PROJECT DESCRIPTION

Mathematics Across the Middle School MST Curriculum (The *MSTP Project*) is a five-year project targeted toward improving teaching and learning in middle schools in 10 districts in Long Island, New York, where on average 74% of students fail to meet state standards in mathematics.

> Unfortunately, middle level mathematics is often the great separator rather than the equalizer. It is the gatekeeper that can exclude students, especially those from groups underrepresented in high school and college completion, from educational opportunities and experiences that can affect their career aspirations, their role in society, and even their sense of personal fulfillment. [1]

MSTP addresses the NCLB Act of 2001 [2] by helping to close the achievement gap between disadvantaged and minority students and their peers. Eight of the 10 high-need targeted Project districts have been identified as federal or New York State No Child Left Behind (NCLB) Schools in Need of Improvement (SINI). The Project will engage university science, technology, engineering, and mathematics (STEM) disciplinary experts and educators, and middle school mathematics, science, and technology (MST) teachers and administrators, in an innovative collaborative effort to improve mathematics understanding and results. The proposal has been designed to explicitly address the MSP key features as described below.

Partnership-Driven. MSTP (a mathematics, science, and technology education partnership) is being submitted by Hofstra University in partnership with the State University of New York at Stony Brook (SUNYSB), the New York State Education Department (NYSED), and 10 heavily minority school districts on Long Island, a region where income and school achievement disparities are among the widest in the state. To achieve its goals, MSTP will work closely with the Long Island Regional School Support Center (LIRSSC); Boards of Cooperative Educational Services (BOCES); professional teacher associations in mathematics, science, and technology education; the Brookhaven National Laboratory (BNL); and the Eisenhower Regional Alliance for Mathematics and Science Education.

The Project will also benefit from the active involvement of community-based social service agencies; the UCLA Center for Mental Health in Schools; the NSF Show-Me Center for Learning and Teaching and its satellite centers; and developers and publishers of NSF-funded exemplary materials. The Project draws on the strengths of respected institutions and proven project managers; mathematicians, scientists, and engineers; expert educators and supportive school administrators; NYSED senior managers and staff; and long-established collegial relationships. (Please see Appendix I for a complete list of Project partners.)

Guided by the philosophy that no MST teacher shall be left behind, the Project will establish and enhance 10 seven-person *Collaborative School Support Teams* (CSSTs) consisting of two university STEM experts and five school district personnel. CSSTs will lead summer and academic year workshops and provide ongoing building-based support to all MST faculty in the targeted middle schools. The school CSST members will include teachers of mathematics, science, and technology, the middle school principal, and a human services professional (e.g., school social worker, school psychologist, guidance counselor). This professional will lead the team in establishing home and student support initiatives.

An implementation and resource guide (IRG) will be developed by the CSSTs and Project consultants for use in workshops and will include sections on curriculum alignment, workshop planning, connecting mathematics in an MST context, scope and sequence templates, related research, and links between Project curriculum materials and the New York MST learning standards. (Please see Appendix XII.)

Teacher Quality, Quantity, and Diversity. MSTP integrates three major components: 1) an intensive, sustained, collaborative professional development program for school-based and higher education faculty; 2) a curriculum revision and alignment process; and 3) a teacher recruitment initiative that inspires underrepresented minority undergraduates in math, science, and engineering to enter careers in education.

Professional development will provide mathematics content and pedagogical enhancement for 20 higher education and 300 school-based faculty. It will also enhance participants' abilities to collect and interpret root cause and achievement gap data, and to develop instructional models based on identified needs.

The CSSTs along with middle school faculty will align mathematics curriculum with state standards and assessments and determine which mathematics connects to science and technology curricula. Curriculum revision and alignment will support district reform initiatives and involve participants as a component of their professional development.

The minority teacher recruitment initiative will target the students who participate in the Collegiate

Science and Technology Entry programs (CSTEP) at SUNYSB and Hofstra. CSTEP programs support the academic work of underrepresented and disadvantaged students engaged in STEM studies. Presently, only 1.8% of these bright and able minority women and men choose to enter teaching careers. CSTEP students will be provided with financial incentives and academic and personal support, and will be introduced to teaching through work as teaching assistants in Project classrooms and as mentors in after-school activities.

Challenging Courses and Curricula. The Project will ensure that middle school students use standards-based mathematics curricula aligned with NYS standards and assessments, and are prepared to succeed in Regents-level high school math courses. The Project will develop an innovative model to increase the time students spend on mathematics in mathematics, science, and technology education classes using suitable pedagogy and curriculum.

NSF-developed exemplary materials will be used as contexts for professional development to facilitate standards-based mathematics instruction. Materials will include modules from the Connected Math Project (CMP), Math in Context (MIC), Integrating Mathematics, Science, and Technology (IMaST), and Science and Technology for Children/Middle School (STC/MS). The Project will support two curriculum revision approaches: 1) adapting local school curricula to reflect standards-based content and good pedagogy and 2) helping interested schools adopt exemplary curricula at discounted pricing.

Evidence-Based Design and Outcomes. The Project design is informed by current literature on how people learn, professional development, mathematics education, contextualizing instruction, and minority teacher recruitment. Key learnings from prior NSF projects managed by the co-PIs guide the design. Outcomes will be broadly disseminated and will, with NYSED leadership, inform statewide scale-up activities. The Project will collect disaggregated data by race, ethnicity, socioeconomic status, gender, and disability, and will include indicators of student learning, effectiveness of the MSTP model, impact of STEM faculty, the effect of the CSSTs on teaching and learning, and the success of the teacher recruitment initiative.

Institutional Change and Sustainability. The MSTP model will be evaluated, documented, and disseminated to make replication feasible by other school districts in NYS and nationally. At the Project's conclusion, NYSED and the core partners will sustain the implementation of MSTP programs. Table 1 (on page 15) summarizes core partner institutional commitments.

MST Collaboration in New York

In NYS, conditions are right for science, mathematics, engineering, and technology educators to apply their diverse expertise and teaching styles to bring new meaning to mathematics instruction. A history of collaboration exists among the constituencies at all levels. NYSED has developed connected K-12 MST learning standards; mathematics, science, and technology are required subjects for all middle-level students; state assessments are administered in each subject at the end of grade 8; and an MST K-16 network meets regularly. Engineering educators have been active in statewide MST reform; professional associations have conducted joint conferences, and major NSF projects in NYS have linked teachers from the three (MST) disciplines. [3]

Project Need and Rationale

In New York State, the Commissioner of Education has described the state of middle school mathematics as "in crisis." [4] New assessments in mathematics were first administered in grade 8 in 1999. In Project schools, performance is exceptionally poor; only 26% of eighth-grade students in 2002 demonstrated understanding of the mathematics intermediate-level standards. The results of these assessments require purposeful actions to strengthen middle school mathematics education. [5] In January 2002, NYSED hosted the Summit on Mathematics Education, which included teacher educators, NYS mathematics association leaders, mathematics teachers and coordinators, NYSED subject specialists, and the Commissioner of Education. The group identified the improvement of content and pedagogical background for teachers as the primary need, and urged the development of a statewide professional development initiative. [6] According to NYSED, it is vital that school districts align local mathematics curricula. [7]

In New York, 44% of public school students but only 16% of teachers are minority. [8] Proponents of a more balanced teaching force contend that there is a legal and moral responsibility to recruit more minority teachers, and remove obstacles preventing their entry into education. [9] Researchers cite the lack of academic, financial, and moral support as barriers to minority students entering the field. [10]

In this regard, MSTP will work closely with the CSTEP directors at Hofstra and SUNYSB, and with the

NYSED Office of K-16 Initiatives and Access Programs that administers university-based CSTEP programs statewide. According to NYSED, CSTEP students perform better, graduate at a higher rate, and pursue graduate programs and licensure at a higher rate than their peers. [11] However, few CSTEP students graduate with mathematics or science teaching certificates. [12] MSTP will address this situation through a program of workshops and teaching experiences that integrate 100 Hofstra and SUNYSB CSTEP students into Project classrooms. CSTEP students will attend workshops to engage them in the excitement of teaching mathematics and science at the secondary school level, partner with Project teachers in classrooms, and serve as mentors for middle school students in class-based and extracurricular mathematics-related activities.

Physical and mental health concerns must be addressed for schools to function satisfactorily and for students, particularly children with special needs, to succeed. [13] MSTP will establish and/or catalyze school- and community-based programs geared to the strengths, styles, and needs of children and families in partner school communities. Programs will increase understanding of Project goals and curricula, facilitate access to community resources, and enhance caregivers' ability to become involved in school and help children learn.

Conceptual Base of MSTP

Respected mathematics and science experts and organizations point to the need to contextualize teaching and learning. The Council for Educational Development and Research reports that for educational reform to occur, students should make real-world connections by exploring how mathematics, science, and technology affect their lives; instruction should integrate math and science content with other subjects; and math problems and examples should come from everyday life. [14]

In her landmark study comparing teachers' understanding of mathematics in China and the U.S., Dr. Liping Ma suggests that contextual understanding underlies Chinese teachers' competence and students' superior performance on international comparisons. [15] NCTM contends that "students should connect math to their daily lives, and to situations from science, social science, and commerce." [16] The National Research Council (NRC) and the American Association for the Advancement of Science indicate that learning how to teach math, science, and technology by studying connections enhances MST literacy. [17, 18]

Research shows that connected learning appeals to educators because it mirrors the real world, links subject areas, interests students, fosters collaboration among teachers, and creates networking throughout the school. [19] NSF has funded several projects that develop mathematical connections and forge links among disciplines: CMP (Michigan State University); MIC (University of Wisconsin); IMaST (Illinois State University); and STC/MS (National Science Resource Center). All of these will be used as Project instructional materials.

Lessons learned from NYSED forums on middle-level education indicate that: there must be a firm balance between strong academics and positive youth development; successful middle-level curriculum and instructional approaches must be used; improvement strategies must recognize variations in school organization and structure; school-based leadership is essential; and there is a hunger for professional conversation on effective middle-level programs. [20]

Sparks and Loucks-Horsley have identified principles and practices essential to successful teacher development programs. [21] These include: programs conducted in school settings linked to schoolwide efforts; teachers helping each other; teachers choosing goals and activities for themselves; concrete enhancement with ongoing support available; administrators supporting teachers and clarifying goals and expectations; changes in curriculum and instruction to improve student learning; and follow-up assistance to ensure that new behaviors are put into practice. These principles underpin the conceptual design of MSTP.

Mathematics in Science and Technology Education

Science and technology teachers and students also stand to benefit from MSTP. NSTA states that " science and math should be coordinated to improve student mathematics understanding." [22] The NRC indicates that "coordination of science and math provides an opportunity to advance instruction in science beyond the purely descriptive." [23] The NYS science supervisor asserts that "science teachers in New York will truly benefit from opportunities to use exemplary science curriculum materials not only to improve their science knowledge, but to provide meaningful contexts through which students may apply and deepen mathematics understandings." [24]

NSF has defined the focus of technology education as "the human-built environment that provides contexts for problem-solving and for understanding MST concepts." [25] In New York State, there are over 2,000 certified technology teachers at the middle level. [26] In technology education classes, relevant mathematics will be embedded in engaging design-and-construct activities. According to the NYSED technology education state supervisor, "MSTP is a new paradigm for collaboration in the service of improving mathematics results." [27]

Partnership Self-Assessment

The MSTP team has conducted extensive planning with partner groups to help design this Project. Management team relationships have been built over a 10-year period through related NSF and NYSED projects. The conceptual design that has resulted from these conversations is driven by partner needs.

The planning group met regularly from January 28 to December 23, 2002. The group included faculty and administrators from core partner schools and universities; NYSED staff; the LIRSSC director; professional association leaders; and BOCES administrators. Formal meetings followed by telephone and e-mail correspondence were held with NYSED personnel including the Assistant Commissioner for Regional School and Community Services (a Project co-PI), the director of Career Opportunity Programs, the supervisor of middle-level programs, and the mathematics, science, and technology state supervisors. NYSED has developed an action plan for middle-level education that MSTP will help to implement. [28]

Decisions regarding Project emphases were made on the basis of data collected from core partners relative to student attainment, teacher quality, school and community demographics, parent involvement, home-school collaboration, and instructional needs (see Appendices IV and X). Meetings were conducted with curriculum directors in the targeted districts to clarify school needs and identify strengths and challenges.

In Project schools, 74% of students fail eighth-grade state mathematics assessments. According to district personnel, students in these schools infrequently participate in group discussions, engage in only limited project-based learning, rarely integrate numeracy or mathematical reasoning into interdisciplinary activities, and do not normally engage in team-based or group problem-solving activities. Teachers indicate a need for professional development in content and pedagogy; implementing hands-on learning; using computers as part of instruction; developing instructional strategies; using authentic assessment and cooperative learning; teaching broad ability levels; integrating curriculum; and raising teacher expectations.

University partners have identified a set of department-based and university-wide institutional changes (see page 15) that align with the Project mission of improving middle-level mathematics understanding and achievement. An assessment of university capability is included in Appendix VI.

Meetings were held with supporting partners including Barbara Reyes, director of the NSF Show-Me Center for Learning and Teaching; the developers of CMP (Betty Phillips and Glenda Lappan), IMaST (Franzie Loepp), and MIC (Margaret Meyer); and with publishers of these materials to arrange for their use. Project management staff met with the presidents of the NYS mathematics and science teachers' and supervisors' associations and with mathematics and science mentor organizations to solicit advice and recruit expert teachers for the CSSTs. Conversations were held with BOCES leadership and directors of the NYS Regional School Support Centers (instituted by NYSED to provide support to low performing schools).

K-12 Core Partner Needs and Opportunities

Core partner school districts include: Freeport CSD, Hempstead UFSD, Uniondale UFSD, and Westbury UFSD (in Nassau County); Amityville UFSD, Brentwood UFSD, Longwood CSD, Riverhead CSD, William Floyd CSD, and Wyandanch UFSD (in Suffolk County). In participating middle schools, students perform dramatically below state standards on eighth-grade mathematics statewide assessments. Passing rates vary from 47% to 5%. The Project-wide average is 26%. Eight of the ten middle schools targeted have been identified as Title I NYS or federal NCLB Schools in Need of Improvement.

The Project will serve over 12,000 middle school students per year in districts with a combined student population of over 66,000 children, of whom 72% are minority. The target population includes schools with the state's highest percentages of minority children, up to 100%. The percentage of economically disadvantaged students ranges from 20.9% to 100% of the student population. The Project will serve all the MST educators in the targeted schools (n=>300 teachers/year). Disaggregated student achievement and participation data, and teacher data for partner schools, are included in Appendix IV.

School administrators and curriculum leaders have been full partners in conceptualizing MSTP and in aligning Project interventions with district needs and initiatives. A signed memorandum of agreement from superintendents of all partner schools is attached in Appendix II. Commitment letters are in Appendix VIII.

The NYS mathematics standards are based on seven key ideas: mathematical reasoning, number and numeration, operations, modeling and multiple representation, measurement, uncertainty, and patterns/functions. Data from the 2000, 2001, and 2002 middle school assessments based on the percentage of students who answered questions correctly show that in the Project schools performance was weakest in patterns/functions, number and numeration, and measurement. Students did little better on questions related

to operations and modeling/multiple representation. [29] Participating districts, NYSED, the BOCES, and the LIRSSC have collected student achievement data for each of the key ideas on the eighth-grade assessment. The districts and the LIRSSC have completed comprehensive status reports that identify root causes linked to low student achievement. A summary of root causes and proposed instructional interventions are included in Appendix X. Institutional reforms in the partner school districts are summarized in Table 1 (page 15).

Higher Education and NYSED Partner Challenges and Opportunities

Hofstra, SUNYSB, and NYSED, building on a decade of collaboration, will partner in this Project and have committed to significant institutional change as outlined on Table 1 on page 15, and in the letters of support in Appendix VIII. Data relative to university capacity have been collected by Project co-PIs (see Appendix VI).

Twenty university faculty members with expertise in mathematics, science, and engineering will serve on the CSSTs (see Appendix XI, Participating STEM Professionals). These individuals will assist in leading summer workshops and will provide ongoing support (15 days/year) in the schools.

Hofstra, the lead agency, will administer the budget. Project Director Burghardt and Project Coordinator Hacker co-direct the Center for Technological Literacy and have conducted numerous NSF K-12 MST education projects. Co-PI Whitton, former chair of the Department of Curriculum and Teaching, provides recognized leadership to math reform efforts and was the PI on an NSF middle school math project. The schools of engineering and education conduct joint projects in the service of education, including an MST master's degree in education. Other CSST Hofstra faculty members have expertise in science, engineering, mathematics, and computer science.

The **SUNYSB** faculty team brings a wealth of experience to the Project. Co-PI Liao is a science and engineering educator who has 40 years' experience in K-12 curriculum development and teacher enhancement. Magram and Ferguson are innovative mathematics educators with expertise in using technology to support MST education. For 20 years, Liao and Ferguson have led programs to increase the number of underrepresented minority students who succeed in STEM studies. Joanne Daly, director of the Laboratory for Information Technology in Education, will provide educational computing support. Other faculty members will provide expertise in applied mathematics, engineering, and minority outreach.

NYSED has identified middle-level mathematics as a statewide priority and nominated partner schools. Dr. James Butterworth, Assistant Commissioner for Regional School and Community Services, is a co-PI. School Improvement staff will liaise with targeted schools. The MST state supervisors have been integral to Project planning and will work directly with Project teachers. They will serve on the Advisory Council, along with Dr. David Payton, supervisor of middle-level education programs. The director of the Career Opportunity Program, Carlos Garcia, will help recruit CSTEP students and serve on the Advisory Council.

VISION, GOALS, AND OUTCOMES

The mission of the MSTP Project is to improve middle school student achievement in mathematics. The Project will accomplish its mission by developing and implementing a collaborative program model that enhances university faculty's understanding of middle school reform, learning standards, and assessments; increases middle school MST teachers' understanding of mathematics content and pedagogy; and improves curriculum alignment in the three subject areas. It will also increase the diversity of the teaching workforce in New York by recruiting CSTEP students and engaging them in the implementation of the Project model.

Through the efforts of the MSTP Project, we envision partner **universities and schools** with enhanced capacity to support faculty, learners, and caregivers and improve middle-level mathematics performance. We envision **students** who are fully engaged in learning mathematics through high-quality MST instruction and demonstrate proficiency in standards-based middle-level math concepts and skills. We envision **parents and caregivers** who are connected to schools and support their children's progress. We envision knowledgeable **educators** who use high-quality curriculum materials aligned with state standards and assessments, co-plan instruction with colleagues, are supported by administrators and community members, and guide students to be independent and reflective learners. We envision **closing the gap** between the state's racial diversity and its teaching workforce.

While the program model will be implemented and institutionalized in 10 low-performing schools, the Project, through its partners and collaborators, will inform middle school mathematics reform and teacher development across NYS and nationally.

Project Goals

To achieve its mission, MSTP projects the following goals. Quantitative outcome goals, objectives, and annual benchmarks are provided in Appendix VII.

1. To Enhance Mathematical Understanding of Middle School Students in Participating Schools
2. To Enhance Mathematical Content and Pedagogical Understanding of Middle School Teachers of Mathematics, Science, and Technology in Project Schools
3. To Enhance Higher Education STEM Curricula and Faculty Pedagogical Skills
4. To Align and Improve MST Curricula in Project Schools with Respect to NYS Mathematics Standards and Assessments
5. To Increase the Number of Underrepresented Minorities Entering the MST Teaching Workforce in New York State
6. To Enhance the Capacity of the NYSED, Partner Universities, Schools, and Districts to Engage in Ongoing Improvement of Middle School Mathematics
7. To Disseminate an Innovative Middle School Mathematics Program Model

RESULTS FROM PRIOR NSF FUNDING

MSTP draws on the success of six large-scale NSF projects that co-Principal Investigators (co-PIs) David Burghardt, Thomas Liao, and Sharon Whitton, and Project Coordinator Michael Hacker, have recently managed. They are co-PIs of The MSTe Project: Integrating Mathematics, Science and Technology in the Elementary Schools ($4.2M, NSF #ESI-9618962, 1997-2002), a five-year project providing leadership and professional development to 1,500 elementary school teachers. The project involves SUNYSB, Hofstra, BNL, 37 NYS school districts, and regional BOCES. According to the project evaluator, MSTe experiences are serving as models for changing classroom practice. Teachers report increased use of: connected instruction in math, science, and technology (92%); alternative assessment such as portfolios, hands-on activity, and observations (86%); cooperative learning groups (79%); student-initiated inquiry (85%); and design (67%) to teach mathematics. Eighty-seven percent of reporting teachers' classes outperformed their schools' averages on state math and science assessments. [30] Interviews with project teachers revealed that "teachers have been involved in a fundamental redefinition of what it means to teach." [31] Findings that will be applied to the MSTP Project are: the knowledge base of the teacher is critical as is support of the principal and superintendent; mentoring other teachers is important for the cascading of change; prioritizing and coordinating reform efforts are important for schoolwide results; teachers are receptive to integrating design into math and science activities; access to support during the school day is necessary to change instructional practices; and team-based staff development requires explicit attention to the team dynamic.

Sharon Whitton was PI of the Leadership in Middle Grade Mathematics (LIMM) teacher enhancement project ($518K, NSF #TPE-9155387, 1992-96). LIMM explored methods for implementing the NCTM Curriculum and Evaluation Standards for School Mathematics and fostered the development of 60 teacher leaders in grades 5-8. According to the evaluator, there was a clear and positive change in the participants' sense of their personal mathematical power and their consequent demeanor as leaders. LIMM participants are now part of a caring and competent network of mathematics teacher leaders. Some of these teachers will be invited to join MSTP leadership teams.

Hacker and Liao are co-PIs of WebTech ($1M, NSF #ESI-9911569, 2000-03), a collaboration between SUNY Buffalo and SUNYSB to develop web-based materials that address the Standards for Technological Literacy. Draft modules (to be field-tested in 2003) are at http://www.eng.buffalo.edu/shaw/index.html.

Burghardt and Hacker are co-directors and PIs of the three-year New York State Curriculum for Advanced Technological Education (NYSCATE) project ($1.53M, NSF #DUE-0053269, 1999-2002). Fourteen curriculum modules in bio/chemical technology, information technology, and physical technology have been developed for grades 9-14 and all have been favorably reviewed. Field-testing to date has established their usefulness in everyday school settings. Modules are available at http://www.nyscate.net.

Burghardt and Hacker were co-PIs of the NYS Technology Education Network (NYSTEN) ($1.6M, NSF #ESI-9343514, 1993-96), which established an MST mentor network serving 1,200 teachers. According to the evaluator, 90% of participants used more cooperative learning in their classes; 86% used more authentic assessment; and 77% increased their use of hands-on strategies. Many of the mentors rose to leadership positions in NYS MST education. Some will be recruited as MSTP leaders.

Thomas Liao was PI of the Teacher In-Service Program in Technological Literacy and Engineering Concepts ($464K, NSF #ESI-9154839, 1992-95). Over 100 classroom teachers attended three-week summer workshops and academic year follow-up meetings in NYS and five other states. All teachers reported having infused engineering examples into at least one of their other mathematics, science, or technology courses.

These NSF projects, and other large-scale initiatives conducted by the co-PIs, have focused on the systemic reform of MST education. MSTP will add an important dimension to this pursuit by developing a new paradigm for improving mathematics literacy in the middle schools.

ACTION PLAN

The five-year MSTP Project will provide over 300 MST teachers with the knowledge and teaching strategies they need to improve the quality of mathematics curriculum, teaching, and learning. The Project will carry out this plan by offering a program of summer workshops, academic year meetings, peer coaching, and ongoing support for teachers, students, and parents. (Please see the Project work plan in Appendix III.)

MSTP will develop a cadre of 10 seven-person CSSTs, one linked to each of the targeted middle schools. After summer and academic year enhancement, the CSSTs will conduct summer workshops and follow-up meetings for middle school teachers recruited and supported by partner districts. The Project will update and analyze student achievement and teacher perceptual data annually.

The teacher recruitment component will target 500 underrepresented and disadvantaged students who participate in CSTEP programs at Hofstra and SUNYSB. CSTEP students will be recruited each year in groups of 25 to enter teacher preparation programs at Hofstra and SUNYSB and will work with the Project for two years. Thus, in four years, 100 CSTEP students will take part. All participating teachers and CSTEP students will receive honoraria.

The Project will support costs for instruction, honoraria, and materials. Local districts will cost-share the teachers' honoraria, recruit teachers, and provide ongoing support. Project co-PIs and CSST members with disciplinary and pedagogical expertise will serve as workshop faculty. Expert consultants will support instruction and ongoing planning and include: Dr. Howard Adelman, UCLA Center for Mental Health in Schools; Dr. David Ferguson, SUNYSB (minority outreach); Dr. Dorit Kaufman, SUNYSB (English language learners); Dr. Janice Koch, Hofstra (gender equity); Drs. Glenda Lappan and Betty Phillips (CMP); Maryann Llewelyn, Nassau BOCES (data-driven instructional planning, peer coaching); Dr. Franzie Loepp (IMaST); Dr. Michal Lomask, Connecticut SED (assessment); Dr. Meg Meyer (MIC); Sandy Philips (a framework for understanding poverty); and Mr. Edward Zero, LIRSSC (school improvement planning).

The Collaborative School Support Team

Each CSST will include two university STEM faculty members (including co-PIs), and five school district personnel (MST teachers, the middle school principal, and a school social worker or other human services support professional). Criteria for selecting faculty members include: expertise in mathematics, science, engineering, or related educational pedagogy; prior work experience with K-12 teachers; and sensitivity to student populations with diverse needs. Teachers will be nominated by their superintendents and include those who are active in their professional associations; have participated in NSF teacher enhancement projects; and have been members of MST state-sponsored mentor networks. The Association of Mathematics Teachers of New York State (AMTNYS), the Science Teachers Association of New York State (STANYS), the NYS Mathematics Mentors, and the New York State Technology Education Association, along with NYSED state MST supervisors, will assist in the nomination of CSST members (see Appendix VIII).

The teams will provide a balance of female and male expertise and will reflect the ethnic diversity of the districts. CSST members will be paid stipends by the Project and will be eligible for SUNYSB graduate credit at substantial cost reductions.

During <u>Year I</u>, CSSTs will participate in four fall and spring weekend retreats and a four-week summer enhancement program (see Appendix IX for complete workshop schedules). The Project will use nationally validated, exemplary NSF-developed middle school materials (CMP, MIC, IMaST, STC/MS) to enhance content knowledge and pedagogical understanding. Teams will develop a shared pedagogical perspective informed by constructivist learning theory, exemplary materials, and findings from NRC's *How People Learn* study that will be provided to all participants and discussed. [32]

During the <u>weekend retreats and the academic year</u>, the co-PIs and CSSTs will analyze school-based achievement gap data and identify instructional interventions. A school-by-school inventory of student and teacher needs and abilities will be designed. Teams will be introduced to exemplary materials and work

through several curriculum modules. They will learn to use Blackboard to facilitate ongoing Internet communication. The Eisenhower Regional Alliance director will introduce its curriculum alignment models.

Hofstra and SUNYSB CSTEP directors (members of the CSSTs) will recruit the first cohort of 25 students from within their programs. The CSTEP students will receive stipends to attend an orientation meeting during a spring retreat. Selected students, CSTEP directors, and other CSST members will design a program in which Project teachers mentor CSTEP students, who in turn mentor students in Project schools.

The higher education team members will visit schools and meet with school CSST members and other personnel, including subject supervisors, to develop a common perspective. They will convene faculty, board of education, and PTSA meetings to explain Project goals, obtain feedback about the Project model, and stimulate faculty and community interest.

During the Year I four-week summer workshop, CSSTs will receive enhancement at three institutions: Hofstra, SUNYSB, and BNL, setting the stage for change in the target schools. Instructional strategies based on gap analysis and root cause data will be identified. Teams will use exemplary materials to deepen content and pedagogical understandings. Co-PIs and consultant experts will serve as workshop faculty. Activities embedded in the exemplary materials will provide contexts for teachers to reflect on pedagogical approaches and refine mental models. CSSTs will establish action research criteria to assess student work for evidence of understanding. At BNL, teams will work with scientists and engineers to see curriculum-related math used in authentic research environments. Hands-on experiences will be integrated with the SUNY/Hofstra program and adapted for classroom use.

A component of the summer workshop will be leadership development with a focus on peer coaching techniques; establishing links with colleagues, subject supervisors, and school administrators; and planning follow-up workshops. Teams will discuss effective staff development models and plan follow-up reflection meetings. BOCES instructional experts will introduce a peer-coaching model. A framework for school improvement planning will be developed with consultant help from the LIRSSC.

Professional development will involve consultants with expertise in gender equity and in teaching English language learners, minorities, and children in poverty. Home and school support programs for students and caregivers will be designed by CSST school social workers. Toward the conclusion of the workshop, CSST members will develop curriculum implementation strategies, develop awareness workshop agendas for colleagues, and plan the integration of CSTEP students into the academic year program.

A one-week workshop for CSTEP students will be planned at the end of the summer. The workshop will be conducted by CSTEP coordinators and selected CSST team members to introduce the CSTEP students to the project and to teaching opportunities.

During the Year II academic year, the higher education faculty will make 15 visits to partner schools. CSST teachers will try out exemplary materials with their classes. The CSSTs will convene a series of workshops to recruit teachers for the Year II summer workshop. CSSTs, MST teachers, curriculum coordinators, and administrators will refine plans for curriculum alignment. The teams and MST teachers in each school will do a content analysis to begin to align mathematics curriculum with state standards and assessments, and to determine which mathematics connects, or might connect, to content in science and technology. CSTEP students will meet with CSSTs in their assigned schools. Regular parent/caregiver meetings will be led by the CSST social workers, and math homework clubs led by Project teachers and paid CSTEP students will be established. The first group of 25 CSTEP students will enroll in methods courses and participate in an internship in Project schools. The second group of 25 students will be recruited and will be paid stipends to attend a spring orientation meeting.

Monthly CSST reflection meetings and two recruitment/awareness meetings for teachers will be conducted at each school. Meetings for administrators will be held to help them create an environment conducive to exemplary mathematics teaching and learning. All Project participants will have access to management staff and connections to each other through e-mail and the MSTP homepage and listserv.

Two full-day meetings (fall and spring) will be held centrally for the CSSTs to reflect on their summer experiences, discuss implementation strategies and peer coaching experiences, review student work and the IRG, and plan next steps. The spring meeting will focus on planning summer workshops for MST teachers.

In the late spring, all middle school MST teachers in partner schools will be invited to the first Show-Me Center conference for learning and teaching. At the conference, Project approaches will be introduced, and exemplary curriculum materials will be showcased and presented by the developers. NYSED mathematics

state supervisors and professional association leaders will discuss statewide initiatives.

During the Year II summer, the 10 CSSTs will lead decentralized district-based 12-day summer workshops for 300 partner school MST teachers. The workshops will have a consistent framework (modeled after the Year I summer workshop) but will take local schedules, district mathematics initiatives, and constraints (e.g., summer school) into account. The workshops along with academic year follow-up will provide over 100 hours of professional development. The IRG will be used and revised. All participants will work through subsets of Project exemplary materials to develop understanding of core disciplinary ideas (see Appendix IX). Math teachers will focus on CMP and MIC modules, while science and technology teachers will use IMaST and STC/MS materials. These materials, rooted in constructivist philosophy and inquiry-based learning, model how mathematics can be integrated into science and technology programs. Several CMP and MIC modules that link particularly well with the science and technology materials will provide a common pedagogical base for all MST teachers.

Action research criteria will be refined and samples of student work will be assessed for evidence of understanding. Teachers will visit BNL to work with scientists and engineers to see curriculum-related math used in a research setting. CSSTs and teachers will plan ongoing school-based reflection meetings and peer coaching sessions.

A one-week CSTEP workshop will team experienced (group I) and new (group II) students. Group I students will prepare for student teaching while group II students will prepare for their internship.

By the end of Year II, a videotape of MSTP leaders effectively teaching mathematics in MST classes will be available. Produced by public television station WCFE with consultant support from Dr. William Peruzzi, the video will be used for professional development, dissemination, and public awareness purposes.

During the Year III academic year, the higher education faculty will continue to make 15 visits to partner schools. MST teachers will try out materials in their own classrooms. Curriculum analysis and alignment will continue. CSST members will conduct faculty, department, and conference day meetings. CSTEP students and Project teachers will conduct math homework clubs in each school. CSSTs will meet with curriculum coordinators and administrators to refine alignment models. Additional parent/caregiver meetings and administrators' meetings will be conducted. Regular CSST reflection meetings will be held during the academic year. Two full-day feedback and reflection meetings (fall and spring) will be held for CSST members. Credit bearing and CEU online courses will be offered to all participating teachers. During the spring, the second Show-Me conference will be convened. Group I CSTEP students will complete student teaching and graduate with certification in mathematics or science. Group II students will enroll in methods courses and participate in internships at selected middle schools. Group III students will be recruited.

During the Year III summer, the second set of decentralized district-based summer workshops will be convened for school MST faculty. Exemplary materials will again be used to deepen understandings, and instructional plans based on data analysis will be developed. The Project will support two approaches to curriculum revision: 1) adapting local curricula to reflect standards-based content and good pedagogy and 2) helping schools adopt exemplary curricula at discounted pricing. Along with CSST leadership, teachers will decide which approach fits their district plan and continue curriculum revision and alignment.

Consultant experts will lead sessions on school improvement planning, caregiver engagement and support planning, and student assessment/action research. CSTEP directors and CSSTs will conduct a one-week workshop that teams experienced (group II) and new (group III) students. Group II students prepare for student teaching while group III students prepare for their internship.

During the Year IV academic year, higher education team members will continue their work in partner schools. CSSTs will meet with administrators and subject supervisors, work with students, conduct peer coaching, and work with teachers on aligned curriculum. Teachers will continue to use adapted curriculum materials. Teams and teachers will develop an articulated MST scope and sequence, and teachers will do action research to assess student understanding. Achievement data will be compared to baseline data. Academic year activities will mirror those of the prior years and include reflection meetings, visits from senior Project staff, meetings with administrators, and parent/caregiver meetings.

Group II CSTEP students will complete their student teaching and graduate with certification to teach math or science. Group III students will take methods courses and participate in internships in Project middle schools. Group IV students will be recruited.

During the Year IV summer, two one-week workshops will be convened. The first, for CSST members,

will focus on analyzing Project data and institutionalizing Project approaches school by school. The second will focus on designing workshops for parents and children. Two parents from each school will be invited and paid honoraria to join the CSST members. The director of the LI Family and Children's Association, and Dr. Howard Adelman (UCLA), will serve as consultants. The Project will focus on establishing partnerships with families, forming school-based support teams, and involving families in their children's schooling. Supports will be designed for the transitions that children and families go through. This workshop will be scheduled at times convenient to working parents.

As in summer III, a one-week CSTEP workshop will be conducted: group III students will prepare for student teaching while group IV students will prepare for their internship.

During the Year V academic year, teams will continue to conduct school-based meetings for teachers and parents. CSSTs and teachers in each target school will formalize the curriculum scope and sequence. At the conclusion of the Project, management of MSTP will transition to NYSED and local district leadership. The CSSTs will conduct statewide workshops with BOCES support. Group III students will complete student teaching and graduate with certification to teach math or science. Group IV students will take methods courses and participate in internships at selected middle schools. Group IV students will complete student teaching in the fall of the following year (2008) under supervision of Hofstra and SUNYSB faculty and graduate with certification to teach math or science at the secondary school level.

During the Year V summer, the Project will expand its reach statewide and focus on disseminating models and results. Teams of STEM higher education faculty, expert middle school teachers, and BOCES representatives from 10 regions will attend a one-week workshop at Hofstra. Regional capacity will be further developed through BOCES, and a statewide Show-Me conference will be held at BNL as a culminating event.

Workshop Content

MSTP seeks to enhance teachers' abilities to help students construct important conceptual understandings in mathematics; develop the conventionally acceptable skills, vocabulary, and notation associated with the concepts; and acquire the disposition to continue study. Learning will be based on constructivist learning theory [33] and founded on respect for teachers and children.

As workshop faculty, CSST members, co-PIs, and expert consultants will model good pedagogy, exemplify how mathematics embedded in science and technology programs provides opportunities for connections to mathematics curriculum, develop student and caregiver supports, and integrate CSTEP students into Project interventions.

Insights from Most Improved Schools

A study of the 147 middle schools that make up New York's most improved schools list (1999 – present) illustrates that they pay close attention to academic achievement, focus on math skills in every subject, and carefully monitor student work. In math, these schools share a set of emphases: student fluency with basic skills and numerical computation, and with fractions and decimals in grades 5 and 6; progression of learning; measurement skills; introductory geometry and trigonometry; proportionality; and algebra. [34] Workshop content will address these emphases.

To emphasize the development of skills necessary for success in more challenging courses, teachers and higher education faculty will horizontally align math content in middle-level courses, and vertically align content as it relates to high school Regents-level expectations. During the workshops, participants will meet in large groups, in "birds of a feather" groups (e.g., all math, all social workers), and in school-based groups.

Mathematics related to NYS standards and assessments will be revisited in various contexts and taught using pedagogical methods promoted by exemplary materials. These include two mathematics programs (CMP and MIC) of outstanding quality and demonstrated effectiveness [35], and two NSF-developed science and technology programs (STC/MS and IMaST). In discussions with the developer of IMaST (Loepp), it was determined that mathematics content in chosen CMP and MIC modules would connect well to selected IMaST science and technology modules. [36] Likewise, the developer of CMP (Philips) has suggested modules where content links with selected IMaST and STC/MS modules. For example, the CMP Filling and Wrapping module focuses on volume and surface area relationships. In the IMaST Human Settlements module, students apply these concepts by combining geometric elements of structures when designing and building a geodesic dome. [37] Appendix V illustrates how chosen curriculum modules interrelate and provide opportunities to revisit math concepts and skills in multiple contexts.

The workshops will enhance teachers' abilities to inform instruction on the basis of analysis of student achievement and teacher perceptual data. Consultant experts from the partner BOCES and LIRSSC will help

participants develop root cause analyses and associated instructional plans.

Participants will develop student and caregiver support strategies based on models developed by the LI Family and Children's Association and by Dr. Adelman. Topics will include establishing relationships with parents, involving CSTEP students in support programs, gearing programs to the needs of families, increasing understanding of child development and parent-child relationships, use of the Internet and other information technology (IT) tools, and facilitating access to community social service resources. School-linked models for early intervention, crisis intervention and prevention, and promotion of positive social and emotional development will be discussed. Please see Appendix IX for comprehensive daily workshop schedules.

Use of Information Technology

MSTP will feature a strong IT component. A website, hosted by Hofstra, will include the Project IRG, announcements of workshop offerings, school district data, links to curriculum materials, and FAQs. A series of IT and web-based workshops will be developed by SUNYSB faculty and will include sessions on use of graphing calculators (SUNYSB CSST member Magram is a Texas Instruments–certified trainer), and distance learning courses using Blackboard as an online teaching-learning application. A survey suggesting course titles such as Creating Interactive Learning Environments with MicroWorldsPro© will be conducted to determine interest levels. An online component will be developed for the minority teacher recruitment program to match CSTEP students with teacher mentors and middle school mentees.

Additional Project Linkages and Resources

MSTP will benefit from over $750,000 in cost sharing. Publishers of nationally validated curriculum materials will donate materials and personnel (see support letters, Appendix VIII). Sets of materials will be given to participating teachers for use during summer enhancement workshops and with their own classes during the academic years. The Show-Me Center will help to plan three math showcases during Years II, III, and V and will provide presenters from the satellite centers. The developers of CMP, MIC, and IMaST will serve on the Advisory Council, ensure that materials are used in pedagogically sound ways, and explain the philosophical basis of their programs. Teachers' associations will assist in recruitment, and cosponsor regional and statewide conferences and showcases (see Appendix VIII).

A great strength of the proposal is a memorandum of agreement developed collaboratively and signed by superintendents of all participating school districts. The MOA illustrates the depth of local commitment to work cooperatively with the Project, and to provide each of the teachers with honoraria, in-service salary credit, and administrative support (see Appendix II).

EVALUATION AND DISSEMINATION

Formative and summative evaluation will be conducted by Dr. Bert Flugman (Director) and Dr. Deborah Hecht (Associate Director) of the CUNY Center for Advanced Study in Education (CASE). CASE was integrally involved in the proposal's development to link Project activities and expected outcomes. The evaluation will use assessment tools designed for the NSF Collaboratives for Excellence in Teacher Preparation (CETP) program. Student achievement data will be collected from state assessments; other assessment tools will be developed. Qualitative and quantitative data will be compared to baseline data and with comparison groups. The evaluation team will attend Project meetings and workshops.

Formative evaluation will assess and optimize key activities. To assess the adequacy of support for curriculum alignment and planning, individuals will be surveyed and materials will be reviewed. Curriculum developers, Project partners, and Regional Alliance personnel will review curriculum alignment models.

Feedback from weekend retreats and summer workshops will be obtained through observations and daily participant surveys. Success in meeting Project objectives will be determined by reviewing data, workshop materials, and agendas. E-mail will be used to collect additional data and track implementation. Curriculum plans will be evaluated and changes at district and school levels will be analyzed. Focus group comments, interviews, and participant surveys will be used to document instructional changes and identify challenges.

To examine the strength, utility, and sustainability of partnerships and collaborations, partners will be surveyed and interviewed about their roles, perceived value, and outcomes. Satisfaction with and challenges related to these partnerships will be assessed and used to make improvements. The degree to which support for students and parents is coordinated will be examined and its impact documented.

To examine the implementation of aligned curriculum, and to identify challenges and successes, teachers will be surveyed online four times each year. Adequacy of face-to-face and web-based technical assistance

will be tracked. Higher education team members and school faculty will complete a checklist during school visits to assess the support provided and determine if a shared understanding of goals has been achieved.

Partner and team collaboration will be examined through interviews, observations, and focus groups to assess the functioning of all teams and the impact of school and district activities. Support provided by CSSTs to teachers will be documented. Collaboration among faculty, teachers, parents, curriculum developers, consultants, and management staff will be assessed through interviews, observations, and surveys.

Efforts to recruit minority teachers will be examined through observations, reviews of materials, and interviews and surveys of participants in the mentoring program (faculty, mentors, and teachers) regarding Project activities, workshop topics, and school experiences.

Documentation of ongoing and culminating dissemination activities will assess how well information is distributed, when, and to whom. The website will be reviewed in terms of usage and instructional design.

Summative evaluation activities are linked to each of the Project goals. To assess student achievement, baseline and yearly data for each school will be analyzed using NYS eighth-grade mathematics assessments and additional grade-level assessments. Science and technology assessments will focus on curriculum units mathematically enhanced in the Project. The extent to which each school moves toward the state standard in mathematics will be compared to similar nonparticipating schools in the region.

To assess the quality and use of curricular and pedagogical enhancement, surveys and interviews of teachers, curriculum coordinators, and principals will be conducted. Teacher observations will occur during Years III, IV, and V and results will be compared with national sample data and data from the evaluation of the New York State Systemic Initiative. To determine changes in content and pedagogical knowledge, self reports and pre-post assessments will be developed, drawing items from validated instruments. These will be used in a manner consistent with good practice in professional development.

The degree to which mathematics curriculum is aligned with standards and assessments, correlated to science and technology curriculum, and addressed by science and technology teachers will be examined over the course of the Project. The focus will be on overall curriculum change and on inclusion of mathematical key ideas identified as areas of student weakness. Data will include experts' reviews of curricula and lesson plans, as well as interviews and surveys of teachers, mathematics coordinators, and principals.

The number and diversity of CSTEP students, applicants to teacher education programs, effectiveness of mentoring (of CSTEP students and middle school students), and student teaching placements will be determined by surveys and interviews of CSTEP students and focus groups. Individual reflections on interest in teaching will also be collected. To assess the impact of parent and student supports, surveys, interviews, and focus groups will be conducted with parents, teachers, social workers, team members, and students. The intensity of support will be examined and compared with student and teacher data.

During Year V, the infrastructure that sustains Project activities will be assessed; school and team data, meeting minutes, participant activity reports, and surveys and interviews of team members will be examined to determine how changes have been institutionalized. Surveys regarding the clarity and functionality of the Project model will be collected from conference participants. The number of website hits and requests for materials will be reviewed, along with indications of interest in replicating the model statewide and nationally. The collaborations among Project partners will be tracked throughout.

Dissemination of approaches and results will occur throughout the Project, beginning in Year I. The Project website will facilitate information exchange. Meetings will be convened yearly with administrators, statewide Regional School Support Center directors, and BOCES representatives. Presentations will be made at statewide and national mathematics, science, and technology education conferences, and conferences held by the National Middle School Association and the Association of Supervision and Curriculum Development.

During Years II, III, and V, statewide Show-Me Center mathematics showcases featuring presentations by leading mathematics educators, Project participants, and materials developers will be convened. During the Year V summer, a one-week dissemination workshop will be held for teams of STEM higher education faculty, expert middle school teachers, and BOCES representatives from 10 regions across NYS. A culminating statewide conference will be held at BNL to share curriculum alignment models and Project results. The IRG will be commercially published and distributed by Encyclopædia Britannica. Project results and descriptions will be submitted for publication in professional journals. The videotape of MSTP teachers sharing effective teaching techniques will be broadcast statewide over PBS stations to publicize the teachers' efforts and create community support (see support letters in Appendix VIII).

PROJECT MANAGEMENT

This Project brings together highly regarded leaders with exceptional credentials, proven teacher enhancement and NSF project management success, and a history of collaboration. As colleagues, they have collaborated on many projects during the last decade and have together and separately conducted numerous large-scale NSF professional development programs for thousands of teachers. The Project management team is a diverse group with collective expertise in mathematics, science, technology, engineering, middle-level education, minority outreach, and pedagogy. They will meet monthly. Many will serve as expert faculty CSST members during the summer workshops and will provide ongoing support to MSTP schools.

Dr. David Burghardt is Professor of Engineering, Chair of Computer Science, and co-director of the Center for Technological Literacy at Hofstra University. He has directed three large-scale NSF projects. As PI and Project Director, he will ensure that goals and timelines are met, administer the budget, assist in the evaluation, and serve as a CSST faculty member.

Dr. James Butterworth is NYSED Assistant Commissioner for Regional School and Community Services. As co-PI, he will leverage NYSED resources and ensure that Project activities align with NYSED priorities. He will oversee comprehensive district education planning and academic intervention services.

Dr. Joan Daly-Lewis is Assistant Superintendent of Schools in the William Floyd CSD. She has expertise in curriculum, instruction, and staff development, and will serve as an instructional design consultant during workshops. She will represent partner districts on the management team.

Dr. David Ferguson directs The Center for Excellence in Learning and Teaching and is a Distinguished Service Professor of Applied Mathematics at SUNYSB. He has been PI on numerous NSF projects aimed at improving STEM programs and is a national leader in programs to enhance the participation of minority students in STEM. He will provide CSST mathematics content expertise and co-direct the CSTEP component.

Mr. Michael Hacker, with 39 years of experience, was a middle school teacher and administrator for 20 years, and from 1984-1997 was state supervisor for technology education at NYSED, where he co-managed the development of the NYS MST standards. He now co-directs the Hofstra Technological Literacy Center. He was Executive Director of the $4.2 M NSF MSTe Project and co-PI/PD of three other large NSF projects. As Project Coordinator, he will be responsible for day-to-day operations and serve as a CSST member.

Dr. Margaret Hunter, Assistant Professor of Environmental Science at Hofstra, will work with participants as a CSST member to integrate and apply mathematics in the context of inquiry-based science.

Dr. Thomas Liao is a Distinguished Teaching Professor and former director of the Professional Education Program at SUNYSB. For over 30 years, he has directed NSF projects focused on MST literacy. He will provide CSST science content expertise and co-direct the minority teacher recruitment component.

Elyse Magram coordinates the Secondary Math Education Program at SUNYSB after having served as an HS/JHS teacher and department chair for 30 years. She received the Tandy Technology Award in 1996 and the SUNYSB Presidential Award for Teacher of Excellence in 2002. She is a Texas Instruments T-FAS trainer. She will provide CSST mathematics pedagogy and content support.

Dr. Brian Murfin, director of the Science Education Center at BNL, will coordinate the linkages between Project participants and BNL scientists and arrange for use of BNL facilities.

Dr. Candee A. Swenson is Superintendent of Schools at the Longwood CSD, one of the partner LEAs. Dr. Swenson has longstanding relationships with BNL and with Project management staff. As co-PI, she will represent the partner districts on the management team.

Dr. Sharon Whitton, Professor of Mathematics Education at Hofstra and co-PI, brings over two decades of university and public school teaching experience to the Project.At Hofstra, she is responsible for instruction in mathematics content and methods, and for educational computing courses in the School of Education. She will provide CSST mathematics pedagogy and content support during workshops and in schools.

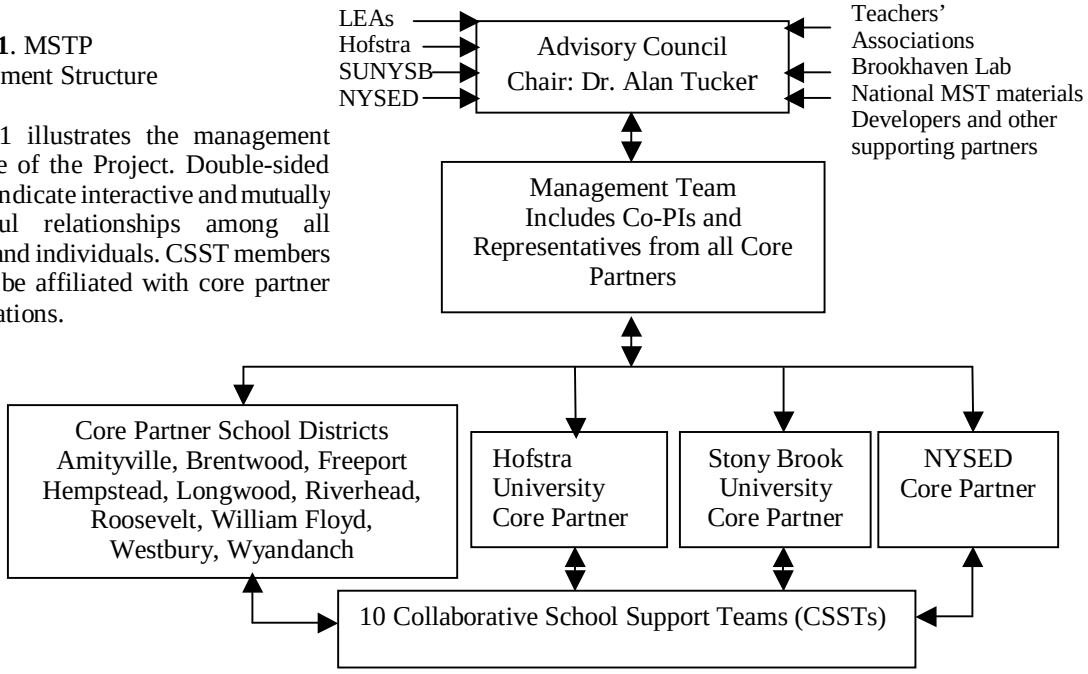
Project Advisory Council

The MSTP Project will establish a multiethnic Advisory Council to provide continuing conceptual direction to the Project management team. Chaired by Dr. Alan Tucker, a respected mathematician active in mathematics reform, the Council will represent all partners and include classroom teachers and administrators; university and BOCES representatives; NYSED personnel; developers of exemplary materials; and MST professional association leaders. The Advisory Council will meet twice during each Project year to review progress; make plans for dissemination and evaluation; and evaluate the IRG framework and workshop content and timetables.

The following persons have formally agreed to participate as MSTP Advisory Council members:
Mrs. Rose Ambrosino, Middle School Mathematics Teacher, and NYS Coordinating Mathematics Mentor
Mr. Steven Berger, Principal, Olive MS, Wyandanch UFSD
Ms. Dianne G. Brown, Principal, Hempstead Middle School, Hempstead UFSD
Mrs. Theresa Grey, Associate in Mathematics Education, New York State Education Department
Ms. Gwendolyn Collins, Mathematics Teacher, Westbury Middle School, Westbury UFSD
Ms. Ann Crotty, Associate in Science Education, New York State Education Department
Ms. Cynthia A. Drakeford, Assistant Principal, Westbury Middle School
Dr. Eric Eversley, Superintendent of Schools, Freeport CSD
Ms. Cary Grim, Chair, Mathematics Department, Longwood CSD
Dr. Cornelius de Groot, Director, K-8 Mathematics Mentors; member, AMTNYS Executive Board
Mr. Thomas Frawley, Technology Teacher and President, New York State Technology Education Association
Mr. Carlos Garcia, Associate in Professional Career Opportunity, New York State Education Department
Mrs. Kathy Gilmore, Coordinator of Curriculum and Staff Development, Eastern Suffolk BOCES
Dr. Franzie Loepp, Project Director, IMaST Program, Illinois State University
Dr. Margaret Meyer, Project Director, Mathematics in Context, University of Wisconsin
Dr. David Payton, Supervisor for Middle Level Education, New York State Education Department
Dr. Elizabeth Phillips, Project Director, Connected Math Project, Michigan State University
Dr. Barbara Reyes, Director, NSF Show-Me Center for Learning and Teaching
Mrs. Gene Silverman, Coordinator of Curriculum and Staff Development, Nassau BOCES
Mr. Eric Suhr, Associate in Technology Education, New York State Education Department
Dr. Alan Tucker, Distinguished Teaching Professor of Applied Mathematics, SUNYSB
Dr. Bruce Tulloch, President, Science Teachers Association of New York State
Mr. Edward Zero, Director, Long Island Regional School Support Center

Figure 1. MSTP Management Structure

Figure 1 illustrates the management structure of the Project. Double-sided arrows indicate interactive and mutually respectful relationships among all groups and individuals. CSST members will all be affiliated with core partner organizations.



INSTITUTIONAL CHANGE AND SUSTAINABILITY

The design of the Project, which includes involvement of building-based support teams, all MST school faculty members, the building principal, and district superintendents, sets the stage for sustained progress at school and district levels. Partner districts have committed to institutional changes that establish a culture of reform in the schools involving establishment of school-based teams, peer coaching, curriculum alignment and revision, redirection of resources to support MST teachers, and time for planning and reflection.

IHE institutional changes will include strengthening involvement of STEM faculty in middle school teacher preparation and development of university courses to support Project goals. NYSED has been integral to the Project's conceptual design and promises to disseminate and scale up Project strategies statewide. Partners have committed to the following institutional changes as shown in Table 1, below, and in support letters (see Appendix VIII).

TABLE 1. Institutional Changes
Districts and Schools
Establish and support district-based Collaborative School Support Teams
Identify district and school staff needs related to professional development in mathematics
Provide professional development opportunities for all MST faculty in math content and pedagogy
Schedule time for CSST members to reflect, plan, and communicate with faculty
Revise mathematics curriculum and align it to standards and to science and technology curricula
Match programs and instruction to diverse needs of females, ELL students, and students in poverty
Increase parent/guardian involvement and support
Increase student curricular and extracurricular support including use of CSTEP students as mentors
Institute achievement gap and root cause data analysis procedures to identify needs and improve student achievement
Develop programs to mentor CSTEP students and for CSTEP students to mentor middle school students
Establish dialogue among grades 5– 9 teachers to create a seamless transition
Develop school improvement plans
Hofstra University
Design a graduate-level math course specifically for middle-level math teachers
Use MSTP schools to satisfy requirement that preservice teachers complete 100 hours in schools before student teaching
Offer seminars conducted by the Center for Teaching Excellence and Scholarly Research on pedagogical change in science, mathematics, and engineering courses
Increase undergraduate student diversity as part of the five-year plan of the Natural Sciences Division (Engineering, Computer Science, Mathematics, and Sciences)
Increase the diversity of the preservice program through recruitment of CSTEP students
Use pedagogical strategies developed by STEM faculty associated with the Project in university classrooms
Revise mathematics methods courses to include focus on high-needs students
Use Blackboard for enhanced communication among students and teachers
Require professional electronic portfolios for all M.S. in Education and B.A. students to indicate how technological expertise and New York State teacher standards have been achieved
State University of New York at Stony Brook
Revise methods courses to include more emphasis on inclusion, teaching slow learners, and high-needs students
Design an applied math graduate course for MST teachers offered through the School for Professional Development
Design applied math linking seminars presented by participating engineering and mathematics faculty members for first-year students in thematic residential colleges
Design applied math and science summer bridging programs for incoming CSTEP students
Use MSTP schools to satisfy requirement that preservice teachers complete 100 hours in schools before student teaching
Engage mathematics faculty members in middle-level education through Project participation
Increase the diversity of the preservice program through recruitment of CSTEP students
Develop plans for a Discovery Math Lab, which will incorporate hands-on learning
Use Blackboard for enhanced communication among students and teachers
Incorporate studies of teaching styles in other countries involved in the TIMMS study in seminar classes
Embed root cause analysis approach in eighth-grade assessment and inclusion studies
New York State Education Department
Create a statewide network of middle-level schools demonstrating high achievement in math
Disseminate successful middle-level curriculum and instructional practices using web-based technology and other tools
Identify strategies for effective extra help for students who fail grade 8 assessments so they can succeed in high school
Help schools create positive youth development programs and partnerships with community service providers
Develop strategies to strengthen parent involvement in the middle grades
Develop strategies to recruit certified and qualified teachers to serve in middle-level schools
Develop strategies to recruit quality leaders to serve in middle-level schools
Develop materials to help teachers develop formal mathematics classroom assessments, target activities to key ideas, and select a contemporary mathematics curriculum