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# Accelerating Students Successfully through Developmental and College-Level Mathematics and Embracing Co-Requisite Models: An 8-week + 8-week Model

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## Abstract

We describe the framework, supports, successes, challenges, goals, and next steps for a Texas four-year public university's accelerated and co-requisite 8-week + 8-week course model for developmental mathematics students. Through this model, these students can successfully complete both their developmental mathematics and subsequent college-level core mathematics course in the same 16-week semester. The university's award-winning Supplemental Instruction (SI) Program, Center for Mathematics and Statistics Support tutoring lab, and the Gator Success Center all play a major role in supporting this model and contributing to student success. The model also contributes to the goals of the Texas Higher Education Strategic Plan (60x30TX) and is compliant with Texas HB 2223, which requires all Texas institutions of higher education to design and implement co-requisite models for its developmental students. Enhancement of this model, along with essential supports such as monitoring, mentoring, advising, counseling, and tutoring, has enabled the university to continue to provide its first-time-in-college (FTIC) developmental student population with confidence to earn credits in college-level courses and graduate more quickly and with marketable skills-based degrees, as well as contribute to the university's FTIC retention and 6-year graduation rates.

*Keywords: developmental mathematics, acceleration, co-requisites, 60x30TX, Texas HB 2223, supplemental instruction*

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## 1 Introduction

Many two-year community colleges, as well as some four-year universities, offer courses in developmental mathematics or English (integrated reading and writing) for its underprepared students. One must complete these courses before enrolling in college-level credit bearing courses in that subject. Such a remediation process may involve a sequence of as many as three courses, and unfortunately often take students one or two years to complete. An analysis by Attewell, Lavin, Domina, and Levey (2006) of data obtained by the National Education Longitudinal Study (NELS:88) reveals that 44% of community college students surveyed enrolled in one to three developmental courses, while 14% enrolled in more than three. For students at "nonselective" four-year colleges, 26% enrolled in one to three developmental courses, and 5% enrolled in more than three. Bailey, Jeong, and Cho (2010) found that while more than one-half of students in community colleges enroll in at least one developmental education course, less than one-half of them successfully complete the courses necessary for them to become college-ready. This same study indicates that only 37% of developmental reading students and only 20% of developmental mathematics students were able to complete their developmental

course sequence and pass the subsequent college-level course within three years. The cost of such failures can be detrimental to students, both financially and psychologically. To help facilitate a faster path to college-level coursework, several colleges and universities have implemented accelerated developmental education models, whereby students enroll in both a developmental and college-level course in the same subject area in the same semester. Such models may be sequential (i.e., an 8-week developmental followed by an 8-week college-level course, or a 4-week developmental followed by a 12-week college-level course) during a single 16-week semester, or concurrent, with students enrolled in two 16-week courses of the same subject area (one developmental and one college-level) during the same semester.

Jaggars, Hodara, Cho, and Xu (2015) analyzed three different accelerated developmental education programs: 1) "FastStart" Math at the Community College of Denver; 2) an acceleration program in reading and writing at Chabot College in California; and 3) the Accelerated Learning Program, or "ALP", in developmental writing at the Community College of Baltimore County. Students in these programs were more likely to successfully complete their developmental course sequence and the subsequent college-level course within three years. Three ingredients integral to student success were the implementation of structured and rigorous

course content, the adoption of professional development for instructors, and the presence of “academic and affective supports” for students in these courses, such as a paired student success course or onsite learning community (Jaggars, et al., 2015). A qualitative analysis by Walker (2015) reports that faculty teaching accelerated developmental education courses found the experience particularly positive and rewarding, citing increased student success and “stronger rapport with students”, and that teaching accelerated courses may “result in newfound faculty perspectives on developmental education reform, effective pedagogical strategies, and student ability” (Walker, 2015).

Accelerating developmental education has potential benefits and risks for its stakeholders. Accelerated course models provide fewer opportunities for students to “drop out”, by minimizing the weeks, months, and years that students can spend in such courses. Another positive consequence of accelerated models is that developmental and college-level courses can become more closely aligned with each other in terms of curricular content. Nevertheless, despite numerous examples of success of these models, there remain fears and concerns that acceleration for already struggling students will actually increase their chances of failing college-level courses, by not providing adequate time for remediation of students’ academic weaknesses (Jaggars, Edgecombe, & Stacey, 2014). Commitments to success in accelerated and co-requisite developmental education must be made to best serve underprepared students. The University of Houston-Downtown (UHD) in Texas has made such a commitment.

## 2 60x30TX and UHD

The goals of the recently adopted 2015-2030 Texas Higher Education Strategic Plan (60x30TX) state that by 2030, at least 60% of Texans ages 25-34 will have a certificate or degree, and at least 550,000 students in that year will complete a certificate or degree from a Texas institution of higher education. In addition, graduates will complete programs with identified marketable skills, and undergraduate student loan debt will not exceed 60% of first-year wages (Texas Higher Education Coordinating Board, 2017). While ambitious, these goals set Texas on a course to becoming one of the highest achieving states in the country.

The University of Houston-Downtown, a four-year public university in Texas and one of four universities in the University of Houston system, embraces the challenges in contributing to the goals of the 60x30TX Plan. According to its vision statement, UHD will be a “premier city university engaging every student in high-impact educational experiences and ensuring that students graduate with 21st century skills” (“About UHD: Mission and Vision”, n.d.). With a student body reflecting the diversity of the greater Houston area, UHD has a teaching mission that emphasizes the inclusiveness and education of underrepresented minority populations. About 70% of its approximately 15,000 students are either Black or Hispanic. A large majority of UHD’s freshman cohorts are first-generation college students, and many receive Pell grants. In addition to its credit-bearing courses, UHD offers two levels of developmental mathematics (MATH 0300: Beginning Algebra and MATH 1300: Intermediate Algebra) and one level of developmental English (ENG 1300: Fundamentals of English (Integrated Reading and Writing) for its underprepared students. While the number of developmental students at UHD has recently declined, particularly in mathematics (see Fig. 1), nearly one-fifth of UHD’s incoming freshman class continues to require developmental coursework. The success of these students is vital to meeting our university’s strategic plan goals for its FTIC 1-year retention rate and FTIC 6-year graduation rate. UHD currently faces a 73% 1-year retention rate and a 29% 6-year graduation rate for its FTIC students (“About UHD: Student

Success”, n.d.). While these rates have increased significantly in recent years, there is still much work to do.

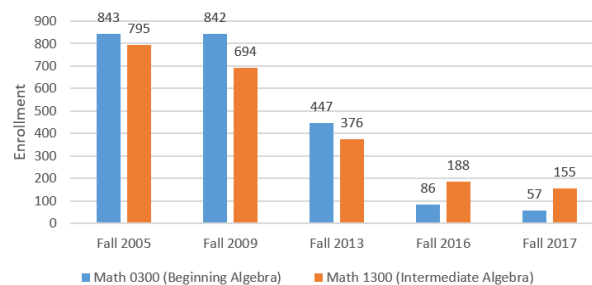


Fig. 1. Enrollment in developmental mathematics at UHD since 2005

## 3 Evolution of an Acceleration/Co-requisite Model for Developmental Mathematics at UHD

In Fall 2014, UHD piloted a developmental mathematics acceleration model after participating in the John N. Gardner Foundation’s Gateways to Completion Program, which strives to improve student outcomes in gateway courses. In August 2016, the Texas Higher Education Coordinating Board (THECB) awarded UHD a two-year Comprehensive College Readiness and Success Models for 60x30TX Acceleration grant (CRSM-2016), with a 6-month no-cost extension through the Fall 2018 semester. This grant supported the continued scaling and enhancement of this acceleration model, and increase the number of developmental mathematics students successfully completing both a developmental and credit-bearing mathematics course in the same 16-week semester (Texas Higher Education Coordinating Board, n.d.). In August 2018, UHD received another Comprehensive College Readiness and Success Models for 60x30TX grant (CRSM-2018) from THECB, which funded the transition from our pre-requisite 8-week + 8-week sequential model to a co-requisite 8 week + 8-week sequential model, after Texas HB 2223 took effect in Fall 2018. Texas HB 2223 requires that all Texas public institutions of higher education with underprepared students develop and implement co-requisite models for developmental education, either sequential or concurrent. In Fall 2018, at least 25% of an institution’s students enrolled in developmental coursework in a particular subject area (mathematics or English) needed to be enrolled in a co-requisite model each semester. In Fall 2019, this required percentage increased to 50%, and for Fall 2020 and beyond, it has increased again to 75%. In addition, the number of state-funded Semester Credit Hours (SCH) per student at community and technical colleges has been reduced from 27 to 18, and at 4-year universities from 18 to 9, also effective Fall 2018 (Texas Higher Education Coordinating Board, 2018).

Prior to Fall 2018, UHD students were required to pass a developmental mathematics course during the first 8-week partial term as a pre-requisite in order to be eligible to take either another developmental or a credit-bearing mathematics course in the second 8-week partial term. In UHD’s current co-requisite model, a student co-enrolls in both a developmental mathematics course in the first 8-week partial term and a credit-bearing core mathematics course in the second 8-week partial term, depending on his/her declared major field of study. Unlike in the pre-requisite model, a student in the co-requisite model cannot be dropped or prevented from taking the credit-bearing course, regardless of his/her performance in the developmental course. Co-requisite course pairs are Beginning Algebra & Contemporary Mathematics (for humanities majors), Be-

ginning Algebra & Statistical Literacy (for social science majors), Intermediate Algebra & College Algebra (for STEM and education majors), and Intermediate Algebra & Math for Business and Social Sciences (for business majors; beginning in Fall 2020). STEM, education, and business majors placing into Beginning Algebra will often take a 16-week developmental course in their first semester, followed by an Intermediate Algebra & College Algebra co-requisite pair of courses in their second semester. However, as of Spring 2021, 100% of developmental mathematics students will be required to enroll in one of the co-requisite course pairs described above. In these accelerated 8-week courses, students meet four days a week for 75 minutes each class period -- the same total number of hours as for a full 16-week semester course. Courses within each pair are taught by the same instructor to provide optimum continuity from the first 8-week course to the second 8-week course. Each pair of courses is also supported by a Supplemental Instruction (SI) Leader, a peer tutor who attends each class and is also available for tutoring sessions and exam reviews. Class sizes are generally small, with approximately 30 to 40 students per section.

## 4 Success of the Model

### 4.1 Early Success

Table 1 and Table 2 illustrate the substantial early impact of the piloted model on student success (i.e., % of students earning a grade of A, B, or C) in our accelerated developmental sections of Beginning Algebra (first implemented in Spring 2015) and Intermediate Algebra (first implemented in Fall 2014) through Spring 2016, respectively.

Table 1. MATH 0300 Beginning Algebra ABC rates, Fall 2013 to Spring 2016

	ABC acc	ABC non-acc	ABC total		ABC acc	ABC non-acc	ABC total
F '13	n/a	54%	54%	Sp '14	n/a	29%	29%
F '14	n/a	38%	38%	Sp '15	61%	29%	42%
F '15	72%	57%	66%	Sp '16	63%	33%	52%

Table 2. MATH 1300 Intermediate Algebra ABC rates, Fall 2013 to Spring 2016

	ABC acc	ABC non-acc	ABC total		ABC acc	ABC non-acc	ABC total
F '13	n/a	49%	49%	Sp '14	n/a	41%	41%
F '14	100%	50%	57%	Sp '15	57%	39%	41%
F '15	87%	60%	70%	Sp '16	76%	58%	64%

### 4.2 Continued Success

Since receiving the CRSM-2016 and CRSM-2018 for 60x30TX grants from THECB, UHD has continued to steadily increase the percentage and/or number of developmental mathematics students enrolled in accelerated and co-requisite sections from fall to fall and from spring to spring (see Table 3).

Table 3. % Enrollment in Accelerated/Co-requisite Math Sections (8-week + 8-week), Fall 2016 to Spring 2020

	% in accelerated or co-req sections			% in accelerated or co-req. sections	
F '16	45%	(108/238)	Sp '17	31%	(26/84)
F '17	78%	(148/190)	Sp '18	61%	(31/51)
F '18	85%	(134/157)	Sp '19	100%	(47/47)
F '19	81%	(171/211)	Sp '20	73%	(106/146)

The model also continues to make a substantial impact on student success in accelerated and co-requisite sections of developmental and credit-bearing mathematics courses. Table 4 compares semester ABC rates for accelerated and co-requisite developmental mathematics sections to ABC rates for all sections of these courses since the Fall 2016 semester. Table 5 and Table 6 show a similar comparison for credit-bearing courses. In most semesters, students in accelerated and co-requisite sections of developmental and credit-bearing courses show a higher rate (and in some semesters, a significantly higher rate) of student success.

Table 4. MATH 0300 Beginning Algebra & MATH 1300 Intermediate Algebra ABC rates, Fall 2016 to Spring 2020

	ABC 0300 acc/co-req	ABC 0300 total	ABC 1300 acc/co-req	ABC 1300 total		ABC 0300 acc/co-req	ABC 0300 total	ABC 1300 acc/co-req	ABC 1300 total
F '16	81%	69%	82%	66%	Sp '17	61%	64%	75%	54%
F '17	89%	79%	81%	71%	Sp '18	83%	83%	79%	64%
F '18	69%	69%	76%	76%	Sp '19	60%	60%	72%	72%
F '19	81%	67%	89%	89%	Sp '20	88%	82%	85%	85%

Table 5. MATH 1310 Contemporary Mathematics & MATH 1301 College Algebra ABC rates, Fall 2016 to Spring 2020

	ABC 1310 acc/co-req	ABC 1310 total	ABC 1301 acc/co-req	ABC 1301 total		ABC 1310 acc/co-req	ABC 1310 total	ABC 1301 acc/co-req	ABC 1301 total
F '16	80%	65%	62%	61%	Sp '17	78%	65%	41%	49%
F '17	59%	63%	69%	67%	Sp '18	78%	63%	81%	48%
F '18	70%	63%	51%	60%	Sp '19	50%	57%	46%	54%
F '19	79%	64%	58%	60%	Sp '20	74%	66%	81%	61%

Table 6. STAT 1312 Statistical Literacy ABC rates, Fall 2016 to Spring 2020

	ABC 1312 acc/co-req	ABC 1312 total		ABC 1312 acc/co-req	ABC 1312 total
F '16	n/a	70%	Sp '17	n/a	53%
F '17	n/a	75%	Sp '18	n/a	62%
F '18	64%	57%	Sp '19	n/a	45%
F '19	94%	75%	Sp '20	89%	54%

Instructors teaching accelerated and co-requisite math sections also continue to observe and report increased levels of engagement in the classroom, and a greater sense of community among students, Supplemental Instruction leader, and instructor. As part of the CRSM-2016 and CRSM-

2018 for 60x30TX grants from THECB, UHD received additional “Completion” funding for each developmental mathematics student who successfully completed a credit-bearing course (with a grade of A, B, or C) during that semester. **Table 7** shows the number of Completions earned by UHD developmental mathematics students from Fall 2016 through Spring 2020. Next to each number of Completions is the percentage of developmental mathematics students enrolled in accelerated and co-requisite sections that earned a Completion in that semester. We see an overall improvement over time in both statistics, from fall to fall and from spring to spring.

**Table 7.** Number of CRSM 60x30TX grant Completions by UHD students, Fall 2016 to Spring 2020

	# and % Completions		# and % Completions
F '16	43 (40%)	Sp '17	8 (31%)
F '17	72 (49%)	Sp '18	19 (61%)
F '18	74 (55%)	Sp '19	22 (47%)
F '19	104 (61%)	Sp '20	82 (77%)

### 5 Supplemental Instruction (SI)

As mentioned above, students in accelerated and co-requisite mathematics sections at UHD are supported by a Supplemental Instruction (SI) Leader, an undergraduate peer tutor who attends each class and is available outside of class for tutoring sessions and exam reviews. SI is an academic support program that was first developed at the University of Missouri-Kansas City over 40 years ago. At UHD, the mission of the SI Program is to “improve student comprehension, content mastery, and critical thinking skills through collaborative, peer-facilitated group study sessions... to improve the individual performance of undergraduate students in order to create a positive impact on institutional retention and graduation rates” (“UHD Supplemental Instruction Program”, n.d.). Altomare and Moreno-Gongora (2018) showed that for each semester from Fall 2015 through Spring 2018, ABC rates in both Beginning Algebra and Intermediate Algebra were higher for developmental mathematics students who participated in SI than for those that did not. Students in accelerated sections of Intermediate Algebra with SI also exhibited higher ABC rates than students in sections of the course without SI. Based on these findings and the overall success of the UHD’s Supplemental Instruction Program, SI will continue to be an integral student support component of UHD’s developmental mathematics co-requisite model.

### 6 UHD’s New ALP Co-requisite Model for Developmental English (IRW)

Beginning in the Fall 2018 semester, all UHD students qualifying for developmental coursework in reading and/or writing are concurrently enrolled in both the developmental course ENG 1300 (Fundamentals of English: Integrated Reading and Writing) and one of two credit-bearing courses: ENG 1301 (Composition I) or HIST 1305 (United States History to 1877). This concurrent model is based on the Accelerated Learning Program (ALP) model implemented at more than 300 institutions across the United States (“ALP: Accelerated Learning Program”, n.d.). For students

enrolled concurrently in ENG 1300 and ENG 1301, the same faculty member teaches both courses in order to provide optimal continuity. For students enrolled concurrently in ENG 1300 and HIST 1305, English and history faculty collaborate to ensure that learning outcomes and objectives of both the developmental and credit-bearing courses are met, while using the reading materials and writing assignments for HIST 1305 in both courses. Graduate students enrolled in UHD’s Master of Arts in Rhetoric and Composition (MARC) degree program are hired to work as Writing Associates (WAs) for these co-requisite pairs of courses. WAs are trained in developmental reading and writing pedagogy, attend each class, are available outside of class for tutoring sessions, and provide written feedback on writing assignments as well as additional support and encouragement for developmental students. In Fall 2018, 47 students successfully completed their developmental English and college-level English or history co-requisites in the same semester, and 48 students did so in Fall 2019. (There were no developmental English students enrolled in co-requisite courses in Spring 2019). Effective Spring 2020, the ENG 1300/HIST 1305 co-requisite option has been discontinued, only the ENG 1300/ENG 1301 pairs of co-requisite courses will continue to be offered. In the Spring 2020 semester, 15 students qualified for the ENG 1300/ENG 1301 concurrent co-requisite model. For Fall 2020, the ENG 1300/ENG 1301 co-requisite courses will be offered online, in a sequential 8-week + 8-week model similar to that of UHD’s mathematics co-requisite model.

### 7 Future Goals and Impact

With the arrival of Texas HB 2223, and co-requisite models for both developmental mathematics students and developmental English students in place, what is the future of developmental education – specifically, accelerated developmental education – at UHD? UHD’s goals for co-requisite developmental education encompass three interconnected categories: 1) intrusive/proactive student advising; 2) faculty professional development; and 3) student academic performance and retention. UHD mathematics and English faculty will continue to work with the UHD Advising Center to ensure that students are correctly placed in appropriate co-requisite course sections based on students’ proposed majors and/or academic qualifications upon matriculation at the university, and also ensure that 100% of UHD’s developmental students in each subject area will be enrolled in co-requisite models, beginning in Spring 2021. UHD faculty teaching co-requisite courses in mathematics and English will continue to engage in professional development initiatives sponsored by the university’s Center for Teaching and Learning Excellence. Such initiatives include “Teaching Circles”, which establish a community of practice of faculty within a discipline or across multiple disciplines, and “Course Innovation Initiatives”, which involve course redesign and redevelopment. In addition, faculty will enroll and participate in workshops on effective online teaching offered by the Online Learning Consortium and Quality Matters, given the current pandemic of COVID-19 and the resulting transition of many courses to online. We will also focus on instructional best practices specifically targeted for students in accelerated and co-requisite courses, including use of technology such as iPads, graphing calculators or graphing calculator software such as DESMOS, Learning Catalytics (an interactive student response tool included with Pearson’s MyLab Math access), screencasting software (e.g., Camtasia), and social annotation tools (e.g., Perusall and Hypothes.is). Faculty have been encouraged to integrate

the discipline-appropriate Texas College and Career Readiness Standards (Mathematics or English/Language Arts) as much as possible into their teaching (Texas Higher Education Coordinating Board & Texas Education Agency, n.d.). All of this professional development is designed to improve and provide consistency in instructional delivery across all accelerated and co-requisite course sections within each discipline. As a final and all-encompassing goal, increased student academic performance and retention is of the utmost importance. In addition to providing students with high-quality instruction and every opportunity to succeed in the classroom, UHD continues to provide students with consistent encouragement and support outside the classroom as well. Such support will come from Supplemental Instruction Leaders in mathematics courses and Writing Associates in English courses, and also through free tutoring available in-person and online through at UHD's Academic Support Center, which houses the Center for Mathematics and Statistics Support and the Writing and Reading Center. UHD's Gator Success Center, staffed with undergraduate students as Academic Coaches, is yet another source of support for students, providing them with assistance in developing skills such as time management, note-taking, student-specific learning strategies, and more ("Gator Success Center", n.d.).

## 8 Conclusion

Sustained and increased progress achieved by UHD's accelerated and co-requisite sequential model for developmental mathematics since its early pilot in 2014 indicates continued success in the future. UHD's new concurrent co-requisite model for developmental English shows similar promise for success. Both are sustainable and scalable, predominantly involve support services and resources already in place at the university, and should be intriguing to other community colleges and universities seeking to implement inexpensive yet effective co-requisite model options for their developmental students. Continued enhancement of these models, in compliance with Texas HB 2223, along with essential supports such as monitoring, mentoring, advising, counseling, and tutoring, has enabled and will continue to enable the university to provide its FTIC developmental student population with confidence to earn credits in college-level courses and graduate more quickly and with marketable skills-based degrees, as well as contribute to the university's FTIC retention and 6-year graduation rates.

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*Conflict of Interest:* none declared.

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