

# The EMERGE Summer Program: Supporting Incoming Freshmen's Success in Mathematics Developmental Coursework

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## **Abstract**

This paper describes the development, results, and future directions of the mathematics component of the EMERGE Summer Program at Northeastern Illinois University. Initiated summer 2014, EMERGE offered English and mathematics sessions for incoming freshmen. The mathematics session aimed to strengthen participants' mathematical foundations, mathematical confidence, and ability to successfully place into higher-level mathematics coursework in the subsequent fall semester. Mathematics participants attended mini-lectures, participated in group activities, and completed online MyMathLab modules. Mathematics component results indicate that 73% and 71% of summer 2014 and 2015 participants, respectively, placed up at least one course level in mathematics in the fall semester.

There has been heightened attention placed on postsecondary developmental education in the U.S. (Attewell, Lavin, Domina, & Levey, 2006; Bonham & Boylan, 2011; Grubb & Oakes, 2007; Hall & Ponton, 2005; Parsad and Lewis, 2003; Smittle, 2003). Parsad and Lewis (2003) define postsecondary developmental education as "courses in reading, writing, or mathematics for college-level students lacking those skills necessary to perform college-level work at the level required by the institution" (p. 1). In fall 2000, approximately 75% of degree-granting two- and four-year institutions that enrolled freshmen offered at least one developmental course, 80% of four-year public institutions offered at least one developmental course, and 28% of entering freshmen in two- and four-year institutions

enrolled in at least one developmental course (Parsad & Lewis, 2003, p. iii). The number of students taking developmental coursework has also continued to increase over time (Smittle, 2003). Although developmental coursework was designed to help students achieve their academic goals, there are many serious concerns surrounding these courses. Such concerns include how this coursework has contributed to preventing students from obtaining postsecondary degrees (Bonham & Boylan, 2011), has impacted and limited the majors they select (Hall & Ponton, 2005), and has negatively influenced their self-efficacy in their academic abilities (Hall & Ponton, 2005).

In fall 2000, the percentage of freshmen enrolled in developmental courses was largest for mathematics (22%) among all developmental subject areas (Parsad & Lewis, 2003). Research indicates that it is particularly imperative that students succeed in mathematics developmental coursework (Hall & Ponton, 2005) since their performance in such courses influences the majors they select and their subsequent ability to attain higher education degrees (Trusty & Niles, 2003). However, low persistence and achievement rates are prevalent in a significant percentage of students in developmental mathematics courses (Bonham & Boylan, 2011). In addition, “the challenge of raising math skills is further compounded by the fact that students who test into remedial math coursework are disproportionately minority and disproportionately first-generation, two characteristics of at-risk students” (Epper & Baker, 2009, p. 3).

An emerging body of scholarship has shed light on various complex factors that have contributed to students’ success in developmental mathematics coursework (Aycaster, 2001; Boylan, 2011). Such factors include strengthening the quality of instruction, students’ mathematical study skill strategies, students’ knowledge about how to reduce test anxiety, and students’ mathematics self-efficacy (Boylan, 2011). According to Boylan (2011):

Developmental students need a multimodality instructional approach which means integrating the lecture with manipulatives, math study skills, and group work; learning math vocabulary words; using web-based support; tutoring students based on their learning style;

giving frequent quizzes and practice tests; and inviting counselors into the class to discuss anxiety issues and provide a referral for personal problems (p. 22).

There is also a significant body of research on successful university-level summer programs that have assisted incoming freshmen in succeeding in developmental mathematics coursework. This includes, for example, the Math Intensive Program at LaGuardia Community College and the Math Jam Program at Pasadena City College (Sherer & Grunow, 2010).

Northeastern Illinois University (NEIU) community members drew on such aforementioned research to develop innovative avenues for increasing NEIU students' abilities to succeed in mathematics development coursework. NEIU is a Hispanic-serving, four-year university in Chicago, Illinois that serves approximately 11,000 culturally diverse, commuter undergraduate and graduate students: approximately 42% Caucasian, 29% Latina/o, 10% African American, 9% Asian, and 10% of other racial/ethnic backgrounds. The Mathematics Development Program at NEIU is housed within the Department of Mathematics and offers three mathematics development courses (Math 090, Math 091, and Math 092). Table 1 provides detailed information for these courses. Such courses do not count towards students' graduation credit or college grade point averages.

According to the 2013-2014 NEIU Mathematics Development Program Annual Report, approximately 80% of NEIU incoming freshmen required at least one developmental mathematics course (Ranney, 2014). Furthermore, this same report indicated that, in developmental mathematics courses, success rates (A–C grades) ranged from 62.1% to 64.0%, and course retention rates (excluding W, I grades) ranged from 87.0% to 89.0%. There is increasing concern about the retention of under-prepared students enrolled in Math 090 and Math 091.

To address these concerns, NEIU's Mathematics Department formed the ad hoc Mathematics Development Curriculum Committee (MDCC) during fall 2013. MDCC aimed to draw on research conducted on effective developmental mathematics curriculums, practices, and broader support structures to implement

changes that strengthened NEIU's Mathematics Development Program. MDCC members included the Department of Mathematics Chair, the Mathematics Development Program Coordinator, Mathematics Development Program instructors, Department of Mathematics faculty, and staff from mathematics support programs.

The first main task that MDCC undertook was to develop and implement an intensive summer program for first-year incoming freshmen admitted for fall 2014.

**Table 1**

*Description of NEIU's Three Mathematics Development Courses*

	<b>Math 090: Elementary Algebra</b>	<b>Math 091: Intermediate Algebra I</b>	<b>Math 092: Intermediate Algebra II</b>
<b>Purpose</b>	To prepare students for Math 091	To prepare students for Math 092	To prepare students for various 100 credit-level mathematics courses (college credit courses)
<b>Required Material</b>	"MyMathLab Student Access Kit," Addison Wesley	"MyMathLab Student Access Kit," Pearson Publishing	
<b>Optional Textbook</b>	<i>Prealgebra</i> by Elayn Martin Gay, Sixth Edition, Prentice Hall	<i>Beginning &amp; Intermediate Algebra</i> by Elayn Martin Gay, Fifth Edition, Pearson	
<b>Prerequisites</b>	A score of "00" on the NEIU Math Placement Test or a Math ACT score of 16 or less	A score of "01" on the NEIU Math Placement Test or a Math ACT score of 17 or 18 or passing Math 090 with a grade of C or higher	A score of "02" on the NEIU Math Placement Test or a Math ACT score between 19 and 21, or passing Math 091 with a grade of C or higher

<b>Course Description</b>	This course develops the foundations of algebra beginning with the real number system and its operations. Topics include variable expressions, linear equations and inequalities, exponents and polynomials, factoring, the rectangular coordinate system, and graphing linear equations. Applications of proportion, percent, and the use of formulas develop problem-solving skills.	This course focuses on the concepts and structures of algebra. Topics include linear equations and inequalities, interval notation, graphing linear equations in two variables, slope of a line, equations of a line, polynomials, factoring, systems of linear equations, and rational expressions.	This course further develops the concepts and structures of algebra. A review of linear equations, factoring polynomials, and linear systems of equations, prepares students for the study of linear, quadratic, exponential, and logarithmic equations and functions. Additional topics to prepare students for college algebra include rational expressions and equations, complex numbers, rational exponents, and properties of logarithms.
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The program had both English and mathematics components and was named the English & Math Enrichment, Readiness & Growth Experience (EMERGE) Program. EMERGE consisted of a 3-week English session followed by a 3-week mathematics session. Students could participate in one or both 3-week sessions. The main objectives of the program included: 1) to support recruitment and retention efforts for incoming freshmen, 2) to strengthen incoming freshmen's foundation and confidence in their English and mathematics abilities, and 3) to possibly support incoming freshmen in placing into a higher level English and/or mathematics course in fall 2014. This paper describes the development, implementation, results, and key learnings of the mathematics component of the EMERGE Summer Program.

## Developing EMERGE

The mathematics component of EMERGE was developed during Spring 2014 and Summer 2014 through the collaborations of several MDCC members, NEIU's College of Arts and Sciences, NEIU's Center for College Access and Success (CCAS), and Pearson personnel. Four MDCC members served as coordinators of the mathematics component of EMERGE. The four coordination positions included the Mathematics Coordinator, the Activities and Outreach Coordinator, the Recruitment and Retention Coordinator, and the Mathematics Curriculum and Instruction Coordinator. Under the direction of the Dean of Arts and Sciences, we received an institutional innovation grant to develop the EMERGE Program. Through our regular collaborations with CCAS, which has implemented several successful summer programs for middle school and high school students in the greater Chicago area, we received guidance on how to effectively implement the EMERGE Summer Program and to engage with the incoming freshmen. Pearson personnel supported the development and implementation of online modules using MyMathLab technology.

Drawing on mathematics education research and MDCC members' prior involvement in various university-level mathematics support programs (e.g., Peer-Led Team Learning mathematics workshop programs), MDCC members incorporated the following elements into the mathematics component of the EMERGE Summer Program: 1) consistent interactions with mathematics instructors and student peer leaders, 2) confidence building activities, 3) strong mathematics course advising for the fall semester, 4) social events to build peer-to-peer networks, and 5) an engaging, multi-faceted curriculum that included mini-lectures, online modules in computer lab settings, and related collaborative mathematics learning activities.

The mathematics component of the pilot EMERGE program served 80 students (approximately 20 students in each of four classes). We offered four separate classes, Math 090 (1 section), Math 091 (1 section), and Math 092 (2 sections), labeled as Math Preparation I, Math Preparation II, and Math Preparation III respectively. The curriculum for each summer class was designed to

align with the existing mathematics development curriculum.

In addition to the four coordinators, mathematics component EMERGE personnel included four mathematics instructors (one instructor for each class) and eight mathematics peer leaders (1 peer leader per 10 students). EMERGE mathematics instructors and peer leaders were recruited by distributing flyers and sending emails. Current NEIU mathematics development instructors and recent graduates of NEIU's mathematics masters and undergraduate programs were targeted for the EMERGE mathematics instructor positions. Each applicant for the instructor position participated in a one hour interview. The interview commenced with a 30-minute teaching demonstration on one of the following developmental mathematics topics: 1) solving systems of linear equations (substitution method), 2) factoring trinomials ( $a=1$ ), or 3) simplifying rational expressions. After which, they participated in an interview with the mathematics program coordinators. Peer leaders involved with fall and spring NEIU academic or mathematics support programs with strong mathematics backgrounds were targeted for the EMERGE mathematics peer leader positions. In addition, an event liaison coordinator employed at CCAS assisted with planning EMERGE social events during the pilot EMERGE program.

EMERGE staff from both the mathematics and English component were invited to participate in a three-day professional development session. While some professional development sessions applied to both program components, other sessions focused on either mathematics or English. Topics discussed during shared sessions included Pearson technologies for developmental coursework, learning disabilities, and equity, diversity, and social justice issues. Topics discussed during the mathematics sessions included the implementation of collaborative mathematical learning techniques and technologies specific to mathematical learning environments.

Incoming freshmen for the fall semesters of 2014 and 2015 were eligible to participate in EMERGE if they satisfied the following criteria: 1) applied to, were accepted, and enrolled at NEIU, 2) completed an online summer program application and expressed interest in EMERGE on their application, and 3) placed

into developmental mathematics or English courses after completing the NEIU placement test. The NEIU placement test consists of three content area exams: mathematics, reading comprehension, and sentence skills and essay writing. To be eligible for the mathematics component of EMERGE students had to place into Math 090, 091, or 092 on the mathematics portion of the placement exam.

Recruitment tactics involved immediately providing students with a link to the online summer application after completing the placement test, distributing EMERGE flyers in the placement testing center, working with CCAS staff members to distribute EMERGE flyers in local high schools, contacting newly admitted NEIU students to encourage them to either take the placement test and/or fill out the online summer program application to determine their eligibility for EMERGE, mailing flyers to newly admitted students and mailing postcards to their parents, and attending various campus events for incoming freshmen to advertise EMERGE (e.g., High School Counselor's Breakfast). In assorted recruitment materials we emphasized that students could save up to \$4,000 on tuition and fees, reduce time to graduation, strengthen their confidence in their English and mathematics abilities, make new friends and form study groups, get to know faculty, staff, and other students, get to know the NEIU campus, receive a free lunch every day, and receive personalized action plans to help them succeed in English and mathematics. Eligible students were admitted to the program on a first-come first-served basis. Once the capacity of 80 students was reached a student waiting list was started.

## **Implementing EMERGE**

### **A Day in an EMERGE Scholar's Life**

The mathematics component of EMERGE began with an opening ceremony on the Friday prior to the program's official start. All EMERGE staff were required to attend the opening ceremony to introduce themselves to the students. Students were encouraged to bring friends and family. During the ceremony, students watched a powerpoint presentation and toured their classrooms and computer labs with their instructors and peer leaders. The powerpoint welcomed and congratulated students, reviewed the goals of



EMERGE, and outlined expectations of students. The opening ceremony closed with an informal pizza party on an outdoor patio and students picked up paid public transportation cards. In addition, parents were encouraged to sign-up for parents' day. Parents' day included lunch with students, a guided tour of the campus, and an introduction to various student resources.

The 3-week mathematics session took place from late July through the first week of August. Students attended the program from 9 a.m. to 3 p.m. on Mondays through Thursdays. Table 2 illustrates the mathematics program components on a typical day of the EMERGE program. At 9 a.m. each morning students checked in at a conference room where we took attendance and distributed name tags. Example check-in activities included distributing and explaining a goal of the day, watching motivational videos (e.g., motivational educational Technology Entertainment and Design talks), having a peer leader model strong mathematics note-taking skills, and providing guidance, advice, and encouragement. Students left the check-in location to go to their assigned classrooms from 9:30 a.m. to 12 p.m. As mentioned previously, students were separated into mathematics classes based on their mathematics development course placement (Math 090, 091, or 092). They attended mathematics development classes run by their assigned instructors. In the classrooms, they received guidance and support from their peer leaders while solving problems. Around 12 p.m. students headed to the cafeteria where lunch was provided for free. During lunch, students had the option of attending informational sessions that covered assorted topics such as career exploration, financial aid, and cultural, academic, and mathematics resources on campus. After lunch students met in their assigned computer labs to complete modules on MyMathLab. The use of MyMathLab allowed us to monitor each student's progress.

**Table 2***Typical Day of the EMERGE Mathematics Component*

<b>Time</b>	<b>Activities</b>	<b>Location</b>
<b>9-9:30 a.m.</b>	Check-in/confidence building activities	Conference room
<b>9:30 a.m.-12 p.m.</b>	Mini-lectures/group work/structured activities	Traditional classrooms
<b>12-1 p.m.</b>	Lunch/optional information sessions	Cafeteria/traditional classroom
<b>1-3 p.m.</b>	Online MyMathLab modules	Computer labs

There were some modifications made to the schedule outlined in Table 2 at certain times during the program. First, we had an extended check-in session on the first day of the program. This extra time allowed us to welcome the students to the program, distribute a supply bag to each student, and help participants meet and connect with peers. Second, during the pilot year on Thursday afternoons students participated in a social event instead of completing online MyMathLab modules. The events included an on-campus scavenger hunt, a team-building activity at the on-campus recreational facility, and a goal setting/career activity that involved a student panel. Third, during the last Wednesday of the program, students retook the mathematics placement test (MPT) in the afternoon instead of completing online MyMathLab modules. Fourth, during the last Thursday of the program, we gave students their MPT results, connected them with their advisors to allow for any necessary adjustments to be made to their fall mathematics course schedules, assisted them with any tasks they needed to complete to prepare for the fall semester (e.g., complete financial aid paperwork), and held a closing ceremony during the late afternoon. Fifth, throughout the full 3-week program, students were given the option of meeting an EMERGE peer leader in a computer lab either the hour before or the hour after the program day to work on online MyMathLab modules.

The closing ceremony for the mathematics component of EMERGE took place on the last Thursday of the program in a large auditorium. During the ceremony, students watched a powerpoint in

the lecture hall, received completion certificates presented by their instructors, and made ice cream sundaes. The powerpoint welcomed the students to the EMERGE closing and thanked administrators, instructors, peer leaders, and student participants. Special student awards were distributed for attendance and achievement. Towards the end of the ceremony a group photograph was taken and students viewed a half-hour documentary video that provided advice for how to succeed in college.

### **A Day in an EMERGE Staff Member's Life**

The EMERGE staff, which consisted of mathematics coordinators, instructors, and peer leaders, met regularly in the mornings and afternoons to discuss program issues and improvement ideas. In particular, EMERGE staff discussed student progress on MyMathLab in order to identify mathematics content areas where individual students needed additional support. This allowed the EMERGE staff to create individualized mathematics study plans for each student. The coordinators were involved with all program components each day; they advised students, and they monitored attendance and behavioral issues. The instructors met regularly with their peer leaders to discuss the curriculum and lesson plans. The peer leaders engaged with each of their ten assigned students throughout the day. Some peer leaders volunteered to meet with students before or after the required program day to help students work on mathematics curriculum materials.

### **EMERGE Results**

We started with 80 and 100 seats available for the mathematics component of the 2014 and 2015 EMERGE Summer Program, respectively. We invited wait-listed students to fill vacancies that arose during both summers. During Summer 2014, 79 of 80 participants in the mathematics component of EMERGE retook the MPT. In Summer 2015, 93 of 95 participants in the mathematics component of EMERGE retook the MPT. We compared students' initial MPT scores to their final MPT scores at the end of the program.

During Summer 2014, of the 79 who retook the exam, 58 advanced at least one level in their mathematics course placement. In particular, 73% advanced at least one level, 37% advanced at least

2 levels, 14% advanced at least 3 levels, and 1% advanced 4 levels. On average, students advanced approximately 1.25 levels in their mathematics course placement.

During Summer 2015, of the 93 who retook the exam, 66 advanced at least one level in their mathematics course placement. In particular, 71% advanced at least one level, 42% advanced at least 2 levels, 12% advanced at least 3 levels, and 2% advanced 4 levels. On average, students advanced approximately 1.27 levels in their mathematics course placement. Figure 1 displays a chart which indicates the percentage of students that increased 1 level, 2 levels, 3 levels, and 4 levels in the 2014 and 2015 EMERGE Summer Program.

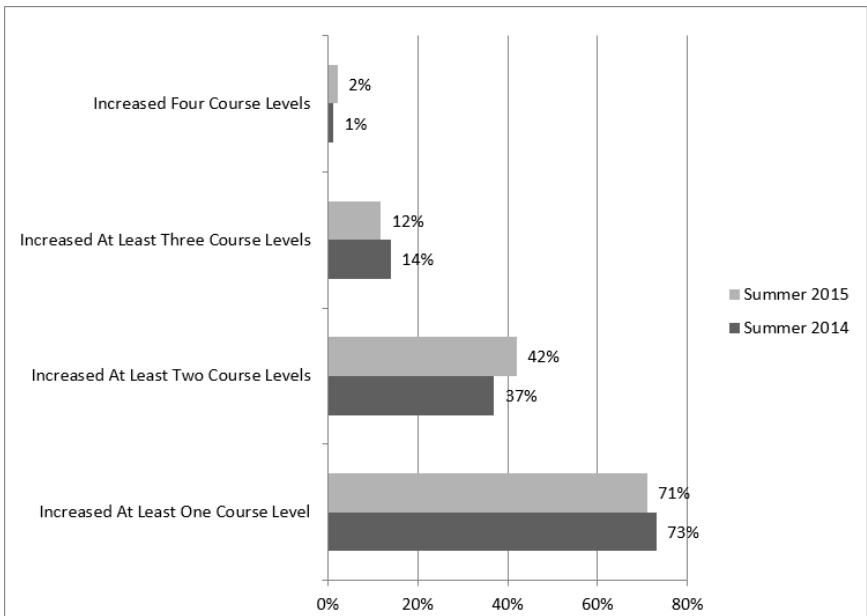


Figure 1. Percentage of students that increased at least one level in the mathematics component of the EMERGE summer Program.

### EMERGE Key Learnings

Following the success of the pilot program, the EMERGE staff discussed potential ways to strengthen the program in the future. We also reviewed student participants' improvement ideas on an end-of-the program survey. Based on discussions with staff

and our review of survey data collected from students we developed several improvement ideas to draw upon in the future. These are outlined in Table 3. The EMERGE staff continues to reflect on best practices and their implementation.

**Table 3**

*Improvement Categories, Specific Improvement Ideas, and Comments on Progress*

<b>General Category</b>	<b>Specific Improvement Idea</b>	<b>Comments on Progress</b>
<b>MPT</b>	Thoroughly investigate the effectiveness of the MPT in placing students into mathematics coursework	Coordinators are in the process of investigating various placement tests and their effectiveness
<b>Curriculum</b>	Develop worksheets for morning mathematics classes to distribute to the students for additional guidance and practice	Implemented during summer 2015
	Include more advanced problems in the online MyMathLab modules to allow students to work ahead	Implemented during summer 2015
<b>Student Behavior Policy</b>	Develop a detailed attendance and behavior policy contract	Implemented during summer 2015
	Link incentives to strong attendance, respectful behavior, and strong progress on mathematics curriculum materials	Implemented during summer 2015
<b>Recruitment</b>	Include an interview process	Logistically challenging

<b>Program Structure</b>	Replace the Thursday social event time with additional computer lab time for participants to work on online MyMathLab modules	Implemented during summer 2015
	Improve morning check-in activities	Implemented during summer 2015 with additional changes planned for summer 2016

### Conclusion

This paper described the development, results, and future directions of the mathematics component of the EMERGE Summer Program at Northeastern Illinois University. Our results align with existing findings on the impact of summer bridge programs supporting the success of underrepresented students in developmental mathematics (Kallison & Stader, 2012; Tsui, 2007). Future research plans include continued analysis of how to strengthen and improve EMERGE, a longitudinal, statistical study on EMERGE participants' academic performance and retention rates, and analysis of participant survey data to better understand the meanings students give to their participation in the EMERGE mathematics component. Such research will help to reveal the factors that support students' success in developmental mathematics and will expand knowledge about how to design effective developmental mathematics support programs.

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