The Making of a Developmental Math Emporium That Works

Anne Praderas Vance, Austin Community College

- Austin Community College repurposed a department store into a grand computer lab to support a developmental math initiative.
- Students who went through the math program in the ACCelerator saw higher rates of completion and improvements in later courses.
- ACC is working to shorten the time it takes students to work through ACCelerator courses.

In fall 2014, 23 math instructors traded in their chalk for computer keyboards to launch Austin Community College’s version of emporium-style math. Classes were held in the nation’s largest computer lab, the ACCelerator, a 32,000-square-foot open space formerly home to a JCPenney store. Two years later, the ACCelerator is still thriving with developmental math courses—among many other academic endeavors—and early results suggest that students are benefitting from the experience.

History

Open admission and low tuition have been the norm among community colleges since they began in the early 1900s. Consequently, the educational—specifically, mathematical—background of community college students has always varied greatly. Many arrive ill prepared for college-credit mathematics courses. It has been the task of community college math departments across the country to figure out how to prepare incoming students for success with college-credit math. Developmental math courses were created to provide such preparation, but they still proved to be a deal breaker for many degree- or transfer-seeking students. Many of them got caught in the ruthless cycle of dreading, delaying, forgetting, failing, repeating, dreading…until dropping out of school became the only source of relief. The Texas Higher Education Coordinating Board intervened in 2003 by requiring all higher education students to immediately enroll in developmental courses for any portion of reading, writing, or mathematics that they had not passed on a state-approved test. The intention was to eliminate the delay-forget-fail syndrome, but many students continued to suffer a slow academic plague of repeated failures or withdrawals because the content was presented too quickly to absorb—or too slowly to endure.

At Austin Community College (ACC), the developmental math sequence consists of Basic Math Skills, Elementary Algebra, and Intermediate Algebra, which lead into College Algebra, the first level college-credit course for STEM majors. Non-STEM majors are directed to take Basic Math Skills followed by Developing Mathematical Thinking prior to taking a college-credit quantitative literacy or statistics course. Over the past decade, ACC’s math department has implemented a variety of carefully considered course redesigns, but for many students, the changes were not enough for them to stay in school and pass a college-credit math course. The ACCelerator was built, in part, to correct those two problems.
The ACCelerator

The ACCelerator is a multidisciplinary learning space that includes 604 computer stations, flanked by multiple small-group study rooms, three full-sized classrooms, an alcove for academic coaches, and the campus tutoring center. The computers are linked by a virtualized desktop interface. Most computers are arranged in pods of four, with the monitors facing outward. Some tables have divided components that can be raised or lowered to accommodate students who need to work at other table heights. ACCelerator staff, math tutors, and technical support personnel are on duty at all times when the lab is open.

Developmental math courses in the ACCelerator require students to attend class with a particular instructor at the same meeting time each week. There is a 24:1 ratio of students to teachers. During peak hours (midmorning and midafternoon), as many as 10 developmental math courses could be taking place simultaneously in the ACCelerator. Developmental math tutors circulate the class areas to offer support for faculty and students. Generally two or three math tutors are on duty for every five classes in session. On evenings and weekends, when no more than three classes are in session simultaneously, one roving tutor will be on duty. When classes are not in session, a dedicated developmental math tutor is still circulating the floor to assist students who do their homework on campus.

Parts of the ACCelerator that are not used for math class are occupied by faculty from other disciplines, as well as early college start, adult basic education, and continuing education programs. Dedicated open computer areas are also available for ACC students to use at any time.

Developmental Math in the ACCelerator

The math courses taught in the ACCelerator are built with ALEKS (Assessment and Learning in Knowledge Spaces), an online instructional system that uses artificial intelligence to continually adapt to each individual learner. Mathematical content is arranged in a circle graph, or pie, where portions of the pie get filled in as students demonstrate mastery of topics. The goal for students is to fill the entire pie. At ACC, the curricula from all three developmental math courses are contained in a single pie. ACC’s pie is divided into 12 sections, called objectives, such that Objectives 1–4 correspond to Basic Math Skills, Objectives 5–8 correspond to Elementary Algebra, and Objectives 9–12 correspond to Intermediate Algebra. Completing the entire pie provides students with excellent preparation for College Algebra. Students who do not complete the entire pie in one semester may return the next semester to pick up where they left off. Or, those whose degree plan requires a quantitative literacy or statistics course instead of College Algebra may exit the pie at a lower level of completion and enroll in the non-STEM developmental math course.

On a typical day in an ACCelerator math class, students log in to ALEKS and work on their pie. Different students work at different paces; however, all students are required to log 8–9 hours per week in ALEKS and to learn 16–20 topics per week. The required hours include both class time and continued work outside class. While students are working in class, faculty answer content questions, monitor the organization of written work, and advise students on goals, pacing, and recommended future math courses. One-on-one conversations are a significant component of these courses, which necessitate the small class size.

Another course requirement is for students to learn how to communicate mathematical ideas on paper. Students are required to take notes and show work on assessment questions in a specially designed binder that faculty issue to students on the first day of class. Faculty grade the quality of written work several times throughout the semester.
Other components of student grades come from class attendance and a final exam. The final exam is taken and graded in ALEKS, but it also requires written work that is assessed by the instructor. Students must copy each problem and make their strategy clear to the reader—an important skill for students heading into college-credit math courses.

Outcomes

From a data perspective, ACCelerator math courses are still in their infancy. However, early returns indicate several promising trends.

Lower Withdrawal Rates

The withdrawal rate in ACC’s traditional developmental math courses consistently hovers around 27%. The significantly lower withdrawal rates in ACCelerator math courses (see table 1) are likely due to the fact that students no longer perceive that their course is too fast—or too slow—for them. ALEKS allows weaker students to spend more time with difficult topics and stronger students to buzz through topics that are easy for them, thus reducing two common causes of students’ dropping out: being overwhelmed and being bored.

Table 1. Withdrawal rates for students in ACCelerator math courses

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<thead>
<tr>
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<th>Fall 2014</th>
<th>Spring 2015</th>
<th>Fall 2015</th>
<th>Spring 2016</th>
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<tbody>
<tr>
<td><strong>New Students</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>10.4%</td>
<td>14.8%</td>
<td>14.2%</td>
<td>19.9%</td>
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<tr>
<td>(n = 81)</td>
<td>(n = 125)</td>
<td>(n = 128)</td>
<td>(n = 135)</td>
<td></td>
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<tr>
<td><strong>Returning Students</strong></td>
<td></td>
<td>15.2%</td>
<td>16.3%</td>
<td>16.5%</td>
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<tr>
<td></td>
<td>(n = 63)</td>
<td>(n = 74)</td>
<td>(n = 86)</td>
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High Return Rates

Since ACCelerator math courses began, consistently 95–97% of students who returned to developmental math in a subsequent semester chose to continue working in an ACCelerator math course. Of students who had previously started in the ACCelerator, fewer than one percent chose to switch back to traditional developmental math courses.

Faculty Satisfaction

One hundred percent of the more than 60 math faculty who have taught in the ACCelerator wish to continue with those courses. The increase in quality and quantity of student interactions is the reason cited most often as why faculty are so satisfied. Not only do faculty get to be the content experts, but now they also feel more closely associated with helping students identify and achieve their goals. The vast reduction in grading is the second most cited reason why faculty enjoy teaching ACCelerator math courses. Several faculty also listed the joy of mathematical improvisation as their favorite aspect of teaching with ALEKS—one never knows which topic will be asked about next!

Future Course Success

Traditionally at ACC, 48–50% of College Algebra students pass with an A, B, or C. So far, of students who completed the entire ALEKS pie and signed up for College Algebra, 60% passed with an A, B, or C. The number of ALEKS alumni who have entered College Algebra is still relatively small, but data will continue to be tracked to see if this positive trend continues.
Lessons Learned

We were surprised to discover that using the phrase “self-paced” sent the wrong message to students—too many thought they could consider their math class like a gym membership and attend when they felt like it. We now say “individually paced,” with an emphasis on the fact that the instructor, not the student, sets the pace based on each student’s prior coursework and demonstrated ability.

We also learned that too much open-endedness leads to slower progress. Without hard deadlines and intermediate goals, students may become complacent. However, having a reduced-pressure environment may contribute to the lower withdrawal rate. When we first opened the ACCelerator, 39% of ACCelerator math students had previously failed at least one developmental math course at ACC—many of them had failed multiple courses, multiple times. For those students, completing developmental math in four semesters would be an improvement! We continue to fine-tune our strategies for getting students to work harder than they thought they could without scaring them away. The most important strategy is the faculty-student relationship. Faculty who know the goals and life circumstances of a student are in an excellent position to know how hard that student can be pushed.

One lesson that we suspected from the start—and has been confirmed—is that faculty and advisers need lots of training, which should be mandatory and in person. Information sent through e-mail and websites was often ignored or quickly forgotten. Advisers must understand the expectations of the courses since they are the purveyors of information about a new course. Faculty left to their own devices might be tempted to use only the parts of the software that are immediately familiar to them rather than implementing the full spectrum of features. Because we offer classes during days, evenings, and weekends, we repeated faculty training sessions two or three times to ensure that all faculty could attend. When the ACCelerator first opened, we required trainings before, during, and after the first two semesters. Now, we require one training session before the start of each 16-week semester. Training sessions consist of updates in course policies and adjustments to student or faculty expectations, along with data progress reports so faculty can see how their efforts are paying off. New faculty must complete six hours of additional training before their first semester begins.

Goals

ACC is an Achieving the Dream (ATD) college; as such, we have periodic visits from ATD coaches to help us meet the national standards set out by the program. On a recent visit, the coaches asked us to narrow our focus to one goal: get students to pass a college-credit math course within one year from when they start with developmental math. No other statistic is as important as that. This one-year-in-and-out goal has put a dramatically different spin on ACCelerator math courses.

College-credit success was always the ultimate goal for ALEKS students, but faculty never felt pressure to accomplish that goal so quickly. On the contrary, math instructors relished the idea that ALEKS was holding students to a higher degree of accountability with math topics. On the surface, it may seem that increased accountability would force students to spend longer in developmental math courses. Our expectation is that it won’t, and we are in the process of collecting data to find out. With ALEKS, students no longer have to repeat the same course over and over because they keep getting stuck in the same place. Plus, the improved level of preparation seems likely to save students time in the long run because they would be more likely to pass College Algebra once they get there. In traditional math courses, students generally have one, maybe two, chances to learn a particular topic before the instructor moves on to the next one. In ALEKS-based courses, there is no escaping any topic; certain topics remain locked until students demonstrate mastery of the prerequisite content—no
matter how long that takes. As math faculty, we found this “airtight” approach to learning to be a refreshing change, and certainly a welcome exchange for speed. Nonetheless, the ATD coaches advised us that students who spend too long in math classes are unlikely to get their degree. So now our focus is on uniting the goals of improved preparation and increased speed.

**Strategies**

In an effort to make the developmental math experience more efficient and effective, ACC will be implementing several strategies for fall 2016 ACCelerator math courses.

**Realistically Higher Expectations**

In traditional math courses, 70% mastery is required for passing a test and the course. For ACCelerator math classes beginning in fall 2016, we will adjust the mastery level required for passing each objective from 90% to 80%. This standard of completion is still higher than traditional courses while allowing students greater freedom to make progress without getting bogged down. ALEKS will still require students to master particular topics that are necessary prerequisites on an as-needed basis. Also, the objectives over which students will be tested on the final exam will still need to be completed at 100% mastery.

**Accountability for Prerequisites**

In the past, all ACCelerator math students were expected to work through prerequisite skills, since all three developmental math courses were in the same pie. Beginning in the fall, students who have a test score or prior coursework that places them at the Elementary Algebra level or higher will automatically be placed into a second pie that contains only material from Objectives 5–12 (Elementary and Intermediate Algebra). Such placement will allow students to bypass the prerequisite skills and get right to work on the material for which they are ready.

**Aggressive Use of Software**

In the past, all students were given a 30-question initial assessment to determine which skills they had already mastered. We found that a single assessment gives an incomplete measure of student ability; after all, there are over 700 topics in our pie! Beginning in the fall, students will be assigned two or more initial assessments, depending on their results, in order to give the truest picture of their ability when they walk in the door. The more questions they get right on an initial assessment, the more of their pie gets colored in to better reflect their entry-level knowledge. Having a more accurate entry pie will prevent students from having to practice skills they have already mastered.

**Increased Faculty Advising**

In the past, faculty offered goals and pacing advice to students with a focus on unconditional support. Although instructors are still expected to be supportive of students (most will be regardless), there will soon be a new emphasis on “tough love.” We need to work harder to extinguish the notion that it’s no big deal for students to finish work in three semesters that they could have managed in two. A more aggressive completion philosophy—overtly stated to students and advisers—will be necessary if we are to get students in and out of both developmental and college-credit math in one year.
Looking Ahead

Even with the mandate for change from ATD coaches, the future of the ACCelerator is bright. Students and faculty love working in this space that is strangely comforting despite its size. Somehow, students are less likely to become wallflowers in the ACCelerator—perhaps because there are so few walls! It is easy for faculty to keep watch over their flock and attend to them readily. Students appreciate the noncompetitive and highly individualized nature of the courses. Faculty love that they get to know their students better than ever before. Advisers no longer must determine which developmental math course a student needs. The truest measure of success will be determined by the data, which are compiled every semester. In the meantime, thousands of students are coming into the ACCelerator every day to work on developmental math. With a cup of coffee in hand and an instructor who knows their name, students have the support they need to accomplish their goals and finally finish with developmental math.