

THE **MATH-UP** INITIATIVE:

Mathematics **A**chievement with **T**eachers of **H**igh-need **U**rban **P**opulations

A Partnership for Teacher Quality among

Lehman College (LC) of the City University of New York, the New York City Department of Education (NYCDOE), the Educational Testing Service (ETS), and BronxNet

Preamble

In the early pages of its final report, the National Mathematics Advisory Panel (2008) makes two troubling statements:

- *International and domestic comparisons show that American students have not been succeeding in the mathematical part of their education at anything like a level expected of an international leader (p. xii).*
- *Moreover, there are large, persistent disparities in mathematics achievement related to race and income—disparities that are not only devastating for individuals and families but also project poorly for the nation’s future, given the youthfulness and high growth rates of the largest minority population (p. xii).*

Two of the Panel’s principal messages were that: “mathematics curriculum in Grades PreK-8 should...emphasize a well-defined set of the most critical topics in the early grades” and that “rigorously evaluated initiatives for attracting and appropriately preparing prospective teachers and for evaluating and retaining effective teachers” should be encouraged (emphasis our own).

This national need to focus on early mathematics education and the rigorous preparation and retention of prospective teachers was raised earlier by the 2001 report of the National Academy of Science. In the executive summary of the report, entitled *Adding it up: Helping children learn mathematics*, the authors state “...too few students in our elementary and middle

schools are successfully acquiring the mathematical knowledge, the skill, and the confidence they need to use the mathematics they have learned” (2001, p. 1). Furthermore, the report claims that “The preparation of U. S. preschool to middle school teachers often falls far short of equipping them with the knowledge they need for helping students develop mathematical proficiency. Many students in grades pre-K to 8 continue to be taught by teachers... who have at best a shaky grasp of mathematics” (p. 4). The McKinsey report (2009), entitled *The economic impact of the achievement gap in America’s schools*, summarizes the impact of ineffective early instruction in maintaining the achievement gap, “...while early test scores are important indicators of a student’s life chances....the period between third grade and eighth grade can be critical....students who improve their performance between third and eighth grade are much more likely to graduate with honors...” (p. 19).

Need for the Project

In the Bronx (population: 1.3 million), where this teacher quality partnership proposal is focused, the urgency and depth of the need is brought into full focus. Over 80% of incoming ninth graders fail to meet state standards in mathematics, demonstrating that Bronx students in grades K through 8 are failing to be adequately prepared for high school mathematics. 4th and 8th grade state tests reveal that fewer than half of Bronx students in grades 3 through 8 score at or above proficiency in mathematics, demonstrating that inadequate mathematical preparation begins early and persists into high school. The McKinsey report (2009), again, notes that “...lagging achievement evidenced as early as fourth grade appears to be a powerful predictor of rates of high school and college graduation, as well as lifetime earnings” (2009, p. 5).

Exacerbating this achievement crisis are the complex and complicating factors of race and income, noted earlier by the Mathematic Advisory Council, that underlie disparities in

mathematics achievement. In its study of achievement gap in America's schools, the McKinsey report (2009) points out that there is a *racial gap* where Latino students are roughly 2 to 3 years behind white students of the same age, a *top gap* where Latinos are overrepresented among low-scoring students and underrepresented at the top with less than 3 percent of Latino children at the advanced level of mathematics achievement, and a *poverty gap* in which impoverished students, as defined by eligibility for free lunch, are 2 years of learning behind better-off students of the same age (2009, pp. 9-12). This "perfect storm" of contributors to the achievement gap is nowhere more evident than in the Bronx where:

- Over 50% of school-age children come from families where languages other than English are spoken.
- The greatest proportion (nearly 25%) of people in extreme poverty (50% below the poverty line) resides in the South Bronx.
- The child poverty rate in the Bronx is over 58% (the highest in the US outside of Puerto Rico).

The need in the Bronx is equally urgent for the preparation and retention of effective teachers. 44% of Bronx teachers have less than 3 years experience, where 5 to 7 years of teaching experience is the period during which a teacher is instructionally most effective at increasing student achievement. In addition, another 27% of Bronx teachers leave teaching in less than 5 years. A recent study of equity issues in mathematics by the Association of Mathematics Teacher Educators (2008) suggests that "Effective teachers...infuse this instruction with culturally relevant and engaging mathematics tasks that are rigorous, yet accessible." However, fewer than 50% of Bronx teachers are culturally and linguistically representative of the Bronx community. As a result, these high teacher attrition rates, low levels of teaching

experience, and cultural and linguistic mismatches among students and teachers persistently subject Bronx students to novice instructional practices unconnected to their lives and the communities in which they live.

Although successful on multiple fronts, including raising teacher quality through alternate route certification programs and increasing the test scores of students city-wide, an enduring challenge to the New York City Board of Education (NYCDOE) are teacher turnover and the mathematics and literacy achievement gaps of Bronx students, particularly in the South Bronx. The South Bronx was designated, in 2009, as a priority area for improvement by the NYCDOE for the coming years. Additionally, in summer 2009 the NYCDOE appointed a new Chief Academic Officer for Curriculum and Instruction to focus on the educational needs of students who speak languages other than English. Thus, the goals and objectives of the MATH-UP initiative targets areas of critical concern to the NYCDOE.

The teacher preparation programs of Lehman College, although nationally recognized and accredited, are in need of reform. Designed primarily to meet state regulations that are input heavy and field experience “light,” existing teacher certification programs are generic, course-based and lacking in responsiveness to the local context of need and urgency to recruit, retain and prepare Bronx teachers for Bronx schools. In addition, current preparation programs are minimally aligned with the professional development initiatives of the schools and, as with teacher preparation programs nation-wide, take little or no responsibility for on-going teacher support and retention. Capacity and commitment are clearly evident at Lehman College. However, a renewed rigor and focus are necessary, if not urgent, to partner with the local schools to address and impact critical concerns of student achievement as well as teacher quality and retention.

To meet the challenges of the national priorities articulated in the preamble and the localized urgency presented in the statement of need, the MATH-UP partnership unites:

- (1) the *nationally recognized* teacher preparation programs and faculty of **Lehman College** a Bronx-based, Hispanic-Serving Institution,
- (2) the *demonstrated commitment* of the **New York City Department of Education** to increase student achievement in the South Bronx,
- (3) the *expertise* of the **Educational Testing Service** to provide research-based professional development and induction support to a consortia of urban host schools and pre-service teachers to impact student achievement, and
- (4) The *technical knowledge and skills* of **BronxNet**, a local cable network, to develop digital educational content to enhance and sustain pre-service training.

The MATH-UP Initiative (Mathematics Achievement with Teachers of High-need Urban Populations) proposes to address Absolute Priority 1: 5th year Baccalaureate/Masters teacher preparation program; Competitive Preference Priority 1: Student Achievement and Continuous Program Improvement; Competitive Preference Priority 3: Rigorous Selection Process; Competitive Preference Priority 4: Broad-Based Partners; and Invitational Priority: Partnership with Digital Education Content Developer.

(a) Quality of the Project Design

(i) The extent to which the proposed project represents an exceptional approach to the priority or priorities established for this competition.

The broad purpose of the MATH-UP initiative is: To develop and implement a model for continuing reform of teacher preparation through an innovative school-centered, needs-based 5th year teacher preparation program with integrated professional development and induction

support programs to produce demonstrated positive impacts on teacher competency and on the mathematics achievement of high-need, low-performing urban (Bronx) students in grades 1 through 6. MATH-UP initiative objectives and related program activities propose to:

1) Reform and implement an elementary education teacher preparation program to meet school needs that will serve as a model for further preparation program reforms. Program activities related to this objective are:

- a. Redesign program of study to provide rigorous mathematics and academic literacy content and pedagogy knowledge and skills based on school needs to raise teacher quality, effectiveness, and competency in these areas.
- b. Integrate data-wise knowledge and skills to inform instruction that are responsive to school priorities and NYCDOE initiatives.
- c. Infuse program of study with knowledge and skills for differentiating instruction for English language learners and students with special needs that are responsive to school demographics and program assessment and formative evaluation data.
- d. Increase the program relevance by engaging school personnel with Lehman faculty to co-teach course offerings.

2) Build host school capacity to provide high quality, *clinical experiences* for pre-service teachers by becoming “best practice” demonstration sites. Program activities related to this objective are:

- a. Form a consortium of 5 South Bronx host schools to develop as clinical placement/ demonstration sites.
- b. Establish mathematics and academic literacy discovery centers at each school site for teacher preparation/professional development/induction support locations.

- c. Engage school personnel in a year of professional development prior to clinical placement of MATH-UP pre-service teachers.
 - d. Place and provide stipends for pre-service teachers to engage in year-long clinical experiences at these host-school sites.
- 3) Provide a sustainable, research-based, integrated *induction* program. Program activities related to this objective are:
- a. Partner with ETS to deliver research-based, effective induction programs.
 - b. Align professional development, teacher preparation, school needs, state standards and NYCDOE priorities with induction program.
 - c. Customize and sustain pre-service preparation, professional development, and induction support processes and materials through video case development.
- 4) Provide multi-layered, coherent, relevant and responsive *training and support* to all stakeholders. Program activities related to this objective are:
- a) Integrate pre-service teachers into early professional development with host schools and cooperating teachers prior to clinical experiences.
 - b) Infuse teacher preparation program with the knowledge and skills developed in the professional development and induction programs.
 - c) Engage Lehman college faculty, school personnel and pre-service teachers to be trained in the same models and processes of professional development and induction
- 5) Engage in extensive *recruitment and rigorous selection* processes. Program activities related to this objective are:
- a. Develop and implement an extensive recruitment plan to attract ethnically and linguistically diverse undergraduates into the MATH-UP program.

- b. Apply rigorous selection criteria to raise the standard for admission to the MATH-UP program as a model for other teacher preparation programs.
 - c. Apply rigorous selection and development criteria for recruiting cooperating teachers and enhancing their knowledge and skills to mentor pre-service teachers during clinical experience.
 - d. Apply rigorous selection criteria for high-need host school sites with highly-qualified teachers and demonstrated capacity to improve student achievement.
 - e. Recruit and engage selected Lehman College faculty to teach in and conduct research on the effectiveness of the MATH-UP program.
- 6) Reform literacy training of pre-service and in-service teachers to support the MATH-Up focus, to be responsive school needs as evidenced by data, and to be relevant to professional development and induction support programs. Program activities related to this objective are:
- a. Focus on academic literacy skills throughout teacher preparation, professional development and induction support programs.
 - b. Identify, demonstrate, and document best practices in differentiating instruction for English language learners and students with special needs throughout teacher preparation, professional development and induction support programs.
 - c. Integrate academic literacy-related, data-informed decision making processes and best practices across teacher preparation, professional development and induction programs.

MATH-UP program objectives and activities and their relationship to GEPA are in Table 1.

Table 1: Relationship of GPRA indicators and MATH-UP initiative program activities		
GPRA Indicators	Measures	Activities
Increasing the percentage of prospective teachers who earn	Baccalaureate graduation from Lehman College and attainment of	<ul style="list-style-type: none"> ● Rigorous admission requirements; ● Ongoing mentoring, supervision and advisement; ● Cohort structure for program entry, progress and graduation;

GPRA Indicators	Measures	Activities
a bachelor's degree and achieve full certification	full teacher certification	<ul style="list-style-type: none"> ● New York State Teacher Certification Exams (NYSTCE) preparation and tutoring as needed; ● Extensive clinical experience in schools during 5th year with MATH-UP participant stipends.
Increasing the retention of new teachers (f.2)	Increase the number of years new teachers remain in teaching positions	<ul style="list-style-type: none"> ● Rigorous induction program aligned with NYC DOE professional development priorities; ● Online MATH-UP network of program participants with access to former host school cooperating teachers and Lehman faculty; ● Continuing MATH-UP special events to sustain community and promote retention.
Increasing the achievement of prospective teachers (f.1)	Improve mathematical content knowledge in prospective teachers	<ul style="list-style-type: none"> ● Rigorous program of study with specialized content and pedagogical knowledge in elementary (grades 1 to 6) mathematics ● Rigorous progress standards; and ● Relevant and responsive assessment of development of MATH-UP participant content and pedagogical knowledge.
Increasing the pass rates of prospective teachers (f.3)	Improve content and pedagogical knowledge of pre-service teachers	<ul style="list-style-type: none"> ● New York State Teacher Certification Exams (NYSTCE) preparation and tutoring as needed; ● Diagnosis of test scores and tutoring as needed; ● Lehman faculty embeds testing content and strategies in graduation coursework.
Increasing the achievement of the students of new teachers (f.1)	Improve math achievement of students served by MATH-UP completers	<ul style="list-style-type: none"> ● Extensive field experience integrated and aligned with professional development and induction; ● Master's degree in Childhood education with specialization in mathematics, ELL/Bilingual and Special education; ● Rigorous induction program aligned with NYC DOE professional development priorities;
Increasing the percentage of highly-qualified teachers hired by high-need LEAs (f.4)	Increase the number of high qualified teachers hired into MATH-UP host schools and other high-need elementary schools in the Bronx	<ul style="list-style-type: none"> ● Master's degree in Childhood education with specialization in mathematics, ELL/Bilingual and/or Special education; ● Certification in Childhood Education, grades 1 to 6 with bilingual or special education extensions ● Employment support of MATH-UP completers through the NYCDOE Teaching Learning Collaborative
Increasing the percentage of teachers from underrepresented groups hired by high-need LEAs	Increase the number of teacher from underrepresented groups (e. g., Hispanic and	<ul style="list-style-type: none"> ● Extensive recruitment efforts targeting undergraduates from underrepresented groups ● Providing stipends for clinical experience ● Cohort structure builds community ● Host schools sites congruent with participants' own school experiences

GPRA Indicators	Measures	Activities
(F.4.i)	Black) into MATH-UP host schools and other elementary schools in the Bronx	<ul style="list-style-type: none"> Cooperating teachers representative of MATH-UP participants' diversity as possible
Increasing the percentage of teachers who teach high-need academic subjects hired by high-need LEAs (f.4.ii)	Increase the number of teachers hired to teach in bilingual/ELL or inclusion classrooms or as subject specialists in mathematics	<ul style="list-style-type: none"> Master's degree in Childhood education with specialization in mathematics, ELL/Bilingual and/or Special education; Certification in Childhood Education, grades 1 to 6 with bilingual or special education extensions Employment support of MATH-UP completers through the NYCDOE Teaching Learning Collaborative
Increasing the percentage of highly-qualified teachers who teach in high need areas of limited English proficient students hired by high-need LEAs (f.4.iii)	Increase the number of highly qualified teachers teaching in MATH-UP host or other Bronx schools that have at least 20% ELL students	<ul style="list-style-type: none"> Master's degree in Childhood education with specialization in mathematics, ELL/Bilingual and/or Special education; <ul style="list-style-type: none"> Certification in Childhood Education, grades 1 to 6 with bilingual extension Employment support of MATH-UP completers through the NYCDOE Teaching Learning Collaborative
Increasing the percentage of teachers who teach in high-need schools (f.4. iv)	Increase the number of Lehman childhood education graduates who go into teaching who teaching in high-need schools	<ul style="list-style-type: none"> Rigorous induction program aligned with NYC DOE professional development priorities; Online MATH-UP network of program participants with access to former host school cooperating teachers and Lehman faculty; Continuing MATH-UP special events to sustain community and promote retention. Employment support of MATH-UP completers through the NYCDOE Teaching Learning Collaborative
Increasing the percentage of teachers trained to use technology to manage and analyze data to improve student achievement (f.6.ii)	Implement changes in Lehman College teacher preparation programs and /or coursework to meet school needs and align with NYCDOE initiatives	<ul style="list-style-type: none"> Teacher preparation program includes coursework on using data to inform differentiated instruction; Integration of NYCDOE student Assessment and Retention Information System (ARIS) into coursework and professional development; Keeping Learning on Track (ETS) professional development with induction support; Field work, small group instruction, collaborative assessment and student teaching
	Model teacher preparation program will be	<ul style="list-style-type: none"> Co-development of Mathematics discovery centers in host schools and at Lehman College; Program delivered at host school sites;

GPRA Indicators	Measures	Activities
	school-site-based.	<ul style="list-style-type: none"> ● Integration of MATH-UP participants in school-based professional development by ETS with MC (Mathematics Challenges) and KLT (Keeping Learning on Track); ● Rigorous selection of high needs host school sites; and ● Co-teaching by Lehman faculty and school-based personnel (mentors/cooperating teachers).
	Model teacher preparation program will be based on identified school needs.	<ul style="list-style-type: none"> ● Host schools selected will show student at or below proficient levels in mathematics; ● Rigorous program of study with specialized content and pedagogical knowledge in elementary (grades 1 to 6) mathematics and in differentiating instruction for ELLs and students with special needs; ● Teacher preparation program includes coursework on using data to differentiate instruction; ● Integration of NYCDOE student Assessment and Retention Information System (ARIS) into coursework and professional development;
	Model teacher preparation program will embed extensive clinical experience and interactions.	<ul style="list-style-type: none"> ● Host school sites with at least five teachers with more than five years experience with demonstrated ability to impact student achievement (value-added); ● Extensive fieldwork (½ day, 5 days per week for a full year) in schools during 5th year with MATH-UP participant stipends; ● Integration of MATH-UP participants in school-based professional development by ETS with MC (Mathematics Challenges) and KLT (Keeping Learning on Track); ● Co-teaching by Lehman faculty and school-based personnel (mentors/cooperating teachers);
To create an assessment protocol for pre-service teachers to measure language, literacy and skills to develop mathematical learning and provide effective literacy and mathematics	Model program will develop aligned expectations and provide training and support for mentors, supervisors and faculty.	<ul style="list-style-type: none"> ● All participants (mentors, supervisors and faculty) engage in MC and KLT with MATH-UP pre-service teachers; ● Alignment of clinical experience assessments with NYCDOE teacher quality effectiveness project; and ● Redesign of clinical experience assessments with input from and training of all participants.
	Model program will incorporate rigorous assessment of progress and	<ul style="list-style-type: none"> ● Refine the existing program assessment systems to integrate developing content and pedagogy to the MATH-UP initiative; ● Supplement assessment of MATH-UP graduates

GPRA Indicators	Measures	Activities
instruction to children in grades 1 through 6.	effectiveness of MATH-UP participants.	with value-added data from NYCDOE; <ul style="list-style-type: none"> ● Alignment of clinical experience assessments with NYCDOE teacher quality effectiveness project; and ● Redesign of clinical experience assessments with input from and training of all stakeholders. developing content and pedagogical knowledge

(ii) The likely impact of the services to be provided on the intended recipients of those services.

Recruiting highly qualified, minority individuals into the teaching force is one of the four core purposes of the Teacher Quality Partnership funds, as described in section 201: Purposes. In each of the five years of grant funding, the MATH-UP initiative will recruit cohorts of 25 Bronx-resident, Hispanic, African American, and students from other underrepresented groups who have the interest, demonstrated achievement in, and affinity for learning to teach mathematics to elementary children, grades 1 through 6. Highly qualified individuals will be recruited from one of the following four contexts:

- 1) From the 900 or more undergraduate students who currently elect to “minor” in childhood education at Lehman College,
- 2) From the Black Male Initiative (BMI) program, particularly TALP (Teachers as Leaders Project) scholars who are primarily Hispanic and Black men interested in teaching in New York City schools.
- 3) From students who transfer into Lehman College from local community colleges with whom the division of education has articulation agreements for childhood education, including Bronx Community College and Hostos Community College.
- 4) From students who transfer into Lehman College from other colleges and/or community colleges without articulation agreements.

Interest, demonstrated achievement in, and affinity for mathematics will be determined by:

- Achieved proficiency on the CUNY Mathematics placement examination.
- Passing algebra in high school with a B or better.
- A minimum of nine semester hours of mathematics study prior to certification (CBMS, 2001).
- Graduation in the top third of their high school class (Commission on the Skills of the American Workforce, 2006).

To prepare prospective teachers with *strong teaching skills* (b.1), the MATH-UP initiative will redesign the currently existing, nationally recognized graduate teacher preparation program in Childhood Education with a bilingual extension (grades 1 through 6). The redesigned preparation program will integrate graduate and undergraduate certification programs into a 5th year, math-focused program of study that draws from the improvement recommendations and identified knowledge and skills of reports from the National Mathematics Advisory Panel (2008), the Carnegie Corporation (2009), and National Academy of Sciences (Kilpatrick, et. al., 2001), among others. In addition, lessons learned from national and international examples of teacher preparation reforms will be investigated and incorporated as appropriate and sustainable, such as video-tape analysis (Sherin, Linsenmeier, & van Es, 2009), lesson study (Japan: Perry & Lewis, 2008), individual feedback (Singapore: Barber & Mourshed, 2007), and the diagnostic interview and teaching strategy model (New Zealand: Higgins & Parson, 2009).

The resulting 5th year program will be cohort-based, math-enriched, integrated with the induction and professional development services (described below and in the next section), and delivered in the context of an intensive, year-long, field-based internship at five host school sites in the South Bronx identified in partnership with the NYCDOE. To further ensure that MATH-

UP pre-service teachers are *highly qualified, content strong*, and experiencing content that they will be expected to teach (National Science Board, 2007), the MATH-UP initiative program will be aligned with New York State professional and learning standards. In addition, as part of the MATH-UP admissions and graduation requirements, participants will be expected to take and attain exemplary levels of achievement on the New York State teacher certification examinations including the LAST, ATS-W, and CST.

To implement a *year-long and rigorous teaching pre-service clinical program component* (b.4), the MATH-UP initiative will select five high-needs, South Bronx host school sites in collaboration with the NYCDOE. To ensure that MATH-UP pre-service teachers are observing and participating in effective instruction, the host-school sites will form the South Bronx MATH-UP consortium and build capacity to serve as demonstration sites for increasing mathematics achievement of urban high-need populations. In addition, the host schools will receive ETS research-based professional development prior to receiving the MATH-UP pre-service teachers to increase capacity for demonstrating high-quality instruction. Each cohort of 25 MATH-UP pre-service teachers will be assigned in learning teams of 5 pre-service teachers for each host school site to leverage the capacity-building for high quality mentoring and preparation. MATH-UP pre-service teachers will teach alongside cooperating teachers, selected for their years of experience teaching (no fewer than 5 years) and for demonstrated ability to have a positive impact on student achievement. MATH-UP pre-service teachers will serve as teaching assistants in the host school sites in the mornings and participate in graduate coursework, delivered on-site at the host schools on a rotating basis, in the late afternoons. Thus, coursework and fieldwork are united and school-based. Research shows that an apprenticeship model for pre-service field experiences is a quality of highly effective teacher preparation programs (Maloch, et. al., 2006).

To prepare MATH-UP pre-service teachers to *understand and use formative assessment data to modify and improve classroom instruction* (b.1), the MATH-UP initiative will engage the Lehman College prospective teachers in ETS-implemented and research-based math and formative assessment data-focused annual summer institutes and on-going teacher professional development at host-school sites. The ETS programs, Keeping Learning on Track (KLT) and Math Challenges (MC) are described in detail in the induction section below. In addition, MATH-UP pre-service teachers, during their year-long internships, will observe and participate in the use of NYCDOE's Achievement Reporting and Innovation System (ARIS) to design and deliver instruction to meet student needs. Lehman College's MATH-UP teacher preparation program will also prepare teachers through its required courses (EDE 743 and 744 on diagnosing mathematical learning difficulties and designing mathematical remediation programs). As a part of the preparation program redesign, these two courses will integrate and reinforce the ETS formative assessment data and ARIS data-use systems and protocols of analysis for differentiation of instruction, where applicable and appropriate.

To prepare *general education teachers to teach limited English proficient students* (b.6) and *to teach students with disabilities* (b.5), the MATH-UP initiative will provide the MATH-UP pre-service teachers with coursework that emphasizes understanding and meeting the needs of bilingual, ELL and special needs students. Courses will require satisfactory completion of field-based assignments, including video analysis and lesson study, in working with bilingual, ELL, and students with special needs: to be developed in partnership with BronxNet.

To provide *high-quality professional development to strengthen the content knowledge and teaching skills of elementary school teachers* (b.3.i) and to support *in-service professional development strategies and activities* (b.2), the MATH-UP initiative will engage host school sites

in summer institutes and on-going professional development in childhood mathematical learning and the use of ARIS and formative assessment data to inform instruction. Starting in the summer of 2010, ETS will provide two-week summer institutes for host school teachers and administrators, Lehman College faculty members, and MATH-UP pre-service teachers. The content of the summer institutes are described in the induction section below. Throughout the school year, host school teachers, administrators, and MATH-UP pre-service teachers will be engaged in twice monthly Professional Learning Communities, consistent and integrated with the NYCDOE's inquiry team initiative, to focus on providing Mathematical Challenges (MC) during instruction, and using formative assessment data to Keep Learning on Track (KLT). Research shows that on-going and on-site professional development results in sustained improvements in instruction and as well as systemic school reforms (Darling-Hammond, Wei, Andree, Richardson, & Orphanos, 2009).

To train other classroom teachers to implement literacy programs that incorporate the essential components of reading instruction (b.3.ii), the MATH-UP initiative will supplement the NYCDOE professional development programs in literacy by emphasizing the language and literacy of mathematics during the Lehman College teacher preparation program. Cooperating teachers who host the Lehman MATH-UP pre-service teachers will be provided with a cooperating teacher training program to familiarize them with the expectations for the development of pre-service teachers' content knowledge, skills, and dispositions. Cooperating teachers and faculty members will also be co-trained in the use of the assessment protocols for pre-service teacher development in the language and literacy of mathematics. Assessment tools for pre-service as well as cooperating teachers, to be developed during the MATH-UP initiative,

will emphasize the language, literacy and skills to develop mathematical learning in and provide effective literacy and mathematics instruction to children in grades 1 through 6.

To engage higher-education *faculty to work with highly qualified teachers in classrooms of high-need schools* (b.3), the MATH-UP initiative will engage Lehman College faculty in supervising the year-long internships of MATH-UP pre-service teachers, co-teaching the internship seminars with cooperating teachers, and integrating ETS professional development activities into seminar content, where possible and applicable. In addition, highly qualified host school teachers and administrators will be invited to co-teach the content and methods courses in the Lehman College teacher preparation program of study. Research demonstrates that engaging higher education faculty and cooperating teachers in school-based coaching, mentoring and teaching prospective teachers results in greater teacher retention and more effective classroom instruction (Darling-Hammond, et. al., 2009).

To involve higher education and host school faculty in the *use of empirically-based practice and scientifically valid research on teaching and learning* (c.2), MATH-UP higher education and host school faculty will engage in the professional development and induction processes and will form higher education professional learning communities/study groups to analyze MATH-UP pre-service teachers' performance assessments and work samples. This faculty research study group will also develop and utilize video-tape analysis as data sources which complement the NYCDOE initiative to develop performance assessments centered on teachers' analyses of video-tapes of their instructional practices.

(iii) The extent to which the training or professional development services to be provided by the proposed project are of sufficient quality, intensity, and duration to lead to improvements in practice among the recipients of those services.

To prepare the MATH-UP pre-service teachers to meet the challenges of urban teaching in high-need schools, the 5th year MATH-UP teacher preparation program begins in the senior year as students complete their undergraduate studies and graduate with baccalaureate degrees in one of the liberal arts and sciences. A sample 5th year MATH-UP program, outlined below, comprises two summers and one full academic year of graduate study, resulting in initial and professional certification in childhood education (grades 1 to 6) with a certification extension in bilingual education.

Under-graduate	ECE 301: The Child in Context: Child Study and Development—Birth to 6 (3 cr) ECE 302: Child, Family, Community and Schools in Sociocultural Contexts—Birth to 6 (3 cr) EDE 715: Learning/Teaching Mathematics in Childhood Settings - Grades 1 to 6 (3 cr) EDE 716: Learning/Teaching Art in Childhood Settings—Grades 1 to 6 (3 cr)
Graduate SU-1	EBS 701: Issues in Bilingualism (3 cr) EDE 621: Introduction to Reading (3 cr)
Graduate Fall-1	EDE 738: Learning and Teaching Literacy in Bilingual/Bicultural Childhood Settings - 1 to 6 (3 cr) or EDE 713: Literacy in Childhood Settings - 1 to 6 (3 cr) EDE 739: Learning/Teaching Social Studies in Bilingual/Bicultural Childhood Settings - 1 to 6 (3 cr) or EDE 714: Learning/Teaching Social Studies in Childhood Settings - 1 to 6 (3 cr) EDE 717: Learning/Teaching Science in Childhood Settings - Grades 1 to 6 (3 cr) EDE 740: Studies in the Teaching of Elementary Mathematics, Advanced course (3 cr)
Graduate Spring-1	EDE 743: Diagnosis of Difficulties in Learning Elementary School Mathematics (3 cr) EDE 744: Practicum in Developing Remedial Programs for Children Experiencing Difficulty in Learning Mathematics (3 cr) EDE 783: Student Teaching Seminar (2 cr) EDE 795: Supervised Student Teaching - 1 to 6 (4 cr)
Graduate Su-2	EDE 718: Learning and Teaching Music in Childhood Settings - 1 to 6 (3 cr) EDE 757: Ethics and Professionalism in Childhood Teaching (3 cr)

In addition to the 5th year program of study and the year-long clinical experience/ internship in the host schools, the MATH-UP initiative will provide professional development and induction support services for all MATH-UP participants, including Lehman College faculty and host school teachers, to ensure the quality, intensity and duration of services. The two

components of the professional development and induction support to be provided by ETS are described below.

Keeping Learning on Track (**KLT**) is a sustained, interactive professional development program that supports teachers to adopt minute-to-minute and day-by-day assessment *for* learning (AfL) strategies that have been shown by research to powerfully increase student learning. Teachers are introduced to key strategies of assessment *for* learning (AfL) and shown how they can incorporate these strategies into their teaching. The teachers are presented with a number of specific AfL teaching techniques that might be used to implement a particular strategy in order to make it come to life in their own classrooms.

The ETS Math Challenges (**MC**) are age and grade appropriate constructed-response tasks with multiple steps that cover key mathematical skills or concepts aligned with state and/or local curriculum standards. The challenges are developed by a team of assessment specialists who are former elementary school teachers and have experience using a variety of teaching and assessment methods. The goal of each challenge is to provide the teacher evidence of the level of student understanding of specific topics and learning targets in order to capture tangible student outcomes. The evidence can be used to identify patterns of learning; support conclusions about a student's knowledge, skills, or other attributes; and provide diagnostic feedback for groups of students as well as for individual students.

To ensure that higher education and host school *faculty will substantially participate in the induction program* (c.3), the MATH-UP initiative will provide stipends and/or summer salary for (a) faculty participation in the ETS summer institutes, (b) through reassigned time (in-kind contribution) higher education faculty will be engaged to serve as Professional Development School (PDS) liaisons to the host-schools, (c) identify faculty to be trained by ETS to co-plan

and co-lead ETS professional learning communities to ensure continuation at the conclusion of the grant, and (d) identify host-school teachers to be trained by ETS as school-based mentors.

Evaluation of the MATH-UP initiative is intended to provide evidence that the MATH-UP 5th year program initiative embedded with a year of clinical experience in host schools as well as participation in on-going, collaborative professional development and two years of induction support provides the level of quality, intensity and duration required to impact teacher competence and student achievement.

(iv) The extent to which the services to be provided by the proposed project involve the collaboration of appropriate partners for maximizing the effectiveness of project services.

Lehman College is well qualified by its programs, partnerships and experience to collaborate to prepare Early Childhood and Childhood teachers in mathematics. The Division of Education has rigorous teacher education programs in mathematics, an existing Teacher Academy for undergraduates who are majoring in STEM, a long-standing commitment to educational needs of local schools and districts in mathematics, interdivisional collaborations in making changes for mathematics education students, partnerships with local schools and community school districts to strengthen their mathematics curricula, and collaborations with informal institutions, such as the Bronx Zoo and the American Museum of Natural History that integrate mathematics into science instruction. The Division of Education's 2008-09 Collaborative Programs booklet highlights Lehman's involvement in more than 50 collaborative education programs with over 150 public schools throughout the Bronx, the other boroughs of New York, and lower Westchester. Lehman also has a *Professional Development Schools* network created to promote partnerships in fostering environments that support teaching and learning in high needs schools. Lehman's Teacher Education programs take advantage of these

schools for professional development purposes to provide their students with authentic classrooms and field experiences through student teaching and internships. Finally, Lehman College has demonstrated effectiveness in requesting, receiving, and implementing externally funded projects. In the past year, for example, Lehman College has been funded for an IPT for the 21st Century proposal (NSF 08-525) to develop teacher leaders who will strengthen teaching and learning in mathematics (Mathematics Teacher Transformation Institutes *MTTI*) within Bronx middle and high schools, as well as the Noyce Teacher Scholarship Program (NSF 07-513) to prepare mathematics teachers for urban middle schools. These funded projects respond to the need to encourage qualified high school students to pursue a STEM career, for preparing qualified undergraduates who are majoring STEM to become science and mathematics teachers in high need schools, and for developing mathematics leaders in Bronx middle schools. These funded projects further demonstrate the capacity and commitment of Lehman College's Division of Education to deliver on the promises outlined in this proposal to prepare childhood pre-service teachers with a mathematics-enriched curriculum to teach in high-need urban schools.

As a MATH-UP partner, the *New York City Department of Education (NYCDOE)* contributes to the development and implementation of the MATH-UP initiative through representation on the expert advisory board as well as a host school consortia member on the operational management team. In addition, the NYCDOE brings the synergy of six key initiatives that will be integrated into or aligned with the MATH-UP initiative: ARIS, Inquiry Teams, CAO for Special Education and English Language Learners, TLC, the Teacher Data Project and the Measures of Effective Teaching project. The New York City Department of Education's *Achievement Reporting and Innovation System (ARIS)* provides New York City teachers, principals, and other educators with an online platform for: (1) Exploring data they can

use to improve student outcomes – teachers are able to view assessment, attendance and student profile information, (2) Finding and sharing effective instructional and organizational practices by publishing documents and taking part in discussions and blogs, and (3) Collaborating with colleagues and other educators in their schools and networks facing similar challenges and solving problems together. *Inquiry Teams* have been a key strategy of the Children First Reforms. The inquiry team is a group of educators at each school who meet regularly with the goal of improving outcomes for a continually expanding group of students with whom the school may not have been successful to implement instructional change strategies to ensure students progress. In July 2009, Chancellor Joel Klein created the position of *Chief Achievement Officer* for Special Education and English Language Learners to improve outcomes for New York City’s highest needs children—those with special needs and those who are still learning English which is consistent with the MATH-UP initiative objectives. The *Teaching Learning Collaborative (TLC)* of the NYCDOE supports selected student teachers in their full-time job search, by providing specialized recruitment assistance including: mock interviews, resume writing and networking workshops, principal panel and career fair invitations, and inclusion in the New Teacher Finder. The NYCDOE *Teacher Data Initiative* provides value-added data reports for teachers in grades 3 through 8. Lehman College is one of two partner colleges currently obtaining value-added data on its program completers who are employed by the NYCDOE in one of the grades in which data is available. Lastly, the *Measures of Effective Teaching* project, funded by the Bill & Melinda Gates Foundation is intended to develop fair, accurate, and useful guides to what really make effective teaching and learning. The project will explore a broad array of teacher measures: video observations, surveys and student growth. The MATH-UP initiative will incorporate lessons learned into teacher preparation.

To effectively prepare teachers by *providing content expertise and expertise in teaching* (c.1), the MATH-UP initiative partners with Educational Testing Service (ETS) to provide professional development and induction support for every teacher in the MATH-UP initiative. Professional development and induction support services include the two research-based programs: Keeping Learning on Track (KLT) and Math Challenges (MC). These programs are presented during a two-week intensive summer program and reinforced throughout the school year via participation in Professional Learning Communities. To ensure communication, collaboration, and integration, ETS will designate a representative, or representatives, as members of the expert advisory board and the operational management team.

To sustain, customize, and enhance the professional development and induction processes as well as the quality of the pre-service teacher preparation program beyond the five year funding cycle, BronxNet, a municipal access cable station, is the fourth MATH-UP partner. BronxNet administers four television channels and provides a wide variety of community programming, as well as television production training for Bronx residents and students in Bronx colleges. With its studios housed on the Lehman College campus and an established partnership with Lehman College Division of Education, BronxNet's partnership with the MATH-UP initiative will develop and produce 20 video cases of pre-service and in-service teachers' instructional practices and student learning. 10 video cases are intended to capture the development of mathematical ideas in diverse, urban elementary school children. 10 video cases are intended to capture the development of key competencies in MATH-UP participants. In addition to collaborating with the NYCDOE, ETS, and members of the expert advisory panel in the development of the video cases, BronxNet will provide a representative to the expert

advisory board and the operational management team to contribute to on-going project development.

(b) Quality of the Project Evaluation

Research for Better Schools (RBS) is a private nonprofit educational R&D firm located in Philadelphia, Pennsylvania. Founded in 1966, RBS has over 40 years of experience providing services to schools, universities, states, and other education organizations in the mid-Atlantic region and beyond. RBS has centers focused on research and evaluation, school improvement, and international studies. In addition, RBS has its own Institutional Review Board (IRB) and has negotiated a Federal Wide Assurance (FWA) stating its commitment to follow the regulations governing protection of human subjects involved in research under the Common Rule (Title 45, Code of Federal Regulations, Part 46, and Subpart A).

RBS has substantial experience in directly providing evaluation services to a number of federally funded education projects including: the New Jersey Statewide Systemic Initiative, the Math & Science Partnership of Greater Philadelphia, and the Lancaster, PA, Local Systemic Change project, all funded by the National Science Foundation (NSF). RBS is currently serving as the external evaluator of one of eight Striving Readers projects funded by the U.S. Department of Education, aimed at improving the reading skills and capabilities of middle school students. This five-year project involves some of the same quantitative and qualitative methodologies that RBS proposes to use in evaluating the Mathematics Achievement with Teachers of High-need Urban Populations (MATH-UP) project.

(i) The extent to which the methods of evaluation include the use of objective performance measures that are clearly related to intended outcomes of the project and will produce quantitative and qualitative data to the extent possible;

The *evaluation design* will consist of formative and summative components. The formative component will include both qualitative and quantitative analyses of data gathered during the first 18 to 24 months of project implementation and will be used to improve the project as it is implemented in its second through fifth years. The majority of the objectives for the formative component will be process-oriented rather than outcomes-oriented. The formative component will continue on a smaller scale during the third through fifth years of MATH-UP implementation to document fidelity to the final design of the project.

The summative component of the evaluation will include quasi-experimental and other quantitative statistical analyses to determine whether the identified goals. Most of the objectives of the summative component will be outcomes-oriented; however, it will still include some process-oriented objectives so implementation can be described.

The summative evaluation will include activities matched to the initiative's goals with respect to teacher hiring, quality, and retention, as well as the achievement of the students of new teachers. However, the top priorities of the evaluation will be the program's impact on pre-service teachers' content and pedagogical knowledge, retention, and academic achievement of students they teach. Since the first cohort of pre-service teachers (cohort 1 hereafter) will be college seniors in 2010–11 (Year 1), part of the focus of the summative evaluation for Year 1 will be assisting the project partners in their development of assessments of content and pedagogical knowledge.

Another focus of the summative evaluation during Year 1 will be the Teacher Retention Questionnaire, developed and validated by RBS, designed to predict teachers' long-term retention (> 3 years). RBS will conduct a thorough literature review before developing the survey items. RBS will select items from other validated surveys or questionnaires that address

how satisfied teachers or employees are with various aspects of their jobs and other factors that might be related to retention-in-job. After developing the items, RBS will pilot-test the instrument to participating in-service teachers and conduct an item analysis (with reported Cronbach's α for each domain) and an exploratory common factor analysis to construct a multidimensional description of job satisfaction and commitment to teaching, especially in high-need schools,. Once the instrument is validated, RBS administer it to pre-service teachers starting in Year 3. Then a confirmatory factor analysis will be conducted using the cohort 1 pre-service teachers' responses. The survey will use the Remark Office OMR software so that these test data can be easily scanned into a computer database for statistical analysis or, if feasible, administer the surveys online.

Ongoing summative evaluation activities

The following section describes cross-sectional and longitudinal analyses designed to answer the following research questions:

1. What is MATH-UP's impact on participating pre-service teachers' likelihood of graduation and attainment of full teacher certification?
2. What is MATH-UP's impact on participating pre-service teachers' short-term and long-term retention?
3. What is the impact of the teacher preparation program on mathematics content and pedagogical knowledge of participating pre-service teachers, including achievement, passing rate of teacher certification exams, and use of instructional technology?
4. What is MATH-UP's impact on the hiring of highly-qualified teachers in MATH-UP host schools and other high-need schools?

5. How do the teacher hiring outcomes compare when disaggregated by teacher characteristics (academic subject, race/ethnicity, certification status, etc.) and school context (ELL student percentage, economically disadvantaged student percentage)?
6. What is the immediate and long-term impact of the program on student mathematics achievement taught by the teachers from cohort 1 and cohort 2?
7. Does the immediate impact of the program vary from the 2012–13 to 2014–15 school years?
8. How do the attained outcomes compare when disaggregated (when possible) by grade level, race/ethnicity, gender, school, socio-economic status, English language proficiency, or disability status for students?

Methods

A quasi-experimental **Non-Equivalent Control Group Design (NECG)** is most appropriate for the evaluation of the program's impacts in Year 3 and on. Five high-need Bronx elementary schools (as measured by percentage of ELL students, economically disadvantaged students) will be selected as the MATH-UP host schools. Five in-service teachers will be selected from each of these five schools ($N = 25$) to participate in the professional development in Year 1. In Year 2, five pre-service teachers will be assigned to each of the five host schools, where they will be matched with an in-service mentor/cooperating teacher and serve their clinical experiences. Twenty-five non-MATH-UP student teachers will be selected from comparable high-need schools in the Bronx as comparison teachers for the cohort 1 teachers. In order to establish initial comparability of treatment (MATH-UP participants) and comparison (non-participants) samples, a comparison teacher cohort will be selected through propensity score matching (e.g., matching nonparticipating and participating teachers on a series of

characteristics prior to the program implementation). The propensity score matching will enable the evaluator to construct an optimally matched comparison group for the 25 participants from cohort 1. In year 3, the second cohort (cohort 2) of pre-service teachers ($N = 25$) will be selected to participate in the program, and a similarly constructed group of comparison teachers will be selected to serve as the comparison group for cohort 2. Both cohort 1 and cohort 2 teachers' responses to the Teacher Retention Questionnaire will be used for a confirmatory factor analysis to ensure that the instrument will derive consistent results to predict teachers' long-term retention.

The NECG design can be visualized as follows:

$$\frac{\mathbf{O}_1 \mathbf{X}_1 \mathbf{O}_2}{\mathbf{O}_3 \mathbf{X}_c \mathbf{O}_4}$$
 where \mathbf{O}_1 , \mathbf{O}_2 , \mathbf{O}_3 , and \mathbf{O}_4 represent observed outcomes at four different time points; \mathbf{X}_1 represents treatment received by the treated group (e.g., MATH-UP pre-service teachers), \mathbf{X}_c represents the condition associated with the comparison group (e.g., non-MATH-UP student teachers). The propensity score matching technique will be applied as the quasi-empirical “correction strategy” to ensure the similarity between treatment and comparison groups in their pre-intervention characteristics and to correct for the selection biases in making estimates of the program impact. At the student level, the program group will consist of the students being taught by cohorts 1 and 2 after they have been hired as professional teachers, while the comparison group will consist of the students being taught by new teachers in comparison groups that will be constructed through similar methods during Years 3, 4, and 5.

Model Specifications

Cross-tabulation Analyses. Cross-tabulation analyses will compare MATH-UP participating pre-service teachers and non-MATH-UP pre-service teachers to determine if MATH-UP participants will have higher retention rates, passing rates on the state certification

exams, and propensity of working in high-need schools and high-need subject areas. Chi-square tests of the significance of the relationship between the treatment variable and each teacher characteristic (minority status, certification status, school demographics) will be performed separately for cohort 1 and cohort 2 pre-service teachers. In addition, the teacher demographic and qualification variables, along with the control variables (e.g., undergraduate GPA, grade level), will be used as predictor variables in bivariate and multivariate logistic regression models of the treatment variable. Measures of the magnitude of association (i.e., effect size) produced by logistic regression analysis will be represented by odds ratios (OR).

Cross-sectional Models. Cross-sectional analyses of the immediate impact of the first year participation in MATH-UP Initiative on teachers' scores on New York State Teacher Certification Tests (NYCTCE) and their students' performance on New York State Testing Program (NYSTP) will be conducted at the end of Year 3, 4, and 5, respectively. To analyze nested data, e.g., students nested within teachers and teachers nested within schools, hierarchical linear modeling (HLM) technique will be used to account for dependency in the observations/measures (Raudenbush & Bryk, 2002). The standard errors of parameter estimates will be accurately estimated using HLM. HLM will also be applied to estimate and test the statistical significance of the difference between mathematics and other subject area achievement of students taught by the participating pre-service teachers. These analyses will include treatment and comparison teachers of all grades and their students. Since the treatment (1= MATH-UP, 0= comparison) will be implemented at the teacher level, the inclusion of teacher variables in three-level models will be investigated. The spring NYSTP test scores for the appropriate year will be the dependent variable in these analyses. The baseline NYSTP scores—representing the same test and subject as the dependent variable—will be a student-level covariate, and other control

variables at the student, teacher, and school level will be tested for inclusion as covariates in these analyses. Equations illustrating the HLM analyses predicting student achievement appear in Appendix D.

In addition to the HLM analysis of data for Cohort 1 and 2 respectively, a “short interrupted time-series” (SITS) analysis will also be applied to the cross-sectional data in order to measure MATH-UP’s impacts on teacher and student achievement over time. The measured impacts will focus on three facets of teacher content knowledge and student achievement: (1) mean test scores, which summarize impacts on total performance; (2) the distribution of scores across specific ranges, which will identify where impacts are experienced in the distribution of teacher/student performance; and (3) the variation of scores, which indicates how the disparity in student performance is affected (Bloom, 2003). Given the potential availability of the mathematics pre-intervention achievement data for the last 5 years, RBS proposes to use a baseline mean model for the SITS analysis, where 5 years of baseline NYSTP scores are used to project counterfactuals, hence reducing the sensitivity of impact estimates to aberrations in student performance. RBS will calculate the statistical power for the comparison of the treatment and control conditions using the Optimal Design software (Spybrook, Raudenbush, Liu, Congdon, and Martínez, 2008) after we receive more information about the school and class sizes.

(iii) The extent to which the methods of evaluation will provide performance feedback and permit periodic assessment of progress toward achieving intended outcomes.

The *formative component* of the evaluation will be used to establish baselines and to identify, modify, and/or create assessments to be used to track implementation and to measure the project’s impact. The research questions that will drive the formative evaluation are:

1. With what frequency does each of the proposed services (academic, professional development, induction etc.) occur?
2. With what frequency and quality does collaboration between pre- and in-service teachers, Lehman faculty and advisory boards occur? How do the components of the organizational system supporting these proposed services integrate and function as a cohesive unit?
3. What kinds of experiences did/do the program participants (pre- and in-service teachers) and program staff have as part of receiving/administering this program?
4. What is the perceived level of satisfaction of those receiving the proposed services? What are service recipient's recommendations for service improvement?
5. What is the context in which this program is operating? How and to what extent do contextual factors affect the provision of the proposed services?
6. What are specific, data-supported recommendations that can be made to program administration and staff in order to support the provision of high-quality services as defined by the U.S. Department of Education in its Teacher Quality Partnership Grants Program?

(ii) The extent to which the methods of evaluation address the evaluation requirements in section 204(a) of the HEA;

In order to answer these questions, RBS will collect data related to the implementation of the six MATH-UP initiative objectives and related program activities.

<i>MATH-UP Program Activity</i>	<i>Type of data and method of collection</i>	<i>Timeline</i>
1. <i>Reform</i> and implement an elementary education teacher preparation program	Review Lehman College program materials Interview appropriate stakeholders (e.g., Lehman College faculty, NYCDOE district and school administrators)	Beginning of project through end of first school year; continuing annually
2. Build school capacity to provide high-quality, <i>clinical experiences</i> for pre-service teachers	Interview Lehman College faculty and host school administrators Observe instances of the following: <ul style="list-style-type: none"> • Math and literacy discovery centers • PD for in-service teachers (Year 1) • In-school activities of pre-service teachers (Years 2 and 3) • Interviews with pre-service and in-service teachers 	Spring or summer 2011 and continuing annually
3. Provide a sustainable, research-based, integrated <i>induction</i> program	Observe meetings of Lehman College, ETS, and NYCDOE representatives; participate in discussions of induction program activities Observe development of video cases; view sample of videos produced	Years 1 through 5
4. Provide multi-layered, coherent, relevant and responsive <i>training and support</i> to all stakeholders	Review Lehman College teacher preparation program documents Observe “5 th -year” activities of pre-service teachers Interview Lehman College faculty, school personnel, and pre-service teachers Observe instances of summer PD, PLCs, and induction activities	Onset of project through Year 5
5. Engage in extensive <i>recruitment and rigorous selection</i> processes	Review recruitment documents Observe recruitment activities Interview participants Examine demographic data of participants	Years 1 through 3
6. Reform <i>literacy training</i> of pre-service and in-service teachers to support the MATH-UP focus	Observe instances of reformed training Review training documents and PD and induction program materials	Onset of project through Year 3

(c) Significance

(i) The likelihood that the proposed project will result in system change or improvement.

The lessons learned through this project will be used to improve/reform all programs within the Lehman College Division of Education. This will be the first 5th year program at Lehman College and the first to engage pre-service teachers in a stipended ½ day, 5 day per week on site fieldwork. Lehman College data show that its diverse pool of undergraduates minoring in teacher education fail to persist to certification because of financial and family constraints that prohibit taking a semester off from undergraduate study to student teach. In New York State teachers are then required to obtain a masters degree within 5 years of certification.

The proposed 5th year program better meets the needs of student from underrepresented groups to obtain both initial and professional certification with a combined BA/MA program that respects their need for employment to support their families. Thus, the MATH-UP program is the first to respond to the needs of the diverse, Bronx resident student population of Lehman College. It will also be the first program working with the NYCDOE to provide a two-year induction program for graduates that collaborates with school personnel. Further, the MATH-UP program provides a model of school-focused, needs-based preparation program development that develops knowledge and skills along a continuum from preparation through induction that is responsive, rigorous and consistent with district priorities and school needs. The digital content developer, BronxNet Cable, will be preparing video cases that ensure the processes and materials are documented and can be utilized to impact further teacher preparation program reform within the partnership, across CUNY, and shared with other teacher education programs. While this is not the first program which uses the cohort model the MATH-UP initiative extends the model to place a sub-cohort of pre-service teachers at each of the five host schools.

Thus, over the five years of this program the program reforms will be documented, sustained, and integrated into additional programs leading to institution-wide reform. Program reforms to be replicated include: rigorous admissions of students from underrepresented groups, cohort supportive structures and monitored progress through the program of study, development of capacity at host school sites, co-teaching with school personnel, extended clinical experiences (1/2 day, 5 days per week from -September to June), school-based courses, needs-based curriculum design in collaboration with the NYCDOE, program emphases integrated with NYCDOE priorities, assessment process for pre-service teachers aligned with NYCDOE identified qualities, and preparation to use data through the ARIS database.

The MATH-UP initiative has the potential to provide systemic improvement in the collaborative nature of the program model between schools and teacher preparation programs and among higher education faculty, school personnel, and recognized experts in evaluation, professional development and mathematics. Historically at odds, the school-focused, needs-based design of the MATH-UP initiative brings together schools and higher education with a common goal that is made real through a focus on student achievement through the continuum of teacher development preparation programs, professional development and induction.

(ii) The extent to which the proposed project is likely to build local capacity to provide, improve, or expand services that address the needs of the target population.

There are three areas of potential impact on local capacity: the capacity of the schools to serve as demonstration sites for best practices, the capacity of an institution of higher education to respond to local needs in program development, and the capacity of both entities to collaboratively improve the preparation, competence, and retention of teachers.

To build local capacity in the schools, the MATH-UP initiative proposes to develop Mathematics Discovery Centers within each host school so that the schools have centers in which to study (through inquiry groups and professional learning communities) the development of mathematical learning in elementary age, urban children. These centers then, also, serve as demonstration sites for best-practices in instruction and assessment. Furthermore, the MATH-UP initiative engages cooperating teachers in professional development in the content focus on the proposed program as well as training as student teacher mentors prior to the placement of MATH-UP participants in the schools. This year-long preparation of host school sites builds their capacity as collaborative partners in teacher preparation.

Lehman College, the only four-year, public senior college in the Bronx will, through MATH-UP, build its capacity to prepare and provide teachers for Bronx schools who are representative of the ethnic and linguistic populations of their neighborhoods. Further, capacity for developing school-focused, needs-based teacher preparation programs is enhanced with school personnel involvement in program course delivery, integration of adjunct and full-time faculty into professional development and induction support, involvement of school personnel in program management, alignment of the content of the teacher preparation program with NYCDOE priorities and initiatives.

Lastly, the collaboration of the schools and the institution of higher education will build capacity for long-lasting improvement in recruitment, retention and competency practices. Teachers are recruited who are from the neighborhoods in which they will teach and, as research shows, are more likely to stay in teaching as a result. Furthermore, teacher competency and a focus on student achievement are congruent between the graduate program of study and the clinical experience, professional development, and induction segments of the program. This

focus on shared ownership of teacher preparation builds local capacity to continue to engage at this high level of simultaneous reform. The MATH-UP initiative project design underscores the value of a shared ownership process to sustain responsibility for the collaborative model after the funding period ends.

(iii) The importance or magnitude of the results or outcomes likely to be attained by the proposed project, especially improvements in teaching and student achievement.

The innovative design for TQP as a 5th year program focused on preparing Early Childhood and Childhood teachers with an emphasis on content and pedagogy in mathematics constitutes a system change and synergizes the capacities of complimentary educational institutions. The program includes: (1) having MATH-UP participants spending ½ days in a host school, selected with the collaboration of NYCDOE, observing and working with a cooperating teacher; (2) preparing teachers to teach mathematics, within the context of early child and childhood settings, to a diverse urban, largely bilingual and special needs population; (3) offering courses co-taught by education faculty/math specialists and teachers from host schools; (4) implementing an extensive, focused two year induction program with mentoring, professional development and summer seminars involving school colleagues; and (5) developing a series of early childhood and childhood visual mathematics case studies for student analyses and professional development.

The importance of program reform in teacher preparation and its potential replication in the Bronx and beyond, however, are not enough. Preparing Bronx residents as teachers for Bronx schools means that Bronx students and families will finally be able to see themselves in the classrooms in which they learn. *That* has the potential to transform student motivation and attendance as well as teacher turnover. Developing best practices at sites in the South Bronx

means that where urban diversity and challenges are urgently real, so is the potential for excellence in teaching and learning. *That* has the potential to transform urban neighborhoods and a cycle of under-education and poverty. Bringing together the talents and expertise of personnel in public schools, public higher education, and private entities means that this is not “their” problem, it is OUR challenge. *That* has the potential to transform business as usual. If we can make a difference here, in the Bronx, we can make it anywhere. And the more models we, as a nation, have for reducing the achievement gap and for improving teacher preparation, the more likely we are to eliminate the “shame” of a society that can build a space shuttle and, yet, fail to educate all of its citizenry to the same level of excellence.

(iv) The potential for continued support of the project after Federal funding ends, including, as appropriate, the demonstrated commitment of appropriate entities to such support.

Continued support for the reforms developed and piloted through the MATH-UP initiative will be pursued during the grant period. The reformed program of study will be registered with the New York State Education Department and will become the first early childhood/childhood mathematics 5th year certification program in the City University of New York. Additional programs will be reformed as evidence of program impact becomes available through formative evaluation and research studies and the video cases created by BronxNet Cable will ensure that preparation training processes and tools are sustained. Demonstration site development will be documented and replication will be instituted at the discretion of the NYCDOE. To sustain the program stipends provided during clinical experience, supplemental financial support will be pursued through the NYCDOE as the program shows impact and effectiveness. The NYCDOE currently allocates millions of dollars to the preparation of alternative route teachers with its NYC Teaching Fellows programs as well as support for the

Teach for America program. When the MATH-UP program demonstrates positive outcomes, NYCDOE financial support for teacher preparation in shortage areas will find support. As additional students are admitted, program tuition revenues, enrollment numbers, and CUNY and grant supplemental funding will sustain further reforms and innovations of the teacher preparation programs at Lehman College. MATH-UP and other program participants will seek TEACH grant and federal funding for graduate study.

(d) Quality of the Management Plan

(i) The adequacy of the management plan to achieve the objectives of the proposed project on time and within budget, including clearly defined responsibilities, timelines, and milestones for accomplishing project tasks.

	Fa 2010	Fa 2011	Fa 2012	Fa 2013	Fa 2014
LC Senior	25 (a)	25 (b)	25 (c)	25 (d)	25 (e)
		Summer 11	Summer 12	Summer 13	Summer 14
LC Graduate		25 (a)	25 (b)	25 (c)	25 (d)
Induction			25(a)	25 (a) and 25 (b)	25 (b)
Total			25 (a)	25 (b)	25 (c)

Timeline	Milestones	Responsible Individual
January 2010 to July 2010:	<ul style="list-style-type: none"> • Search Processes initiated • Hiring completed for Project director, administrative asst. and data support person, • Initial planning meetings of Advisory Panel and Operations team • Host school sites/cooperating teachers identified • Recruitment of MATH-UP undergraduates • Preliminary screening and pre-assessments as proposed in evaluation plan • Program redesign meetings, • Revisions and initiation of internal curricular approval process • Coordination of summer institute with ETS 	Principal Investigator PI and search committee PI PI, NYCDOE PI, Lehman Faculty, Research Coordinator Research Coordinator, RBS Lehman Faculty Project Director, ETS, DOE

¹ The letters designate progression of students through the program year to year.

August 2010	<ul style="list-style-type: none"> • Kick-off with ETS summer institute • Registration of selected, cohort 1, MATH-UP participants 	ETS, NYCDOE, Bronx Schools and Personnel, project staff, Lehman faculty
September 2010 to May 2011:	<ul style="list-style-type: none"> • Cohort 1 MATH-UP Undergraduate Coursework, • Ongoing assessment and evaluation • Ongoing school visitations • Curriculum approval through College and CUNY, • Research team meetings • TQP team to DC meetings (twice) • Monthly operational team meetings • Advisory Meetings 	Lehman Faculty, Bronx school personnel Research Coordinator, RBS, Faculty Research Team, Project director, Lehman Faculty Lehman Faculty PI, PD, RBS, Research Coordinator Project Director PI
June 2011 to August 2011:	<ul style="list-style-type: none"> • Recruitment of cohort 2 undergraduates into MATH-UP program • Preliminary screening and pre-assessments as proposed in evaluation plan • ETS summer institute 2 • Summer research team meetings • Summer advisory meetings 	As in summer 1
September 2011 to May 2012:	<ul style="list-style-type: none"> • Cohort 1 begins 5th year program in field • Cohort 2 MATH-UP Undergraduate Coursework and ongoing visitations, • January advisory and research team meetings • Replication of successful program elements into additional preparation programs <ul style="list-style-type: none"> • TQP team to DC meetings (twice) • Monthly operational team meetings 	Lehman Faculty, Bronx school personnel Lehman Faculty, Bronx school personnel PI, PD, RBS, Research Coordinator Project Director PI
June 2012 to August 2012: Recruitment and Summer 3	<ul style="list-style-type: none"> • Recruitment of cohort 3 undergraduates into MATH-UP program • Preliminary screening and pre-assessments as proposed in evaluation plan • ETS summer institute 3 • Summer advisory and research team meetings 	PD, Lehman Faculty, Research Coordinator Research Coordinator, RBS As in summer 1
September 2012 to May 2013:	<ul style="list-style-type: none"> • Cohort 1 graduates and begins induction • Cohort 2 begins 5th year program in field • Cohort 3 MATH-UP Undergraduate coursework and ongoing visitations,, • January advisory and research team meetings • TQP team to DC meetings (twice) • Continued replication efforts 	ETS, NYCDOE, mentors Lehman Faculty, Bronx school personnel Lehman Faculty, Bronx school personnel PI, PD, RBS, Research

	<ul style="list-style-type: none"> • Monthly operational team meetings 	Coordinator Project Director PI
June 2013 to August 2013: Recruitment and Summer 4	<ul style="list-style-type: none"> • Recruitment of cohort 4 undergraduates into MATH-UP program • Preliminary screening and pre-assessments as proposed in evaluation plan • ETS summer institute 4 • Summer advisory and research team meetings 	As in summer 1
September 2013 to May 2014:	<ul style="list-style-type: none"> • Cohort 1 continue induction • Cohort 2 graduates and begins induction • Cohort 3 begins 5th year program in field • Cohort 4 MATH-UP Undergraduate coursework and ongoing visitations, , • January advisory and research team meetings • TQP team to DC meetings (twice) • Monthly operational team meetings 	ETS, NYCDOE, mentors ETS, NYCDOE, mentors Lehman Faculty, Bronx school personnel Lehman Faculty, Bronx school personnel PI, PD, RBS, Research Coordinator Project Director, PI
June 2014 to August 2014:	<ul style="list-style-type: none"> • Recruitment of cohort 5 undergraduates into MATH-UP program • Preliminary screening and pre-assessments as proposed in evaluation plan • ETS summer institute 5 • Summer advisory and research team meetings 	As in summer 1
September 2014 to December 2014:	<ul style="list-style-type: none"> • Cohort 2 continue induction • Cohort 3 graduates and begins induction • Cohort 4 begins 5th year program in field • Cohort 5 MATH-UP Undergraduate coursework and ongoing visitations,, • January advisory and research team meetings • TQP team to DC meetings (twice) • Monthly operational team meetings • Continued replication efforts • All activities institutionalized 	ETS, NYCDOE, mentors ETS, NYCDOE, mentors Lehman Faculty, Bronx school personnel Lehman Faculty, Bronx school personnel PI, PD, RBS, Research Coordinator PI, PD, RBS, Research Coordinator PI, NYCDOE, Lehman

(ii) The adequacy of procedures for ensuring feedback and continuous improvement in the operation of the proposed project.

The existing Lehman College Early Childhood/Childhood programs are nationally recognized by the National Association for the Education of Young Children (NAEYC), and the Division of Education at Lehman College is accredited by the National Council for the Accreditation of Teacher Education (NCATE). A strong factor in establishing national recognition and accreditation is the existence of an assessment system that provides on-going feedback for program improvement. Thus, this innovative program will benefit from an assessment system that monitors aspiring teachers' progress through the programs at the following key transition points: admission, pre-student teaching, student teaching, exit and a three year induction period.

In addition, this project will employ a Continuous Improvement Plan (CIP) with a set of additional activities designed to bring gradual and continual improvement to the program through the oversight of an operations board that will meet at least eight times per year to review the process and outcomes of the program and to review the reports from RBS, our external evaluator. The CIP will focus on reviewing the progress of *project activities* with a focus on assessing the key outcomes of MATH-UP reforms, identifying any problems or issues with implementation, and exploring solutions to make any needed adjustments. All members of the operations team are partners in the MATH-UP initiative (schools, NYCDOE, ETS. Lehman, RBS) and will bring diverse perspectives to program improvement needs and solutions.

In addition to the program improvement activities described above, the RBS evaluator will work with the internal research coordinator and division faculty to supplement program evaluation processes with faculty formulated research studies of the impact of course and clinical

experiences on teacher preparation, student outcomes and divisional efforts to extend teacher preparation reforms to all programs. The MATH-UP initiative will also be guided by the expertise and feedback of an expert advisory panel that will meet twice yearly to review program data and suggest program improvements.

Figure 1. Management Organization

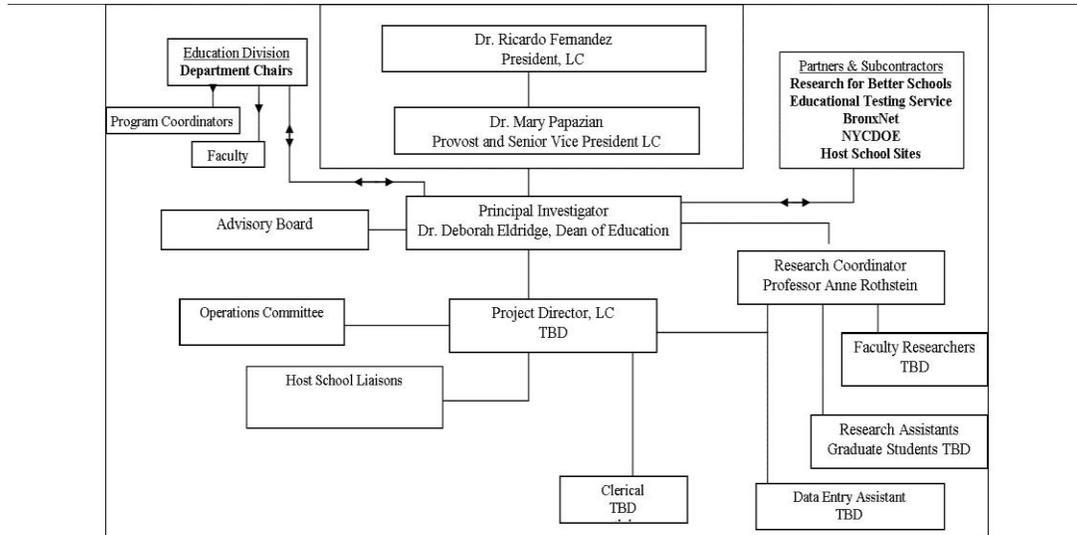


Table 6. Roles and Responsibilities of Program Personnel		
Name/Position/Title	% T&E	Responsibilities
Dr. Deborah Eldridge Principal Investigator (resume in Appendix D)	10%	Oversee fiscal and accountability structures. Review, approve and submit project reports. Chair the program advisory committee and meet with the operations committee. Review and approve collaborative agreements. Supervise project director. Participate in review of candidates for admission. Assure program coordination within and across the division, schools and college. Initiate and monitor reform efforts across the division based on lessons learned from this project.
TBD Project Director	100%	Oversee day-to-day implementation of program components. Prepare recruitment materials. Screen applicants. Work with department to schedule courses. Work with participating schools to place MATH-UP participants. Work with partners (ETS, BronxNet) to schedule workshops and training. Member of operations committee.
TBD	100%	Oversee student recruitment, program admission and registration. Meet

Table 6. Roles and Responsibilities of Program Personnel		
Name/Position/Title	% T&E	Responsibilities
Clinical Instructor Coordinator of Student Services		with each student bi-weekly. Obtain feedback from instructors on student progress, performance. Communicate regularly with students via e-mail and broadcast messages. Make site visits to internship sites and solicit student feedback, concerns and questions. Member of operations committee.
Dr. Anne Rothstein, Research Coordinator (resume in Appendix D)	40%	Collaborate with evaluation consultant. Chair faculty research committee. Oversee work of research assistants (graduate students). Member of operations committee and advisory board.
TBD 5 Faculty Researchers	1 month	Interested education and liberal arts and sciences faculty will plan, design and carry out MATH-UP program based research.
TBD Research Assistants (3)	100%	Work with department, divisional and college faculty on preparing and implementing IRB approved research projects related to MATH-UP program and expanded reform efforts within the Education Division.
Faculty Advisors/Instructors (5) (resume in Appendix D)	1.5 mo	Faculty serving as program advisors, curriculum developers, student assessors and researchers for program. Prepare and implementing IRB approved research projects related to MATH-UP program and expanded reform efforts within the Education Division.
TBD Cooperating Teachers	In-kind	In each of the five host schools a minimum of 5 teachers will be selected to work with a MATH-UP student. As the students will be in each school for one year they may rotate to additional teachers/classes.
TBD Fiscal Manager and Registrar	20%	Justify budget with Research Foundation web reports; act as liaison to Grants Office and CUNY Research Foundation; order all materials, equipment and supplies; process payroll; submit tuition waivers and register students for waived sections. Process ICAs and sub-contracts; reimburse travel for advisory board members. Process all bills.

(iii) The adequacy of mechanisms for ensuring high-quality products and services from the proposed project.

The project represents an extensive collaboration and partnership among four respected partners: Lehman College of the City University of New York, the New York City Department of Education, the Educational Testing Service and BronxNet. We have commitments from highly regarded individuals (whose letters of commitment and resumes are in Appendix D) with national reputations to serve on the expert Advisory panel, including Deborah Loewenberg Ball and a junior colleague as the expert team from the University of Michigan: Dr. Alfinio Flores, Hollowell Professor of Mathematics Education from the University of Delaware; and Dr. Honi

Bamberger, Executive Director of MathWorks and professor of mathematics education from the University of Maryland. In addition, the MATH-Up initiative sought and secured the support of individuals from the NYCDOE and Lehman College faculty in education and mathematics that have significant expertise in mathematics, mathematics education, teacher education and early childhood/childhood education.

The proposed project management plan provides multiple layers of evaluation, research and accountability for ensuring high quality products and services. There will be two committees with representation from project partners: (1) The Expert Advisory Panel (meeting two times per year) will be the previously mentioned individuals with national reputations in mathematics education and teacher preparation, and (2) an Operations Team (meeting monthly), which will include representation from all partners, program staff, college faculty, school sites and program students (e.g. project director, associate director, faculty members, host school liaisons TBD, the dean, the research coordinator and student representatives). There will be a bi-monthly program meeting which will include all MATH-UP participants, school cooperating teachers and the operations committee. A research committee comprised of the external evaluator, the research coordinator, faculty and research assistants will meet three times yearly in October, February and June to ensure the quality and application of evaluation and research.

The faculty members who will be actively engaged in the implementation of this program include: Dr. Jeanne Peloso, Science Specialist and Childhood Graduate Program Coordinator; Dr. Robert Feinerman, Chair of Computer Science and Mathematics; Dr. Nancy Dubetz, Professional Development School liaison, Bilingual Specialist and graduate advisor; Dr. Victoria Rodriguez, Bilingual Special Education Graduate Program Coordinator; Dr. Cecilia Espinoza,

Early Childhood Graduate Coordinator and Bilingual Specialist; and Dr. Helene Silverman, Faculty Advisor and Early Childhood/Childhood Mathematics Specialist.

Summary

In conclusion, the over-arching purpose and objectives of the MATH-UP initiative are designed to meet the intent and spirit of the Teaching Quality Partnership grant program and to achieve the goal of increasing the mathematics achievement (and reducing the achievement gap). The MATH-UP initiative has the potential to impact the achievement of a minimum of 18,750 South Bronx students in grades 1 through 6 during the life of the grant by increasing the number of childhood educators who are:

- *Diverse* and representative of the communities in the Bronx by recruitment, rigorous selection and preparation to enter teaching of 125 Hispanic, African-American and other students from under-represented groups who are Bronx resident undergraduates.
- *Content strong* in Mathematics and Literacy by developing an innovative and replicable model of teacher preparation in a 5th year program that is content-enriched, school-focused, needs based, and integrated with professional development and induction along a continuum of teacher learning. In addition, increased student achievement and teacher competence in mathematics and academic literacy are sustained with the development of 5 demonstration sites in the South Bronx and the development of video cases.
- *Data-wise* and prepared to differentiate instruction for students who speak languages other than English and who have special learning needs by integrating assessment knowledge and skills from complementary resources in teacher preparation, professional development and induction, sustained through the development of video cases.

- *Highly qualified* in both childhood education and bilingual/ELL methods of instruction to impact student achievement by redesigning a math-rich, assessment-focused teacher preparation program to include courses in meeting the needs of and differentiating instruction for students who are bilingual/English language learners.
- Inspired to make *a long-term commitment* to remain in teaching to meet the needs of the urban populations in Bronx schools by teaching where they live and through receiving extensive services throughout their preparation, professional development, and induction years as beginning teachers.