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ACHIEVING WORLD-CLASS MATHEMATICS PERFORMANCE K-12

A Proposed Partnership Between

The North Penn School District

and

The Greater Philadelphia Secondary Mathematics Project
A Program of the National Science Foundation at La Salle University

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Rationale

The decade of the 1990s has witnessed the growing public demand to raise academic standards. Parents want their children to be prepared to compete in the emerging knowledge-based global economy of the 21st century. Business leaders want employees to be well-versed in handling non-routine problem-solving and data-intensive tasks in team settings. The First, Second and, more recently, Third International Mathematics and Science Study (TIMSS) document America=s lackluster performance in mathematics and science as compared to other First World countries--even among our top performing students when compared to the top performing students of other countries.

Political and educational leaders are concerned that our democracy will suffer without the broad electorate possessing basic mathematical and scientific concepts. The 1983 report entitled, *"A Nation at Risk,"* warned the American public that the performance level of students risked "unilateral educational disarmament.@ Still others want young people to better comprehend the beauty and complexity of the natural world and appreciate the pivotal role of mathematics in history, philosophy and theology. Such varied learning goals requires students to acquire a deeper understanding of important mathematical and scientific concepts and to know the processes of scientific inquiry.

Reports by the mathematics education community have advocated not only steps to increase student achievement, such as requiring more years of mathematics for students to graduate, but more significantly, a *re-conceptualization* of what constitutes important mathematics content, effective teaching practices and authentic assessments[1].

All of these reports delineate an expanded concept of "basic math" to include: higher-order

[1] These reports include: the National Council of Teachers of Mathematics' (NCTM), *Curriculum and Evaluation Standards for School Mathematics* (1989); the National Research Council's (NRC) *Everybody Counts: A Report to the Nation on the Future of Mathematics Education* (1989); NRC's *Reshaping School Mathematics: A Philosophy and Framework for Curriculum* (1990); NRC's *Summit on Mathematics Assessment* (1991), and NCTM's *Professional Standards for Teaching Mathematics* (1991)

algebraic and geometric thinking, statistical inference, probability, extended problems, modeling, and use of calculator and computer technology. Moreover, rather than organizing mathematics education into an amalgam of topics, these reports advocated the integration of mathematics topics into fewer core concepts, which delve deeply into mathematic's "big ideas." The *Standards*, for example, stress the importance of mathematical reasoning and communication skills for the purpose of fostering mathematical "power," for *all* students.

NCTM's Professional Teaching Standards have called for changes in the traditional "teacher-telling/student-listening" teaching paradigm. Teachers are urged to lecture less and facilitate more inquiry-based learning activities. By stimulating students' active investigations with rich mathematical problems in interesting contexts, teachers can instill in students a deeper understanding of mathematics. Accordingly, assessment of a student's mathematical knowledge must extend beyond computational proficiency to include non-routine problem-solving in an application context.

While there has been widespread acknowledgment and acceptance of the *NCTM Standards*, how to actually implement change in the classroom on an everyday basis remains problematic. Neither the *NCTM Standards* nor the recently adopted *Pennsylvania Chapter 4 Standards* are detailed enough to enable regular classroom mathematics teachers to implement *standards*-based lessons on an everyday basis, 180 days a year.

Recognizing this problem, the National Science Foundation has sponsored over the past 8 years the development of 13 innovative, standards-based mathematics curricula, K-12, which are intended to be "full replacement" texts. At the high school level, these texts include: *The Interactive Mathematics Program (IMP), CORE-Plus Mathematics Project, Applications Reform in Secondary Education (ARISE), Math Connections, and Systemic Initiative for Montana Mathematics and*

Science (SIMMS). For the middle grades, innovative NSF-sponsored curricula include: *Mathematics in Context, Mathscape, and Connected Mathematics*. These NSF-sponsored mathematics curricula share the following features:

1) The curricula are organized using multiple strands of algebraic, geometric, statistical, probabilistic, numerical and discrete mathematical ideas that build upon each other throughout each grade level;

2) Core mathematical ideas within each strand are carefully sequenced and articulated with each other through more advanced grades;

3) These core ideas are conceptual integrated and presented in the form of thematic units designed to intrigue and engage students at different levels of depth and abstraction;

4) The curricula use modeling, group data collection, simulations and predictions;

5) Students work in collaborative learning groups and individually to actively investigate non-routine problems over an extended period of time using a variety of manipulatives;

6) Graphics and scientific calculators are used as an integral component of the lessons;

7) The curricula are college-preparatory material accessible to all students.

These design features of the above NSF-sponsored curricula, accompanied by student-centered teaching methods, are supported by a substantial body of cognitive science research (Bruer,1993; Caine, R., & Caine, G. 1991; Piaget, 1971). These curricula presuppose students are inherently "active learners" who interpret and construct meaning from their engagement with interesting mathematical questions and concrete materials. In these curricula, a series of carefully sequenced activities lead students to discover relationships and, therefore, acquire deeper conceptual understanding of important mathematical ideas. Students work in small groups and collaborate on developing strategies to solve open-ended problems. Teachers guide the groups through "organized

discovery" whereby the teacher asks probing questions provoking students to think rather than memorize. Students generate a variety of algorithms and are assessed using a variety of measures.

The internal organization of these new curricula is in sharp contrast to traditional texts which organize and present mathematics formally, topic by topic, emphasizing algorithmic manipulations and computational tasks. A mathematics curriculum organized linearly by topic encourages an instructional teaching method whereby the teacher stands and tells concepts and procedures to students, interspersed with teacher-led whole class questioning. Students in traditional classes typically sit passively in rows watching and listening as the teacher shows them a procedure on how to solve a particular problem. Students are then assigned homework problems to practice the day's new procedure and are later tested for mastery of the algorithms. The teacher then moves on to the next topic in an effort to "cover" the material. As a result, according to the *Third International Mathematics & Science Study (TIMSS)*, (1997), the U.S. curriculum has become "a mile wide and an inch deep."

The promulgation of new mathematics content, teaching and assessment *standards* has coincided with the need to change the "system" at the state and school district levels. These systemic change efforts include:

- Establishing state-wide curricular standards as a *matter of policy*;
- Reformulating student assessments in light of these new content standards;
- Aligning school and state administrative policies to support these standards;
- Arranging for intensive and extended whole-staff teacher professional development;
- Adopting standards-based curriculum.

The National Science Foundation has been the lead agency in supporting large-scale

mathematics and science systemic reform. Since 1990 the NSF launched various systemic programs: the *Statewide Systemic Initiative (SSIs)*, the *Rural Systemic Initiatives (RSIs)*, the *Urban Systemic Initiative (USIs), and most recently the Local Systemic Initiatives (LSCs)* programs.

Statement of Need

In January 1999, **Pennsylvania** adopted new state-wide mathematics standards consistent with the thrust of reform in the mathematics community. As a consequence, Pennsylvania's 501 school districts are in varying stages in the process of adopting these curriculum and assessment standards for their schools.

Many schools have realized they must re-train their mathematics faculty if these standards are to have any impact in the classroom. Teachers will need to learn new inquiry-based curricula and student-centered pedagogical techniques. They will need to infuse their classrooms with more statistics and probability, more algebraic and geometric problem solving, and more real-world applications. Such re-training requires facilitating a major paradigm shift in the habits of mind and behavior of traditionally schooled teachers. Even eager and willing teachers have difficulty making this transition. This is not an easy or quick task.

Scope of the Greater Philadelphia Secondary Mathematics Project (GPSMP)

The Greater Philadelphia Secondary Mathematics Project is a Local Systemic Change program funded by the National Science Foundation. It builds upon nearly five years of work in Philadelphia implementing the Interactive Mathematics Program. Over the next five years the GPSMP will extend its previous work to include more NSF reform curricula for both middle and high schools and extend its service to include schools and school districts in southeastern Pennsylvania, and southern New Jersey. From a total of possible 1,100 schools in both states, this

project will eventually work with approximately 30 school districts that have demonstrated readiness to engage in standards-based mathematics reform. The goal is to train **600** teachers over five years in this local area and to establish institutional mechanisms to sustain the reform process.

GPSMP Professional Services

There is no charge to participating school districts for the following services:

This grant will provide the necessary professional development, in-classroom follow-up mentoring, and administrative technical assistance to schools who have made a commitment to align the *curriculum* and *instructional practices* of their secondary mathematics classrooms with the new mathematics standards and appropriate state assessments.

The North Penn School District will develop a professional development plan in joint consultations with the GPSMP's project directors and the district's administrators and teachers and at each school. The plan should have the following components:

1) a multi-year, intensive in-service schedule,

2) student-centered instructional methods,

3) inquiry-based, integrated curriculum,

4) teacher leadership development,

5) provisions for classroom mentoring, and

6) administrative technical assistance.

1. In-service Curriculum: The professional development plan for NPSD's math staff will be designed to meet the needs of a range of teachers who are at different stages in their careers, who have different teaching assignments in their schools, and who have had different amounts of previous professional development.

The professional in-service curriculum consists of two types of training. Each teacher will have a somewhat different mix and schedule of training depending on the particular needs of the school, and the teaching assignments and experience of its teachers.

The first type is centered around one of several *NSF-sponsore*d middle and/or high school curricula which NPSD has selected. This type of training ranges from 180 to 240 hours depending on whether the curriculum spans 3 or 4 years. The following is an example of a training program that *is typical for any NSF-validated curriculum.*

a) The Interactive Mathematics Program (IMP) is a high school curriculum that requires four years of training involving a total of 240 hours. Sixty hours of training will be conducted each year for each grade level: (30 hours during each summer and 30 hours during each of four successive academic years, 9th grade through 12th grade). **IMP** was one of the earliest NSF-sponsored, standards-based, full-replacement, high school mathematics curriculum projects. Like other new curricula sponsored by the NSF, IMP is a high performance curriculum requiring non-traditional instructional practices that deeply embody *NCTM's Curriculum, Teaching and Assessment Standards.* IMP consists of 20 highly contextualized thematic units built around large problems, such as "The Overland Trail." The IMP curriculum was developed by EQUALS educators at the Univ. of California at Berkeley, mathematicians from San Francisco State University, and teachers.

b) Mathematics in Context (MiC) is a middle school curriculum that requires three years of training (6th - 8th grade) involving a total of 180 hours. Sixty hours of training will be conducted

each year: (30 hours during each summer and 30 hours during each of three successive academic years). The instructional materials consist of 10 units per year, each about 3-4 weeks in duration. MiC was developed by the Wisconsin Center For Education Research at the University of Wisconsin.

A second type of training is *elective* and consists of 30-45 hours of content institutes. **Harvard Reform Calculus with Graphing Calculators**: "Reform Harvard Calculus" is a 45-hour summer course for high school calculus teachers using the latest revised text of the Harvard Calculus Consortium. This course will allow teachers to revise their regular and AP calculus courses to articulate more fully with standards-based curriculum.

b) AP Statistics Course with Graphing calculators is a 45-hour summer course which builds on the substantial statistics and probability already contained in all NSF-sponsored curricula. This course uses an inquiry-based, thematic problem-solving approach.

c) Graphics Calculators for Algebra Teachers is a 30-hour summer workshop for algebra 1 and 2 teachers. The focus will be on algebraic applications using graphics calculators and calculator-based laboratories (CBL).

d) Geometer's Sketchpad is a 30-hour summer course in the use of a computer software program which enables students to visually experiment with algebraic and geometric conjectures and problem situations. The Geometer's Sketchpad computer program was developed by the NSF-sponsored *Visual Geometry Project* at Swarthmore College.

Since NPSD has faculty with individual needs and unique circumstances, *a school's mathematics teachers will not all necessarily take the same type of training on the same schedule*.

2. In-service Instructional Methods: The in-service instructional methods for the above training model an inquiry-based, student-centered classroom. For example, in IMP in-service sessions, teachers are seated in groups of four, like their students. The in-service presenters guide teachers through the units as they would their own students. Teachers work on selected problems in each unit. In addition to new math content, the training will also focus on student-centered instructional strategies and various forms of assessment, including portfolios, long-term problem-based essays, and group presentations. An integral part of training is for teachers to actually teach all levels of a full-replacement curriculum. The in-services will focus on practical instructional issues in the classroom. Teacher manuals, videotapes and electronic networking will supplement the in-services.

3. Promoting Teacher Leadership. Teacher leaders can be important agents of systemic change are within schools (Day, Goertz, & Floden,1995). Teacher leaders are important because they:
1) act as agents of change within their building, 2) persuade their colleagues to take risks involved with change, 3) provide programmatic stability in the face of administrative turnover, 4) persuade parents of the need for change, and 5) become better classroom teachers. We will promote teacher leadership by providing teachers the opportunity to co-present in-service sessions with more experienced presenters including the co-directors. Teachers leading in-services encourages the development of teacher-to-teacher networking and collegial support. Therefore, one goal of this project is to train more veteran teachers and mathematics department heads to lead or co-present in-service sessions. For example, over two dozen veteran Philadelphia IMP teachers have been involved in presenting or co-presenting IMP in-service sessions to new teachers in Philadelphia, New York and Boston. Experienced NPSD teacher leaders will be utilized as much as possible to help schedule and conduct in-services for newer teachers.

4. Classroom Teacher Mentoring: As a follow-up to the in-service sessions, NPSD teachers will be regularly visited in their classrooms to receive one-to-one mentoring. Secondary math teachers who were traditionally schooled must not only shift their thinking about the way students learn, but must also adopt different approaches to classroom management and student assessment. At the same time, many teachers must re-learn a large volume of mathematics content that is not usually taught in high school, such as probability, statistics, matrix algebra, and linear programming. Teachers also need to master the use of graphing calculators and must work through many unfamiliar, non-routine problems. New IMP teachers, for example, are regularly visited in their classroom by a veteran IMP teacher-mentor or IMP director. During these visits, a mentor may team-teach part of a lesson or help lead classroom discussions. After each class, the mentor will provide feedback to the teacher.

5. Administrative Technical Assistance: The project directors will provide technical assistance to principals, mathematics department heads, roster persons and other personnel concerning:

1) Budgeting support for program implementation in their school;

2) Classroom materials, book, and calculator requisitions;

3) Teacher and student recruitment and classroom rostering issues;

4) Student transfer, absentee, retention and readiness issues;

5) Intra and inter-school and grade articulation issues;

6) Student test performance and program evaluation, re: parents; others

7) School-based implementation issues such as: ESL, special education inclusion, college admissions, NCAA, and AP Calculus and AP Statistic courses.

Program Logistics

1. Schedule: One half of the training will take place during the months of June, July and August, and will occur in 5-day blocks, 6 hours a day. (Lunch will be an additional 45 minutes). Approximately 10 weeks will be available for summer training. The academic-year training typically will occur on Saturdays or on other in-service days for 6 hours each day. Approximately twenty-two (22) Saturdays per academic year are available for training. (In-service sessions may run concurrently during the same summer week and on Saturdays). All training dates will be scheduled at the most convenient times for NPSD teachers. NPSD are also permitted to attend in-service training scheduled at other times with other participating school districts.

2. Location: Depending on the number of teachers per course, the location of training will occur either at La Salle University, or on-site at NPSD, or another nearby school district. We strive for a class size of about 20 participants. A calendar of the dates, times and locations of summer and academic year training will be distributed to all teachers preceding the in-services.

3. Classroom Mentoring: Teachers who have undergone training during the summer will be provided classroom mentoring during the following academic year. Teachers will be visited an average of 8 times during the first year of their training; 4 times during the second year and 2 times during the third year. Each mentor will have a set of teachers and schools as their responsibility. It is expected that each mentor will visit three different teachers per day, usually within the same school. Each visit will entail a pre- and post-conference with the teacher. Each mentor will submit a brief report of every visit. Periodically the mentors will meet to discuss the progress of their teachers.

4. Administrative Technical Assistance : The technical assistance to schools will be provided by the co-directors and other project specialists. The average number of project days per year devoted to providing technical assistance for schools is approximately 8 director-days per school district

which includes meetings and telephone conferences. The number of consulting days diminishes each year until there is sufficient implementation expertise at each school site.

Criterion for GPSMP Participation

All participating GPSMP schools will be selected based on three criteria:

1. Administrative Support: The administrative staff of a school district--superintendent, curriculum supervisors, school principals, roster chairs and mathematic's department heads--have to be willing and able to commit school-based and district resources to support sustained multi-year teacher enhancement. In particular, they have to commit to the acquisition of books, classroom materials, audiovisual equipment, graphics calculators and adequate classroom space, including desks for students to work in groups.

Principals must be visible supporters of change in their schools. This means teachers must have stable teaching assignments as they undergo extensive staff development over time. Teachers-in-training must also be provided the time during the school day to plan the use of new curriculum materials and discuss their classroom experiences with other teachers. For example, in Philadelphia high schools, IMP teachers-in-training have typically received a reduced course load or compensation for an extra preparation period while in training.

2. School District Policy: Perhaps the greatest single challenge to institutionalizing local systemic reform is maintaining the continuity of the reform process in the context of administrative personnel changes. For this reason, it is important that school districts adopt policies and practices which will continue the change process with different administrators. The following policy indicators are used to select schools:

a) Adoption of standards-based curriculum and assessment frameworks;

b) Previous professional development on the NCTM *Standards;*

c) Willingness to align other professional development resources with this project; such as Title 1, Eisenhower, and Goals 2000 funds;

d) Adoption of administrative policies to support classroom reform, such as ensuring teachers have stable classroom and building assignments from one year to the next;

e) Provision for all students from diverse racial and economic backgrounds to have equal access to an inquiry-based, student-centered classroom;

f) Development of parent and community relations outreach and information program;

g) Alignment of new math teacher hiring criteria with the NCTM *Teaching Standards*;

3. Teacher Readiness: Five years ago, many math teachers were simply not ready to undertake change. As of 1993, according to the National Science Board's *Science and Engineering Indicators* report, (1996), 44% of high school math teachers and 72% of middle school math teachers were **not** "well aware" of the *NCTM Curriculum and Evaluation Standards*. An even greater percentage were **not** "well aware" of *NCTM's Professional Teaching Standards*. And, 44% of high school math teachers surveyed had 6 or less hours of in-service per year.

One major outcome of NSF's support for urban and statewide systemic change efforts has been to increase teachers' familiarity with the *NCTM Standards* and their implications for changes in their own classroom practice regarding curriculum, instruction and assessment. Nevertheless, teachers vary in respect to their own readiness to change. We look for schools with a sufficient critical mass of the school's teaching staff willing to participate in intensive, sustained professional development necessary to implement standards-based change.

Partnership Development Process

The process of forming a partnership between the GPSMP and a participating school district usually involves the following steps:

1) an initial invitation to participate or a request from the school district for an initial discussion;

2) meetings between the project co-directors and key administrative personnel;

3) meetings with the mathematics supervisor or department head and teacher leaders;

4) a 2 to 3 hour presentation before the mathematics teaching staff;

5) teacher visits to other schools;

6) a two-day (12 hour) in-service featuring a replacement unit teachers can use in their classrooms; 7) a series of meetings to plan the types of professional development in-services and to work out logistical and funding details;

8) presentation and/or approval from the school board;

9) a letter-of-commitment from the school superintendent;

10) further meetings to plan in-services, classroom implementation and public relations.

School District Obligations

The North Penn School District will be responsible for:

1) providing incentives and/or time for teachers to attend the in-services,

2) providing extra time for lesson planning during the academic year; and,

3) purchasing books, graphics calculators, overhead projectors, overhead graphics calculators, computer software, and classroom durable and consumable materials.

These costs are essentially one-time investments to make the transition to a standards-based program. However, all of these investments will remain inside the district. None of the expenditures of the NPSD will be spent for items outside the district such as for consultants.

This investment is usually spread over several years as the implementation is progressively rolled out. How these expenditures, e.g., textbooks, are amortized depends on the speed and scope of implementation and the extent to which the NPSD already has these items, e.g, classroom sets of graphing calculators.

The NPSD will be asked on a semi-annual basis to supply documentation of its local cost share for textbooks, teacher stipends and graphics calculators. Local cost share is an NSF requirement for GPSMP's continued funding

The NPSD will also be asked to provide assistance to the GPSMP=s external evaluator, *Research for Better Schools (RBS).* RBS's role is to evaluate how well the GPSMP is performing in serving the needs of NPSD, not the performance of NPSD students. For more detail, please see Appendix 1.

Project Management

1. Project Directors: **Mr. Joseph Merlino, Dr. Edward Wolff**, and **Dr. Alice Jordan** are the directors and co-principal investigators of the project.

F. Joseph Merlino, M.A., Education, has been a co-director of Philadelphia Regional IMP Center at La Salle University for 6 years. He currently is the GPSMP Project Director and provides technical assistance to schools, supervisors all the mentors and presenters.

Edward Wolff, Ph.D., Mathematics, has been a co-director of Philadelphia Regional IMP Center at La Salle University and a Professor of Mathematics and Computer Science at Beaver College. For this project, Dr. Wolff: 1) provides IMP Level 4 training, Reform Harvard Calculus and AP Statistics in-services, and 2) conducts analyses of school performance data.

Alice Jordan, Ph.D. Mathematics, has been a co-director of Philadelphia Regional IMP

Center at La Salle University for 6 years while also being a Department Head at Strawberry Mansion High School where she taught IMP for three years. Now retired from high school teaching, Dr. Jordan is presently on the education faculty of Beaver College. For this project, she: 1) provides IMP training (11th grade), 2) constructs the in-service calendar, 3) mentors teachers and 4) supervises the other mentors.

2. Additional Key Staff: Approximately 35 other teachers and university faculty are involved with providing in-services and mentoring to school teachers. A sample of these personnel are listed

Barbara Stankus, a teacher on special assignment from Strath Haven High School in Wallingford/Swarthmore School District, works full-time as a lead mentor and school specialist.

Richard Clancy is a recently retired IMP teacher from Girls High school in Philadelphia. He has taught three levels of IMP and has co-presented numerous IMP workshops and has mentored dozens of new IMP teachers. He is also experienced in Math-In Context. He is a lead mentor and school specialist who works nearly full-time on the project.

Anthony Campione is a recently retired IMP teacher from Furness High School in Philadelphia. He has taught two levels of IMP and has co-presented numerous IMP workshops and has mentored dozens of new teachers. He is also experienced in the Connected Math program (CMP). He is a lead mentor and school specialist who works nearly full-time on the project

Nancy Eckert, is a recently retired mathematics Department head from Freedom High School in Bethlehem Area School District. She mentors CORE-Plus teachers.

Regina Keller is a recently retired mathematics supervisor from Strath Haven High School in the Wallingford/Swarthmore School District. She mentors IMP teachers at the high school. As a trainer in NSF's *Visual Math* program she also has the ability to mentor middle school teachers in MiC and CMP.

Assisting this team is an experienced cadre of other in-service presenters and in-classroom teacher mentors familiar with IMP, Core-Plus, ARISE, and Math Connections and various NSF middle school curriculum.

3. Institutional Involvement: *La Salle University* is the fiscal agent for this project. Project partners include the *Pennsylvania Department of Education Mathematics Office* and the *New Standards Project in Education-University of Pennsylvania*. Schools from Delaware, Bucks and Montgomery counties, the Pennsylvania State Education Association and the Center for a Greater Philadelphia have joined together to form the *Southeastern Pennsylvania Standards Consortium*. The *New Standards Project* is part of the National Center on Education and the Economy.

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APPENDIX 1

Program Evaluation Plan

The external program evaluator is *Research for Better Schools **(RBS)*** in Philadelphia. RBS has been conducting educational evaluations for over 30 years. Ms. Susan Danin leads the evaluation team. The evaluation will focus on the project's implementation process and outcomes relative to systemic change in the following five areas: (a) the quality of the professional development activities, (b) the alignment of the professional development with a school's goals and teacher needs, (c) the support system for implementation, (d) the level of teacher engagement in the local systemic change efforts as a result of professional development activities; and (e) the impact of the professional development activities on curriculum, instruction, and assessment.

a. The quality of the professional development activities will be measured by written teacher evaluations of all their professional development activities. In addition, Ms. Danin will observe a sample of the in-services and interview a sample of teacher participants at various times during the summer and throughout the academic years to obtain their evolving assessments of the impact of the professional development on their teaching.

b. The alignment of professional development with a school's goals and previously stated staff needs will be analyzed by first creating a profile of each participating school and district which will contain such information as student demographics, experience of teaching staff, average class size, existence of school based improvement team, and policies on staff development. Much of this information will be collected from school documents such as curriculum frameworks, instructional materials, and student assessment measures. Follow-up interviews will be conducted with each school's principal and a sample of teachers.

c. The support system for implementation will be measured by having participating teachers complete an RBS-designed survey, which will contain items related to the following:

1) the factors promoting and hindering classroom implementation;

2) whether teachers were provided sufficient time to master the skills and knowledge related to standards-based curriculum and instruction;

3) the quality, quantity and influence of classroom mentoring;

4) whether and to what degree classroom materials, graphics calculators and other equipment was readily available;

5) whether student and teacher classroom assignments were configured in a manner to support new teacher training.

d. The level of teacher engagement in the local systemic change effort will be assessed by asking questions on the RBS survey on teachers' level of involvement in classroom decision making and the extent of shared teacher planning and collegial interaction. The written surveys will be augmented by a sample of teacher and administrator semi-structured interviews.

e. The impact on curriculum, instruction, and assessment will be assessed by having all participating teachers and a sample of non-participating teachers complete the RBS survey as it pertains to their own changes in methods of instruction, use of instructional materials and educational technology, and measures of student performance. Local administrators will complete a similar survey to assess the project's impact on school culture, instructional practice and assessment policies in k-12 mathematics education. Ms. Danin will observe a sample of classrooms representative of the participating schools in the project's third and fifth years. Ms. Danin will also conduct in-depth semi-structured interviews with the teacher leaders to determine

the impact they have had in their schools and classrooms compared with other teacher participants in the project. Ms. Danin will perform a longitudinal analysis as to whether, and to what degree, a teacher's actual curriculum and instruction practice, including classroom materials and student assessments, was changed as a result of this project. Ms. Danin will also ask teachers to review samples of student work to assess changes in the quality of student work over time. The products of this evaluation will be:

1) a longitudinal database which will track the changes in participating districts and teachers over the five-year course of the project. The database will include school district data (e.g., demographic data, mathematics and science curricula and materials, etc.) and data collected on each participating teacher (e.g., surveys, interviews, observations) over time. The data will be analyzed by school or district and across schools or districts;

2) a report comparing participating teachers' professional development over time and whether the project has made a difference in the practices of the participants. The report will include an analysis of the relationships between process and outcome results. Results will be shared informally with the participants and co-director organizers on a regular basis to promote learning and refinements, as needed, to the project;

3) a progress report on the status of the evaluation will be provided at the end of each year of the project;

4) a final report summarizing the findings over the full course of the project due at the end of the project.

The project directors will continue to collect local student evaluation data in collaboration with each participating school district. This data will supplement Ms. Danin's work.

APPENDIX 2

Prior Experience of the Project Directors

The *Philadelphia Regional IMP Center* was established as a result of a 1992 NSF grant awarded to the San Francisco Interactive Mathematics Program development team. The grant supported the development of a fourth year of the IMP curriculum and the dissemination of the pre-publication version to three regional sites around the country. The sites chosen were *California, Minneapolis, and Philadelphia*.

The Philadelphia Regional IMP Center co-directors are **Mr. Joseph Merlino**, **Dr. Alice Jordan** and **Dr. Edward Wolff**. They were charged with introducing the IMP curriculum to at least three high schools in Philadelphia wherein they would also teach IMP themselves after being trained directly by the San Francisco IMP authors. The Philadelphia site was awarded a 4 2 year subcontract. (Other regional IMP sites were later formed with NSF and private funds: Boston, Colorado, Phoenix, Chicago, Portland, New York, Hawaii).

In the 1993-94 school year, Philadelphia IMP began with only **9** teachers out of a total of approximately **440** high school mathematics teachers and department heads. At the time, there were no Pennsylvania State mathematics standards; there were no Philadelphia District mathematics standards; there was no Pennsylvania State Systemic Initiative (SSI); there was no Philadelphia Urban Systemic Initiative; and there were no state-wide or city-wide tests aligned with *NCTM's Assessment Standards*. At the time, IMP represented the *only* standards-based secondary mathematics reform initiative in Philadelphia.

Establishing IMP in Philadelphia posed major challenges to the Philadelphia IMP Regional Center directors. Not only did IMP mean teaching a radically new curriculum using non-traditional pedagogy, but it was being implemented in an environment where there was a

lack of state-wide and district-wide mathematics standards, a lack of school-based performance accountability measures, heavy computational-based assessments, and great administrative instability. During the first three years of IMP's implementation, the School District of Philadelphia had three different superintendents and three different sets of various associate and assistant superintendents. The six high schools which first piloted IMP in Philadelphia went through 14 different principals and 10 mathematics department heads.

Nevertheless, five years later, by the 1998-99 academic year, the Philadelphia Regional IMP Center has grown to involve **over 100** teachers from **17** high schools in Philadelphia and the suburbs. In addition, the Philadelphia Center is in its second year of providing IMP training to approximately **80** teachers from nearly **20** New York City schools in conjunction with the New York City 2424USI. Philadelphia now has a stable superintendency, it has adopted city-wide mathematics standards, a high stakes city-wide standards-based assessment (Stanford 9 Achievement Test) and a new school accountability system based largely on the results on the SAT-9 tests. And, the School District of Philadelphia is entering its fourth year of an NSF **Urban Systemic Initiative** grant whose over-arching goal is systemic reform in mathematics and science k-12. Indeed, IMP's growth in Philadelphia would not have been possible without the financial support and cooperation from the USI in the 1996-97 and 1997-98 academic years, and the dedication and persistence of its teachers, department heads, principals, and district administrators who believed in the need for change content and teaching approach.