

<b>Table of Contents</b>		<b>Page #</b>
<b>(a)</b>	<b><u>Quality of the Project Design</u></b>	2
	(i) <i>The extent to which the proposed project represents an exceptional approach to the priority or priorities established for this competition.</i>	2
	(ii) <i>The likely impact of the services to be provided on the intended recipients of those services.</i>	5
	(iii) <i>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.</i>	9
	(iv) <i>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.</i>	14
<b>(b)</b>	<b><u>Adequacy of Resources</u></b>	17
	(i) <i>The adequacy of support, including facilities, equipment, supplies, and other resources, from the applicant organization or the lead applicant organization.</i>	17
	(ii) <i>The relevance and demonstrated commitment of each partner in the proposed project to the implementation and success of the project.</i>	20
<b>c</b>	<b><u>Quality of the Management Plan</u></b>	22
	(i) <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.</i>	22
	(ii) <i>The adequacy of procedures for ensuring feedback and continuous improvement in the operation of the proposed project.</i>	31
	(iii) <i>The adequacy of mechanisms for ensuring high-quality products and services from the proposed project.</i>	32
<b>d</b>	<b><u>Quality of the Project Evaluation</u></b>	34
	(i) <i>The extent to which the methods of evaluation will provide valid and reliable performance data on relevant outcomes</i>	35
	(ii) <i>The extent to which the methods of evaluation are thorough, feasible, and appropriate to the goals, objectives, and outcomes of the proposed project.</i>	35

**(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.***

Lehman Urban Transformative Education in STEM (LUTE- STEM) aims to 1) recruit, train, graduate, and credential 100 diverse, highly effective teachers who are well prepared to teach in New York City Department of Education (NYCDOE) high-need schools; 2) reduce the achievement and opportunity gaps of P-12 Bronx students in STEM; 3) build host school capacity to provide high-quality clinical experiences for preservice teachers by preparing mentors who are skilled in working with clinical residents to improve their practice; 4) design and implement a clinically-rich teacher preparation program grounded in evidence-based practices as well as findings from rigorous formative/process/outcomes program evaluation; and 5) design and implement a sustainable induction program for new teachers (Years 1-2) and retention program for second stage teachers (Years 3-10).

In order to accomplish these objectives, LUTE-STEM will prepare four cohorts of preservice teachers through course work that leads to a Master of Science in Education (M.S. Ed.) at Lehman College, a full-year internship in a Bronx, NYCDOE high need school, and supplemental professional development activities (including but not limited to those leading to a micro-credential in computer science education). LUTE-STEM commits to defining, fully articulating, and becoming masterful at developing and measuring teacher candidates' degree of classroom instructional competencies around a common, programmatic framework of teaching excellence, known in New York City as the *Criteria for New Teacher Readiness*. In addition, mentor teachers and building administrators in partner schools will receive a minimum of 50 clock hours of intensive training that aligns with project goals and NYCDOE *Connected Practices in Supporting Students with Disabilities, and Engaging in Culturally Sustaining*

*Practices.* LUTE-STEM: TQP will comply with Competitive Priority 1: Computer Science and have presented support for the approach that will be used at the end of this proposal and as an attachment.

<b>Table a-1: GPRA Performance Measures Linked to LUTE-STEM program activities</b>	
<b>GPRA Performance Measures</b>	<b>Program Activities</b>
<p><i>Performance Measure 1: Certification/Licensure.</i> The percentage of program graduates who have attained initial State certification/licensure by passing all necessary licensure/ certification assessments within one year of program completion</p> <p>-and-</p> <p><i>Performance Measure 6: Student Learning.</i> The percentage of grantees that report improved aggregate learning outcomes of students taught by new teachers.</p>	<ul style="list-style-type: none"> <li>• Extensive recruitment efforts targeting undergraduates from underrepresented groups</li> <li>• Rigorous admission requirements</li> <li>• Ongoing mentoring, supervision and advisement</li> <li>• Community-building cohort structure for program entry, progress, and graduation</li> <li>• Extensive clinical experience during residency year ( with participant stipends) integrated and aligned with professional development and induction</li> <li>• Host school sites congruent with participants’ own school experiences</li> <li>• Mentor teachers representative of participants’ diversity</li> <li>• New York State Teacher Certification Exams (NYSTCE) content and testing strategies embedded in graduate coursework</li> <li>• NYSTCE preparation and tutoring as needed</li> <li>• Master’s degree with specialized coursework in mathematics, science, teaching ELL/Bilingual populations, and a full-year residency in a high-needs school</li> </ul>
<p><i>Performance Measure 2: STEM Graduation.</i> The percentage of math/ science program graduates that attain initial certification/licensure by passing all necessary licensure/certification assessments within one year of program completion.</p>	<ul style="list-style-type: none"> <li>• Master’s degree with course of study aligned with grade-band-level mathematics and science standards</li> <li>• Rigorous program of study with specialized content and pedagogical knowledge in STEM areas</li> <li>• Computer Science micro-credential (non-credit) and graduate course work leading to a NYSED Computer Science Education Extension</li> </ul>

**Table a-1: GPRA Performance Measures Linked to LUTE-STEM program activities**

GPRA Performance Measures	Program Activities
<p><i>Performance Measure 3: One-Year Persistence.</i> The percentage of program participants who were enrolled in the postsecondary program in the previous grant reporting period, did not graduate, and persisted in the postsecondary program in the current grant reporting period.</p> <p>-and-</p> <p><i>Performance Measure 4: One-Year Employment Retention.</i> The percentage of program completers who were employed for the first time as teachers of record in the preceding year by the partner high-need LEA or ECE program and were retained for the current school year.</p> <p>-and-</p> <p><i>Performance Measure 5: Three- Year Employment Retention.</i> The percentage of program completers who were employed by the partner high-need LEA or ECE program for three consecutive years after initial employment.</p>	<ul style="list-style-type: none"> <li>• Rigorous induction program aligned with NYC DOE professional development priorities</li> <li>• Online network of program participants with access to former host school mentor teachers and Lehman faculty</li> <li>• Continuing special events to sustain community and promote retention</li> <li>• Employment support of LUTE-STEM residents and completers through collaboration with NYCDOE and US PREP</li> <li>• Professional learning communities for graduates of the program, including both novice and second-stage (Year 3-10) teachers, collaborative relationships between Lehman professors, partnering school administrators, mentor teachers, and LUTE-STEM graduates</li> </ul>
<p><i>Efficiency Measure: The Federal cost per program completer.</i></p>	<ul style="list-style-type: none"> <li>• The efficiency measure will be calculated by the evaluators once data from all project years is available.</li> </ul>

***(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 USDOE Teacher Quality Partnership Projects. In four of the five years of grant funding, LUTE-STEM 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 and science in elementary or secondary classrooms. Highly qualified individuals will be recruited from one of the following four contexts:

- 1) From the more than 1000 undergraduate students who currently elect to minor in education at Lehman College
- 2) From the New York City Men Teach and LUTE TOC programs, New York City and New York State funded projects designed to increase diversity in the teacher preparation pipeline
- 3) From students who transfer into Lehman College from local community colleges with whom the School of Education has articulation agreements 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 and science will be determined by:

- Undergraduate GPA of 3.0 or higher
- Two college level mathematics courses and two college level science courses with grades of B or better

- Attestation Letter (Recommendation) from STEM CUNY faculty member

The residency year will be cohort-based, clinically intensive and integrated with the professional development offered to partner school personnel. To further ensure that LUTE-STEM pre-service teachers are *highly qualified, content strong*, and experiencing content that they will be expected to teach (Strong, 2011), the program will be aligned with New York State professional and learning standards. In addition, as part of admission 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 required Content Specialty Tests, the Educating All Children Test and the edTPA.

To implement a *year-long and rigorous teaching pre-service clinical program component*, LUTE-STEM will select five high-needs Bronx host school sites in collaboration with the NYCDOE for phase one (Years 2-3) and an additional five schools for phase two (Years 4-5). To ensure that pre-service teachers are observing and participating in effective instruction, the host-school sites will form a LUTE-STEM consortium and build capacity to serve as demonstration sites for increasing mathematics and science achievement and providing computer science for all students. In addition, the host schools will receive research-based professional development prior to receiving LUTE-STEM pre-service teachers to increase capacity for demonstrating high-quality instruction. Each cohort of 25 pre-service teachers will be assigned in learning teams of at least 5 pre-service teachers for each host school site to leverage the capacity-building for high quality mentoring and preparation. LUTE-STEM pre-service teachers will teach alongside cooperating mentor teachers, selected for their years of teaching experience (no fewer than 5 years) and for demonstrated ability to have a positive impact on student achievement. LUTE-STEM pre-service teachers will serve as co-teachers while completing

graduate course work required in a Master of Science in Education (MSED) course of study. Thus, coursework and fieldwork are integrated. Successful residency models generally combine an average of ten courses with the internship (Silva, McKie, Knechtel, Gleason & Makowsky, 2014).

To prepare pre-service teachers to *understand and use formative assessment data to modify and improve classroom instruction*, LUTE-STEM residents will observe and, with their mentor teachers and building instructional coaches, participate in the use of NYCDOE's data system in order to design and deliver instruction to meet student needs. In addition, course instructors teach about and model research-based Keeping Learning on Track formative assessment strategies (<http://keepinglearningontrack.nwea.org> ) as part of each preparation program's course of study. Since assessment is a key component of the edTPA, the performance assessment required of all NYS teacher candidates, residents will demonstrate their ability to use data to create a lesson sequence, to assess the effectiveness of the instruction on a daily basis, to provide educative feedback to students, and to determine what could have been done differently to enhance student learning.

To prepare *general education teachers to teach English New Language (also referred to as ELLs) students and to teach students with disabilities*, LUTE-STEM will provide pre-service teachers with coursework that emphasizes differentiation. Residents will complete field-based assignments, including video analysis and lesson study, designed to demonstrate competency in working with bilingual students and ELLs as well as students with special needs.

To provide *high-quality professional development to strengthen the content knowledge and teaching skills of teachers* and to support *in-service professional development strategies and activities*, the initiative will engage host school sites in summer institutes and on-going

professional development in STEM learning as well as the use of district achievement and formative assessment data to inform instruction. Starting in the summer of 2020, the Institute of Literacy Studies (the outreach unit in the School of Education that regularly provides professional development to over 300 teachers in 50 schools) will coordinate a one-week summer institute for host school teachers and administrators, Lehman College faculty members, and pre-service teachers. The content of the summer institute is described in the professional development/induction section below. Throughout the school year, host school teachers, administrators, and pre-service teachers will be engaged in monthly professional development activities sponsored by the district, College or the LUTE-STEM project. 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.* LUTE-STEM will supplement the NYCDOE professional development programs in literacy by emphasizing content area literacy during the Lehman College teacher preparation program. Mentor teachers and residents will be expected, and host school teachers encouraged, to attend annual full day professional development conferences designed and implemented by teachers for teachers and sponsored by the New York City Writing Project and New York City Mathematics Project, two of the three subunits in the Institute for Literacy Studies. During teacher-led sessions, participants learn about best practices in content area literacy as well as high impact mathematics practices. The annual conferences, held each spring semester, attract between 200-300 area teachers.



To engage higher-education *faculty to work with highly qualified teachers in classrooms of high-need schools*, LUTE-STEM will assign a full time faculty member to serve as a site coordinator for each host school. Lehman College and New York City Department of Education have signed onto US PREP, a coalition of 15 University/District partnerships committed to renewing teacher preparation. Using the US PREP model, site coordinators will work closely with mentor teachers to ensure that LUTE-STEM residencies reflect US PREP guidelines and project objectives. In addition, highly qualified host school teachers and administrators will be invited to co-teach or 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*, higher education faculty will work alongside mentor teachers from the host schools and LUTE-STEM graduates who have entered the second stage of their career (Years 3-10) in the design and execution of school-based and/or classroom inquiry projects. Research study groups will develop and utilize video-tape analysis as data sources in addition to student work samples and test scores.

***(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 pre-service teachers to meet the challenges of urban teaching in high need schools, the 5<sup>th</sup> year 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. Four 5<sup>th</sup> year programs are comprised of two summers and one full academic year of graduate study, resulting in initial and eligibility for professional certification with a certification extension in bilingual education for early childhood and childhood candidates. Below is the Secondary Mathematics and Early Childhood courses of study which serve as samples. Curriculum maps for Science and Childhood follow a similar format. For all four certification sequences, candidates will earn a MSED and be eligible for a NYSED Provisional Teaching Certificate by the end of the summer following the full year residency. Each curriculum map begins with prerequisite undergraduate courses and graduate courses that can be taken during a student's undergraduate career.

<b>MATHEMATICS EDUCATION 7-12</b>			<b>Number of Credits</b>	<b>Shared Course (Between Undergraduate and Graduate Requirements.)</b>	<b>Meets Undergraduate Requirement MINOR and/or MAJOR</b>	<b>Meets Graduate Requirement for 7-12 Math Education</b>
<b>Undergrad Minor in Education</b>	Not Part of the program	ESC 301: <i>Psychological Foundations of Education</i>	3		X	
		ESC 302: <i>Historical Foundations of Education: A Multicultural Perspective</i>	3		X	
<b>SENIOR YEAR (Undergrad)</b>	<b>FALL I</b>	ESC 529: <i>Language and Literacies Acquisition in Secondary Education</i>	3	X	X	X
		ESC 532: <i>Methods of Teaching Mathematics in secondary schools Methods 1</i>	3	X		X
		MAT XXX: Elective I	3-4 Graduate	X	X	X
		ESC 790: <b>Level I Internship</b>	3	<i>Will substitute for ESC 501 taken as ESC 301</i>		X
	<b>SPRING I</b>	ESC 506: <i>Special Needs Student: Assessment and Instruction</i>	3	X	X	X
		ESC 748: <i>Problem Solving in the Mathematics Classroom-Methods 2</i>	3	X		X
		MAT XXX: Elective II	3-4 Graduate	X	X	X
		ESC 790 (2) <b>Level II Internship</b>	3	<i>(Repeat of I) Will substitute for ESC 502 taken as ESC 302</i>		X
<b>GRADUATE PROGRAM</b>	<b>SUMMER I</b>	ESC 740: <i>Methods of Teaching Mathematics in Grades 7-10</i>	3			X

		<b>ESC 749: Teaching Mathematics in Grades 11-12</b>	3			X
	<b>FALL II</b>	<b>ESC 742: Research in Mathematics Education</b>	3			X
	<b>SPRING II</b>	<b>ESC 596: Student Teaching in the Middle and High School Grades</b>	3			X
		<b>ESC 612: Student Teaching Seminar</b>	3			X
		<b>ESC 706: Research in Problems of Teaching a Specialized Subject</b>	1			X
		<b>ESC 707: Project Seminar</b>	2			X

<b>Early Childhood Education Initial NYS Certification: Birth to Grade 2 &amp; Bilingual Extension</b>			<b>Number of Credits</b>	<b>Shared Course (Between Undergraduate and Graduate Requirements.)</b>	<b>Meets Undergraduate Requirement MINOR and/or MAJOR</b>	<b>Meets Graduate Reqs for MtM Early Childhood Education</b>
<b>ECCE Minor in Education</b>	Not Part of the program	<b>ECE 301: The Child in Context: Child Study and Development-Birth to Grade 6</b>	3		X	
		<b>ECE 302: Children, Families, Communities, and Schools in Sociocultural Contexts-Birth to Grade 6</b>	3		X	
		<b>ECE 304: Foundations of Early Language and Literacy Development, Birth to Grade 2</b>	3		X	
		<b>ECE 311: The Teaching Profession-Birth to Sixth Grade</b>	3		X	
<b>SENIOR YEAR</b>	<b>FALL I</b>	<b>ECE 435: Bilingualism for Classroom Teachers, Birth to Grade Six</b>	3		X	
		<b>ECE 427: Methodology of Teaching English to Speakers of Other Languages, Birth to Grade Six</b>	3		X	
		<b>EDS 702: The Young Child with Special Needs</b>	3			X
		<b>*ESC 790: Level I Internship</b>	3	X	X	X
	<b>SPRING I</b>	<b>ECE 436: The Young Child and the Arts, Birth to Grade 2</b>	3		X	
		<b>ECE 438: The Young Child and Music, Birth to Grade 2</b>	3		X	
		<b>EDS 743: Behavioral Assessment, Management, and Change</b>	3			X
		<b>ESC 790 (2) Level II Internship -Take EAS Exam</b>	3			X
<b>GRADUATE PROGRAM (Residency Year)</b>	<b>SUMMER I</b>	<b>EDC 738: Literacy in Bilingual/Bicultural Early Childhood Settings, Birth to Grade 2</b>	3			X
		<b>EDC 739: Social Studies Concept Development in Bilingual/Bicultural Early Childhood Settings, Birth to Grade 2</b>	3			X

	FALL II	EDC 715: <i>Mathematical Concept Formation in Early Childhood Settings, Birth to Grade 2</i>	3			X
		EDC 717: <i>Developing Science Concepts in Early Childhood Settings, Birth to Grade 2</i>	3			
		EDS 704: <i>Curriculum and Instructional Practices for Culturally and Linguistically Diverse Young Children with</i>	3			
	SPRING II	EDC 790: <i>Supervised Student Teaching: Pre-K to Grade 2</i> <b>OR</b>	3			X
		EDC 784: <i>Supervised Student Teaching in Bilingual Settings, Pre-K to Grade 2</i>	3			X
		EDC 795: <i>Student Teaching/Internship Seminar</i>	3			X
		EDC 756: <i>Teacher as Researcher and Writer</i>	3			X

LUTE- STEM will provide structured opportunities for professional learning prior to, during and after the residency year for all participants, including residents, Lehman College faculty and host school teachers, to ensure the quality, intensity and duration of services. The five-day summer institute will be key to successful onboarding of host school administrators, mentor teachers, Lehman faculty, and residents. The Institute of Literacy Studies (Lehman School of Education) will design and execute a five-day summer institute that will serve to onboard both mentor-teachers and teacher-residents in the STEM-LUTE Program. Additionally, ILS teacher-consultants as well as a contracted external instructional coach will be available to provide on-site coaching services as appropriate to supplement the support provided by the Lehman College site coordinator assigned to each building. Since there are many areas in which STEM learning and literacy overlap, the two-pronged approach to supporting the residents will result in graduates who are prepared to teach on day one, with an approach that allows them to provide effective and engaging STEM learning to students in schools in the Bronx. During the week-long institute, there will be opportunities for participants to work with colleagues by STEM discipline (P-12), by building (elementary, middle and high school), by certification area

(early childhood, childhood, secondary mathematics, and secondary science), and by role (mentors, residents).

In addition to the program elements that yielded positive outcomes in Lehman’s first TQP urban residency project (co-teaching, Danielson framework, formative assessment, and standards-based instruction: See Fayne, Coffey, Marshall, Dubetz, & Barra, 2017), LUTE-STEM will add computer science education to its professional learning toolkit. Mouse.org, a lead partner in this effort, will offer computer science professional learning opportunities leading to a Computer Science badge or micro-credential. For those mentor teachers and program completers who wish to pursue a Computer Science Education extension, 21 credits of graduate course work in computer science and computer science education will be required (Note: Extension will be submitted to NYSED by January 2020 with approval anticipated by August 2021). Extension courses can be taken as electives or content substitutes in the LUTE-STEM graduate course of study with advisor approval.

To ensure that higher education and host school *faculty will substantially participate in the induction program*, the LUTE-STEM initiative will provide stipends and/or summer salary for (a) College faculty and mentor teachers for participation in the summer institutes that lay the foundation for induction; and (b) through reassigned time (in-kind contribution) for higher education faculty who will be engaged as site coordinators or research faculty in the host-schools.

Duration and utilization of inquiry learning models are critical for effective professional development (Desimone 2002; Desimone & Stuckey, 2014; Garet et al. 2001). Thus, the LUTE-STEM spaces of professional development will be grounded in several guiding principles: duration, collaboration, and inquiry. To ensure that the LUTE-STEM program supports and

sustains the professional learning communities for graduates of the program, including both novice and second stage (Year 3-10) teachers, collaborative relationships between Lehman professors, partnering school administrators, mentor teachers, and LUTE-STEM graduates will be created and sustained during and beyond the five years of the grant. In addition to supplementing NYCDOE induction activities with an online community of practice for LUTE-STEM completers and special campus events (reunions) held annually, professional learning inquiry communities will be established in which teachers (with 3-10 years of experience) are supported to conduct research (Mills, 2018; Risko & Vogt, 2016). An inquiry cycle will be utilized to support graduates' professional growth. A faculty member with experience in guiding action research for graduates of our first teacher residency program will be the Lehman lead on follow-up.

Evaluation of the LUTE-STEM initiative is intended to provide evidence that a 5<sup>th</sup> year program with a year of clinical experience in host schools as well as participation in on-going, collaborative professional development and induction support provides the level of quality, intensity and duration required to impact teacher competence and student achievement. MATH UP, our first TQP project, was able to provide evidence that such was the case.

***(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 teachers for New York City schools. The School of Education has rigorous, CAEP and NYS approved teacher education programs in early childhood, childhood, mathematics and science; two units (Bronx Institute and Center for School/College Collaboratives) that offer STEM-oriented college access programs; existing Careers in Teaching, Teacher Opportunity Corps and New York City Men Teach programs that recruit and

incentivize undergraduates from diverse backgrounds to consider teaching as a career; and partnerships with over 200 schools, including five Professional Development Schools. To strengthen STEM curricula, long-standing collaborations with the Bronx Zoo, the Botanical Gardens and the American Museum of Natural History have provided candidates with rich experiences that help them to capitalize on community assets. Finally, Lehman College has demonstrated effectiveness in requesting, receiving, and implementing externally funded projects. In recent years, Lehman College has been funded by NSF to develop teacher leaders who strengthened teaching and learning in mathematics (Mathematics Teacher Transformation Institute) within Bronx middle and high schools, as well as two Noyce Teacher Scholarship Programs to prepare math and science teachers for urban middle and high schools. These funded projects responded 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 STEM leaders in Bronx schools. These successful projects further demonstrate the capacity and commitment of Lehman College's School of Education to deliver on the promises outlined in this proposal to prepare pre-service teachers with a STEM-enriched curriculum to teach in high-need urban schools.

As a partner, the *New York City Department of Education (NYCDOE)* contributes to the development and implementation of the LUTE-STEM initiative through representation on the Advisory Panel as well as on the Operations Committee. New York City Schools Chancellor Richard Carranza established four priorities for the 2018-2019 academic year that underscore the district's commitment to equity and excellence: Accelerate Learning and Instruction; Partner with Communities; Develop People; and Advance Equity Now. LUTE-STEM can help to

advance the Chancellor’s vision by contributing to the preparation and retention of a diverse, highly qualified teaching force (in early grades literacy, middle school mathematics, and computer science, to name three targeted areas in his strategic plan) and through design and execution of an evidence-based model for clinically rich teacher preparation.

Lehman’s School of Education has strong ties to NYCDOE through active participation in New York City Teaching Fellows as well as other district initiatives. As the anchor institution in the Bronx, we provide an alternative certification program to cohorts of 100 or more Fellows each year. In addition, Lehman has a special program to certify health teachers who are currently working out of license. Particularly germane to this proposal, Lehman and New York City Schools, through our participation in the US PREP coalition, have committed substantial resources to training mentors and site coordinators in our partner schools.

To effectively prepare teacher by providing *expertise in teaching*, LUTE-STEM will help us to advance the mission of *US PREP*, a very important partner in our efforts to re-envision teacher preparation at Lehman College. Lehman’s membership in the US PREP alliance signals School of Education’s commitment to work collaboratively with New York City Schools and other key stakeholders to prepare “classroom-ready” teachers for high need schools. The US PREP National Center (located at Texas Tech University) provides technical support, design-based research and shared data across teacher education programs.

To effectively prepare teachers by *providing content expertise*, LUTE-STEM will partner with faculty and administrators in the School of Natural and Social Sciences. The School of Natural and Social Sciences (NSS) has been a strong partner with the School of Education (SOE) in teacher education. Faculty from biology, chemistry, and mathematics have played leadership roles in the Noyce grants and routinely teach discipline-based courses for the teacher education



master's programs in STEM. NSS and SOE recently strengthened the partnership by creating a Mathematics faculty line that has half the workload responsibilities in each school. In addition, the Department of Computer Science has been exploring curricular changes to support creating new discipline courses for teacher education for the Computer Science Extension described in this proposal. Computer Science is no exception in NSS. All STEM departments are actively engaged in higher education curricular and instructional reform that is both informed by and informs the work with teacher education. In 2016, NSS supported initiatives to improve the gateway courses in chemistry, mathematics, and biology. These efforts resulted in new pedagogies (online support, flipped and structured classroom, inquiry-based laboratories, new supplemental instruction models, and undergraduate research experience) that significantly improved student success in the sciences. Most of the gateway initiatives were supported by funding from NSF, NIH and USDOE. As part of the funding, faculty professional development institutes and workshops were held in active learning strategies, the use of personal response systems, and growth mindset. Lehman's STEM faculty's focus on the scholarship of teaching and learning is highly supported by NSS, and the College and is fully committed to supporting the goals and objective of LUTE-STEM.

**(b) Adequacy of Resources**

***(i) The adequacy of support, including facilities, equipment, supplies, and other resources, from the applicant organization or the lead applicant organization.***

Lehman College, a lovely, tree-lined, 37-acre campus in the Bronx, is home to the largest population of low-income, first-generation college students in New York City. The College is committed itself to provide the resources and personnel necessary to support the objectives and activities of its LUTE-STEM: TQP program.

**Applicant Support.** The LUTE-STEM: TQP program will be located in the Center for School/College Collaboratives, which also houses the New York State Teacher Opportunity Corp II Program and the Student Support Services: Careers in Teaching Program. Both of these are central to the pipeline programs that support Lehman's mission to provide highly qualified, content prepared teachers for the Bronx. The programs are located in a suite of offices in 176 Carman Hall in one of the busiest classroom buildings on campus and next door to the Information Technology Center. The LUTE-STEM project director will have an office in the Center complex, and project support staff will be located there as well. The Principal Investigator has an office on the floor below the Center. The College provides phone service, Internet connections, and e-mail service as well as staff computers. In addition to the administrative hub for LUTE-STEM, Lehman College offers use of the following facilities:

The Computer Center. The academic computer center has over 225 computers in 8 classrooms and at least 100 computers are contained in an open area available to students whenever the center is open. Support staff is on hand whenever the center is open to assist students and faculty. (In addition, the School of Education has 3 additional computer labs.)

The Lehman Library. The Lehman College Library has a fully automated CUNY-wide book catalogue and circulation system, periodical indexes, an electronic full-text databases, and Internet access. The library subscribes to 1,500 periodicals and is a designated depository for state and federal documents. There are six Internet workstations for student use. The Education Room contains K-12 curriculum materials and the ERIC microfiche collection. Of special interest to project participants is a collection of appropriate and interesting books for teacher educators. Librarians are available to assist students during library hours.

The Academic Center for Excellence. Participating undergraduate and graduate students enrolled in college credit courses can access the Lehman College Writing /Learning Center. Tutors assist students in interpreting assignments, generating ideas, posing questions, organizing thoughts, and developing coherent papers in most academic fields.

The Math Lab. The Math Lab offers free tutoring to any student needing assistance in algebra, geometry, pre-calculus, or in computer language courses. Special assistance is offered to students in developmental math courses.

The Mathematics Education Lab. The Mathematics Education Lab located in Carman Hall, near several School of Education offices, is a fully resourced space that is used for math education undergraduate and graduate coursework. The lab has extensive books, materials, manipulatives and lesson planning resources for grades PK-12. It also has state of the art technology set-up including a smart board, projector and 5 computers. During the summer the space is used to host elementary school children for week-long summer mathematics camps.. In addition, the lab will be used for professional development activities.

The Science Education Lab. This space was recently renovated from Capital Campaign funds provided to the college at a cost of \$1.7M for construction and 103,000 for equipment. It will be ready to open in fall 2019. As with the Math Lab described above it is used for Science Education courses and has a full complement of technology resources for teaching. Summer Science camps will be hosted here as described for the Math Lab. Professional Development workshops will also be hosted here.

EdTPA Lab/Support. This facility is staffed by a full time education technology coordinator and 3-4 student assistants who work during open lab hours to assist Clinical Residents and other pre-teachers to complete EdTPA submissions. This lab and the associated

seminar experiences have been extraordinarily helpful in increasing EdTPA passing rates for Lehman teacher graduates.

LUTE Resource Center: This resource center, staffed by two full-time individuals, is available as a help and support center for two of our funded programs: Teacher Opportunity Corp II and New York City Men Teach. Both programs are designed to increase the number of underrepresented populations in teacher education programs by providing early career advising, mentoring, and financial assistance. We anticipate that a majority of recruitment activities for LUTE-STEM will be coordinated through the Resource Center.

Student Services. Lehman College has a fully staffed financial aid office to assist in the preparation of financial aid applications. Our career center has the latest in software and print information to assist participants in exploring career prospects, with a specialist in Education/Teaching. Staff members regularly prepare and give workshops for participants on topics central to their degree completion and job searches.

***(ii) The relevance and demonstrated commitment of each partner in the proposed project to the implementation and success of the project.***

The School of Education at Lehman has been a pioneer in the Bronx in working successfully with community organizations and public schools toward academic achievement for all students. The phase one schools (AMPARK, CIMS, In-Tech, Laboratory School of Finance and Technology and Samara Community School) have agreed to provide the following:

- Identify at least five mentor teachers who have the interest and aptitude to work closely with College faculty who are willing to participate at least 50 clock hours of professional development during the summer that will focus on: co-teaching; standards-based instruction; formative assessment, and STEM pedagogical content knowledge and serve as host teachers for pre-service candidates who will complete a full year residency in their classrooms.
- Appoint a lead contact who will participate in project advisory group meetings and project activities such as recruitment, selection, and assessment of candidates

- Encourage participation beyond the five mentor teachers in workshops during the school year and in the summer.
- Partner with LUTE-STEM project staff in efforts to redesign programs and staffing so that school improvement goals are met through the residency partnership during and after the grant period is concluded
- Provide data for evaluation purposes, including confidential data that will be fully protected by the highest levels of security, to a highly reputable research organization.

Community Support. The College has long-term relationships with many community based organizations, businesses, health providers and educational organizations. Many of these have consistently supported the College and have provided services for program students. For this project, key partners are: Mouse.org, USPREP and NYCDOE.

Mouse.Org will be partnering to provide a micro-credential program for Clinical Residents. Mouse commits to partnering with Lehman College to leverage our existing computer science content and digital badging infrastructure on the Mouse Create online platform to deliver up to 50 hours of blended professional learning for pre-service teachers in the LUTE-STEM residency cohort during each year of the grant.

USPREP is a coalition of 15 university-based teacher preparation programs/partner school districts located in seven states with a technical assistance hub located at Texas Tech University. Members are committed to transforming teacher preparation through quality clinical programming that is implemented with fidelity, scaled to impact all teacher candidates, sustainable, and designed to have a positive impact on communities and PK-12 learners. As coalition members, Lehman College and the NYC Department of Education have committed to work together to re-envision teacher preparation (both curriculum and clinical experiences). Lehman has agreed to assign a full time faculty member as a site coordinator for each of the partner schools. Teacher candidates undergo a rigorous evaluation process including

formal and informal evaluations that are aligned with district standards. Data on teacher candidates and program graduates are shared and used for program improvement.

New York City Department of Education (NYCDOE). As a partner, the *New York City Department of Education (NYCDOE)* contributes to the development and implementation of the LUTE-STEM initiative through representation on the Advisory Panel and the Operations Committee. Personnel at the district and building levels will co-design mentor training prior to and during the summer institutes, host Clinical Residents as co-teachers in partner schools, and help LUTE-STEM graduates secure teaching positions either in one of the partner schools or in equivalent high need schools in the Bronx. In addition, district personnel will be active participants in the instructional conversations and education design experiments leading to teacher education curriculum that narrows the theory-practice gap.

**(c) Quality of the Management Plan (20)**

*(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.*

The timeline presented in Table C-1 indicates the period within which the indicated milestones will be achieved; the specific milestones and the individual project member responsible for completion.

<b>Table c-1. Project Timeline</b>		
<b>Timeline</b>	<b>Milestones</b>	<b>Responsible Individual</b>
Fall 2019	(i) Search Processes initiated (ii) Hiring completed for Project director, registrar, and data support person (iii) Host school site project liaisons identified (iv) Advisory Panel members notified (v) Initial planning meetings of Advisory Panel and Operations team (vi) Identification of at least 50 possible applicants with SOE, NSS faculty. (vii) Review applicants and recruit at least 25 LUTE-STEM undergraduates (viii) Preliminary screening and pre-assessments as proposed in evaluation plan (ix) Planning of summer institute (x) Planning and Development of Computer Science micro-credential	(i) Principal Investigator (PI) (ii) PI and search committee (iii) PI, Principals (iv) PI (v) PI, Project Director (PD) and Research Coordinator (RC) (vi) PD, Faculty (vii) PI, PD, Faculty (viii) RC, Metis, Deb Coffey (ix) Faculty, Operations Committee, PD, Institute for Literacy Studies (ILS) (x) PI, Mouse.org, RC
Spring 2020	(i) Clinical Residents (Cohort 1- N=25) take program required classes and graduate with B.S. or B.A. degree (ii) Cohort 1 completes the following during spring: Tour partner schools, Meet mentors, Complete mentor/student match survey, Attend social event with mentors; Complete observation hours (required for classes) in partner schools (iii) Mentors (5 schools/5 per school) complete the following during spring: Attend 18 hours of mentor training, Complete RFCUNY paperwork for payment; Review LUTE-STEM Project Handbook; Meet with prospective clinical residents; Complete mentor/student match survey (iii) Monthly Operations Team Meeting	(i) Lehman Faculty, School Liaisons, Mentor Teachers, Cooperating Teachers, Principals, PD, RC and PI. (ii) Project Registrar, PD, RC, School Liaisons (iii) School liaisons, PI, PD, RC
Summer 2020	(i) Cohort 1 takes 2 summer courses and practicum with school students (ii) Mentors and Residents attend summer institute (5 days in August, 2020) (iii) Registration of 25 admitted, cohort 1, LUTE-STEM Clinical Residents for Fall courses.	(i) Faculty (ii) NYCDOE, Bronx Schools and Personnel, project staff, ILS (iii) Lehman faculty

<b>Table c-1. Project Timeline</b>		
<b>Timeline</b>	<b>Milestones</b>	<b>Responsible Individual</b>
Fall 2020	<p>(i) Discuss August workshop, look at evaluations of attendees, modify or enhance as needed for following summer.</p> <p>(ii) Cohort 1 LUTE-STEM Graduate Coursework and placement as Clinical Residents</p> <p>(iii) Ongoing assessment and evaluation and ongoing school visitations</p> <p>(iv) Implementation of Computer Science Micro-credential, through College and Mouse.Org</p> <p>(v) Research team meetings</p> <p>(vi) LUTE-STEM team to DC meetings</p> <p>(vii) Monthly Operational Team meetings</p> <p>(viii) Advisory Meetings</p> <p>(ix) Identification of at least 50 possible Cohort 2 applicants with SOE, NSS faculty.</p> <p>(x) Review applicants and recruit at least 25 LUTE-STEM undergraduates</p> <p>(xi) Preliminary screening and pre-assessments as proposed in evaluation plan</p> <p>(xii) School based PD for mentors, clinical residents, cooperating teachers</p>	<p>PI, PD, ILS, Metis, Deb Coffey, Cohort 1 attendees (3)</p> <p>(ii) Mentors, Cooperating Teachers, Field Work Supervisors, Faculty</p> <p>(iii) RC, Metis, Deb Coffey</p> <p>(iv) PI, RC, Mouse.org</p> <p>(v) Faculty Researchers, RC</p> <p>(vi) Project director, PI</p> <p>(vii) School Liaisons, RC, PD</p> <p>(viii) PI, PD, RC, Advisors</p> <p>(ix) PD, Lehman Faculty</p> <p>(x) PI, Lehman Faculty</p> <p>(xi) RC, Metis, Deb Coffey</p> <p>(xii) ILS, Greenlight</p>
Spring 2021	<p>(i) Clinical Residents (Cohort 2- N=25) take program required classes and graduate with B.S. or B.A. degree</p> <p>(ii) Cohort 2 completes the following during spring: Tour partner schools, Meet mentors, Complete mentor/student match survey, Attend social event with mentors; Complete observation hours (required for classes) in partner schools</p> <p>(iii) Mentors (5 schools/5 per school) complete the following during spring: Attend 18 hours of mentor training, Complete RFCUNY paperwork for payment; Review LUTE-STEM Project Handbook; Meet with prospective clinical residents; Complete mentor/student match survey</p> <p>(iii) School based PD for mentors, clinical residents, cooperating teachers</p>	<p>(i) Lehman Faculty, School Liaisons, Mentor Teachers, Cooperating Teachers, Principals, PD, RC and PI.</p> <p>(ii) Project Registrar, PD, RC, School Liaisons</p> <p>(iii) ILS, Greenlight</p>



<b>Table c-1. Project Timeline</b>		
<b>Timeline</b>	<b>Milestones</b>	<b>Responsible Individual</b>
Summer 2021	(i) Cohort 2 takes 2 summer courses (ii) Mentors and Interns attend summer institute (5 days in August, 2020) (iii) Registration of 25 admitted, cohort 2, LUTE-STEM Clinical Residents for Fall courses.	(i) Lehman faculty (ii) NYCDOE, Bronx Schools and Personnel, project staff, ILS (iii) Program Registrar
Fall 2021	(i) Discuss August workshop, look at evaluations of attendees, modify or enhance as needed for following summer. (ii) Cohort 1 become Teachers of Record and receive continued induction (iii) Cohort 2 LUTE-STEM Graduate Coursework (iv) Cohort 2 placement as Clinical Residents (v) Ongoing assessment and evaluation and ongoing school visitations (vi) Continuation of Computer Science Micro-credential, through College/Mouse.Org (vii) Research team meetings (viii) LUTE-STEM team to DC meetings (ix) Monthly Operational Team meetings (x) Advisory Meetings (xi) Identification of at least 50 possible Cohort 3 applicants with SOE, NSS faculty. (xii) Review applicants and recruit at least 25 LUTE-STEM undergraduates (xiii) Preliminary screening and pre-assessments as proposed in evaluation plan (xiv) School based PD for mentors, clinical residents, cooperating teachers	PI, PD, ILS, Metis, Deb Coffey, Cohort 1 attendees (3) (ii) Mentors  (iii) Lehman Faculty, Bronx school personnel (iv) Cooperating Teachers, Field Work Supervisors Research Coordinator, Metis, Deb Coffey (vi) PI, RC, Mouse.org (vii) Faculty Researchers, RC (viii) Project director, PI (ix) School Liaisons, RC, PD (x) PI, PD, RC, Advisory Board (xi) PD, Lehman Faculty (xii) PD, Lehman Faculty, (xiii) RC, Metis, Deb Coffey (xiv) ILS, Greenlight
Spring 2022, Summer 2022, Fall 2022, Spring 2023, Summer 2023, Fall 2023 and Spring 2024 replicate the activities shown above for continuing cohort 2 and cohorts 3 and 4. In Fall 2023 we add 5 additional schools to the project.		

The Table shown below, c-3, illustrates the progression of each cohort from Undergraduate College Senior, through the summer program, summer workshop, placement as a

graduate student Clinical Resident and hired as a Teacher of Record with ongoing Induction Services.

	2020			2021			2022			2023			2024		
	Sp	Su	Fa	Sp	Su	Fa	Sp	Su	Fa	Sp	Su	Fa	Sp	Su	Fa
L/S Senior	1			2			3			4					
Grad Work Sum		1			2			3			4				
Pre-CR PD/Aug		1			2			3			4				
LC Graduate/CR			1	1		2			3			4	4	4	
TOR/Induction						1			1/2			2/3			3/4

\*The numbers designate progression of program cohorts through the program year to year.

The roles, time and effort allocation, qualifications and responsibilities of program personnel are presented in Table C-4. The resumes of individuals identified by name are in the attachments section of the proposal. In addition to individual program personnel the consultants are also included in this table so that their qualification and responsibilities to the project are clearly stated.

Name/ Position	% T&E	Qualifications	Responsibilities
<b>Dr. Harriet Fayne</b>  <b>Principal Investigator</b>	Academic Year 30%	Dr. Fayne has served as a PI in many projects and was the PI for Lehman’s previous TQP. She is a skilled facilitator of people/groups and has an extensive network of individuals within the college and from the university, the schools, the NYCDOE who respect her deep knowledge of education and teacher education and will work with her for the success of this project.	Oversee fiscal/accountability structures. Review/approve/submit project reports. Chair the program advisory committee and meet with the operations committee. Review/approve collaborative agreements. Supervise project director. Participate in review of candidates for admission. Assure program coordination within and across the schools and college. Initiate and monitor reform efforts across the SOE based on lessons learned from this project.
<b>TBD</b>  <b>Project Director</b>	100%	The project director will have a master’s degree (doctorate preferred) in an area related to Teacher Education with a STEM	Oversee day-to-day implementation of program components. Prepare recruitment materials. Screen applicants. Work with department to

<b>Table c-4. Roles and Responsibilities of Program Personnel (Resumes in Appendix C.)</b>			
<b>Name/ Position</b>	<b>% T&amp;E</b>	<b>Qualifications</b>	<b>Responsibilities</b>
		focus preferred. The position requires excellent organizational, speaking, writing and supervisory skills as well as familiarity with project leadership.	schedule courses. Work with schools to place LUTE-STEM participants. Work with partners to schedule workshops and training. Member operations committee.
<b>TBD Coordinator of Student Support Services</b>	50%  Shared position with TOC II/ SSS	The clinical instructor should have: teaching experience in K-12; familiarity with teacher evaluation systems; excellent communication skills; leadership and supervisory experience; ability to provide usable feedback to teachers.	Oversee student recruitment, program admission and registration. Meet with each student bi-weekly. Obtain instructor feedback on student progress, performance. Communicate with students via e-mail and broadcast messages. Site visits to internship sites and solicit student feedback, concerns and questions. Operations committee
<b>Dr. Anne Rothstein, Site Liaison/ Research Coordinator</b>	1 month  Academic Year 40%	The School Liaison Coordinator has extensive experience working with school personnel to access relevant data needed to assess the project and has good relationships with local schools, teachers and principals.	Collaborate with school liaisons, principals, teachers and other school personnel and with the assessment consultant to assure that school based data is collected. Chair school liaison committee and serve on the operations committee and Advisory Board. Monitor data storage, apply for IRB approvals. Site coordinator for one partner school.
<b>TBD 4 Faculty School Site Liaisons</b>	1 month  Academic Year Match	Past experience with project-based research and Professional Development Schools, Content expertise in STEM, Education, Pedagogy and/or Content Literacy. Skilled in working with clinical residents and mentors. Able to work successfully within schools.	Serve as site coordinators for partner schools; plan and execute design-based research projects in collaboration with partner school teachers and administrators; participate in all LUTE-STEM professional development activities.
<b>TBD School/ Research Assistants (2)</b>	40 hours	SLA will be doctoral students from CUNY graduate center skilled in observation, working within schools and with teachers and administrators. Able to conduct observations when trained on protocols. Organized and thorough with good writing skills.	Work with school liaisons to observe and collect qualitative data on school operations. Accompany School liaisons to school meetings. Work with Clinical Residents and continue when they are teachers of record to help collect lesson plans, student work and classroom test scores.

**Table c-4. Roles and Responsibilities of Program Personnel (Resumes in Appendix C.)**

Name/ Position	% T&E	Qualifications	Responsibilities
<b>TBD</b> <b>Mentors</b>	\$3000/year	4+ years of teaching experience/tenure; Experience facilitating academic progress for diverse high-need students; Proven ability to use data to inform instruction; Experience modeling best teaching practices; Able to help colleagues improve their practice; Experience with instructional coaching/debriefing conversations; Extensive knowledge of Danielson’s <i>Framework for Teaching</i> and Common Core Learning Standards; Ability to foster trust with colleagues; Excellent written and verbal communication skills	In each of the five host schools a minimum of 5 teachers will be selected to work with LUTE-STEM students. Mentors will: continuously explore new and innovative instructional practices; Align lessons to Danielson’s <i>Framework for Teaching</i> and model the use of Next Generation Learning Standards; Create a welcoming and open environment for clinical resident reflection and growth; Model culturally responsive mindset and practices; Collect observational, low-inference notes to develop goals and actionable next steps that foster Clinical Resident (CR) growth; Reflect on and debrief own lessons with colleagues, modeling a collaborative environment; Demonstrate/ articulate effective teaching practices; Facilitate practice sessions, to support CRs’ acquisition/ improvement of key instructional skills; Gradually release lead-teaching responsibilities to CR(s); and Foster trust and a collaborative relationship with CR(s) to encourage reflection, growth and risk-taking
<b>TBD</b> <b>Enrollment Specialist</b>	50%	Experience working with students, familiar with CUNY recruitment, enrollment and registration processes. Knowledgeable about RFCUNY processes and procedures, good working relationship with staff, consultants and project personnel. Good organizational and time management skills. Ability to track and reconcile project student stipend payments with RF requirements and budget.	Develop recruitment materials with the PD; Send out letters to potential students. Process enrollment of students with Admissions Office. Process students’ paperwork needed for stipends. Work with registrar to schedule courses for appropriate times and locations. Submit tuition waivers and register students for waived sections.

<b>Table c-4. Roles and Responsibilities of Program Personnel (Resumes in Appendix C.)</b>			
<b>Name/ Position</b>	<b>% T&amp;E</b>	<b>Qualifications</b>	<b>Responsibilities</b>
<b>Assessment Coach  Debra Coffey</b>	Contractual	Debra Coffey has designed and conducted multi-method evaluations for clients in the nonprofit, educational, and governmental sectors. Her experience includes instrument design and implementation studies, analysis of quantitative and qualitative data, and document and discourse analysis. She has excellent skills in working with clinical residents and mentors to facilitate their use of assessment techniques for their own performance and that of their students.	Assist project staff, school staff and mentors to report on all project processes: attend operations and advisory meetings; observe at school sites; interview participants, mentors, and faculty; suggest assessment improvements; work with evaluator and project staff to triangulate findings. Contribute to annual report.
<b>Instructional Coach  Shirley Hall  Greenlight</b>	Contractual	Skilled at facilitating professional learning and partnering with educators and policy leaders at all levels to strengthen professional practices and promote education policies that elevate teacher development and leadership in service of student learning.	Provide on-site support for clinical residents, mentors, administrators and additional teachers from the participating schools.
<b>Evaluator  Metis Associates</b>	Contractual	Dr. Harnett has 20 years of experience with program evaluation, research design, sampling, field research, qualitative/quantitative methodology, statistical analysis, data maintenance and technical writing. Since joining Metis in 1999, she has been the principal researcher on the evaluation of several large-scale educational initiatives in New York City (NYC) and other urban school districts around the country.	Collect outcome data from participants, schools, classes, teachers and students: grades, test scores, evaluation, attendance, and observation reports. Work with process evaluator and project staff to triangulate findings. Contribute to annual report.
<b>Mouse.Org</b>	Contractual	Mouse is a national nonprofit organization that successfully empowers all youth and educators to engage with computer science and creative technology to solve	Mouse will leverage existing content and digital badging infrastructure on their online learning platform, Mouse Create, to deliver up to 50 hours of blended professional

Name/ Position	% T&E	Qualifications	Responsibilities
		real problems and make meaningful change in our world.	learning for 25 CRs in each cohort. Mouse’s integrated computational thinking micro-credential aims to be a research-based, personalized, and competency-based professional learning program to address the needs of this particular cohort of teachers by providing flexible online supports to complement live experiences during students’ development

Table c-5 presents the names, affiliations, titles and job roles/grant positions of individuals who have agreed to serve on the Advisory Panel. As LUTE-STEM: TQP continues additional members might be added to reflect additional needed expertise.

Name	Affiliation	Title	Role
Charlene Clarke	NYCDOE	Associate Director, University Partnership	NYCDOE Liaison
Leigh Ann DeLyser	CSforAll	CEO/Founding Partner	Computer Science
Sarah Beal	USPREP	Executive Director	USPREP liaison
Thomas O’Connell	Mouse.org	Chief Partnership Officer	Micro-credentials
Pam Mills	Lehman College	Interim Dean NSS	Member
Gaoyin Qian	Lehman College	Interim Dean, SOE	Member
Harriet Fayne	Lehman College	Professor	PI
Anne Rothstein	Lehman College	Professor	Research Coordinator

Figure 1 presented below offers an organizational chart to clarify the reporting process of the LUTE-STEM: TQP project.

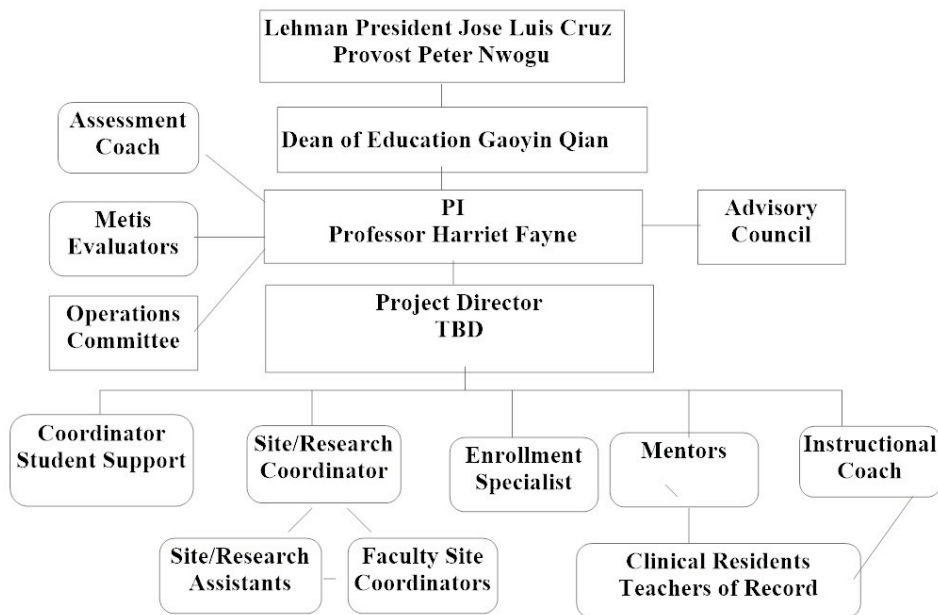


Figure 2. LUTE-STEM: TQP Organizational Chart

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

The existing Lehman College Teacher Education programs are nationally recognized by Specialized Professional Associations (SPAs), and the School of Education at Lehman College is accredited by the Council for Accreditation of Educator Preparation (CAEP). A strong factor in establishing national recognition and accreditation is the existence of an assessment system that provides on-going feedback for program improvement. Data are collected while Clinical Residents are taking coursework, in their residency, preparing for and taking the EdTPA and during their first two years of teaching. In addition the project will track participants through their sixth year of teaching to determine program impact on teacher retention and performance.

Monitoring of student outcomes and achievement in the schools in which Clinical Residents are placed and where they have their placement as teachers of record will enable the program to continuously improve the operation of the project to assure best outcomes for both

teachers and the students they teach. 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-clinical residency, clinical residency, graduation, employment, a two year induction period and six year follow-up for retention.

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 Committee that will meet at least eight times per year to review the process and outcomes of the program and to review the reports from Metis, our external evaluator, and Deb Coffey, our assessment coach. The Operations Committee will focus on reviewing the progress of *project activities* with a focus on assessing the key outcomes of LUTE-STEM: TQP reforms, identifying any problems or issues with implementation, and exploring solutions to make any needed adjustments. All members of the committee are partners in the LUTE-STEM: TQP initiative and will bring diverse perspectives to program improvement needs and solutions.

In addition to the program improvement activities described above, the Metis Evaluator and Assessment Coach will work with the internal research coordinator and College 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 SOE efforts to extend teacher preparation reforms to all programs. The LUTE-STEM: TQP 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.

***(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 three respected partners: Lehman College of the City University of New York, the New York City Department of Education, and Mouse.org. We have commitments from highly regarded individuals with national reputations to serve on the Advisory Panel, including NYCDOE and Lehman College faculty who have significant expertise in STEM and teacher education. Metis will be asked to appoint one member to the Advisory Panel who can report on outcomes data at the second meeting of each project year.

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 Advisory Panel (meeting two times per year) with the previously mentioned individuals with national reputations in STEM and teacher preparation, and (2) an Operations Committee (meeting monthly), which will include representation from all host schools, program areas (Early Childhood, Childhood, Secondary Mathematics, Secondary Science), and LUTE-STEM project staff. A research committee comprised of the external evaluator, the external assessment coach, 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.

### **School Liaisons**

The faculty members who will be actively serving as liaisons to the five schools in their project on this program and will serve as site coordinators include: Dr. Anne Rothstein, Professor, Center of School/College Collaboratives Director and LUTE-STEM Research Coordinator; Dr. Anne Marshall, Mathematics Specialist and Elementary Program Coordinator; Dr. Cecilia Espinoza, Bilingual Specialist and Early Childhood Program Coordinator; Dr.

Wesley Pitts, Science Specialist and Secondary Science Coordinator, and Dr. Celia Cruz, Mathematics Specialist and Doctoral Lecturer.

### **Operations Committee**

The Operations Committee will be chaired by Dr. Fayne (PI) and will meet monthly. Membership will include: 1) a liaison from each partner school, five Lehman faculty serving as site coordinators, LUTE-STEM staff, and the Assessment Coach.

### **(d) Quality of the Project Evaluation**

Lehman College proposes to retain the services of two external consultants to conduct a thorough evaluation of LUTE-STEM implementation and outcomes. The two will work closely throughout the process to ensure coordination of activities and effective flow of information. To conduct the formative, implementation evaluation activities, LUTE-STEM will retain the services of Dr. Deb Coffey, who has designed and conducted multi-method evaluations for clients in the nonprofit, educational, and governmental sectors and has excellent skills in working with clinical residents and mentors to facilitate their use of assessment techniques for their own performance and that of their students. To conduct the formal outcomes evaluation, the project will contract with Metis Associates, an independent research and consulting firm headquartered in NYC. Metis was formed in 1977 to provide human services evaluation, research, and design support to public, philanthropic, and private-sector organizations. Metis has worked with hundreds of schools and school districts, government agencies, foundations, institutions of higher education, and community-based organizations on diverse projects, with the vast majority of this work being carried out in NYC. Notably, Metis has a more than 40-year history working with the NYCDOE and has requested, accessed, and analyzed student demographic and achievement data from the NYCDOE.

Metis also has experience in evaluating teacher preparation initiatives, such as NSF-funded Noyce Scholars programs at Lehman College, Hofstra University, Long Island University Post, and Morehead State University. In addition Metis has evaluated several Math Science Partnership grants including those in the School District of Philadelphia and across multiple school districts in New Jersey. Metis also has a duly constituted Institutional Review Board (IRB) that is registered with the U.S. Department of Health and Human Services (IRB #00003465) and ensures compliance with Federal Wide Assurance (FWA) requirements for the Protection of Human Subjects (#FWA00004755). More information about Metis's experience can be found in the letter of support in the attachments.

***(i) The extent to which the methods of evaluation will provide valid and reliable performance data on relevant outcomes;***

***(ii) The extent to which the methods of evaluation are thorough, feasible, and appropriate to the goals, objectives, and outcomes of the proposed project.***

The LUTE-STEM evaluation design includes implementation and outcome components. Implementation evaluation activities will track the extent to which grant activities are being carried out as planned and provide formative data to inform project management about the quality of implementation, identify problems needing immediate attention, and generate recommendations for improvement. Outcome evaluation activities will examine the extent to which the program has met desired outcomes, addressed performance and GPRA measures, and provided summative information about the academic and professional development of LUTE-STEM participants and the academic performance of the students they teach. Dr. Susanne Harnett from Metis will serve as the quantitative lead. Dr. Deb Coffey, will serve as the qualitative lead and collect ongoing formative data (including observations of Clinical Residents and induction teachers, observations of LUTE-STEM programming, and interviews and focus

groups with key stakeholders). Résumés are in the attachment. Overall, the evaluation will be guided by the following formative and summative evaluation questions.

### **Formative Evaluation Questions**

1. What strategies does the LUTE-STEM program implement to recruit students? To what extent are these strategies effective in ensuring that participants are high achieving, strong in STEM content, diverse, and motivated to work in high-need NYC schools? What recruitment activities have the most demonstrated effectiveness?
2. To what extent are strategies used to retain students in the LUTE-STEM program effective? What contextual factors and individual characteristics contribute to student attrition?
3. What is the nature of the coursework and other components (e.g., clinical work, induction, summer PD, work with host schools) of the LUTE-STEM program? To what extent do they adequately prepare LUTE-STEM participants to teach in high-need NYC schools?
4. What evidence-based practices are included in LUTE-STEM teacher preparation? What is the nature of the clinical experiences of the program and how do they offer participants content knowledge and supports needed to become highly-effective teachers?
5. What supports/strategies does the LUTE-STEM program use to build the capacity of host schools to provide high quality clinical experiences for pre-service teachers? How effective are these supports/strategies? Which activities do participants perceive as most effective?
6. What supports/strategies does the LUTE-STEM program provide for its induction program for new teachers? The retention program for new teachers? How effective are these supports/strategies in ensuring that new teachers feel supported, continue in their content knowledge and pedagogical growth, and persist as teachers in high-needs NYC schools?

7. What are the overall successes and challenges of LUTE-STEM? What steps have been taken to address the challenges over time?

**Summative Evaluation Questions**

1. To what extent do LUTE-STEM participants experience changes in their STEM content and pedagogical knowledge, level of comfort with teaching in high-needs NYC schools, and in their plans to continue as STEM teachers in high-needs schools?
2. To what extent are there changes in the number of highly-qualified STEM teachers hired in host and other high-needs NYC schools?
3. To what extent do the host schools experience changes in their clinical residency programming, including in the skills of mentors who work with clinical residents?
4. To what extent do the students of LUTE-STEM completers demonstrate growth in their math and/or science academic achievement? How, if at all, do changes vary by race/ethnicity, gender, school, socio-economic status, ELL, and/or special education status?

**Data Sources**

In order to address each of the evaluation questions as well as to measure the extent to which the program has met project and GPRA outcome measures, evaluators will gather, review, and analyze qualitative and quantitative data from a variety of sources. Table D-1 presents the goals, objectives, and outcomes of the project, along with the data sources that will be used to evaluate progress made toward meeting these outcomes and to respond to the evaluation questions.

<b>Table d-1. Objectives, Outcomes and Data Sources</b>		
<b>Objectives</b>	<b>Outcomes (Performance Measures)</b>	<b>Data Sources</b>
<b>Goal 1: Engage in an extensive recruitment and rigorous selection process</b>		

<b>Table d-1. Objectives, Outcomes and Data Sources</b>		
<b>Objectives</b>	<b>Outcomes (Performance Measures)</b>	<b>Data Sources</b>
<b>Objective 1.1:</b> In each program year, LUTE-STEM will collaborate closely with partners, including Teacher Opportunity Corps and NYC Men Teach, to recruit and incentivize undergraduates from diverse backgrounds to consider teaching as a career.	<b>Outcome 1.1.:</b> In each of Years 2-5, LUTE-STEM will recruit a cohort of 25 Bronx-residents from under-represented groups to teach math and science in high-need P-12 classrooms.	-- <i>Project documentation</i> (e.g., recruitment, application, partner meeting minutes/agendas, stipend, program participation and persistence data) -- <i>Focus groups</i> with LUTE-STEM participants and Lehman program staff
<b>Objective 1.2:</b> In each implementation year, LUTE-STEM will provide stipends for participants' clinical experiences.	<b>Outcome 1.2:</b> In each of Years 3-5, 92% of the participating students from the previous grant reporting period will persist in the program (or complete) in the next grant period ( <i>GPRA 3</i> ).	-- <i>Surveys</i> of LUTE-STEM participants and Lehman faculty
<b>Goal 2: Design and implement a clinically-rich teacher preparation program</b>		
<b>Objective 2.1:</b> Over the course of the program, LUTE-STEM will prepare four cohorts of diverse pre-service teachers through a rigorous program of study with specialized content and pedagogical knowledge in STEM areas, leading to an and a Computer Science micro-credential at Lehman College.	<b>Outcome 2.1.1:</b> At least 92% of students in each of the four cohorts will earn a Master's Degree from Lehman ( <i>GPRA 1 &amp; 2</i> ). <b>Outcome 2.1.2:</b> At least 92% of students in each of the four cohorts will earn a Computer Science micro-credential by the end of the residency year. <b>Outcome 2.1.3</b> At least 52% of students in each of the four cohorts will attain an NYSED Computer Science Education Extension credential within three years of completion. <b>Outcome 2.1.4:</b> At least 88% of LUTE-STEM participants will report changes in each of their STEM content knowledge, pedagogical knowledge, level of comfort teaching in high-needs NYC schools, and plans to continue as STEM teachers in high-needs schools	-- <i>Project documentation</i> (e.g., Lehman Program of Study, program graduation/micro-credential documentation, certification/credential data, NYSTCE scores ) -- <i>Focus groups</i> with LUTE-STEM participants and Lehman program staff -- <i>Surveys</i> of LUTE-STEM participants and Lehman faculty -- <i>Observations</i> of program activities (e.g. trainings and supports) and LUTE-STEM participants during their clinical and induction teaching.

<b>Table d-1. Objectives, Outcomes and Data Sources</b>		
<b>Objectives</b>	<b>Outcomes (Performance Measures)</b>	<b>Data Sources</b>
<b>Objective 2.2:</b> Each of the students will be provided with individualized supports and coursework embedding NYSTCE content and strategies, focused NYSTCE preparation and tutoring, and diagnosis of test scores and tutoring, as needed.	<b>Outcome 2.2:</b> At least 72% of students in each of the four cohorts will pass the NYSTCE and attain certification in STEM areas within one year of program completion ( <i>GPRA 1 &amp; 2</i> ).	
<b>Objective 2.3:</b> Through implementation of the LUTE-STEM program, Lehman College coursework will undergo changes to include Universal Design principals.	<b>Outcome 2.3:</b> By the end of the grant, Lehman College at least 5 courses in STEM areas and education will be redesigned with Universal Design principles.	
<b>Goal 3: Build host school capacity to provide high-quality clinical experiences</b>		
<b>Objective 3.1:</b> The LUTE-STEM program will provide training/ summer institutes, professional development, stipends/ summer pay, and support for the mentors, supervisors, and faculty in each of the Bronx host schools.	<b>Outcome 3.1:</b> At least 85% of mentors, supervisors, and faculty at the Bronx host schools will report changes in their ability to provide high quality clinical experiences to LUTE-STEM participants.	<i>--Project documentation</i> (e.g., host school staff and LUTE-STEM participant program participation, employment data, clinical experience placement and participation data) <i>--Focus groups</i> with LUTE-STEM participants, host school faculty/mentors, and Lehman program staff <i>--Surveys</i> of LUTE-STEM participants, cooperating teachers/mentors and principals, Lehman faculty <i>--Observations</i> of program activities (e.g. trainings and supports) and LUTE-STEM participants during their clinical and induction teaching
<b>Objective 3.2:</b> Each of the students in the four LUTE-STEM cohorts will complete a full-year internship at a Bronx, NYCDOE high-need school, gaining extensive clinical experience integrated and aligned with professional development and induction supports.	<b>Outcome 3.2.1:</b> At least 80% of program completers in Cohort 1 (Year 3) and Cohort 2 (Year 5) will be employed by a host high-need school and retained for the school year ( <i>GPRA 4</i> ). <b>Outcome 3.2.2:</b> At least 72% of LUTE-STEM students will be hired to teach in bilingual/ELL or inclusion classrooms or as subject specialists in math and science in high-need schools.	

<b>Table d-1. Objectives, Outcomes and Data Sources</b>		
<b>Objectives</b>	<b>Outcomes (Performance Measures)</b>	<b>Data Sources</b>
<b>Objective 3.3:</b> Participating students will be placed in host school sites that are congruent with their own school experiences and paired with mentor teachers who are representative of their diversity.	<b>Outcome 3.3:</b> At least 88% of LUTE-STEM students in each cohort will report that their school placements were in keeping with their own school experiences and that their mentor teachers were representative of their diversity.	
<b>Goal 4: Reduce achievement and opportunity gaps of P-12 Bronx students in STEM</b>		
<b>Objective 4.1:</b> In each implementation year, the LUTE-STEM program will provide a rigorous, technology integrated program of study with emphasis on knowledge in math and science, differentiating instruction for ELLs and students with special needs, using data to differentiate instruction.	<b>Outcome 4.1:</b> In each of Years 3-5, students of LUTE-STEM participants who are teaching in NYCDOE schools will demonstrate statistically significant growth in their math and science standardized test scores from baseline to the end of the school year ( <i>GPRA 6</i> ).	<i>--Project documentation (e.g., Lehman Program of Study, host school site and teacher selection data)</i> <i>--NYS standardized math and science test data for students in LUTE-STEM classrooms during their induction year and beyond.</i>
<b>Objective 4.2:</b> Participating host school sites will have at least five teachers with more than five years experience of demonstrated ability to impact student achievement.	<b>Outcome 4.2:</b> In each implementation year, 100% of host teachers will have more than five years experience of demonstrated ability to impact student achievement.	
<b>Goal 5: Design and implement sustainable induction and retention programs</b>		
<b>Objective 5.1:</b> LUTE-STEM will develop and implement a rigorous induction program aligned with NYCDOE priorities, and will collaborate with partners to provide activities and supports that promote program retention.	<b>Outcome 5.1:</b> By the end of Year 5, at least 72% of program completers from Cohort 1 will be employed by a host high-need school or an equivalent school for three consecutive years after initial employment ( <i>GPRA 5</i> ).	<i>--Project documentation (e.g., induction program materials and professional development opportunities, online network usage data, ongoing support meetings/agendas, employment records)</i> <i>-Focus groups with LUTE-STEM participants, host school faculty/mentors, and Lehman program staff</i> <i>--Surveys of LUTE-STEM participants, cooperating teachers/mentors/principals, Lehman faculty</i>



The paragraphs below describe in more detail the evaluation data sources and methods.

**Surveys.** Survey questions will be derived from both locally-developed items and those from surveys from the previously funded Math-UP TPQ project at Lehman.

- *LUTE-STEM participants* will complete surveys on an annual pre-post basis in order to gather data on the recruitment, context, characteristics, and organization of the program. The surveys also will ask participants to reflect on the integration of STEM content and pedagogy into their teaching, as well as their beliefs related to teaching in high-need NYC schools.
- *Cooperating teachers/mentors* (during clinical teaching) and *principals* (during induction) for LUTE-STEM participants will complete an annual survey asking them to rate participants' instructional knowledge, their skills and beliefs related to teaching in high-need schools, their instructional and content knowledge expertise in STEM, and the impacts they perceive the participants are having on the P-12 students they teach.
- *Lehman faculty* (and mentors) will complete an annual survey asking them to reflect on program impacts on participants, and the extent to which they believe the program has the potential to impact the pipeline of STEM educators in high need NYC schools.

**Focus Groups and Interviews.** *LUTE-STEM participants, host school faculty/mentors, and Lehman program staff* will participate in annual focus groups and interviews. The interviews and focus groups will gather rich data from participants about their perceptions of the impact of the program, as well as the successes and challenges and their recommendations for improvement.

**Documentation Review.** Documentation, such as recruitment and retention information, demographics of participants, course syllabi, enrollment and completion of required courses, participation in LUTE-STEM activities, host school and teacher recruitment, placement in clinical and induction teaching, student transcripts/graduation, NYSTCE scores, and data from

observations of LUTE-STEM program participants at schools during their clinical /induction teaching will be collected to obtain information about program implementation.

**Observations.** The evaluation will include observations of program activities, such as LUTE-STEM trainings/events, and coaching/mentoring activities for the LUTE STEM participants. Additionally, LUTE-STEM participants will be observed during their clinical/induction teaching to assess participants' learning and effectiveness in teaching STEM in high-needs NYC schools.

**Academic Achievement.** New York State standardized math and science achievement test data from students in LUTE-STEM participants' classrooms will be analyzed to determine the extent to which students have improved in their math and/or science academic outcomes. Metis will work with the NYCDOE to access de-identified data of students in the classrooms of LUTE-STEM participants. The collection and analysis of student math and science achievement data will begin during LUTE-STEM participants first year of employment as full time teachers. During the project's first year, the evaluators will participate in planning meetings and work closely with the project team to finalize the evaluation design, develop all instruments, collect and review program documentation, establish data-sharing agreements, and collect baseline data. Metis will prepare all required documentation and submissions to its internal Institutional Review Board (IRB), the Lehman IRB Board, and the NYCDOE IRB. In subsequent years, evaluators collect and analyze program documentation, surveys, interview/ focus groups, and academic achievement data. Evaluators will share findings and provide specific project improvement recommendations for with LUTE-STEM program staff during ongoing program meetings. An annual report will be prepared and shared at program meetings as part of ongoing

planning and decision-making going forward. In addition, evaluators will fully cooperate all required USDOE third-party monitoring and evaluation activities.

*Evaluation Note: 1) The dollars allocated for the evaluation are fixed across the five years. Therefore, it is a much bigger percentage year one (when we are asking for a total of approximately \$600k). In subsequent years when we are asking for slightly over \$1M (to cover residents' stipends), the percentage goes down substantially.*

*2) In year one, we need the evaluation team to establish relationships with NYCDOE data folks in order to ensure that we will have the data we need to report on GPRA measures. In addition, our formative evaluation (employing largely ethnographic and qualitative techniques) is dependent on establishing relationships with key informants in the partner schools as well as with College faculty and staff. By the end of year one, we have routines/policies/ and expectations in place that can be shared with and approved by the Operations Committee. Individual evaluations of residents and mentors are beyond the scope of the evaluation; evaluation of candidate performance will be conducted by Lehman faculty, and evaluation of mentor performance will be conducted by the building leader or their designee.*

*3) During years two through five, we have an iterative process that allows us to track how well we are doing at meeting GPRA indicators. Formative evaluation will allow us to determine fidelity of implementation and whether or not there is a need to make adjustments. Again, evaluators report to the Operations Committee so that the Committee can determine what actions need to be taken to keep the project moving in a positive direction.*

*4) We intend to disseminate our findings. Therefore, we use a robust design in order to meet American Evaluation Association standards.*

### Competitive Priority 1

Gallup (2016) conducted a study that concluded that underrepresented groups face structural barriers in access and exposure to computer science (CS). They report that minority students are: less likely: than White students: to have classes dedicated to CS at school; to have access to computers at home; to use the internet for or be aware of online computer learning activities; to see individuals like them using CS on TV or in their neighborhood. In summary the report indicates that “These complex and interrelated structural and social barriers have far-reaching implications for underrepresented groups in CS. Not only do females, Blacks and Hispanics lack

some of the access and exposure to CS that their counterparts have, but the persistence of long-standing social barriers that foster narrow views of who does CS can also halt interest and advancement.

New York City Mayor DeBlasio (2015) announced Computer Science for All (CS4All), a 10-year initiative to scale computer science education to 100% of the city's public schools.

CS4All is a public-private partnership between CSNYC and the City of New York and the NYC Department of Education. He stated that "In an increasingly digital world, knowledge of CS is fundamental to being a critical user and consumer of technology. It offers a new way of thinking and of learning, empowers students with practical knowledge and skills, while nurturing confidence and intrinsic motivation." Therefore, by 2025, all New York City public school students will receive at least one meaningful, high-quality CS learning experience at each school level: elementary, middle, and high school. The centerpiece of the initiative is the training of 4,775 teachers who will, by Year 10, bring CS to more than 245,000 students each year. The rationale is that most students in public schools either lack access to CS or gain it too late, after biases and stereotypes have formed. Early and widespread exposure to CS is seen as the key to breaking down gender and racial barriers, and will pave the pathways towards greater diversity and equality in the tech sector and relevant academic fields.

A search of the What Works Clearinghouse for review of research on instruction and student achievement in Computer Science revealed no citations. However, a search of publications and conference summaries yielded more than 500 references to computer science instruction and student achievement. Of these about 40 were directly relevant to the questions of:

1. What will work to increase student knowledge of and achievement in computer science?
2. How can teachers be prepared in content for computer science?

3. What are successfully pedagogies that teachers can use in delivering rigorous instruction?

Vogel, et al (2017) explored arguments for and possible impacts of teaching CS to all students with attention to ensuring the coherence of CS4All initiatives. Data drawn from a researcher- facilitated participatory knowledge building process involving 26 CS education stakeholders who articulated 161 arguments, they identified seven areas of impact for universal CS education: (1) economic and workforce development, (2) equity and social justice, (3) competencies and literacies, (4) citizenship and civic life, (5) scientific, technological and social innovation, (6) school improvement and reform and (7) fun, fulfillment and personal agency.

Ravitz, et al (2017) compare self-reported learning gains and experiences of teachers in four professional development courses funded through Google's 2014 Computer Science for High School program. Two of the courses used a face-To-face approach, one was online only, and one used a hybrid format. Analyses from 314 pre-surveys and 129 post-surveys indicate CS teachers are far from homogenous, suggesting that some customization may benefit professional development. We also saw a stronger sense of community in the two face-To-face courses.

Among the outcomes we measured, teacher concerns (Hall and Hord 1977) were more sensitive to change than our measures of self-efficacy, outcome expectations, readiness, or beliefs.

Findings illustrate the variety of CS teacher professional development experiences and the need to study the best ways to scale effective CS teacher education.

Margolies, et al. (2017) studied the impact of in-classroom coaching for computer science (CS) educators as a way to support teachers in their classroom while they master new curricula or educational approaches and is not evaluative in purpose. They used qualitative methods to assess: How does in-classroom coaching support inquiry and equity-based teaching practices?

The study illustrated the importance of having in-classroom coaches who collaborate and reflect with teachers about current practices and who can help support new inquiry and equity-based instructional skills. Teachers reported that in-classroom coaching helped (1) positively impact changes in pedagogy, (2) enrich teachers' CS content knowledge, and (3) break CS teacher isolation at schools.

Cutts, et al. (2017) evaluated aspects of a professional development program for existing CS teachers in secondary schools by focusing on formation of a teacher professional development network across several hundred teachers and a wide geographical area. Evidence from a series of observations and teacher surveys over a two-year period is analyzed in order to illustrate not only whether it worked as intended, but why. Results indicate that the design was successful in increasing teachers' professional confidence and appears to have an impact on changes to attitudes to learning. The PD used challenging pedagogical content knowledge, conceptual frameworks, high-quality teacher-led professional dialogue, and reflection and classroom trials to trigger examination of the teachers' own current practices.

Hur, et al. (2017) examined ways to promote computer science (CS) among girls by exploring young women's experiences and perceptions of CS as well as investigating factors affecting their career aspirations. American girls aged 10–16 attending a summer Computer Science camp and participated in focus group interviews as well as pre-, post-, and follow-up surveys. The study demonstrated that participation in the CS camp motivated a small number of participants to be interested in majoring in CS, but the activity time was too short to make a significant impact. Based on the findings, we suggest that providing CS programming experiences in K-12 classrooms is important in order to boost girls' confidence and interest in CS.

Heininger, et.al, (2017) employed the playful learning approach (PLA) to teach programming as one of the core digital skills. In this paper, we offer a lesson structure for a PLA to programming by addressing the five core success factors of playful learning. Our structure includes six units and follows an iterative and agile procedure by combining game features with the educational content. Educators and teachers can use the presented results to design the lesson structure in their classes. Furthermore it offers a basis for further research in the area of PLA and can be used as a starting point for the development of educational games and concepts in teaching how to program. These factors are: motivation, integration and involvement, adaption to the audience, interaction and feedback, and integration of educational content into gameplay.

LUTE-STEM TQP will partner with Mouse.Org to develop micro-credentials in computer science and will provide, through our Credly Acclaim platform, the opportunity for clinical residents, mentors and teachers in partner schools to earn micro-credentials in CS leading to a CS Badge. Mouse is a national nonprofit organization that empowers all youth and educators to engage with computer science and creative technology to solve real problems and make meaningful change in our world. As a Lehman Teacher Quality Partnership partner, Mouse will leverage existing content and digital badging infrastructure on their online learning platform, Mouse Create, to deliver up to 50 hours of blended professional learning for 25 pre-service teachers in the cohort. Mouse's integrated computational thinking micro-credential aims to be a research-based, personalized, and competency-based professional learning program to address the needs of this particular cohort of teachers by providing flexible online supports to complement live experiences during students' development. Mouse's learning content includes computer science and computational thinking topics that are linked to CSTA and ISTE standards and

designed to be integrated into any subject area, including competencies in coding, design thinking, information technology, impacts of computing, web literacy, and cybersecurity.

Teachers will submit evidence of their learning along with reflections on their teaching experiences through the badging platform to be reviewed during the grant by Mouse professional development facilitators. Badge hours will count toward CTLE credit in New York State toward teachers' continuing education. Mouse will provide an introduction to computer science and computational thinking during the LUTE Summer Institute for teacher residents and new mentor teachers during each of four summers during the grant.

In order to facilitate CS professional development efforts LUTE-STEM: TQP and Mouse.org will employ micro-credentialing and badging using Credly Acclaim for our badging platform. You can find the platform here: <https://www.youracclaim.com/organizations/lehman-college/badges> and information on Credly here: <https://info.credly.com/how-credly-works>.

Since Lehman College piloted the platform about 18 months ago:

- 11 badges have been issued to more than 5,000 students.
- Several new badges are in planning.
- One of the most popular badges is in information technology.
- The overall acceptance of badges is 37%. In the last six months, four badges were issued to about 300 students and the acceptance rate was 95%
- Almost 90% of accepted badges are posted by students.



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