

Exponential Attrition and the Promise of Acceleration In Developmental English and Math

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Community colleges are the point of entry to higher education for the majority of nation's first generation, minority and low-income students. But there is a harsh reality that these students may not understand when they receive their English and Math placement results: the more semesters of remedial courses a student is required to take, the more remote that student's chances of passing college-level Math or English and being eligible to transfer or earn a degree.

In his nationwide study of 57 colleges participating in the Achieving the Dream project, Thomas Bailey of the Community College Research Center found that student completion rates in college English and Math drop with each additional level of remedial coursework required. Students placed three levels down from college Math go on to pass the college-level course at a rate of just 10%. For students placing three levels down in reading, the figure is 24%.¹ What happens to the rest? The vast majority leaves the sequence along the way in what's called "the pipeline effect" – they "leak" away by not enrolling, not passing, and/or not persisting to a subsequent level.

What causes this hemorrhaging of students? Is it that students arrive with such weak skills that they can't cut it in college? Are they demoralized by the long road of non-transferrable courses ahead of them? Are they de-motivated by the tasks they are asked to perform in these sequences – reviewing rules and procedures for adding fractions,

¹ Bailey, T., et al. Referral, enrollment, and completion of developmental education sequences in community colleges. *Economics of Education Review* (2009), doi: 10.1016/j.econedurev.2009.09.002

completing fill-in-the-blank grammar workbooks?

While student motivation, preparedness, and curricular content are important, none of these provide sufficient explanation for the low completion rates in college English and Math. This article begins by demonstrating that the problem is fundamentally structural. Attrition is high in developmental sequences, but more important, attrition is exponential. As students fall away at each level, the pool of continuing students gets smaller and smaller until only a fraction of the original group remains to complete the sequence.

We will then present evidence questioning whether long sequences are even necessary to prepare students for college-level work in English and Math. This section includes an in-depth look at models of acceleration from Chabot and Los Medanos. Both colleges offer open-access, one-semester developmental courses that lead directly to the transfer level. One is a brand new experiment, the other has been in place for fifteen years. Both have produced dramatic increases in the number of basic skills students who successfully complete college English and Math.

This article is intended for community college faculty, administrators, and researchers interested in ways to improve student outcomes from developmental sequences. We are particularly interested in starting a conversation with our fellow developmental faculty to envision a way forward from a status quo that none of us can feel good about.

What drives exponential attrition: “the multiplication principle”

As leaders on our own campuses, both of us have spent years working on initiatives we hope will improve student outcomes – learning communities, tutoring, professional development for faculty, linked counseling and academic instruction. In all this work, we have seen tremendous value for students. But over the last several years, we have become convinced that these kinds of initiatives are never going to be enough to address the hemorrhaging of students inside long developmental sequences across the country – and therefore, never enough to impact student transfer and degree completion.

For Myra Snell, this realization came when she confronted the results of a pipeline study at Los Medanos, which showed that only 18% of students beginning two courses below college-level successfully completed a college Math course. The Math department had spent years of intensive work on professional development, curricular innovation, and careful attention to student learning outcomes. Course success rates had increased and student learning, as measured by collective analysis of final exams, had improved. But Snell now asked the question “How good would our success and persistence rates have to be to see significant improvement in this statistic?” With a sinking dread, she realized that even if her department could raise course success and persistence rates to levels they had never seen, they would see only modest gains in that completion rate. The problem was the length of the sequence.

Snell came to call this the “multiplication principle” and view it as the primary reason behind the low completion rates for college-level courses that Bailey documented across

the country. She started having conversations about the issue with people inside and beyond her college.

Let’s do a thought experiment, she’d say: Imagine you have 100 students who start the curriculum three courses below college-level, and imagine that 75% of this group passes the first course. That means 75 students are eligible for the next course in the sequence. Of course, not all students who pass a course will enroll in the next course, so imagine that 75% of the eligible students persist to the next level. At the beginning of the second course, the pool of students has already shrunk from 100 to 56, and there are still three more semesters to complete. If your success and persistence rates stay at 75% for the rest of the sequence, only 13 of the original 100 students will pass the college-level course.

In conversations with Snell, faculty tend not to accept the multiplication principle right away. This is fine as a thought experiment, they might say, but in reality, success and persistence rates vary inside a sequence. Or they might raise their own hypotheticals: if we add a lower level, couldn’t we improve success rates in the middle course, and then improve the overall sequence completion rate? Take out your calculator, she’d say, try it.

Table 1: Illustration of the multiplication principle

How many students will pass the college-level course?			
If this was the student’s initial placement...	And these were the rates at which they passed each class and persisted to the next class in the sequence...		
	70%	80%	90%
1 level below transfer	34%	51%	73%
2 levels below	17%	33%	59%
3 levels below	8%	21%	48%

The reason this principle is hard to accept is that it goes against our whole way of understanding developmental education. The purpose of providing lower levels of the curriculum is to better *prepare* students for the demands of the next course. What the multiplication problem suggests is that providing 2, 3, 4 semesters of developmental instruction is actually harmful because it reduces students’ chances of completing the transfer course so dramatically. To faculty who have devoted their lives to helping students learn, it just doesn’t make sense that providing more courses could be harmful.

The thing is, the multiplication problem has very little to do with the quality of our teaching. There may be excellent things going on in these classrooms, and the individual students who survive the sequence may get a lot out of the work they’ve done there. The issue is simply that huge numbers of their classmates disappear along the way.

How Many Levels of Remediation Do Students Really Need?

The Reading-and-Writing Side of the House

The Academic Senate for the California Community College system recently worked with the state Chancellor’s office to create a rubric defining common learning outcomes for four levels of developmental reading and four levels of developmental writing.² But the length and structure of developmental sequences vary widely across the state. Some colleges require students to enroll in separate sequences in reading and writing; others have just one English sequence. San Francisco City College offers a five-course developmental sequence. Las Positas College, on the other hand, has recently changed its placement policies so that the vast majority of students are directed to a one-semester accelerated reading-and-writing course.

Chabot College provides an interesting reference point in this larger debate. Students at Chabot have two options for developmental English. They can self-place into either a two-semester sequence of integrated reading and writing instruction (8 units) or an accelerated one-semester reading-and-writing course (4 units). Both options are open to students with any Accuplacer score, and both lead to college English.

While she was co-chair of the Chabot basic skills committee, Katie Hern had a conversation with Myra Snell about the multiplication problem that caused her to look more closely at the results from the English curriculum. She took the raw data on course success and persistence and posed the question, “How many students who start developmental English at Chabot go on to pass college English?”

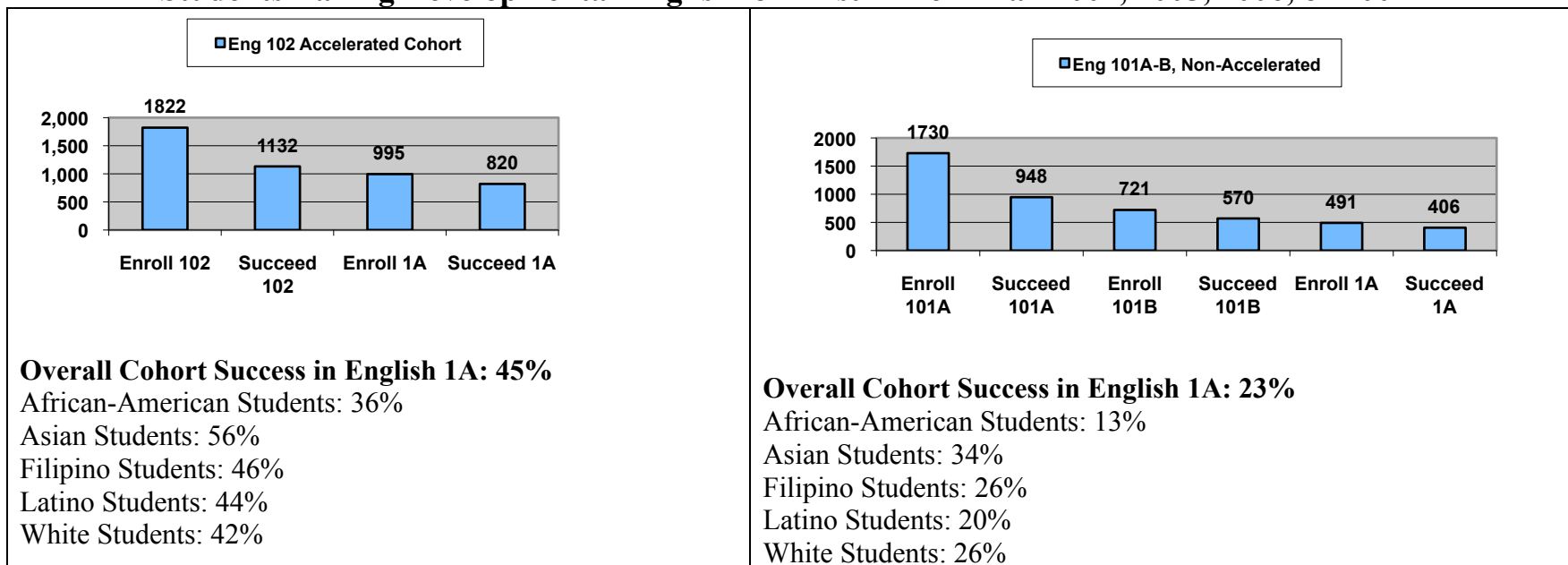
The answer could have been predicted by the multiplication principle, but Hern was shocked by it nonetheless: students who self-place into Chabot’s one-semester, accelerated course pass college English at a rate *double* that of students who self-place into the two-semester developmental sequence.

² Guide for Proper CB 21 Coding of ENGLISH Courses below Transfer-Level. Available at <http://www.cccbsi.org/cb21-information>

How Many Chabot College Students Make it through Basic Skills and Pass College English? It Depends on which Path They Take...

Students self-place into either a two-semester developmental sequence (Eng 101A-101B, 8 units)
or an accelerated one-semester course (Eng 102, 4 units).

Students Taking Developmental English for First Time in Fall 2004, 2005, 2006, or 2007*



Curricular Notes: All levels of curriculum integrate instruction in reading, reasoning, and writing. In addition to the composition sequence, there are also ESL classes (ESL 110A-110D) and courses targeted to students with learning disabilities (Eng 116-118). Students can voluntarily choose these courses, or may be directed to them by college assessment process. However, they can also self-place directly in English 101A or 102. 23% of the above English 102 students were enrolled in a learning community.

- Timeframe for completing college English: 2 years for accelerated cohorts, 2.5 years for non-accelerated. Students who switched between 101A and 102 not included above.

These findings are counter-intuitive for most developmental educators, including many Chabot English teachers. So are the data on how students do once they enroll in college English. Students who pass just one 4-unit course succeed in the course at exactly the same rate (82%) as students from the 8-unit two-semester sequence. It's hard to believe. We would think that more guidance and practice in academic literacy would result in better performance at the higher level. But four years of data, involving thousands of students, show that it didn't. These four years of data also make clear the stark reality of exponential attrition: only 23% of students who began in the longer sequence went on to complete College English versus 45% from the accelerated track.

A bit of background is useful here. Chabot's developmental English curriculum is grounded on a central principle: to be prepared for college-level academic literacy, students need concentrated practice in these skills and habits of mind. The shorthand for the principle is "1A at all levels." In both the accelerated and two-semester tracks, students engage in the same types of work required in an English 1A class, but in an environment of greater scaffolding and support.

At Chabot, English does not progress from courses on sentence writing, to courses on paragraph writing, and then expository and argumentative essays. Instead, students at all levels read full-length books, mostly non-fiction, and are guided in strategies for understanding and engaging these texts. They pose critical questions, summarize, analyze, and synthesize; they write academic essays and make arguments. Sentence-level issues are addressed along the way, depending upon students' needs. The key difference between the one-semester and two-semester options is pacing and how much time students have to reach an English 1A-level of mastery.³

The outcomes from Chabot's accelerated course have inspired a lot of discussion. How do we explain such a huge difference between the two paths? Is it the influence of learning communities? (23% of the accelerated students were part of a learning community.) Is there a difference between the kinds of students who choose the accelerated track and the students who choose the slower sequence? Is there something we can do to improve outcomes in the two-semester track, or does the multiplication principle mean that completion rates will always be low?

These conversations are ongoing, but Chabot's experience with acceleration has interesting implications for the larger debate about the length of developmental sequences.

One important issue to emerge is that, despite extensive analysis, it has been impossible to use our placement test (Accuplacer) to distinguish which students should take the slower sequence and which should take the accelerated course.

³ To get a sense of what happens in an accelerated classroom at Chabot, watch a 5-minute video of accelerated students in Katie Hern's Fall 2009 class discussing an excerpt from Paulo Freire's *Pedagogy of the Oppressed*. <http://www.vimeo.com/7186965> See also collection of readings, tests, and writing assignments from Katie Hern's Spring 2010 class – "Window into an Accelerated Classroom," available at <http://www.rpgroup.org/resources> under the heading "Acceleration."

Cabrillo College Institutional Researcher Craig Hayward conducted several analyses of student data from Chabot’s accelerated course and the course two-levels down, including logistic regression. The data included 8 semesters of enrollment and nearly 5,000 students. His conclusion was that placement scores explain only about 3% of the variation in students' pass rates: “Knowing a student's placement score does not meaningfully enhance our ability to predict whether that student will pass or not.”

Even students with the very lowest Accuplacer scores pass the accelerated course at a rate of 48% (students scoring below 50 on both reading and sentence-skill tests, who constitute 5% of the accelerated enrollment). Students with these scores actually do slightly *better* in the accelerated course than if they enroll in the class two-levels down (their success rate in that course: 45%). Of course, low-scoring students generally succeed at a lower rate than their high-scoring peers, but their success rates are much stronger than we might have predicted. What’s interesting too is that learning community classes were removed from this analysis. That means the lowest scoring students are succeeding in mainstream, stand-alone courses with no special interventions.

At most California colleges, students with such low scores would be blocked from enrolling in a class one level below transfer. Each college has to validate pre-requisites, but only against its own existing curriculum. There’s no way to see what low-scoring students might be capable of in a different environment.

So, as an experiment, we took the Accuplacer cut scores from two other California community colleges and compared them with data from the Chabot curriculum. The Chabot data included more than 2,700 students who had enrolled in the accelerated course for the first time during 8 semesters between 2006-2008. Summer terms and learning community sections were excluded.

The first college, College X, places students into three levels of English below transfer. Accuplacer reading and sentence scores are weighted equally to determine a student’s course placement, with the formula: $(\text{reading score} + \text{sentence score})/2$

Table 2: Student success in accelerated course by College X placement levels

College X Placement Levels and Cut Scores	Number of students in Chabot’s accelerated course with scores at each level	Success Rate in Chabot’s accelerated course
Transfer level: 95 or above	75	81%
1 level below: 72-94	1507	68%
2 levels below: 41-71	1062	52%
3 levels below: 40 or lower	72	57%
Total	2716	62%

So how did Chabot students in each scoring group do in the accelerated course? Not surprisingly, students with scores above the transfer level had the highest pass rate, followed by students scoring one-level down. What is surprising, however, are the pass rates for students who would have been required to enroll in two to three semesters of remediation if they attended College X. At Chabot, the majority of these students were able to move into the transfer level with just one semester of developmental work, and the lowest scoring group had a higher pass rate than the group above it (57% versus 52%).

The second college, College Y, also places students into three levels of English below transfer. Accuplacer reading scores are weighted more heavily than sentence scores, with the following formula: $0.65 * \text{Reading score} + 0.35 * \text{Sentence score}$.

Table 3: Student success in accelerated course by College Y placement levels

College Y Placement Levels and Cut Scores	Number of students in Chabot's accelerated course with scores at each level	Success Rate in Chabot's accelerated course
Transfer level: 95 or above	87	83%
1 level below: 72-94	1403	68%
2 levels below: 50-71	991	55%
3 levels below: 49 or lower	235	48%
Total	2716	62%

With the reading score weighted more heavily, success rates in Chabot's accelerated course follow a more predictable pattern – lowest for the lowest scoring group, highest for the group that placed directly into the transfer level. However, a 48% pass rate is nevertheless striking for the lowest group. These students would be required to take three semesters of developmental English at College Y, but almost half of them reached the transfer level with just a one-semester course at Chabot.

When we share results like these with faculty, the most common explanation we hear is that it must be student motivation; students who choose the accelerated course must be more highly motivated. Chabot doesn't have a good way to measure motivation, but a bit of context is useful here. The college has expanded its accelerated offerings over the last several years so that the majority of students now enroll in this path; 29 sections were offered in Fall 2009, compared to 15 sections of the course two levels down. The accelerated course is taught by full-timers and part-timers, veteran and new. We're talking here about the general student body in the standard curriculum, not a tiny subset of high achievers taught by a few exceptional teachers.

It's also useful – though politically impolite – to ask: What options are available for motivated students at colleges that track them into 2, 3, 4 levels of remediation? In those environments, regardless of a student's motivation, placement results are often destiny.

There's a deeply held belief among faculty that some students *need* more than one semester of developmental coursework to be truly prepared for the literacy demands of college. We recall specific individuals from our classes and think, *No way, that student could never get there in one semester*. Even at Chabot many faculty believe the two-semester track is a better fit for some students.

For us, this remains an open question for further study. What makes the question tricky is that – as the above Accuplacer analysis shows – we don't have a reliable way to identify these students in advance and guide them to the longer sequence. And of course, even if we think some students might benefit from more courses, the harsh statistical reality is that placing them on a longer path means fewer will reach the end.

What *is* clear from the Chabot data: students are capable of more than our placement systems might lead us to assume. As a field, we need to become much more skeptical of the idea that placement scores = number of semesters of remediation needed.

How Many Levels of Remediation Do Students Really Need?

The Math Side of the House

Developmental curricula are more standardized in Math than in English. The content is generally the same, and what varies is whether a college spreads the content across three or four levels, or offers alternative formats such as software-supported independent study.

The topics covered in developmental Math build sequentially upon each other. A student must learn to add fractions by hand so that they can add rational expressions in Algebra so that they can perform an integration technique in Calculus II. But here lies the problem. The vast majority of students who complete the developmental sequence will never take Calculus. At many colleges the course that most students choose is Statistics. At Los Medanos, for every student who takes Calculus I, eight students take Statistics.

How much of the developmental math curriculum is necessary for understanding Statistics? Snell and her colleagues did a content mapping exercise and confirmed that only a small fraction of the developmental sequence is relevant to the study of Statistics. So, unless a student is planning to be a STEM major (Science, Technology, Engineering, and Math), most of the developmental curriculum is not pre-requisite knowledge they will ever need.

It became necessary to ask: Why is every student being forced through the existing sequence, especially when so many are lost along the way? Does the Math sequence have to be the place where college dreams go to die?

These realizations led Snell to develop – and her department to unanimously approve – Statpath, an experimental course in developmental Statistics. The 6-unit course, offered for the first time in Fall 2009 and studied as part of the Faculty Inquiry Network, enables students to bypass the traditional sequence and complete all their Math requirements within one year. It has no minimum placement score, and the first semester’s class was divided equally between students placing into Arithmetic/Pre-Algebra, Elementary Algebra, and Intermediate Algebra. Statpath was linked with the campus Puente program for Latino students but also open to students from outside the learning community.

Snell developed the course through the principle of backwards design. She looked at the learning goals of the college-level course and created a class that would give students direct experience with statistical concepts and ways of thinking. She built a course that had the look and feel of a course in descriptive statistics with “just-in-time” development of relevant Arithmetic or Algebra skills. Students performed exploratory data analysis with complex data sets, developed regression models, and used simulations to draw conclusions. Along the way they worked on “prerequisite” skills, such as computing with percentages, interpreting graphs, and evaluating formulas.

The model of a separate Statistics track is gaining momentum in the world of Math education. MacArthur Genius award-winner Uri Treisman has been advocating for the idea in high-profile venues like the *Chronicle of Higher Education* and nationwide keynote addresses. The Carnegie Foundation for the Advancement of Teaching has developed a project called Stat-Way and is recruiting community colleges from across the country to pilot it.⁴

But the Los Medanos experiment is the first to be offered in California and the first to demonstrate the promise this model holds for improving completion rates in college Math. Student outcomes data are still being analyzed from the first year, and Snell cautions that the numbers were small – 29 students began the two-course sequence. However, the early results are encouraging, with high retention, success, and persistence rates throughout the two semesters.

⁴ <http://www.carnegiefoundation.org/problem-solving/developmental-math>

Table 4: Overall achievement measures for Fall 2009 Statpath cohort

Accelerated Pre-Statistics Course	Retention	97% (of 29 students in cohort, 28 took the final exam and turned in the final paper)
	Success	76% (of 29 in the cohort, 22 earned a C or better in course)
	Persistence	82% (of 22 who passed Statpath with a C or better, 20 enrolled in Statistics Spring 2010 and 18 remained past the first census date)
Transfer-Level Statistics	Success	94% (of the 18 enrolled in Statistics at first census, 17 passed with a C or better)
Completion of Transfer Course		59% (of 29 in cohort, 17 passed college-level Statistics)

When Snell talks with other faculty about this experiment, one of their first responses is usually: *Open access? You mean no minimum placement score?* They wonder how the lowest-scoring students perform – can Arithmetic-level students really cut it in this environment?

For Snell, this is still an open question. It's true that pass rates in the first semester were lower for students placed into the lowest level. Four out of the eight Arithmetic-level students did not pass the developmental course, a 50% success rate, compared with a 100% success rate for students who had placed one level below transfer.

But, Snell argues, that doesn't necessarily mean that the traditional sequence would have been a better option for these students. We can't assume that their pass rates would have been higher in a course three or four levels down from the college level. And the multiplication principle guarantees that far fewer of them would make it from that course into college Math. Though Snell's Arithmetic students had a lower completion rate than the rest of the cohort, they were nevertheless *seven times* more likely to complete college Math than Arithmetic students from the traditional sequence.

Table 5: How many students completed college Statistics from each placement level?

Placement Level	Statpath	Traditional Algebra Sequence*
Intermediate Algebra (1 level below transfer)	89%	29%
Elementary Algebra (2 levels below transfer)	50%	17%
Arithmetic/Pre-Algebra (3-4 levels below transfer)	38%	5%

* Comparisons are based on the first Statpath cohort and previous persistence studies at Los Medanos College. Statpath included 8 students placing into Arithmetic/Pre-Algebra, 12 placing into Elementary Algebra, and 9 placing into Intermediate Algebra. Statpah students were tracked for two semesters with no retakes. Persistence studies were conducted on 2003 cohorts from the traditional Algebra sequence: 155 Pre-Algebra students, 292 Elementary Algebra students, and 320 Intermediate Algebra students. Students assessing 3 levels below transfer were tracked for 3 years, 2 levels below for 3 years, 1 level below for 2 years. Retakes were included.

How did Statpath students perform in Statistics compared to students from the longer sequence? During the second semester, enrollment in Snell’s Statistics class opened up to include not only the Statpath group, but also students who had come from the traditional Algebra sequence. This allowed her to make some interesting observations. First, despite “more” Math preparation, students from the longer sequence were not immune to arithmetic or algebraic mistakes. More interesting: students from the one-semester accelerated course outperformed those from the traditional path. They were more likely to earn As and less likely to earn Ds and Fs, and they passed Statistics at a rate of 94% (17 of 18), compared to 85% (11 of 13) for students from the traditional sequence. The previous spring, the college-wide success rate for Statistics was 61%. Finally, on the departmental final for Statistics, Statpath students outperformed students in the Honors section of the course, including higher performance on problems taken from a national statistics exam.

Where Do We Go From Here?

Acceleration has emerged as a promising strategy for increasing college completion rates, a focus for attention from the Bill and Melinda Gates Foundation, the Community College Research Center, the Lumina Foundation, and the Achieving the Dream project. Models like those in place at Chabot and Los Medanos provide a vision for what might be possible, backed up by data that show it can work.

Another vision of the possible is the Accelerated Learning Project at the Community College of Baltimore County. Here, students with placement results one level below College English are enrolled directly into a mainstream college-level course, with an additional support class taught by the same instructor. Students in the program complete college English at more than twice the rate of students from the longer sequence, in half the time.⁵

Another vision: We might take several different levels and collapse them into a more intensive format. This idea has been advocated by Steve Spurling, an Institutional Researcher at City College of San Francisco who has conducted extensive analyses of attrition in the college's developmental sequence. Spurling argues that if CCSF took the existing English sequence -- 5 levels of 3-unit courses -- and changed it to 3 levels of 5-unit courses, overall completion rates for the transfer-level course could be expected to increase from 30% to 55%.

Or perhaps colleges might do a combination of the above ideas: collapse levels of the sequence but build in extra support for lower-scoring students, such as tutoring or an attached lab.

Another possibility: What if, instead of using the placement test, we relied upon students' high school transcripts to determine eligibility for Statistics and directed non-STEM majors who had passed Algebra II to enroll directly into the course?

Perhaps most radically: What if we did away with mandatory pre-requisites that block students from enrolling in college-level courses? Several large-scale studies have shown that students who ignore their developmental placement recommendation, and instead enroll in the college-level course, pass at rates very similar to students who placed directly into the class or went through the developmental sequence.⁶

In Bailey's study of the 57 Achieving the Dream colleges, he found that such students had slightly lower pass rates than other students. However, because they bypassed the attrition of the developmental sequence, they were *significantly* more likely to complete the course. He writes, "About 72% of those who went directly to the college-level course passed that course, while only about 27% of those who complied with their [developmental] referral completed the college-level course."⁷

While most colleges are unlikely to do away with mandatory pre-requisites any time soon, one exciting thing about the state of California is that Title V regulations make it

⁵ <http://faculty.ccbcmd.edu/~padams/ALP/Site%20Folder/alpdescription.html>

⁶ See Jenkins, D., et al. Promoting gatekeeper course success among community college students needing remediation: Findings and recommendations from a Virginia study. Summary report. (November 2009). New York: Community College Research Center. Available at <http://ccrc.tc.columbia.edu/Publication.asp?UID=714> ; see also Bailey (below).

⁷ Bailey, T., et al. Referral, enrollment, and completion of developmental education sequences in community colleges. *Economics of Education Review* (2009), doi: 10.1016/j.jeconedurev.2009.09.002

fairly simple to get experimental courses approved. Though departmental politics can be intractable and issues of turf and territory can block efforts toward curricular change, committed teachers can use experimental courses to carve out space to try new things. This is how Myra Snell created Statpath, and it's how teachers at American River College and San Diego Mesa College are planning their own versions of accelerated developmental English courses in the fall.

Experimental courses provide a toehold, a small wedge into the ossified curriculum from which you can make a case for broader change. That is, as long as you collect compelling data to show that students are really learning. When Myra Snell comes before her department to propose that Statpath become a permanent part of the Los Medanos curriculum, it's going to be hard to argue against it, because she has already amassed such compelling evidence for the program's effectiveness.⁸

While there are many possibilities for rethinking developmental education, significant change will come only if we can step outside the prevailing assumption that multi-level sequences are the best way to support underprepared students for the rigors of college. We will never increase completion rates for College English and Math – and therefore increase the numbers of students becoming eligible for transfer and degrees – unless we shrink the length of our sequences.

As we restructure our sequences, we need to question whether everything we *teach* in developmental courses is what students actually *need* to succeed in college. Developmental classes should provide students the chance to practice, and receive guidance in, the kinds of complex intellectual challenges they will actually see in a good college course. This will require conceptual shifts of us as developmental educators, a willingness to question our own certainties that before a student can do ____, they need to first do _____. Perhaps most of all, we need to catch ourselves when we say a group of students *can't handle* a particular challenge, and use that moment to channel our creativity as teachers toward helping them successfully approach and engage it.

Katie Hern and Myra Snell are interested in collaborating with other faculty, administrators, and researchers on reducing the length of developmental sequences and restructuring the curriculum through backwards design from college-level learning goals. We can be reached at khern@chabotcollege.edu and msnell@losmedanos.edu

⁸ In addition to the data discussed earlier, Snell has created compelling video windows into the classroom, including a 5-minute movie that shows developmental Statpath students discovering an error in the answer key for an item on the national Statistics exam. <http://www.vimeo.com/7186965>

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