

First, supplemental instructional videos were created specifically to help facilitate learning. ALEKS Placement, Preparation and Learning (ALEKS PPL) was also utilized to place groups of 25 students into classes led by undergraduate learning assistants. The classes met three days a week in computer labs to focus on lesson material, and once every two weeks to tackle problem-solving activities in groups of five or six. The course included 18 ALEKS objective assignments, with the first objectives front-loaded with review topics.

Through the use of ALEKS' reporting capabilities, faculty were able to closely monitor student progress and identify individuals who needed

additional assistance. The major assessments, which included three tests and the final, were all taken in ALEKS and proctored by Software Secure's Remote Proctor Now.

Beyond closely monitoring individual student performance, at approximately two-thirds of the way through the semester, instructors identified every student that might need more time or instruction in order to pass the course. Faculty discovered that students who spent a significant portion of the semester on remedial topics were often the ones who needed additional support or time. As a result, the math department partnered with the registrar's office to develop an unconventional system that allowed these students to earn a "continuation grade" (Z) in their class and finish College Algebra as a "stretch" course (MAT 117S) the following year.

Through the ALEKS implementation and course structure changes, ASU faculty saw an immediate impact with improved course pass rates and increased student confidence.

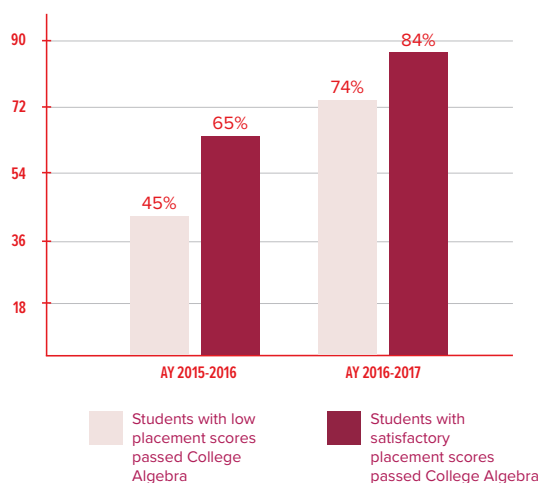


The Proof is In the Results

The ASU faculty attribute the improvement of their students' grades to the use of ALEKS resources, which are specifically designed to engage, challenge and motivate students in math. For example, faculty members used the detailed reporting to measure proficiency for each of the 380 learning objectives in College Algebra. The ALEKS system requires a 90% mastery of objectives before progressing to the next lesson. In the Fall 2016 term, students that completed College Algebra achieved a whopping 95.6% mastery of the learning objectives they completed. Prior to adopting ALEKS, ASU was unable to track student performance and measure mastery of individual objectives.

In the past, without the use of adaptive technology, students with low placement scores passed College Algebra approximately 45% of the time. There was a 20-percentage point gap between their rate and the pass rate of students with satisfactory placement scores (see Figure 1). In the academic year of 2016–17, nearly 84% of the students with satisfactory placement scores passed, while 74% of the students with low placement scores passed. These results represent significant improvements for both groups. ASU's math department made impressive strides in closing the achievement gap from 20 percentage points down to 9.5 percent.

Figure 1

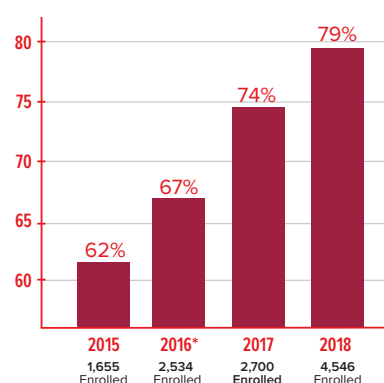


“IN THE FIRST THREE YEARS OF USING ALEKS WE’VE SEEN ONGOING STUDENT PERFORMANCE IMPROVEMENT AND ATTRIBUTE THAT SUCCESS TO THE APPLICATION.”

– Dale Johnson, Director of Adaptive Learning Initiatives at ASU

Before the course redesign and ALEKS implementation, ASU College Algebra overall pass rates hovered around 60%. 2015 pass rates were actually above average at 62%. After implementing the new system and approach, course pass rates for Fall 2016 through Fall 2017 terms increased year-over-year to 67%, 74%, and 79% respectively (see Figure 2). When accounting for students who chose a Z grade and successfully completed the stretch course the following semester, the Fall 2017 term results increased even further, from 74% to 79%.

Figure 2





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ALEKS offers a window into the future of learning and is an example of how we can provide a scalable, personalized learning experience.

– Dale Johnson
Director of Adaptive Learning Initiatives at ASU

In fact, within the first term of implementing the new approach and technology, 670 more students passed College Algebra compared to when Enhanced Freshman Math was a prerequisite the year before. An additional 280 students passed College Algebra via the stretch course path. Williams' team credits ASU's close partnership with McGraw-Hill Education and its implementation of ALEKS as essential part of achieving such successful results for their program. The system's adaptive nature, algorithmically-generated math problems, and student-tailored lesson plans have played an important role in the structure of the course.

Taking Student Feedback in to Account Too Or maybe...

What Students Say

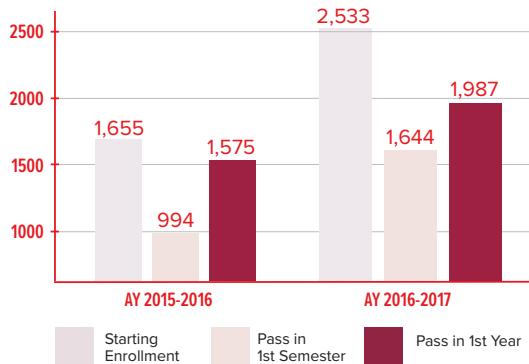
Based on feedback from surveys and focus groups conducted by ASU, students responded positively to the new learning system. Students reported that they found the program easy to navigate. They also liked ALEKS' Knowledge Checks, which gave them the opportunity to skip ahead in the content based on their mastery of certain core questions. ALEKS also incorporated motivational

opportunities for students, such as the system's Learning Mode, where students received double credit for getting multiple problems correct in a continuous streak. With ALEKS, students were given the opportunity not just to learn but also to become more proactive and take ownership of their own success in the course.

The Bottom Line

What's the result of developing a more self-motivated, independent learning process for ASU math students? ASU's enrollment numbers (Figure 3) showed that significantly more students are successfully completing coursework in one semester in what previously took most students two semesters to complete. As a result, students are saving time and money. Now, students only have to pay for one course instead of two and the financial impact is astonishing. Within just one semester, ASU students collectively saved over \$1 million in tuition and course fees.

Figure 3



SUMMARY

The ASU program has flourished since its implementation. More students are passing College Algebra in less time, which is a critical factor in helping to eliminate math as one of the key barriers in obtaining a college degree. And when more students flourish in math, it helps to create a stronger pipeline to high-paying STEM careers.

Benjamin Franklin said it best, “an investment in knowledge pays the best interest”.



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