

POLICY RESEARCH BRIEF



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ENLACE FLORIDA is a state-wide network promoting college-readiness, access, and success for underrepresented students in Florida.

Opening the Gates to Success in Florida Higher Education

This fall, for the first time in the twelve-year history of the Bright Futures Scholarship Program, any scholarship recipient who withdraws from a class late in the semester will have to pay the full cost of that course. In the past, the scholarship would cover the cost of a class that a student dropped after the early-semester add/drop period. Now, as a result of legislative efforts to reduce the costs of this popular merit-based scholarship, students will incur a substantial financial penalty if they drop a course. For limited-income students who are dependent on a Bright Futures Scholarship, that threat is likely to affect their academic choices. As reporter Catherine Dolinski explained, “A wealthy student facing the prospect of failing a class may not care about the cost of dropping it, but an impoverished student in the same circumstance may feel trapped by the cost and fail the class rather than drop it.” If they fail, their grade point average is likely to drop below the 2.75 minimum GPA required to maintain their Bright Futures Scholarship, leading some limited-income students to drop out of college altogether.¹

Given these financial risks, students should intensify their efforts to pass their courses. At the same time, universities, departments, professors, and graduate assistants must do everything they can to facilitate the success of students who enroll in their classes, particularly those large, introductory courses that must be passed in order for students to fulfill university requirements. These courses, commonly referred to as “Gatekeepers,” typically constitute a significant barrier to success in higher education. Courses like Biology 101 and Chemistry 101 are commonly taken in the first year of college, when students are adjusting to college life and the more rigorous academic demands of higher education. A recent study found that first-year college students are more likely to drop out of college if their gatekeeper courses are taught by part-time adjuncts.²

In our previous report on Student Success Programs at community colleges and universities in the state, ENLACE Florida highlighted the importance of these policies and programs in higher education. Improving student performance in these gatekeeper courses constitutes an important part of a much larger effort to improve graduation and retention rates throughout the

¹ Catherine Dolinski, “Bright Futures covers fewer costs,” *Tampa Tribune*, August 11, 2009.

² David Glenn, “‘Gatekeeper’ Courses Should Not be Assigned to Part-Time Instructors, Research Suggests,” *The Chronicle of Higher Education*, March 27, 2008.

state and nation. ENLACE Florida supports and promotes the “Big Goal” of Lumina Foundation, to raise the percentage of Americans with a high quality higher education degree or certificate from 39% to 60% by 2025. To meet this goal, our colleges and universities must become more productive and efficient. As part of our effort to promote student success in higher education, ENLACE Florida examined State University System (SUS) data on student performance in just one discipline: mathematics. Recognizing that the success of a student in any course is the product of a number of inter-related factors, including the academic preparedness of students, we approached this study fully aware that we would not be able to generate definitive conclusions about the causes of student success or failure in any particular course.

Our analysis revealed that 37% of SUS students enrolled in a Math gatekeeper course in the 2007-08 academic year did not pass. While some professors may argue that this is a reasonable rate of failure in difficult classes, when rates approach 60%, we should all begin to wonder why fewer than four out of every ten students manage to pass a course. It is possible, of course, that six out of ten students in the class simply were not prepared for the higher academic demands of a college-level course. However, this is not a conclusion that should be reached without careful deliberation and analysis. Our intent in this policy brief is to encourage just that, reflection and dialogue on passing rates in mathematics gatekeeper courses. Low passing rates at particular institutions and in specific classes should compel professors, department chairs, and deans to take a comprehensive look at the factors that might contribute to such disappointing rates, such as the class size and structure, curriculum, and the pedagogical methods of the instructor. These days, when so much is at risk for our students—including a substantial financial penalty—we must monitor student performance carefully, and consider any and all means by which we can improve student success in these critical courses.

SURVEY OF STUDENT PERFORMANCE IN MATHEMATICS GATEKEEPER COURSES

Scholars, students, and educators recognize gatekeeper courses by their common characteristics: large enrollments, lecture format, high levels of competition between students, little contact with the professor, and high failure rates. They are most commonly and popularly associated with mathematics and science classes, but introductory courses in English and American history can also be considered gatekeeper courses. Gatekeeper courses have received significant criticisms from students and scholars for a number of reasons, including:

- the lecture format encourages passive learning
- professors often grade students on a curve
- a high premium is often placed on memorizing information rather than thinking critically about concepts
- they are often taught by part-time adjunct faculty
- they are deliberately designed by some faculty to weed-out students³.

To gain a better understanding of gatekeeper courses and their place in student success efforts, ENLACE Florida

³ M. Kevin Eagan Jr., and Audrey J. Jaeger, “Closing the Gate: Part-Time Faculty Instruction in Gatekeeper Courses and First-Year Persistence,” *New Directions for Teaching and Learning*, no. 115 (Fall 2008):

requested student performance data from the Board of Governors of Florida in mathematics gatekeeper courses. The state of Florida requires college students to complete six hours of mathematics coursework at the level of college algebra or higher with at least a grade of C- in order to obtain an Associate of Arts degree or to enter the upper division of a public university or college⁴. The question that inspired and guided our analysis of this data was rather simple: what was the passing rate for students enrolled in a mathematics gatekeeper course in the 2007-2008 academic year? We first identified six mathematics courses that function as gatekeepers. Then, we asked for the passing rates for students in each one of these courses at each of the 10 universities in the SUS. A grade of C- or better was considered a success (or Pass) in a mathematics course. As shown in Table 1 below, College Algebra had the highest enrollment of any mathematics gatekeeper course, and 61% of the 23,388 students who enrolled in that course passed it with a grade of C- or better.

Table 1
Enrollment and Passing Rates in State University System
Mathematics Gatekeeper Courses, 2007-2008

Course Number	Course Name	Annual Enrollment	Pass Rate
Mathematics Courses for Students in a Liberal Arts Track			
MGF1106	Math for Liberal Arts Majors (3 cr)	12,516	63%
MGF1107	Math for Liberal Arts II (3 cr)	5,162	71%
Traditional Track			
MAC1105	Basic College Algebra (3 cr)	23,388	61%
MAC1114	Trigonometry (2 cr)	6,647	65%
MAC1140	Precalculus Algebra (3 cr)	4,031	73%
MAC1147	Precalculus: Algebra and Trigonometry (4 cr)	4,759	68%

Of these gatekeeper courses, two (Mathematics for Liberal Arts Majors and Math for Liberal Arts II) are designed for Students in a Liberal Arts track. The other four courses are designed for students in a Traditional Track for Mathematics, Science, Engineering, and Business Majors. If we analyze student performance in these courses by institution and by academic track (See Figure 1), we observe that the percentage of students who earned a “D,” “F,” or withdrew from the course (DFW rate) was 42%, while the DFW rate for students in the Liberal Arts Track was 35%. The University of Florida (UF) led the state with a 10% DFW rate for students in the Liberal Arts Track, and Florida International University (FIU) posted a 60% DFW rate for students in the Traditional Track, the highest of any SUS institution. An examination of the data per course at each institution reveals similar patterns.

The University of Florida, Florida State (FSU), and the University of Central Florida (UCF) tend to post the lowest DFW rates in the state, while FIU and Florida Atlantic (FAU) tend to post the highest DFW rates. One should also note in the figures that follow that more than 30% of students in some courses withdraw before the end of the semester, a rate that may be impacted significantly now that a Bright Futures Scholarship recipient who drops a class late in the semester will have to pay the full cost of that course.

⁴ Florida State Board of Education Rule Number 6A-10.030 <https://www.flrules.org/gateway/RuleNo.asp?ID=6A-10.030>

Figure 1
DFW Rate for Students in Math Gatekeeper Courses
by Academic Track and Institution, 2007-2008

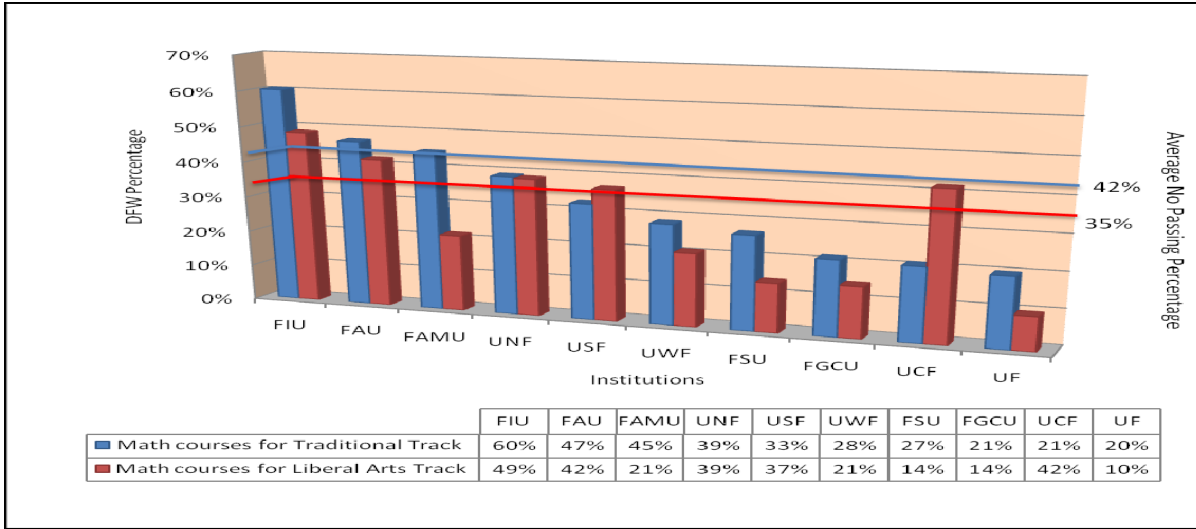


Figure 2
MGF 1106: Mathematics for Liberal Arts Majors, 2007-2008

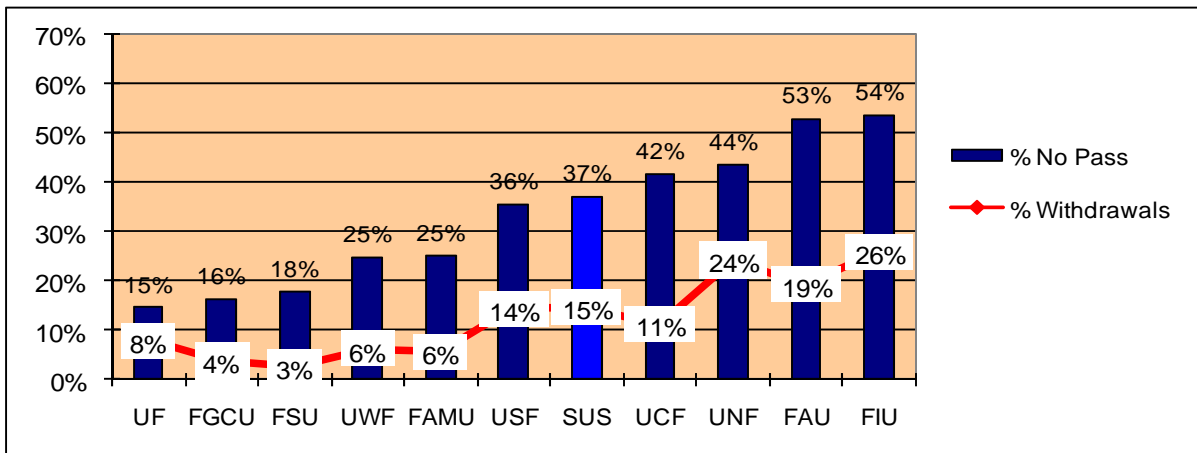


Figure 3
MGF 1107: Mathematics for Liberal Arts II, 2007-2008

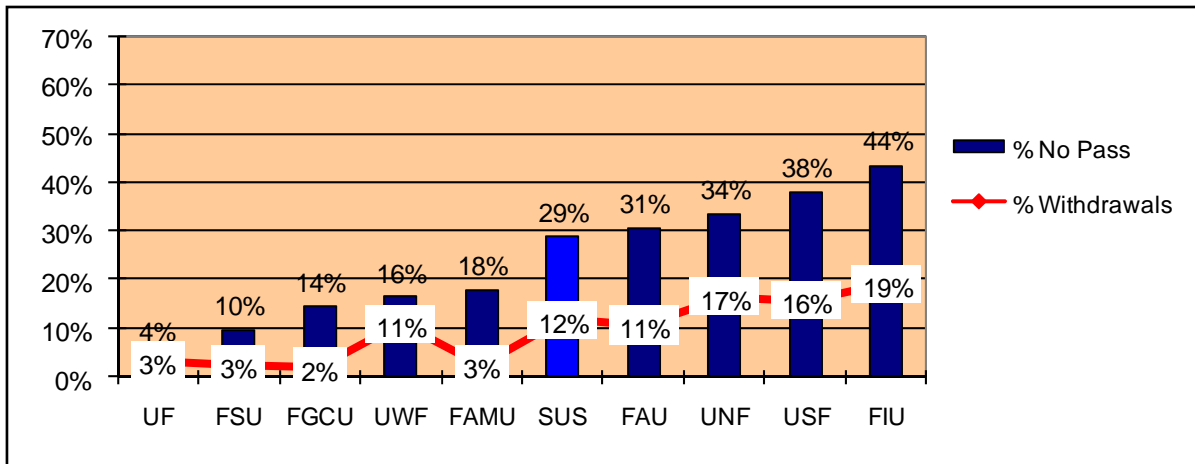


Figure 4
MAC 1105: Basic College Algebra , 2007-2008

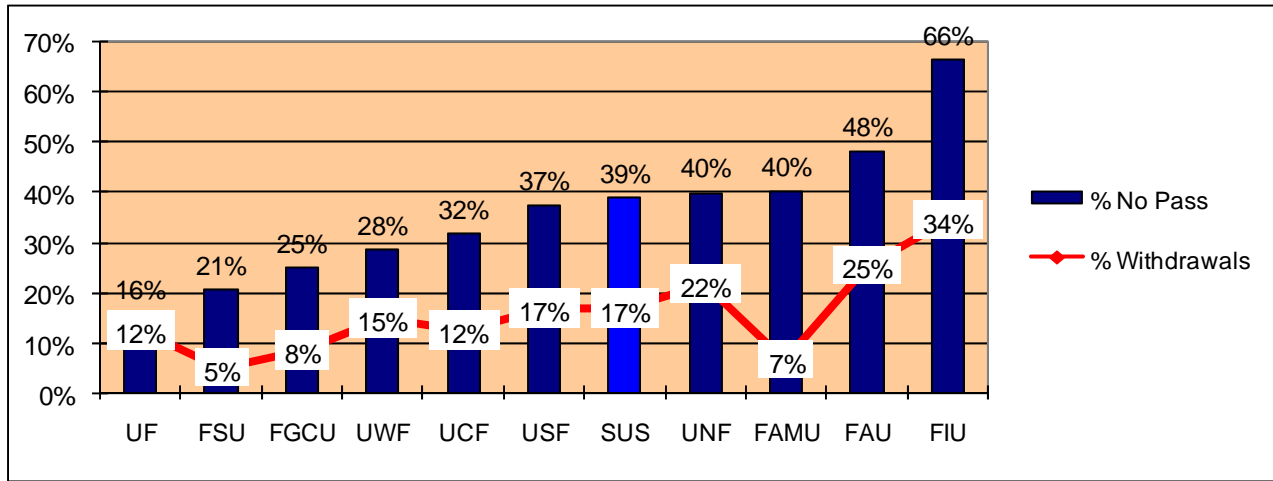


Figure 5
MAC1114: Trigonometry, 2007-2008

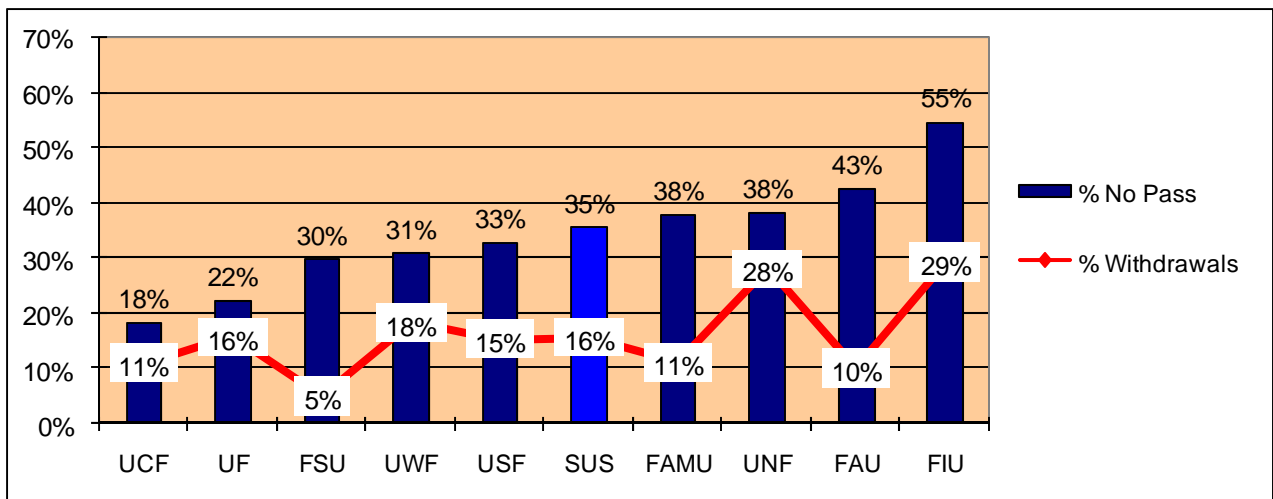


Figure 6
MAC1140 : Pre-Calculus Algebra, 2007-2008

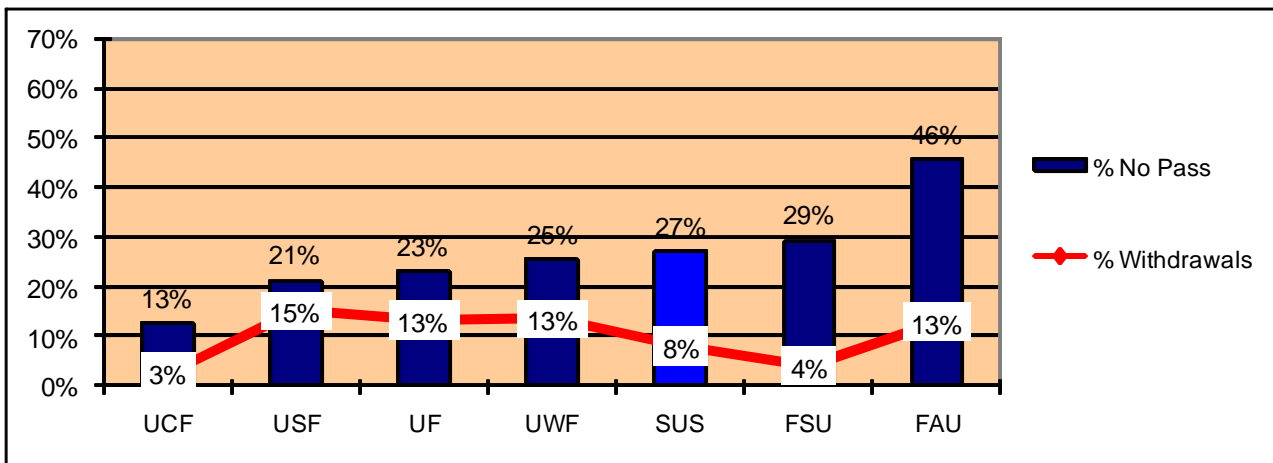
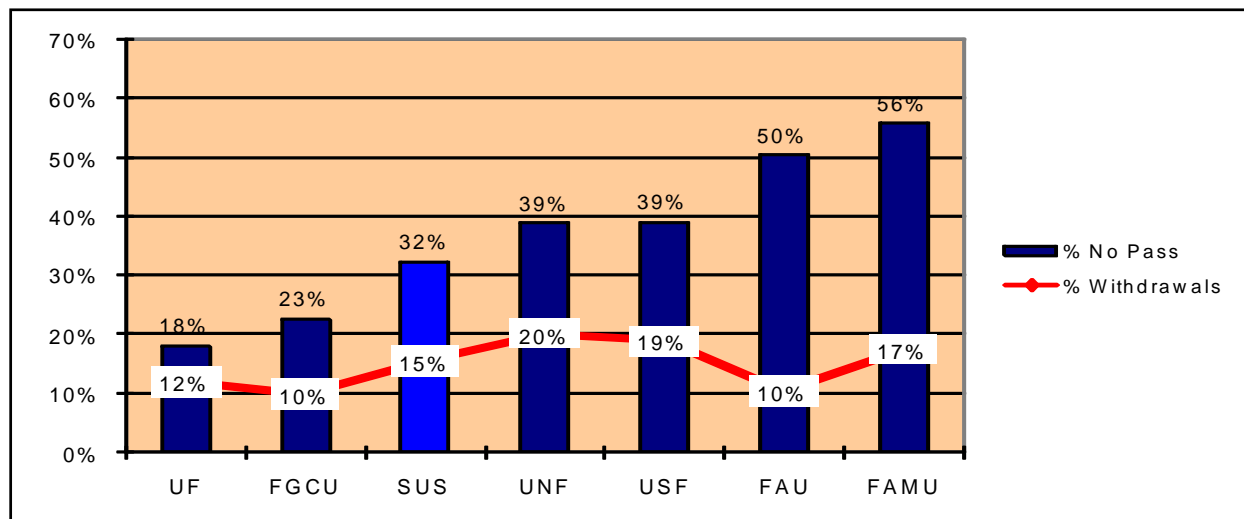


Figure 7
MAC 1147 : Pre-calculus :Algebra and Trigonometry

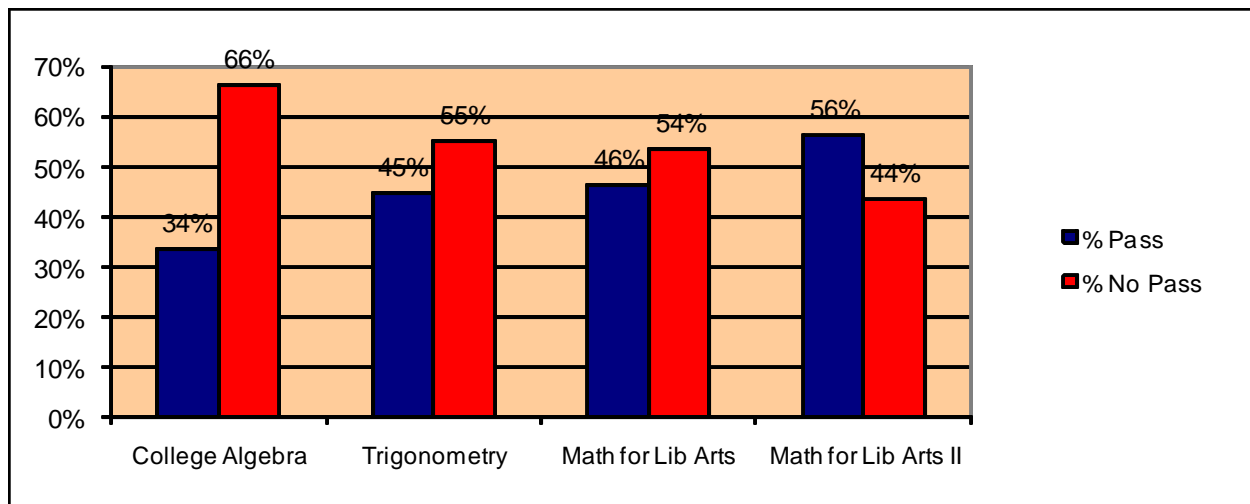


Given that a number of variables contribute to success rates in these particular courses, we hesitate to draw any definitive conclusions about the passing rates in mathematics gatekeeper courses. Our data would not (and was not designed to) substantiate any claim that any particular institution, department, or professor is at fault for high rates of failure in their math gatekeeper courses. We can only express our concern and recommend that math departments, instructors, and support personnel take a closer look at their own experiences very carefully.

To encourage and facilitate independent analysis, we have posted our data base on our web site (www.enlaceflorida.org) and we stand ready to assist research and analysis at any institution. A comprehensive analysis of a particular course or professor would include a careful review of student preparation, test scores, class size and structure, teaching methods, and curriculum by course and professor.

A closer look at FIU reveals that students were more likely not to pass than succeed in College Algebra, Trigonometry, and Math for the Liberal Arts, as shown in Figure 8. The passing rates vary widely per course, but in-depth analysis would be required to identify the critical variables to explain the low success rates in mathematics gatekeeper courses at FIU. Any professor who does not pass one out of every two students should be disappointed in these results and take a close look at his or her teaching style, course structure, assignments, and grading policies. At the same time, high withdrawal rates from these courses may also indicate that students were poorly prepared for these courses. In many cases this may indeed be the cause, but colleges and universities should not just shrug their shoulders and blame high schools for not preparing their students properly. These days, with students assuming a financial risk for withdrawing, colleges and universities should intensify their efforts to ensure that the best academic advising and support services are available to students.

Figure 8
Florida International University Success Rates in Math Courses, 2007-08



In 2003 a team of researchers reported on the persistent problems that students have encountered with mathematics courses at FIU. Similarly high rates of failures among all students, regardless of race, ethnicity, or gender, led the analysts to recommend that professors and administrators examine the “other side” of the teaching-learning equation, namely the instructors. The researchers advised that increased minority retention in higher education may result from shifting the focus away from the “usual suspects” in math failure—that is, student characteristics—to issues of curriculum, teaching, and learning⁵.

BEST PRACTICES IN MATHEMATICS GATEKEEPER COURSES

Fortunately, a number of universities, including FIU, have already begun to revise their curricula and class formats to improve student outcomes. Growing concern about student performance in gateway math classes, FIU applied for and received a \$100,000 3-year grant from the Wal-Mart Foundation to improve gateway math pedagogy through faculty development and peer-led instructional practices for these courses, with a particular emphasis on a historically vulnerable population: first generation students. The grant project just got underway in the Fall 2009 Semester. In addition, the Math Department also adopted a course textbook this term for College Algebra that provides online homework and math support for students, hoping to give them more opportunities for immediate math feedback.

⁵Dora Acherman-Chor, Gerardo Aladro, and Shamita Dutta Gupta, “Looking at Both Sides of the Equation: Do Student Background Variables Explain Math Performance?” *Journal of Hispanic Higher Education*, 2:2 (April 2003), 142.

FIU also initiated an innovative math placement pilot project using a math product called **Assessment and LEarning in Knowledge Spaces (ALEKS)**, a Web-based, artificially intelligent assessment and learning system⁶. ALEKS uses adaptive, free response questions to assess each student individually, pinpointing the student's capabilities more accurately than standardized tests, and adapting subsequent questions to the student's level of proficiency. Entering freshmen are required to take this online placement test before they take the first Math course at FIU. They are notified to take the test before coming to Orientation. This pilot program, which has also been implemented at FAU, distinguishes between forgotten and unlearned knowledge, and includes prep and remediation products.

Although the University of Central Florida has done relatively well in its math gatekeeper courses, the math department has also initiated significant reforms. In the fall of 2006, 35% of UCF students enrolled in College Algebra failed to pass the course. Persuaded that it could do better than that, UCF redesigned its College Algebra courses using the Emporium Model, designed to create a student-centered learning environment in which students are active learners. Students are required to spend at least three hours per week in a computer lab staffed by graduate assistants, undergraduate teaching assistants, and peer tutors. Students have a face-to-face meeting each week with the course coordinator to discuss areas of difficulty and address any problems that the students may experience. The redesigned courses also incorporate the use of new learning software, *MyMathLab*, providing videos, worked examples, quizzes and practice tests with automated feedback, and homework assignments and tests.

The course redesign has already produced positive results. For instance, the student success rate in the redesigned sections was 74% in 2008, up from 65% prior to course redesign. Moreover, the redesigned sections had a withdrawal rate of only 7.25%, compared to the 8.4% prior to redesign. Encouraged by these results, professors have begun to consider redesigning other mathematics courses. Best of all, the redesign reduced the cost-per-student from \$77 to \$44, savings that will be used by the department to offer additional math courses⁷.

Universities can also support departmental efforts to improve student performance in gatekeeper courses by offering supplemental instruction (SI) to students. The Center for Academic Achievement at Florida Gulf Coast University (FGCU), for example, provides SI services to students enrolled in historically difficult courses (in which 1/3 or more of the students typically earn a D, F, or withdraw). In the fall 2009 semester, the Center offers supplemental instruction at regularly scheduled hours for 14 different courses, 7 in science, 4 in mathematics, 1 in economics, 1 in psychology, and 1 in Business Finance. The SI sessions are aligned with the schedule of the class and are facilitated by model undergraduate students who have already taken the course. The student leaders facilitate group discussions and brainstorming efforts to increase understanding of the course material. They also provide students with facilitating tips such as better study techniques, note taking methods, exam preparation, time management, and other academic skills critical for success.

⁶For more information about ALEKS, go to: www.aleks.com/.

⁷http://www.center.rpi.edu/RedesignAlliance/C2R/R2/UCF_Abstract.htm

Research has shown that SI—at FGCU and elsewhere—contributes to higher retention and graduation rates as well as better GPA's. In fact, the Center for Academic Achievement at FGCU claims that “students who regularly attend SI sessions (as well as attend class and complete assignments) have been found to improve their class performance by a full grade!”⁸ While we cannot confirm the accuracy of this claim, supplemental instruction has become a critically important component of student success programs at FGCU, UCF, FSU, and other institutions around the country.

POLICY IMPLICATIONS

Gatekeeper courses may be a fact of life in the SUS and they are likely to remain a constant in the university curriculum for many years. That does not mean, however, that gatekeeper courses must be taught in the same way, using the same curricula and teaching methods. Innovative practices in Florida and around the country have already demonstrated that passing rates in gatekeeper courses can be improved by reforming the class structure, offering supplemental instruction, and strengthening student support services. The failure to pass a gatekeeper course does not reside entirely with the student. Professors, departments, and higher academic officials at colleges and universities also have an obligation—including ethical responsibilities—to facilitate the learning and success of every single student who walks into any university classroom.

Colleges and universities have an obligation to themselves and to their students to open the gates of these gatekeeper courses as wide as possible to maximize the opportunities for each student in that classroom to succeed. High DFW rates will only increase student waiting lists for courses and increase student demand for additional support services, such as tutoring and supplemental instruction. The cost to the student can be so high as to force a student to postpone or abandon any dreams of earning a college degree. If a student's academic progress is delayed by dropping or not passing just one course per semester for his or her first three years, the student will have to enroll for at least one additional year to earn a degree, at a total cost of well over \$16,000. The more immediate cost to students in Florida is staggering. In the 2007-08 academic year, 20,210 students did not receive a passing grade in one of the six math gatekeeper courses analyzed this study. At an average price per 3-hour credit course about \$394.77, the cost incurred by these students for having to retake the course was about \$8 million! Unfortunately, with the burden of financing higher education shifting overwhelming to students and their families, many limited-income students will have to cover these expenses on their own.

Any strategic campaign to improve student success rates in higher education should include a careful review of all policies and programs affecting student performance in gatekeeper courses, including financial aid. Universities do not have to wait for a change in state policy, however, to enhance student success at their institutions. To reach the “Big Goal” of increasing the percentage of Americans with a higher education degree to 60%, students, families, professors, administrators, and support staff will all have to do their part. Improving student performance in gatekeeper courses is but one small component of a complex problem that will require coordinated efforts in a number of related fields. In

⁸ Florida Gulf Coast University, Center for Academic Achievement, <http://www.fgcu.edu/CAA/si.html>

some particular cases, gatekeeper courses may constitute an unfair barrier to student success in higher education. Colleges and universities can improve student performance by taking a number of steps, including:

- Conducting an in-depth examination of student performance in traditional gatekeeper courses, combining student grades with other factors, such as student evaluations of the course and instructor;
- Initiating course redesign in gatekeeper courses that have high DFW rates, recognizing that some universities have initiated such redesigns when DFW rates were above 35%;
- Providing professional development support for faculty as part of the redesign effort, with a particular emphasis on the means by which these traditionally passive-learning gatekeeper courses can incorporate more active learning design elements;
- Providing more staff and budgetary support for student support services that include supplemental instruction as part of a larger student success strategy;
- Collaborate with and support efforts to define college readiness standards and align the high school curriculum with course expectations at colleges and universities.

Even if colleges and universities redesign their gatekeeper courses, offer a full and effective array of student support services, institutionalize and promote innovative teaching practices, and create a student-centered learning environment, the primary responsibility for completing the work will remain with the student. Colleges and universities should only be expected to offer the best possible instructional services and facilities to their students. With DFW rates as high as 65% in some mathematics gatekeeper courses in the SUS, students and their families will find it difficult to believe that they cannot do a better job in mathematics gatekeeper courses.

ENLACE FLORIDA is a statewide network promoting college readiness, access, and success for Latinos, African-Americans, and other underrepresented students in Florida through non-partisan research, communication, advocacy, and support. The views expressed in this Policy Brief were developed independently and do not reflect the opinions of the universities with which the Leadership Team and staff are affiliated.



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