Mathematical Bridges to Student Success

Increasing Mathematics Skills through Collaborative Bridge and Mentoring Programs

Proposal Simulation to the National Science Foundation

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Executive Summary

Basic mathematics skills are essential to academic success through secondary school and into college. Because academically at-risk, minority students often leave urban public schools with deficiencies in these areas, many require extensive remediation in basic mathematical skills when they reach college. Union County College serves students from low income, urban areas in Union County, NJ. Students from these communities must complete one or a series of remedial or developmental mathematics foundation courses before progressing to courses carrying college credit. Frequently, this student population fails to pass developmental courses on the first attempt. This academically at-risk, underserved student population is often inclined to abandon their dream of a college education and drop out of college before their actual post-secondary education even begins. Moreover, students from urban areas frequently lack the emotional support, positive roll models, and resulting motivation to persist in their education.

There is a great need for the provision of supplementary support to students from poverty-stricken urban areas of Union County. This proposal will outline a two-tiered support plan to increase the academic success of students from Elizabeth, New Jersey. Initially, Union County College (UCC), in conjunction with Elizabeth High School (EHS) and New Jersey Institute of Technology (NJIT) will implement a bridge program to support EHS students through their senior year of high school and into their first year at UCC. The program will enable members from these partner institutions to work collaboratively to execute a series of intensive 3-week mathematics programs in basic mathematics skills during the summer between the junior and senior years of high school. Conducted on the Elizabeth campus of UCC, these summer programs will provide pre testing in computation and algebra skills with subsequent placement into appropriate three-week emersion courses, taught by UCC mathematics faculty, to review and regain basic mathematical skills in preparation for college. The intensive workshops will incorporate a traditional lecture format supplemented with computer-aided instruction to provide

individualized, focused training to each student. Additionally, academic mentors from mathematics science programs at NJIT will work with EHS students in and out of the classroom. These trained, academically successful student mentors will provide motivational support and academic tutoring to EHS students. Mentors will incorporate on-line technology into the program for enhanced support and assessment.

The second tier of the plan occurs in the following academic year. Students completing the intensive summer program will receive scholarships covering tuition and books to attend UCC during their senior year of high school. Depending on placement testing, students will take progressive preparatory developmental mathematics courses, or college level courses through the college's bridge program. Students have the opportunity to utilize existing agreements with UCC and EHS to earn high school credit while attending UCC in their senior year. NJIT student mentors will continue to meet with EHS students to provide motivational support and academic tutoring throughout the academic year to ensure success in the bridge program.

The two tiers of this proposal support separate objectives. The first objective is to motivate, support and encourage students to learn or relearn basic mathematical skills in preparation for college. The second is to provide the opportunity for students to gain success early in their college career through the existing bridge program while receiving financial assistance and intensive academic support. This proposal will outline the background of need, plan of action, plan for assessment, timeline and budget for a funding request of $870,000.00 to serve and follow a cohort of 150 students over three years.

Background

The under preparedness of high school students entering community college is a pervasive problem. Nationwide, only 70% of students entering high school will actually graduate (Paying). Of students who do earn a high school diploma, some 60-70% test into remedial mathematics courses in their first year of college. As a result, 97% of public 2-year colleges offered mathematics remediation in 2000. Students who take remedial courses in mathematics typically have a lower than 50% passing rate on the first attempt of these basic, preparatory courses. (Trenholm). The statistics become even more dismal for urban minority students. Seventy-five percent of Black and Hispanic students entering community college require remediation in basic mathematics compared to 55% of their white counterparts (Bettinger). This reality negatively influences the likelihood of minority students entering fields in mathematical sciences. In fact, of minority students nationwide, only 4% possess the mathematical skills to apply directly to college engineering programs. Of those admitted, 61% leave the programs before graduation (McNeil).

Urban students attending Union County College are no exception. As the oldest community college in New Jersey, UCC is a public college serving the greater Newark metropolitan region. The college is comprised of four campuses: Cranford, Elizabeth, Plainfield and Scotch Plains. Each campus serves an increasingly academically at-risk population from surrounding urban communities. In an institutional report from fall 2004 to spring 2006, UCC's Office of Assessment, Planning and Research reported 778 students requiring remediation in mathematical computation and 775 in elementary algebra. These students represented an average of 80% of the incoming student population. Of this sample, only 48% were successful in remedial mathematical computation and just 15% were successful in remedial algebra (Appendix A).

Remedial courses typically add one year to the expected time required to complete a two-year degree. It is not surprising, given the failure rate in remedial courses,

that graduation rates at UCC are very low. The average three-year graduation rate of students beginning in the fall semester of 2003 at UCC was 5.6%. This is an alarming statistic, but even more troubling when viewed from the perspective of ethnicity and income. The three-year graduation rate of Latino and African American students falls to 2.7% and 2.1% respectively – less than half the percentage for the overall population. Low-income students in general fared similarly at a 2.1% three-year graduation rate (Appendix C).

There are as many causes for academic failure in at-risk student populations as there are individuals. The list is sometimes overwhelming: Time constraints due to family responsibilities, poverty, transportation issues, lack of family and community support, and academic deficiencies all conspire to derail students in their quest for a college degree. Many of these issues are outside the control of any educational system, but others can be addressed. Union County College has a variety of institutional support programs in place to address the important issues of student retention and persistence. Each campus has a stand-alone learning center staffed with talented and dedicated peer, paraprofessional and professional tutors. Tutoring on an unlimited, walk in basis as well as in on-line format is available to all students enrolled at the college. UCC provides a mandatory 2-credit, first year seminar course designed to support student success in the first year of college. Student development specialists counsel students in academics and career development. These efforts support all students at the college. Additionally, an Educational Opportunity Fund program (EOF) supports a limited number of under-privileged students. While these programs provide support, the statistics indicate that much more help is needed for at-risk students in Union County.

Objectives

This proposal supports two objectives: First, to motivate, support and encourage urban high school students to develop and refine basic mathematical skills, and second, to provide the opportunity for urban high school students to realize early success in college through bridge programs, financial assistance, mentoring and academic support. These objectives, accomplished through a comprehensive program of intensive, individualized academic support, apply traditional instruction, computer-aided instruction, on-line resources, academic mentoring, tutoring, and financial assistance to high school students. The program will support a cohort of 50 EHS students each year for three years, to increase success in early mathematics courses and encourage the completion of a college education for this at-risk student population.

Plan of Action

The keys to academic success for at-risk urban students are multifaceted. The plan for this proposal includes three vital components, as diagramed in Figure 1:

1. Intensive Instruction
2. Academic Mentoring and Tutoring
3. Financial Support

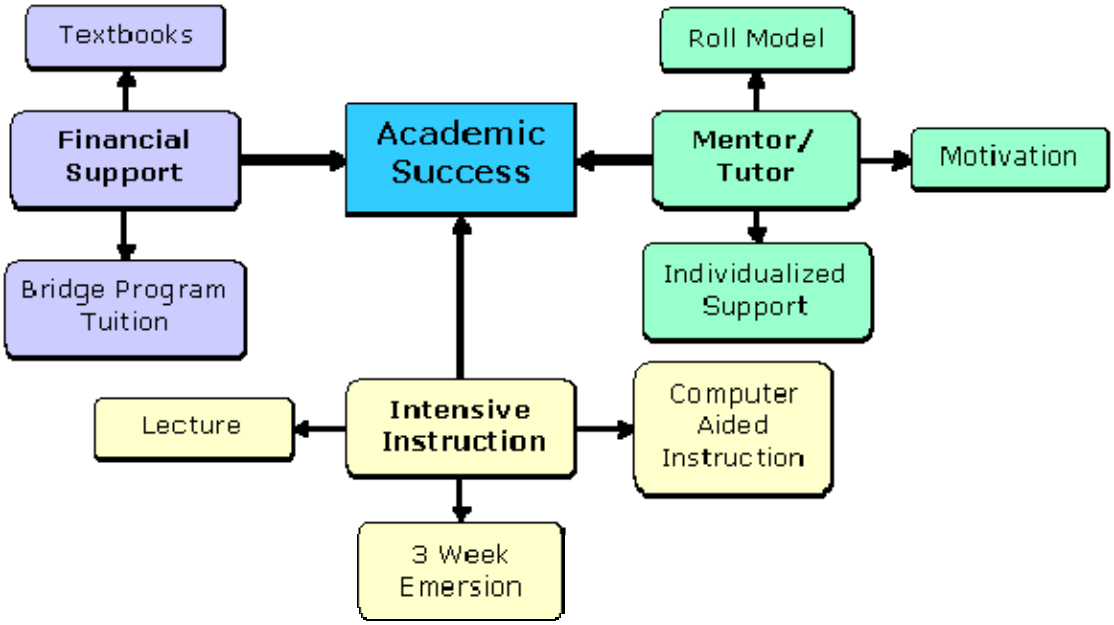

Figure 1

Intensive Instruction

This component will occur during the summer between the junior and senior years of high school. Through selection criteria and pre-testing, (Appendix B) students will attend a three-week emersion course in either basic mathematical computation or elementary algebra, determined by pre test results. Led by UCC faculty members and assisted by NJIT academic mentor/tutors, three sections will run simultaneously, employing traditional classroom lecture, computer aided instruction (CAI), and workshop sessions. Research indicates that developmental learners respond positively to a variety of instructional modalities in the classroom (McClendon), so classes will rotate through separate learning areas throughout the day to provide different learning environments.

Since developmental students typically arrive in the classroom with a wide variety of skill levels, the use of Computer Aided Instruction, utilizing existing computer labs and software at UCC, will help to address this common problem. Self directed CAI allows each student to work at his or her own pace, and on his or her specific areas of need, creating a non-threatening, individual focused learning environment (Keup).

Led by instructors and supported by student tutors, daily workshop sessions round out the learning experience by providing students with the opportunity to practice their skills and complete assignments. Working in groups, students learn the value of using study groups for mathematics courses while receiving immediate response to questions from instructor and tutors.

Academic Mentoring and Tutoring

A vital component of the program is the use of student mentors in and out of the classroom. Peer mentors, used within the classroom, are academically beneficial to all student populations (Smith). Minority students in particular benefit from positive peer roll models in post secondary education (Myron). Recruited from mathematical science programs at New Jersey Institute of Technology, mentors are successful students who are solid in their education and career plans. They provide constant and consistent academic support to students throughout all aspects of the summer program, as well as into the next academic year. They attend class to assist instructors and support students, and serve as mentors, tutors, roll models and advisors. Mentors work to nurture positive relationships with assigned students in the program, and establish on-line journals via virtual classrooms to monitor program student attitudes and impressions. They encourage on line communication through email, IM and blogs, maintaining contact with their assigned students after the intensive summer program is complete. Each mentor undergoes comprehensive on-line training in the months preceding the summer program to provide the best possible mentoring and tutoring support to students in the program.

Financial Support

Financial need is a major concern for urban, at-risk student populations. Students often work two and three jobs while attending college, leaving little time and energy to study and learn. To alleviate some of this financial stress, students who complete the intensive summer emersion program will receive tuition and books to cover the cost of bridge courses in mathematics during their senior year of high school. After high school graduation, UCC will provide individualized financial aid counseling to help fund the next academic year.

Assessment Plan

The program assessment will be conducted through student focus groups, student on-line journals and grade/placement score tracking. The following lists the goals, objectives, outcomes and assessment methods for the program.

Goals

1. To improve basic mathematical skills in preparation for college level math courses to urban students
2. To provide role models to urban students
3. To provide tuition assistance and financial aid counseling to urban students

Objectives

1. A total of 150 students receive intensive summer training in basic mathematics
2. A total of 150 students experience mentoring by mathematics science students
3. A total of 150 students receive tuition assistance during senior year of high school

Outcomes

1. Students will pass remedial math courses on the first try, or test into higher level math courses
2. Students will set goals to pursue and complete a college education
3. Student attitudes (via online journals and blogs) reflect a clear awareness of support from instructors and mentors

Assessment Methods

1. Track student scores on basic skills (Acuplacer) placement exam for improvement
2. Track student grades in remedial mathematics courses and college level mathematics courses to compare with UCC institutional data
3. Monitor and record student attitudes and impressions through on-line journaling activities and blogs
4. Conduct student focus groups with program students on attitudes and impressions

Key Personnel

The proposal includes the following key personnel.

Instructor/Coordinator (1) Full-Time

This full time employee is responsible for the overall operation of the program, as well as planning curriculum and teaching in the summer emersion program. The program coordinator will develop and maintain a support relationship with program students as well as academic mentors throughout the program. Coordinator will:

- Collaborate with Elizabeth High School
- Collaborate with New Jersey Institute of Technology
- Recruit EHS students
- Recruit, hire and train NJIT academic mentors
- Plan and coordinate all aspects of summer program
- Serve as lead instructor in summer program
- Recruit, hire and train summer instructors
- Coordinate mentoring activities in summer program and throughout academic year
- Collect and analyze assessment data
- Research for grant opportunities to sustain program past NSF funding, and to provide program growth
- Coordinate services of UCC personnel (academic and financial aid counselors) and facilities for the program

Part Time Instructors (2) Part-Time

Summer mathematical computation and elementary algebra instructors responsible for teaching 3-week summer emersion program

Academic Mentors (6) Part-Time

Academic mentors provide intensive support to students throughout the summer emersion program and through the academic bridge year.

High School Coordinators (2) Part-Time

Coordinators identify potential high school students for program, assist students with application process and serve as program point persons representing EHS

NJIT Coordinators (2) Part-Time

Coordinators identify potential academic mentors from mathematic science majors and serve as program point persons representing NJIT

Assessment Consultant (1)

Outside evaluator to provide program assessment advice and report preparation

Budget

The single-year funding outline is detailed in Figure 2. This yearly funding request of $290,000 provides salaries for eight support professionals (1 full time, 7 part time) and six undergraduate academic mentors for a total of $203,000. Funding also includes $13,500 for teaching and training materials, $65,000 for tuition and textbook provisions, and $8,500 for hospitality items throughout the year. The total funding request for each year is $290,000, for a three-year total of $870,000.

Personnel		**Each**	**Total**
Program Coordinator/Instructor	Full time, including fringe benefits	68,000.00	$68,000
Summer Instructors	2 instructors	10,000.00	$20,000
NJIT Coordinators	2 coordinators	5,000.00	$10,000
High School Coordinators	2 coordinators	5,000.00	$10,000
Mentor/Tutors	6 mentor/tutors	15,000.00	$90,000
Assessment Consultant	1 outside consultant	5,000.00	$5,000
		Subtotal	**$203,000**
Materials			
Teaching materials	$250/student x 50 students		$12,500
Training materials, peer mentors, instructors			$1,000
		Subtotal	**$13,500**
Financial Assistance			
Academic year tuition	$125/credit x 8 credits x 40 students		$40,000
Text books	$250/course x 2 courses x 50 students		$25,000
		Subtotal	**$65,000**
Other			
Summer program hospitality: lunch, refreshments	$10 x 15 days x 50 students		$7,500
Hospitality throughout academic year	Training for Mentors, Instructors, Coordinators		$1,000
		Subtotal	**$8,500**
		Total:	**$290,000**

Figure 2

Implementation Timeline

Outlined in Figure 3, the project implementation timeline for year 1 is based on a requested start date of January 1, 2009.

Date	Activity
1/09-3/09	Recruit and hire coordinators and instructors
2/09-4/09	Create summer program curriculum Create mentor training materials
2/09-4/09	Recruit and hire NJIT mentors (6) Identify potential EHS students
5/09	Select EHS students for program (50)
5/09	Administer placement testing for selected students
6/09	Train mentors, instructors Complete summer program planning
7/09	Conduct summer emersion program
9/09	Coordinate fall semester bridge program.
9/09-12/09	Continue mentoring/tutoring program for participating bridge students
12/09	Assess program Make necessary adjustments
12/09	Coordinate spring semester bridge program
12/09	Continue support and contact with year 1 cohort. Recruit for year 2 utilizing first cohort for connection, support and community

Figure 3

Conclusion

There is no question that many at-risk, minority students from public urban school districts suffer from academic deficiencies. These deficiencies are the result of a multitude of barriers, which students must overcome before completing a college education (Paying). Union County College, the Elizabeth Public School system and New Jersey Institute of Technology, working collaboratively, have the ability to help increase the basic mathematics skills of these underserved students to prepare them for successful careers. A summer emersion program during the summer between the junior and senior year of high school, coupled with intensive academic and mentoring support will provide the necessary basis for this success. Additional financial support with continuing academic assistance will provide students with the tools for ongoing progress and ultimate success.

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Appendix A:

Union County College Annual Institutional Developmental Courses Effectiveness Report, Fall 2004 to Spring 2006

(Table B, page 12)

	Students Identified as Needing Remediation				Students who Successfully Satisfied All Remedial Requirements in the Skill Areas			
	Full-time		Part-time		Full-time		Part-time	
	#	%	#	%	#	%	#	%
Reading	842	84.9%	307	78.1%	392	46.6%	83	27.0%
Writing	762	79.4%	286	76.3%	346	45.4%	83	29.0%
Mathematical Computation	778	77.3%	318	80.7%	407	52.3%	141	44.3%
Elementary Algebra	775	77.1%	329	83.7%	137	17.7%	44	13.4%

Appendix B:

Participating Student Entrance Criteria

- Demonstrated financial need – NJ Eligibility Index based on Federal guidelines for financial need*
- High School GPA of 2.0 or above
- (2) letters of recommendation, one academic, one personal
- Signed attendance and commitment statement
- Need for remediation (see process below)

Process

- Students are tested using Accuplacer testing
- Students place into developmental mathematical computation or elementary algebra

* Federal guidelines sometimes exclude students in financial need, therefore students who do not meet federal standards for financial need will be assessed on a case-by-case basis (Financial, Unfair).

Appendix C:

Union County College Annual Institutional Profile FY 2007

(Tables II.E.1.c and II.E.1.d, page 9)

Two and Three-Year Graduation Rates of
Fall 2003 Full-time First-time Freshman by Race/Ethnicity

	White		Black		Hispanic		Asian		Alien		Other*		Total	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Fall 2003 Cohort	359		336		479		75		26		381		1,656	
After 2 Yrs.	11	3.1%	2	0.6%	2	0.4%	2	2.7%	3	11.5%	8	2.1%	28	1.7%
After 3 Yrs.	40	11.1%	7	2.1%	13	2.7%	3	4.0%	6	23.1%	23	6.0%	92	5.6%

* Other indicates American Indian and Unknown Race

Two and Three-Year Graduation Rates of
Fall 2003 Full-time First-time Freshman by Income

	Low Income		Non-Low Income		Unknown Income		Total	
	#	%	#	%	#	%	#	%
Fall 2003 Cohort	521		609		526		1,656	
After 2 Yrs.	0	0%	9	1.5%	19	3.6%	28	1.7%
After 3 Yrs.	11	2.1%	34	5.6%	47	8.9%	92	5.6%

* Low income is defined as students with a NJ Eligibility Index between 1 and 2,499