



REPORT OF THE UNIVERSITY WORKING GROUP ON MATH AND SCIENCE TEACHER PREPARATION AT CUNY

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University Working Group (WG) on Math and Science Teacher Preparation

Executive Summary

The summary presented below represents the WG's efforts to meet the goal set before it in September 2008: to develop recommendations for the University Chancellor regarding options for preparing the high quality math and science teachers needed in New York City public schools, including appropriate modifications to the Teacher Academy. To accomplish this goal, the WG was charged with comparing and contrasting different teacher preparation options, taking stock of lessons learned from the Teacher Academy, and assessing the impact of the current Teacher Academy partnership with the New York City Department of Education and New York University. The findings and recommendations are as follows:

1. A detailed and historical picture of math and science teacher education across CUNY is not routinely available as a basis for evaluating successes and challenges. The WG recommends that CUNY's Office of Institutional Research and Assessment establish an annual reporting cycle so that progress in the University's efforts to attract, retain, and graduate high quality math and science teachers can be monitored and assessed.
2. Having compared different teacher preparation options (see page 2 onwards of the report) and reviewed lessons learned from the Teacher Academy (page 13 onwards), the WG recommends adopting a set of rigorous design principles and key outcome goals to help produce well-prepared math and science teachers. Such design principles and outcome goals allow campuses to develop math and science

teacher preparation programs in the context of their campus's specific mission, culture, and strengths, and help foster the institutionalization of best practices.

3. Recommended program design principles are elaborated on page 17 of the report. In summary, the WG reached consensus on six design principles that focus on the need for financial incentives to attract high quality, diverse students: the need for programs to demonstrate financial sustainability; the need for multiple program entry points such as via Community Colleges; the need to identify for students a career progression through to the master's degree and professional certification; the need for intensive and early clinical experiences within programs; and the need for collaborations among arts and science, education, and public school faculty.
4. The WG reached consensus on seven recommended program outcome goals that are described beginning on page 17 of the report. The outcome goals address the need to establish and accomplish program recruitment and retention targets; the need for evidence of candidate progress in teaching skills; the need for sustaining target performance on the New York State Department of Education (NYSED) licensure exams; the need for graduates' employment in high need schools, especially middle schools; the need to track retention in the profession; and the need for evidence of CUNY graduates' positive impact on student learning.
5. The WG recommends that these design principles and outcome goals not only serve as standards for programs to strive toward, but also serve as criteria for awarding funding that may be obtained through the central office. The WG recommends that, given evidence of the high costs associated with offering quality programs and recruiting and retaining candidates in these shortage fields, the

CUNY central office continue to seek funds to help seed future campus program developments.

6. The WG recognized that partnerships are critical to the success of preparing teachers, and are the context within which these principles and outcomes must be embedded (see page 18). The impact of the Partnership for Teacher Excellence, which includes the Teacher Academy, is being examined as part of an external evaluation at this time.
7. The WG identified three program exemplars that warrant further support and development: Five year BA/MA programs; Urban Teacher Residencies; and a modified Teacher Academy. These are described in detail beginning on page 21 of the report.
8. The WG made additional recommendations regarding the need for cluster faculty lines and clinical faculty lines.
9. The WG recommended improving the coherence of messages about math and science teacher preparation across campus Web sites and publications. The WG acknowledged the important role of the University in promoting a message about the value of teaching as a career choice.

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Introduction

In August 2008, Interim Executive Vice Chancellor and University Provost Alexandra Logue called for the convening of a University Working Group (WG). The goal of the WG was to develop recommendations for the University Chancellor regarding options for preparing high quality math and science teachers, including appropriate modifications to the Teacher Academy. Appendix 1 contains the charge to the WG, along with a list of members.

The Teacher Academy was launched in 2006 as one of a number of City University of New York (CUNY) programs addressing the urgent need of New York City (NYC) public schools for high quality math and science teachers, especially in under-served public schools. These programs include CUNY's Teaching Opportunity Program and the New York City Teaching Fellows program. The Teacher Academy has enjoyed the generous support of the Carroll and Milton Petrie Foundation. This support has enabled CUNY to establish scholarships and stipends for students, as well as conduct a wide array of planning and curriculum development activities, including partnering with the New York City Department of Education (DOE) in the selection of Host Schools. A list of participating CUNY campuses is included in Appendix 2.

CUNY committed itself to covering the costs associated with the waiving of tuition and fees for the Teacher Academy students, as well as covering some additional administrative costs. However, in August 2008 CUNY faced significant City and State budget reductions and the likelihood of further fiscal restraints. It became evident that the projected costs of the current Teacher Academy model in its more fully implemented form were prohibitive. A pause in Teacher Academy admissions is currently in place;

CUNY is maintaining its full financial commitments to the Teacher Academy's current students. The University convened the Working Group to learn from the Teacher Academy's successes and to identify teacher preparation options for educating and training, in a cost-efficient manner, as many mathematics and science teachers as the Teacher Academy's current configuration anticipates. Presently, two hundred and ninety-nine students are enrolled in the Teacher Academy.

The convening of the WG reflects CUNY's sustained dedication to preparing high-quality math and science teachers for under-served public schools in New York City. As an example of that commitment, we note that the University Chancellor is a member of the Commission for the Science and Math Teacher Imperative, a national initiative designed to draw attention to, and address, the chronic teacher shortages in these critical fields. The Science and Math Teacher Imperative has been launched by the National Association of State Universities and Land Grant Colleges (NASULGC, 2008).

Background Research and Findings

The WG reached its recommendations through extensive deliberations on a number of relevant topics. Although the WG had to limit the scope of its inquiries given time constraints, individual WG members investigated particular aspects of math and science teacher preparation including the Teacher Academy, sought evidence of best practices, and then shared their findings with the WG. A number of experts were consulted informally. Appendix 3 provides a list of topic presentations and presenters.

In brief, the WG:

- Compared research on the impact of four year versus five year teacher education programs on teacher employment, retention, and effect on student learning.
- Compared features of CUNY and non-CUNY math and science teacher preparation programs, such as UTeach (Austin, Texas), as well as online programs.
- Examined data regarding the enrollment of math and science teacher education students at CUNY.
- Examined employment and shortage field trends using New York State teacher supply and demand data and local information regarding the teacher demand situation in NYC.
- Examined key features and promising practices of urban teacher residency programs, such as the Boston Teacher Residency program and the Denver Urban Teacher Residency.
- Examined the role of Community Colleges as a pipeline for math and science teacher candidates.
- Considered costs of different program options.

It should be noted that the WG began its deliberations fully mindful of the weak research base and lack of clear evidence about the “state of the art” (NASULGC, 2008) regarding the most effective and efficient preparation models for math and science educators.

The Impact of Four-Year Versus Five-Year Teacher Education Programs

Given that New York State Education Department (NYSED) teacher certification regulations require a master's degree for professional certification, the WG was interested in the impact of four year undergraduate teacher education programs versus five year teacher education programs that offer both a bachelor's and master's degree. The analysis of several research studies reported in Zeichner and Conklin (2005) revealed that graduates of five year versus four year programs enter teaching at higher rates, have higher retention rates in teaching, and perceive themselves better prepared to teach. However, only some of the teachers described in these studies were in shortage fields such as math and science. The WG noted that five year teacher education programs leading to a master's degree and teacher certification offer a coherent progression of education course work and clinical experiences. Undergraduate teacher education students who complete a master's degree in education at a later point in time and at a different institution may end up experiencing a lack of alignment and progression between their undergraduate and their graduate education course work.

A Comparison of Math and Science Teacher Preparation Programs

One WG member analyzed 11 math and science teacher education programs. Four programs were from within CUNY, and the other programs represented a mix of public and private institutions. Of particular interest was the extent to which programs involved partnerships with schools and other organizations, adopted special student recruitment strategies, included extensive clinical experiences, involved collaboration with arts and

science faculty, and incorporated online or hybrid courses. Program costs also were a consideration and are addressed later in this report.

All the programs studied had substantial clinical experiences, and almost all the programs were involved with one or more partner organizations. In terms of notable recruitment strategies, the UTeach program offers a free introductory education course (combined with field work) as a way to interest students in education as a career. In addition, the UTeach program has multiple entry points for interested and qualified candidates. Only five of the programs studied cited evidence of retaining their graduates in the profession for two to three years beyond program completion.

In a separate analysis, another WG member addressed the role of online courses in teacher preparation. Lesley University and Rossier School of Education at the University of Southern California are two examples of institutions that offer full or partial online teacher preparation programs. Hunter College School of Education offers online courses in literacy and other subject fields; Brooklyn College School of Education offers online science courses through a partnership with the American Museum of Natural History; Hostos Community College has designed a fully online Associate of Applied Science program in Early Childhood Education.

Online courses do pose challenges, including the need for more frequent evaluations compared to traditional face-to-face courses and the need for more fine-grained assignments (Picciano, 1998). The challenge of using online courses as a basis for learning classroom management and subject-specific pedagogy skills can be addressed by linking video of classroom teaching with the online environment. Costs are

within the same range as traditional course delivery. This is an area where math and science teacher preparation course work could expand.

CUNY Student Enrollment in Math and Science Teacher Education

Draft analyses provided by the University's Office of Institutional Research and Accountability (OIRA) offered the WG an overview of the number of enrolled students in science and math teacher education programs at CUNY. In fall 2008, 678 science, technology, engineering and mathematics (STEM) majors were pursuing teacher certification at the bachelor's level. This compares with 4,167 non-STEM majors pursuing teacher certification at the bachelor's level. At the master's level, 1,169 STEM majors were pursuing teacher certification in the fall of 2008. This compares with 7,365 non-STEM majors pursuing teacher certification.

Of those students in STEM majors pursuing teacher certification at the bachelor's level in fall 2008, 57 percent were in mathematics (n=386). Of the science fields, biology was the one with the highest number of students enrolled (n=74) at approximately 47 percent of the total science education students. The remaining students were distributed across chemistry, earth science, physics and general science. At the master's level, the picture was similar, with over half the students (62 percent, n=728) enrolled in mathematics. Approximately half of the science education students were enrolled in general science (n=237). Biology had 170 students enrolled, with much smaller numbers of students in chemistry (n=23) and physics (n=11).

Using the Scholastic Aptitude Test (SAT) as an indicator of academic preparation, we found that undergraduate STEM majors who were pursuing teacher certification

performed higher overall than did STEM majors not pursuing teacher certification. However, missing data mean that this finding should be interpreted with caution.

A separate analysis conducted by Teacher Academy staff using OIRA data reveals that in the three years since its implementation, the Teacher Academy has added 33 percent more STEM majors (n=321) at the undergraduate level preparing to be math and science teachers than in the period 2001 to 2007 (n= 192). Thus, the Teacher Academy has made a significant contribution to increasing the number of undergraduate teacher candidates for these shortage fields.

With the exception of the analysis completed for the Teacher Academy, these data provide only a snapshot at a single time point of enrolled math and science teacher candidates across CUNY. A detailed and historical picture of math and science teacher education across CUNY is not routinely available. The WG regards more comprehensive data as essential for understanding and tracking CUNY's contribution to preparing teachers for these shortage fields in NYC public schools. Evaluating the extent to which the University is producing as many math and science teachers as the current configuration of the Teacher Academy can only be accomplished through regular reporting on a consistent set of variables. Such a reporting cycle will also assist the University in meeting its obligations to the Science and Math Teacher Imperative (NASULGC, 2008).

The WG recommends that an annual reporting cycle be established by the Office of Institutional Research and Assessment for these shortage fields so that progress in the University's efforts to attract, retain, and graduate high quality math and science teachers can be monitored and evaluated.

Teacher Supply and Demand in New York City

From the NYSED report on teacher supply and demand (2008), the WG learned that there continues to be a regional and local (New York City) shortage of teachers in math and science, with an over-supply of elementary education teachers. However, NYSED data are one year old by the time they are published. Evidence from CUNY teacher preparation programs indicates that math teachers in our NYC Teaching Fellows program (n=11) and in CUNY's Teaching Opportunity Program (n=6) still lacked teaching positions as of the start of the 2008-2009 school year. Some math teacher candidates in these programs were still not placed as of this report's writing. The enrollments for the NYC Teaching Fellows program appear to be on a downward trend (DOE, 2008). We learned that in both math and science hiring, middle schools typically experience a harder time recruiting appropriately qualified content area teachers compared to high schools. All these dilemmas raise a question about future demand for math and other shortage field teachers in NYC and the problems associated with predicting and subsequently planning for an adequate supply of highly qualified teachers for our highest need NYC schools.

The Urban Teacher Residency Model

One WG member presented information and analysis regarding recent developments in teacher residency models. Currently, models have been implemented in the Boston, Denver, and Chicago public school systems, but not yet in New York (Berry et al. n.d.). These programs describe themselves as having a rigorous selection process and offering intensive, one-year classroom residencies for teacher candidates alongside a

master teacher. The residency is accompanied by university course work leading to a Master's degree. The master teacher is carefully selected and undergoes training. This model draws on the medical residency requirement, immersing the prospective teacher in the clinical setting that will most closely match his/her eventual employment. The residency model draws on the evidence that early and intensive field experiences appear to positively impact teacher candidates' learning and understanding about the principles of how to teach within a content area (Hammerness & Darling-Hammond, 2005).

The three residency programs identified above are all targeted at preparing high quality teachers for the school systems in which they are located. The Chicago model involves partnerships among two universities, the Chicago public school system, and a private foundation. Together, these stakeholders founded an educational reform organization, the Academy for Urban School Leadership (AUSL). AUSL then worked with the partners and coordinated curriculum development for the residents' preparation. AUSL also leads major "school turnaround" efforts for interested schools, and offers leadership training and progress monitoring through data analysis. Evidence that these models are having a positive impact may be measured through teacher retention rates. For example, AUSL reports a 91 percent retention rate for residents after five years. Costs of these residency programs vary depending on whether residents earn a beginning teacher salary or a stipend; the cost of tuition, too, differs by program. All three models require teaching service beyond the period of residency training.

Community Colleges as a Pipeline for Future Math and Science Teachers

The WG learned a great deal about the under-representation of women and persons of color in math and science teaching, a problem compounded by a national decline in students pursuing math and science majors as careers (Moin, J., Dorfield, J.K., & Schunn, C., 2004). Three WG members representing community colleges emphasized the significance of community colleges as particularly rich entry points into teacher education for a diverse group of students. A recent report produced by the Education Commission of the States (Coulter & Vandal, 2007) addresses the role of community colleges in teacher preparation and presents compelling data on the diversity of the these colleges' population (p.10). Further, because entering community college students tend to be older than typical college freshmen, often resuming their educational paths, they also tend to be highly focused and committed to their choice of a profession. At CUNY, three community colleges have engaged in Teacher Academy partnerships with senior colleges. As will be noted later, these partnerships have enabled the community colleges to develop secondary education courses, thus moving beyond their typical focus on early childhood education.

Cost-efficient Approaches to the Preparation of Math and Science Teachers.

One WG member led a review of cost implications of the Teacher Academy and other teacher education models. The WG recognized that financial incentives play an important role in motivating students to enroll and remain in teacher education, especially in shortage fields, such as math and science. Although the WG understood the potential of full tuition scholarships to attract high quality students into the Teacher Academy, the

group similarly recognized that in the current economic climate, the University is unlikely to be able to resume that level of tuition support. It is not clear where the financial tipping point will be for attracting the same quality of students.

Given the variation in staffing and implementation of the Teacher Academy across participating campuses, the true program cost varies from campus to campus, with the cost defined as the campus per-student expenditure plus the cost of funding campus-specific design features of the Teacher Academy. For example, some programs have hired a dedicated Teacher Academy director, while other campuses are utilizing existing staff and/or providing release time for a faculty member. Thus, campus programs vary in the extent to which they are financially and organizationally integrated into existing costs and staffing structures. Currently, the Teacher Academy has no grant-funded central office staff, but significant central office funds have been allocated for the administration of the Teacher Academy.

The CUNY Teaching Opportunity Program and the NYC Teaching Fellows programs rely on vouchers for educational expenses including tuition support offered to math and science teachers through the National Service Corporation (AmeriCorps) awards program. In addition, students enrolled in these programs become teachers of record after an eight-week summer program and thus earn a beginning teacher salary with benefits.

As noted earlier, residency models offer an intense clinical experience for the beginning teacher, who is typically paired with a master teacher for at least a year. Costs of these programs vary, as does the distribution of costs between partner organizations and individual resident teachers. Master teachers are recruited and trained for this role in

the context of a school-university partnership, and this is a cost factor. A stipend or training salary is awarded to the beginning teacher with tuition sometimes paid by the beginning teacher. The residency programs examined by the WG typically enrolled small groups of between 12 and 25 students. These residency programs typically involve a period of mentoring support beyond the boundary of the program, and this also adds to costs.

The WG concluded that high quality preparation of teachers, especially in shortage areas, involves many costs including recruitment, stipends, tuition, clinical supervision, professional development, and induction. These features all add up to sizeable financial commitments. Cost-sharing can be accomplished where partnerships between universities, school systems, foundations, public funding agencies, and other entities form the basis for the teacher preparation models.

The WG recommends that the central office continue to work to secure private and/or public funds that can be used for incentivizing students, seeding new campus-based initiatives, or modifying existing initiatives in these shortage fields. Distribution of funds to campuses should be via a “request for proposal” process. Evaluation of proposal quality would be based on principles and outcomes described later in this report.

Examples of funding sources include:

- Private foundations.
- Federal funds, such as the Teacher Quality Enhancement grants (request for proposals to be made available spring 2009).
- State funds, such as the Higher Education Services Corporation, as a source of financial aid to students.

- Teacher Education Assistance for College and Higher Education (TEACH) grants as a source of financial aid to students.
- Funding allocations included in the recent American Recovery and Reinvestment Act

The expectation is that funding would be augmented with campus-based resources and services to create attractive, sustainable, and cost-effective ways of supporting students and programming.

The WG also recognized the potential of non-financial benefits to act as incentives for students. Examples from the Teacher Academy include cohort membership and dedicated meeting space. The Working Group recommends that math and science teacher preparation programs incorporate non-monetary incentives such as targeted faculty mentoring and advising, “fast-track” registration processes, dedicated meeting space, and cohort membership.

Lessons Learned from the Teacher Academy

Launched in 2006, the Teacher Academy is a significant, collaborative effort to prepare high quality teachers in math and science and to leverage change within teacher education programs. Ten CUNY campuses now participate in the Teacher Academy (see Appendix 2 for a list of participating campuses). As a model, the Teacher Academy follows in the steps of other system-level initiatives at CUNY, such as the Teaching Opportunity Program and the New York City Teaching Fellows.

However, the Teacher Academy is distinctive in a number of important ways. It benefits from the context of a partnership with a private foundation, the DOE, and New

York University. The clinical experiences that Teacher Academy students encounter are supported by partnerships with high need, high performing, public schools, known as Host Schools. These Host School experiences immerse the Teacher Academy students early in their programs in teaching environments similar to the settings in which they will be employed.

CUNY teacher education programs have benefited from curriculum initiatives leveraged through the Teacher Academy. For example, some 18 curriculum projects have received funding to pursue a number of worthwhile endeavors, from redesigning mathematics and science courses to improving students' understanding of formative assessment. These efforts have resulted from a request for proposal process. Proposals have been reviewed through a collaborative process with staff from the Partnership for Teacher Excellence; proposal development involved collaborations among education faculty, arts and science faculty, and experienced DOE teachers. These projects will provide a lasting contribution to the overall quality of campus programs and offer models of purposeful collaborations within and beyond campuses.

As described below, evaluation of the Teacher Academy yields evidence of further positive lessons learned as described below from which we can learn, particularly given the sustained assessment of the Teacher Academy over time.

- In cohorts 1 and 2, the Teacher Academy has been successful in recruiting females (67 percent) and students from under-represented groups (49 percent).
- The Spring 2008 survey of Host School Collaborating Teachers (n=34) revealed that these teachers regarded the Teacher Academy as positively impacting their

school through fostering greater collaboration among Host School teachers and creating more awareness of teaching skills.

- The Host School model, which was designed to create more extensive clinical experiences in high need, high performing schools, appears to be accomplishing this goal. According to a survey completed by 132 Teacher Academy students in May 2008, 94 percent of Teacher Academy students spent anywhere from 1 – 6 hours per week at their Host School, with the majority, 52 percent, spending 4-6 hours weekly.
- In a spring 2008 survey of Host School Principals (n=12), most respondents agreed that becoming a Host School had positively impacted student learning and achievement in their schools.
- Based on a modified version of the Continuum of Teacher Development, a self-assessment tool completed by Teacher Academy students in May of 2008, there is modest evidence of performance distinctions between students in the first and second Teacher Academy cohorts. Teacher Academy students in cohort 1 (n=49) rated themselves at the *apprenticing* level as compared to students in cohort 2, who, as would be anticipated, rated themselves at beginning levels of *identifying* and *understanding* effective teaching practices.
- The involvement of three community colleges allowed those institutions to expand their teacher education pathways, adding secondary education to their traditional focus on early childhood programs, and has provided further entry points into the Teacher Academy.

In order to consider potential modifications to the Teacher Academy, the WG also addressed lessons learned regarding the challenges of the Teacher Academy as a teacher education program model. Questions were raised about the absence of built-in options for Teacher Academy students to complete a master's degree, which is the requirement for professional teacher certification in New York State. The exception here is Hunter College's plans to offer a fifth year program to qualified Teacher Academy students. The WG was concerned that embarking on a teaching career straight from high school is too early for many students to make a clear decision and commitment. This concern was based on persistence data about sophomore students entering in cohort 1 of the Teacher Academy. Only 60 percent of those students remained in the spring of 2008, although the persistence trend for cohort 2 shows improvement in comparison.

In summary, the Teacher Academy is an important initiative adding substantially to the number of undergraduate students in math and science pursuing teacher certification. As a multi-campus initiative, the Teacher Academy represents a system-level message about the importance the University attaches to the preparation of high quality math and science teachers. The Teacher Academy has led to curriculum developments of lasting significance and, in partnership with the DOE, has developed an intensive clinical experience closely matched to the future employment setting of Teacher Academy students.

Program Design Recommendations for Math and Science Teacher Preparation

Having compared different teacher preparation options and reviewed the lessons learned from the Teacher Academy, the WG believes that CUNY colleges may most effectively prepare teachers in the key shortage fields of mathematics and science by:

- adopting a set of rigorous program design principles based on the best evidence to date and use those principles as criteria for evaluating campus program proposals for funding support, and
- establishing a set of key outcome goals that all campus programs in these shortage fields are striving to accomplish, and utilize these outcome goals as benchmarks for assessing the impact and success of program initiatives.

By recommending design principles and outcome goals, math and science teacher preparation initiatives can be developed in the context of a campus's specific mission, culture, and strengths, in ways that are financially sustainable. Principles and outcomes avoid the "horse race" approach of competing programs and keep a focus on high standards and accountability.

Design Principles and Outcome Goals

The WG reached consensus on recommended design principles for math and science teacher preparation programs as follows:

- Math and science teacher education programs should include financial incentives to ensure that diverse and academically strong students are attracted and retained in these shortage fields.

- Where funding for math and science teacher education is drawn from private or public funds channeled through the central office, cost-effectiveness and sustainability must be demonstrated.
- Programs need to have more than one entry point for students, such as a community college pathway.
- Programs need to identify for students clear steps in a career progression from entry through to completion of a master's degree and professional certification. This may involve partnerships between colleges.
- Programs should incorporate intensive and early clinical experiences and demonstrate partnerships with high need and high performing schools for these clinical experiences.
- Programs should involve collaborations between math and science faculty, education faculty, and public school faculty.

The WG reached consensus as well on recommended outcome goals and indicators of success for math and science teacher preparation programs:

- Establish recruitment and program retention goals for math and science teacher education programs (diversity of candidates, academic quality profile, persistence, time to completion); monitor progress to achieving these goals.
- Provide evidence of candidate progress in the development of teaching skills (measured by appropriate instruments).
- Sustain campus target performance on NYSED licensure exams.
- Program graduates gain employment in high need schools.

- Program graduates gain employment in middle schools as content prepared teachers
- Track program graduates' retention in teaching as measured by number of years beyond service requirements.
- Provide evidence that program graduates impact student achievement as measured by test performance and other measures of gains in learning appropriate to specific subject fields.

The WG recommends that these design principles and outcome goals serve not only as standards for campus programs, but also as criteria for awarding funding that may be obtained through central office grant making. The WG has not established numeric targets for each of the above outcome goals, as that is beyond the immediate scope of its work.

Partnerships

Partnerships are integral and critical to the success of preparing teachers and are the context within which the principles and outcomes described above must be embedded. Such partnerships are investments in capacity building at many levels, and have been actively promoted as critical for effective teacher preparation since the mid-1960s (Patterson, Michelli, & Pacheco, 1994, p.14). CUNY campus teacher education programs actively pursue partnerships with other campuses within CUNY and foster partnerships between arts and science faculty and education faculty and between campuses and public schools. These collaborations represent a set of shared responsibilities for preparing high quality teachers. Partnerships with private and public

funding entities also are critical given the challenges of the high costs associated with attracting and preparing candidates for teaching in shortage fields. Finally, other partnerships that contribute to math and science teacher preparation are cultural organizations such as museums.

The Teacher Academy is noted for being in a partnership – the Partnership for Teacher Excellence (PTE) – with the NYC Department of Education and New York University. The WG considered some of the specific benefits arising from participation in this partnership. Examples include exchanging ideas about effective strategies for recruiting students, and participating in the Curriculum Expo held in May 2008. However, the partnership’s full impact in supporting the preparation of math and science teachers remains to be determined as part of an external evaluation funded through the Carroll and Milton Petrie Foundation.

Modifications to the Teacher Academy

Several campuses are already moving ahead with modifications to the Teacher Academy that will allow them to sustain their programs within their specific institutional missions, culture, and strengths. For example, the College of Staten Island (CSI) is actively recruiting students (n=10) into their Teacher Academy program for the fall 2009 semester. The motivation to continue with the program stems from CSI’s interest in enrolling the same high quality students that historically have been recruited into the program. In addition, CSI is committed to the partnerships with its Host Schools. CSI Teacher Academy students will be offered a series of no-cost benefits including priority registration, a cohort model using learning communities to sustain student retention, and

access to dedicated meeting space. CSI is assessing the extent of scholarship opportunities available to this new cohort of students to cover tuition costs, and is examining ways to support the continued engagement with Host School sites.

Both Hunter College and Lehman College have been successful in their applications for Noyce Scholarship funds. Drawing on their Teacher Academy experiences, each campus is applying these funds to attract undergraduate students into teacher education programs in math and science. The design of these campus efforts shares other characteristics with the Teacher Academy. The Hunter College Noyce Scholars (n=10 each year over four years) will be admitted in their junior year into a three year B.A/M.A program, leading to professional certification in one of the following areas: biology, chemistry, geography, physics, or mathematics. Students in this program will be fully integrated with the Teacher Academy program students. The Noyce Scholars (n=12 each year over three years) at Lehman College will receive scholarships for their senior year plus two years of graduate study, including paid internships in NYC public schools. Students graduating from this program will be employed in middle schools in either math or science. Like the Teacher Academy, both these campus programs seek to use these scholarships to recruit high achieving students, who demonstrate a strong commitment to public service and teaching in New York City.

Exemplars of Math and Science Teacher Preparation
Endorsed by the Working Group

Using the findings from its deliberations and the lessons learned from the Teacher Academy, the WG achieved consensus around six core design principles based on the best evidence to date, and reached agreement concerning seven outcome goals as described earlier. The WG considered three programmatic exemplars that would meet the criteria of the WG's recommended design principles and outcomes goals and are implemented to some degree within the CUNY system. The exemplars are: five-year BA/MA programs, urban teacher residencies, and modifications to the Teacher Academy.

Five Year Programs

The combined features of the Noyce Scholars programs at Hunter College and Lehman College offer an exemplar of a five year BA/MA program in math and science education with multiple attractive elements. These programs include: different entry points (junior year, senior year); financial incentives (scholarships, stipends); a clear career trajectory from an undergraduate arts and science degree through a master's degree and teacher certification; collaborations between arts and science faculty and education faculty; partnerships with public schools for internships; and guaranteed employment for well-prepared teachers in high need NYC middle schools.

Other interpretations of this exemplar could include:

- A four year math and science undergraduate program with a direct pipeline into an alternate route master's program such as CUNY's Teaching Opportunity Program.

- Entry points such as a 2+3 program for Community College students, adding to the diversity of the candidate pool (Coulter & Vandal, 2007).
- A pathway from an undergraduate degree-granting campus to a master's degree-granting campus.

The Hunter College and Lehman College programs have funding for a limited time period, so sustainability beyond the grant period will be a challenge. For these programs to meet all of the WG's recommended outcome goals, numeric targets would need to be established; the annual OIRA reporting cycle that the WG recommended would allow campuses to monitor progress toward most goals.

Urban Teacher Residencies

The WG recognizes the importance of residency programs as a teacher preparation model currently implemented in several urban areas through partnerships between universities and school systems and financed through varying combinations of public and private funding. As described earlier, these programs have been developed specifically to address the challenge for urban school systems of attracting and retaining high quality teachers in shortage fields. In contrast to the typical alternative route preparation programs, residencies offer an intense one-year clinical experience observing and co-teaching alongside a master teacher without having to assume full responsibility for a class from day one.

Within CUNY, Hunter College School of Education is in the advanced stages of designing an urban teacher residency in collaboration with New Visions for Public Schools. Science teacher- residents would be a target group for this program. Funding is

being secured through a mix of private and federal dollars for a two-year pilot. There are no other residency models implemented in NYC. The evidence regarding the importance of clinical experiences in relation to teacher effectiveness and retention left the WG eager to learn from the Hunter College School of Education model and to consider the potential to scale up to other campuses.

Residencies meet a number of the WG's recommended design principles. They use financial incentives to attract a diverse group of undergraduates into master's programs leading to certification in shortage fields. They offer a clear career progression, and they involve partnerships with schools as sites of focused clinical practice and mentoring. Offering different entry points, however, is a challenge. One way to create different entry points might be to establish a pre-residency program similar to the current pre-Teacher Academy model.

In terms of meeting outcome goals, both the Boston Teacher Residency and the Chicago Academy for Urban School Leadership cite retention rates of over 90 percent after three years (Berry et al. n.d.) High teacher retention rates provide justification for the high costs associated with this model.

A Modified Teacher Academy

As a third exemplar, the WG recognized the significance of the College of Staten Island's (CSI) efforts to sustain the Teacher Academy with a plan to enroll new students in the fall of 2009. This modified version of the Teacher Academy will:

- Continue partnerships with Host Schools.

- Offer no-cost benefits.
- Institute learning communities to promote student retention and persistence.
- Seek funding for partial tuition scholarships.

The CSI program could function like the UTeach Institute as a site for studying and disseminating continued developments in math and science teacher preparation at the undergraduate level. As described earlier, the Teacher Academy does meet some, but not all of the WG recommended design principles. It does not offer a career path through to the master's degree, and as a relatively new program it does not yet provide sufficient data in relation to some of the recommended outcome goals regarding employment and impact on students' learning.

In conclusion, the WG regards these three exemplars as important options that build on the momentum of the current Teacher Academy model and incorporate many, though not all, of the recommended design principles. The WG recommends that these program developments be monitored and evaluated, especially in relation to the key outcome goals recommended by the WG.

Additional Recommendations and Report Limitations

In considering the above design principles and outcome goals, the WG recognized that high quality teacher preparation in the fields of math and science requires successful collaborations between faculty in the arts and sciences and faculty in education. But there are barriers to the effectiveness of such collaborations. For example, sufficient incentives do not currently exist for math and science faculty to devote the time needed to

professional program development. The WG recommends that new faculty cluster lines be devoted to appointments that are specifically dedicated to collaborations in support of math and science teacher preparation across CUNY Arts and Science Schools and Education Schools.

In addition, the WG is mindful of the importance of quality clinical experiences in the preparation of teachers, as demonstrated in the design of the Teacher Academy. At the same time, the WG recognizes that clinical supervision of teacher candidates makes intense demands on education faculty. The WG therefore recommends that campuses consider dedicating one of the new full-time clinical faculty lines to a shortage field with a view to supporting stronger mentoring and supervision of candidates in their school placements.

The WG did not have sufficient time or resources to engage in an extensive analysis of all CUNY math and science teacher preparation programs. However, a review of campus Web sites and the central office Web site undertaken for the WG revealed that math and science departments do not typically promote teaching as a career option. Although education department Web sites promote teaching careers in math and science, it is not always clear that these are shortage fields linked to special programs and career options. The WG therefore recommends that CUNY College and the central office review their online communications about math and science teaching as a career option. Simultaneously, they should promote greater coherence in the messaging about the opportunities in New York City public schools in these shortage fields.

The WG identified some other important teacher preparation program issues beyond the scope of its charge. For example, the WG focused for the most part on

preparing high school-level teachers of mathematics and science. However, the WG learned that the lower middle school grades and the upper elementary school grades face special challenges ensuring that pupils have knowledgeable and pedagogically skilled math and science teachers. Only two CUNY campuses (Brooklyn and Hunter) offer a math specialization program at the elementary level. However, there is little incentive for teachers to complete such programs given that in New York State there is no specialty certification in math, such as there is in literacy. The recent National Mathematics Advisory Panel (2008) attends more specifically to teacher preparation issues at the elementary and middle school levels.

It also should be noted that the WG did not address the importance of mentoring and induction for new teachers as this was beyond the immediate scope of its charge. However, research evidence suggests that induction support for beginning teachers by a mentor teacher in the same subject field, accompanied by opportunities for professional collaboration with other teachers, results in a beginning teacher being less likely to move to another school or to leave teaching (Smith & Ingersoll, 2004).

Finally, it should be noted that this is a consensus report; some ideas and proposals from individual WG members have not been included as a consensus did not emerge.

Looking Ahead

The above recommendations concerning math and science teacher preparation represent rigorous program design principles linked to a set of key outcome goals, with progress monitored through regular and systematic data analysis, and supported by stronger communication about math and science teaching careers. The Teacher Academy initiative has clearly helped pave the way for multiple campuses to reach consensus around these recommendations. The WG recognizes that in general, CUNY campus teacher education programs already evidence some, but not all, of the recommended design principles, and demonstrate progress toward some, but not all of the outcome goals. Notably, assessing the value added impact on pupil learning of our math and science graduates is on the horizon (initially at Hunter College), but is not yet a reality. Although teacher retention information will be documented for some teacher education graduates in the Teacher Quality Research Center institutional reports, those reports have been delayed, reflecting the challenges in producing such information. Partnering with underserved schools that are also high performing schools as sites of clinical practice is emerging as a priority for campus programs, but will take time to implement. Thus, closing the gap between this report's recommendations and the reality of our math and science teacher education programs will require attention, action, creative funding, and productive partnerships to ensure that progress is made in keeping with the overall mission of the University regarding academic excellence and opportunity for students.

Some important and lingering questions remain. The recommended outcome goals should be considered foundational to future program developments. However, the WG has not attached numeric targets to those goals, as that process is outside the scope

of its charge. It is not clear how these goals would translate into practice and how progress toward meeting them would be evaluated. The WG recommends that the principles and outcomes serve as criteria for awarding funding from a central CUNY grant award. In addition, the WG recognizes the value of a collaborative proposal review process involving all partners – the DOE, the foundation, campuses – in the process.

The WG was not charged with developing funding proposals. However, given the WG's conclusions about the important role of financial incentives in attracting students to the teaching profession, program funding and scholarships arose frequently in discussion. The WG agreed that campus-level and centrally-sponsored funding proposals could go forward in a complementary manner. Campuses are where academic initiatives are best developed. A consortium organization of CUNY college education units with CUNY central office support and the involvement of other key stakeholders could serve to evaluate math and science teacher education program developments, evaluate progress toward incorporating the recommended design principles, and assess achievement of the outcome goals. The WG also concluded that the University as a whole has a vital role to play in promoting a coherent and consistent message about the value of teaching as a career choice and the importance of attracting an academically strong and diverse pool of candidates into the profession, especially in shortage fields in the New York City public schools.

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APPENDIX 1

9/16/08

University Working Group:

As announced in the Interim Executive Vice Chancellor and University Provost's memorandum to the Teacher Academy listserv members, the Office of Academic Affairs is convening a University Working Group (WG) to examine options for generating the high quality math and science teachers needed in the New York City public schools.

The goal of the WG and its charge are identified below.

Goal: To develop recommendations for the University Chancellor regarding options for preparing high quality math and science teachers, including appropriate modifications to the Teacher Academy.

Charge:

- Compare and contrast different options for the preparation of high quality math and science teachers that meet the needs of the New York City public schools;
- Take stock of the lessons learned from the Teacher Academy programs at CUNY and examine options for institutionalizing the best practices within efficient and effective teacher preparation models;
- Assess the impact of CUNY's participation through the Teacher Academy in a partnership with the NYC Department of Education and with New York University as that participation contributes to the preparation of high quality teachers; and
- Based on the above, develop a set of recommendations for the Chancellor regarding options for preparing math and science teachers, including modifications to the Teacher Academy.

Work Group Membership:

In order to be inclusive of the many constituencies invested in the preparation of math and science teachers at CUNY and in the Teacher Academy in particular, the WG is quite large. In addition, there is an important group of experts that the WG will need to call on. To ensure that WG meetings are productive, break-out groups (to include the participation of WG experts) will be asked to study and report back on best practices in the preparation of prospective math and science teachers including such topics as, recruitment, support for retention, maintaining academic progress and learning, cost models, preparation models, evaluation practices, curricula redesign, field experiences, and school partnerships.

The first meeting of the WG will review the charge to the group and the questions and topics to be addressed. This will enable appropriate materials and relevant data to be distributed in a timely manner for follow-up meetings.

Members are as follows:

Members:

Jane Ashdown, University Dean for Academic Affairs, OAA (Chair)

David Steiner, Dean, School of Education, Hunter College

Deborah Shanley, Dean, School of Education, Brooklyn College

Coleen Clay, Chairperson, Department of Education, York College

Deborah Eldridge, Dean, Department of Education, Lehman College

Alfred Posamentier, Dean, School of Education, The City College of New York

Penny Hammrich, Dean, Division of Education, Queens College *

Gail Simmons, Dean for Science and Technology, College of Staten Island

Community College Representatives:

Christine Mangino, Chairperson, Department of Education, Hostos Community College

Michael Gillespie, Associate Dean, Academic Affairs, BMCC

Sandra Peskin, Director TIMEQCC, Queensborough Community College

Anthony Rini, OAA, Director of Financial Management

Burt Sacks, Deputy Chief Operating Officer for Management Services, Central Office

Gabriela Fighetti, Management Services Director, Central Office

Maura Donnelly, Acting Director, Teacher Academy

Work Schedule:

September: Establish WG membership and distribute invitation. First meeting held to review charge and establish key questions and topics for future meetings. Identify break-out group topic and membership including experts.

October: Distribute relevant materials and data. Hold second meeting of the WG.

November – December: Third and fourth meetings held

January: Draft report prepared for review by WG and the EVC/UP so that recommendations can be reviewed in time for potential implementation for the 09-10 academic year.

* Dean Hammrich was unable to attend the WG.

APPENDIX 2

Campuses participating in the Teacher Academy

Borough of Manhattan Community College in partnership with City College

Brooklyn College

City College

College of Staten Island

Hostos Community College in partnership with Lehman College

Hunter College

Lehman College

Queens College

Queensborough Community College in partnership with York College

York College

APPENDIX 3

University Working Group meeting topics and presenters:

Research comparing four year (BA) versus five year (BA/MA) teacher education programs. Institute models. On-line models. *David Steiner*

Key program features and promising practices from residency models. The role of partnerships in teacher preparation. *Deborah Shanley*

Exit data and employer survey results. *Al Posamentier*

The role of Community Colleges in math and science teacher preparation. *Michael Gillespie, Sandra Peskin and Christine Mangino.*

From the student perspective – on-line information about CUNY math and science teacher education programs. *Gabriela Fighetti*

An overview of the complexities of the teacher supply and demand situation in NYC. *Burt Sacks and Jane Ashdown*

Analysis of math and science teacher preparation program features (CUNY and non-CUNY); a synthesis of learning to date. *Deborah Eldridge*

What lessons have we learned from the Teacher Academy? *Maura Donnelly*

Modifications to the Teacher Academy at the College of Staten Island. *Gail Simmons*

Financial Implications for Math and Science teacher preparation. *Anthony Rini*

Questions for School Partnerships. *Michael Gillespie and Coleen Clay*

Experts:

The WG is grateful to a number of “experts” who provided perspectives on math and science teacher preparation through informal conversations.

Professor Laurel Cooley, Department of Mathematics, Brooklyn College

Aminda Gentile, Vice President of Education Issues, UFT

NYC Middle School Principals Association – President, Vice President, and Past President.

Teacher Academy Student Advisory Board

Senior staff at the NYC Department of Education:

Marica Lyles, Deputy Chancellor for Teaching and Learning

Amy McIntosh, Chief Talent Officer

Vicki Bernstein, Executive Director for Teacher Recruitment and Quality

Daniel Weisberg, Chief Executive, Office of Labor Studies

The Working Group is grateful to Nancy Laing (Carroll and Milton Petrie Foundation), Amy McIntosh (DOE Chief Talent Officer), and Audra Watson (DOE Executive Director for Teacher Development) for attending a WG meeting on February 3rd 2009 and contributing their insights to the WG deliberations.