1

Historical Context: How National Science Foundation Reforms Build on Earlier Reforms

Urban schools have been the target of a series of reforms over the last twenty or more years. During this time, strategies for school improvement to prevent student failure have addressed a wide range of matters: school safety, computer use, parent involvement, business partnerships, and more. Many claim that these earlier efforts have been piecemeal, targeting one or two dimensions of the schooling process rather than the system as a whole. The National Science Foundation's (NSF) approach, in contrast to the plans that preceded it, emphasizes the simultaneous application of a number of policy levers (called drivers) to move the reform agenda forward. NSF also emphasizes the point that all children can achieve to high academic standards.

In this book we argue that implementing and sustaining systemic reform in mathematics and science for all students requires unremitting effort throughout the national system. Increasingly, with the passage of No Child Left Behind (2001) and related legislation during the George W. Bush administration, education policy emanates from national, state, and local levels. In addition, the federal government has tied funding through national programs such as the reauthorization of the Elementary and Secondary School Act to requirements affecting teaching and learning at the school and classroom levels such as the

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mandate that all public school teachers will teach only those subjects for which they have been certified. Nonetheless, because the United States is so vast, educational change is still most effectively carried out at the local district level. From the superintendent's office to the classroom, improving mathematics and science practice to benefit all demands that teaching practices are student-centered, taking student needs into account but also assuming all students can and will learn to high standards. Intensive professional development carried out in the school and focused upon both substantive academic content and pedagogical practices is an essential condition for the improvement of student outcomes. In addition, community resources including both parent involvement and the contributions of civic organizations such as museums and local businesses must combine to accelerate student growth and attainment.

Throughout this volume we maintain that unless the strategy in question is designed to (a) promote the academic achievement of all students and to close the achievement gap, (b) engage teachers and school principals in forging a community of learners, and (c) involve parents and stakeholder groups, it will not be sustainable. In agreement with Cuban (2001), we further believe that:

- All schools do not need school-based reform; those schools that do are the lowest performers academically and are the hardest to turn around.
- School-based reform and district reform in urban areas should work in tandem for desired changes to take root and endure at the school site.
- Advocates of research-based school reform who are dependent upon practitioners adhering narrowly to a single design and the use of norm-referenced measures to determine success offer a narrow, technical version of what is a "good" urban school. In doing so, promoters reject teacher expertise while largely ignoring the school's political and cultural dynamics essential for improvement to occur.
- School-based reformers must do their homework on past successes and failures of urban school reform to understand the deeper complexities of the work in which they are engaged (pp. 1–2).

In the remainder of this chapter we turn to an examination of systemwide reform as a national strategy for improving teaching and learning, including a discussion of the NSF driver model as the organizing rubric for mobilizing reform in mathematics and science.

SYSTEMIC REFORM

Although policies at the national level directed toward educational reform predated the 1980s, several prominent documents published in that decade (for example, National Commission on Excellence in Education, 1983; Southern Regional Educational Board, 1981), as well as results from national and international assessments (Crosswhite, Dossey, Swafford, McKnight, and Cooney, 1985; McKnight et al., 1987) revealed the difficulties in providing all students pathways to high-level academic achievement in America's public schools. Most notably, the National Commission on Excellence in Education's report, *A Nation at Risk* (1983), illuminated problems confronting the nation's public education and focused society's attention on the need for a national strategy to improve education. In addition to preserving the status of the Department of Education as a cabinet-level entity, the report also triggered a national debate about what students should be learning and how student learning should be assessed—a debate that is far from over.

According to the report, those working in America's schools were content with low expectations and low standards, and the nation as a whole was in danger of losing its preeminent status as a world power to nations such as Germany and Japan, countries making enormous technological strides at the time. In addition to making a full-scale indictment of the system, the report's authors at the same time called for action to combat "complacency" and "mediocrity." Recommendations included higher standards for students and teachers and an academically challenging core curriculum for all students. Documents demanding reform, coupled with an outcry from business and community leaders, manifest in the Secretary's Commission on Achieving Necessary Skills (1991) report subsequently resulted in policies requiring higher standards for student learning in America's schools. Although the policy-making community still lacked research documenting poor pedagogical practice at the classroom level, there was reason to believe that teacher-centered instruction focused on student learning of facts, basic skills, and not much more was widespread. In fact, weak U.S. student performance on tests measuring the capacity to perform at high levels in comparison with student performance in other nations was the only proof necessary to stimulate the press for reform (Smith and O'Day, 1991).

The current thrust for systemwide reform addresses the assumption that schools have not provided students, especially those students attending the poorest performing schools, with knowledge necessary to be successful in society—the outcome stressed by Newmann (1996)

and his colleagues. Students were not sufficiently challenged by the instruction they received, with the result that many were ill-prepared to attend college upon graduation, to enter technologically complex careers, or to engage in challenging intellectual work. By setting more rigorous standards for students, Roeber (1999) and others contended, the general level of student achievement would rise, better preparing students for post-secondary educational opportunities and employment.

The systemic reform movement differs from reform efforts in the past in emphasizing rigorous academic coursework for all students. In addition to improving the overall quality of education for all children, as emphasized in the effective schools approach, educational equity is at the core (Kahle, 1998; Smith and O'Day, 1991; O'Day and Smith, 1993). As a result of this emphasis, the achievement gap between majority group students and students of color is expected to decrease (Williams, 1996). Unlike prior reform efforts, systemic reform recognizes that attempts to change one aspect of the system will require changes in other aspects at all levels of the system. However, the most important change must occur at the level of the school classroom, translated by the teacher and buttressed by policies at the school district and state levels, including those policies and resulting strategies focusing on curriculum, instruction, and assessment.

Led by the National Council of Teachers of Mathematics (NCTM), national content-specific professional groups developed standards to communicate what students should know and be able to do in mathematics (NCTM, 1989, 2000), science (American Association for the Advancement of Science, 1993; National Research Council, 1996), and other subject areas. As described in these documents, instruction should emphasize active learning and higher-order thinking skills, while providing investigative and problem-solving opportunities for all students. Since their introduction, these documents have been used to guide and develop policy at the national, state, and school district levels, in the form of curriculum changes and related high-stakes accountability measures.

The NSF has been critical in providing both the support and the conceptual rubric for institutionalizing systemwide reforms. According to the NSF,

> Systemic reform occurs when all essential features of schools and school systems are engaged and operating in concert; when policy is aligned with a clear set of goals and standards; when forthcoming improvements and innovations become intrinsic parts of the ongoing educational system for all children; and when the changes become part of the school system's operating budget. (NSF, 2000)

Initially, NSF provided support to twenty-five states through its Statewide Systemic Initiatives program (SSI). The goal of the SSI is to assist states in developing the capacity to move from independently devised science and mathematics educational reform measures to state-developed efforts and in coordinating such improvements as teacher preparation, the development of standards-driven instructional materials, and the assessment of student performance. Although large numbers of teachers received curricular and instructional materials, and schools of education undertook some degree of curriculum change in teacher preparation programs, these programs failed to reach those urban schoolchildren in the most difficult circumstances.

To address this need, NSF established the Urban Systemic Initiatives (USI) program in 1993. Funding under the USI program was made available to the urban school districts in the United States with the highest rates of poverty among their school-aged children according to the 1990 census. Twenty-one of the eligible school districts successfully applied for and received a total of 15 million dollars each over a four-year period to carry out systemic reforms in mathematics and science (Westat*McKenzie Consortium, October 1998, p. 6) (see Table 1.1). The funding provided by NSF was considered a medium for developing, expanding, or sustaining reform through partnerships with businesses, educational institutions, and community organizations.

Although NSF did not prescribe approaches to systemic reform, four years into the initiative, and mindful of contextual differences among the sites, NSF developed a model of systemic reform that identified a set of six policy levers, or drivers. Thereafter, grantees were required to assess progress against these drivers (Kahle, 1998). The six-driver model (see Table 1.2) is an interrelated and overlapping structure of

Table 1.1.
National Science Foundation USI Sites

Cohort 1 (Granted in 1993)	Cohort 2 (Granted in 1995)	Cohort 3 (Granted in 1996)	Cohort 4 (Granted in 1998)
Baltimore	Cleveland	Milwaukee	Atlanta
Chicago	Columbus	San Antonio	Jacksonville
Cincinnati	Fresno	San Diego	
Dallas	Los Angeles	St. Louis	
Detroit	Memphis		
El Paso	New Orleans		
Miami-Dade	Philadelphia		
New York City			

Table 1.2.
NSF's Six-Driver Model

Driver	Description
Driver 1	Implementation of a comprehensive, standards-based curriculum and/or instructional materials that are aligned with instruction and assessment available to every student served by the system and its partners.
Driver 2	Development of a coherent, consistent set of policies that support provisions of broad-based reform of mathematics and science at the K–12 level.
Driver 3	Convergence of all resources that are designed for or that reasonably could be used to support science and mathematics education—fiscal, intellectual, materials—both in formal and informal education settings, into focused program that upgrades and continually improves the educational program in science and mathematics for all students.
Driver 4	Broad-based support from parents, policymakers, institutions of higher education, business and industry, foundations, and other segments of the community for the goals and collective value of the program that is based on an understanding of the ideas behind the program and knowledge of its strengths and weakness.
Driver 5	Accumulation of broad and deep array of evidence that the program is enhancing student achievement through a set of indices. In the specific instance of student achievement test scores, awardees on an annual basis are excepted to report the results of student mathematics and science achievement in a multigrade level context for the USI-impacted schools/districts/state(s) relative to appropriate cohort entities (non-USI districts, the state), all of which are defined by the performance baselines.
Driver 6	Improvement in the achievement of all students, including those historically underserved, as evidenced by progressive increments in student performance characterized by the requisite specificity of the USI as a catalytic resource and the appropriateness of attendant attributions.

Note: NSF, 2000.

process and outcome reform drivers. The first four, called process drivers, focus on sustainable success in changing the system's approach to the teaching and learning of mathematics and science. Driver 1 (D1) encompasses the overall intent of the reform effort by encouraging the use of standards-based curriculum that is aligned with instruction and

assessment practices. Drivers 2 (D2) through 4 (D3 and D4) support the achievement of the goals of D1. The outcome drivers, Drivers 5 (D5) and 6 (D6), focus on the end result of the reform effort, increasing achievement in mathematics and science and closing the existing achievement gap between advantaged and disadvantaged students. With these drivers in mind, USI programs were designed to be strongly student achievement outcome oriented (D5, D6), with explicit emphasis on resource convergence (D3), establishing a leadership nexus (D2, D4), partnerships that entail more than the provision of resources (D4), and the advocacy role of community relations (D4, D2), in addition to standards-driven curriculum, instruction, and assessment practices (D1). As a result, most projects engaged in a process of policy alignment and employed programs of intensive professional development focused on both subject matter content and constructivist approaches to teaching mathematics and science across grade levels K–12. Other reforms and policy analysts have noted that several policy levers must be engaged in a coordinated fashion. A good recent example is the work of Datnow and her colleagues (2002), whose analysis of comprehensive school reform (CSR) is framed by five "necessary conditions" for success: (1) the success of the reform selection process; (2) quality leadership at site and district levels; (3) CSR design team support and professional development; (4) fiscal resources to support reform; and (5) the reform's ability to help schools meet state accountability mandates.

SCHOOL CULTURE—A POSSIBLE 7TH DRIVER

In addition to policy drivers identified by the NSF, we believe school culture must be viewed as a mediating set of factors that influence the creation of social ties and relationships, and is likely the critical element enhancing or curtailing effective teaching and successful student outcomes. These factors are increasingly seen as vitally important in strengthening or undermining school reform (Fullan, 2001). Additionally, there is evidence to support the notion that student learning is facilitated when principals, teachers, and others develop collaborative relationships within a professional learning community (Newmann and Wehlage, 1995; Louis, Marks, and Kruse 1996; Stein, 1998). According to Supovitz and Turner (2000), teachers who felt supported by their principal reported significantly greater use of reform approaches than did teachers who did not feel encouraged.

Researchers studying the organization of high-achieving urban schools have regarded the development of professionally enriching

work groups as a major facilitator of commitment and effort with the potential to improve student learning (Louis, 1998, p. 1). Those who study the social organization of schools also emphasize "the multiple, embedded ways in which teachers seek and use professional networks to increase their knowledge and skills" (Louis, 1998, p. 2). While high-quality instruction depends on the competence and attitudes of individual teachers, individual knowledge, skills, and dispositions when put to use collectively within a school can create a strong professional community (King and Newmann, 2000).

THE CURRENT CRISIS: CLOSING THE PERSISTENT ACHIEVEMENT GAP

The United States requires a literate, technologically savvy, mathematically proficient population capable of high-level problem solving. Students in turn require an environment in which educators can teach the materials effectively and challenge students to think creatively while instilling appropriate knowledge and skills as a foundation for future learning. The first issue to acknowledge is the persistent educational achievement gap between students of color and white students:

> This ethnic educational achievement gap is hardly news. It is a well-studied and well-established fact, using almost any measure (the well-known 15-point average I.Q. gap between blacks and whites sensationalized by *The Bell Curve,* SAT scores, college and high school grade-point averages, graduate and dropout rates) black students nationwide do not perform as well as whites. (Singham, 1998, p. 8)

Corresponding gaps are also evident in financial inequities that persist in school funding; in schools that cannot keep up with high technology in either equipment or teaching; in tracking and course offerings that offer some students more challenging academic content and leave others with courses such as "basic math" or "general science." Although the achievement gap is well documented in the United States, no clear conclusion has been reached to explain the persistence of the gap, and many "measures" showing disparities in cognitive abilities between groups have been discredited as valid indicators of achievement differences.

Making meaningful and durable systems change requires both taking into account the unique nature of each school and community and applying standards-based criteria to evaluating teaching, learning, and other features. Change must be structured to be adaptable to different

populations and regional areas without sacrificing an adherence to the goals of high achievement and continued learning of all students. Together with standards for student achievement, standards for teaching are important because teacher knowledge is a critical component in the classroom (Haycock, 2001). The importance of these factors is reflected in the USI reform efforts through increased standards-based instruction and professional development for teachers in urban school districts. By increasing policy makers' and the public's understanding of the varying impacts of systemic change at the state, district, and school levels, systemic reform efforts including the USI offer multiple avenues for educational improvement and the reduction of achievement differentials (Corcoran and Goertz, 1995).

NSF-sponsored USI reform efforts attempt to reduce the achievement gap and address factors that contribute to it. Research has identified several problems faced by teachers, students, and administrators in urban school districts and schools. First, low-performing schools often suffer from a lack of coherence among activities deemed as priorities by school district or school-level administrators (Bryk, Sebring, Kerbow, Rollow, and Easton, 1998). The lack of coherence includes fragmentation of the curriculum, fragmentation or lack of coordination in organizing the school day, poorly related or incompatible instructional strategies, inconsistent behavioral expectations, and the lack of a shared purpose and shared values. Second, many of these schools face a poorly organized or nonexistent program to support the acquisition of knowledge and skills needed to engage in effective reform at the school level. In addition, teachers and principals lack the time and resources to mobilize the information, skills, and knowledge to undertake radical transformations of teaching, learning, and assessment, as well as school organizational change. Third, there are major disincentives for teachers to elect to work in schools with histories of failure much less to stay with schools undergoing major shifts in practice. Developing pedagogical skills, the capacity to undertake complex organizational transformation, and the willingness to stay with a career with minimal financial rewards for the work required seems a most difficult challenge for even the most dedicated teachers and school staff.

Measures such as standardized testing, increased school accountability, community involvement, and resource allocation must also be structured and evaluated in ways that relate them to achievement differentials. An increasingly important factor is the use of technology as part of school and work environments. When business leaders began to worry about applicants meeting their minimum literacy requirements and possessing higher-level thinking skills, the question of educational

efficacy came to the forefront (Mizell, 1992). The commitment of educational leaders to increase the achievement levels of all students should be a real part of reform efforts to make certain all students are ready and able either to continue into higher education or to be successful in a rapidly changing, technically demanding job market. Systemic changes in both structure and practice are important to this goal and to the reduction of achievement differentials through increased alignment of teaching philosophy and policies with classroom practices.

In the first part of this chapter our goal has been to set the stage for a discussion of the nature of the work that we undertook in our study of the implementation of NSF's Urban Systemic Initiative program in four sites. Our aim has been to show how a concern with the failure of so many students to attain to high levels of achievement in mathematics and science coupled with the perception by policy makers that most classroom instruction in the nation's public schools was teacher-centered rather than student-centered led to the development of strategies to improve both conditions. In addition, it was widely (and in our view correctly) perceived that reform on the revolutionary scale envisioned by NSF required the concerted efforts of many dedicated individuals throughout the system and school community. Without the targeted efforts of superintendents both to create the vision and to mobilize resources in concert with those of the school principal, teachers, parents, and community members, systemic reform is impossible to achieve. In the next section of the chapter we turn to a discussion of the research plan we followed in building an understanding of the impact of systemwide reform.

ASSESSING THE IMPACT OF THE URBAN SYSTEMIC INITIATIVES

During the course of our three-year project, we researched the effectiveness of NSF's driver model in explaining educational reform and estimated its effectiveness as a template for district and school policies designed to close the achievement gap and increase overall success in science and mathematics. The participating cities in our evaluation project (Chicago, El Paso, Memphis, and Miami-Dade) were chosen because they provided a reasonably representative sample of the twenty-one districts supported by NSF's USI. These four cities vary by region, size, predominant ethnicity, and native language of students and their families. Because we intended to carry out an assessment of both the efficacy of the driver model and the effectiveness of USI programs, our

methodological approach is understandably complex. Below we provide a brief description of the methods used in this research.

The major goals of this research study were: (1) to assess the impact of USI reforms by modeling relationships between each latent variable (driver) and a set of manifest indicator variables; (2) to determine how reforms in curriculum and instruction affect teacher and student outcomes at the classroom level through the enacted standards-based curriculum in mathematics and science; and (3) to investigate the roles of leadership, local resources, and national, state, and local policies related to systemic reform that foster or inhibit student achievement outcomes and outcome differences. Our research plan called for three studies (the Mathematics and Science Attainment Study, the Study of the Enacted Curriculum, and the Policy Study) to be conducted over a three-year period simultaneously. These interconnected studies included a number of questions that guided the work:

Mathematics and Science Attainment Study:

- What is the impact of successful initiatives funded through NSF's USI program?
- To what extent do both (a) student achievement outcomes in general and (b) attainment outcomes between underserved students and their peers differ as a function of the duration and intensity of treatment?
- To what extent is the causal structure implied by NSF's reform drivers consistent with the observed relationships among the indicators of each driver?
- What are the similarities and differences in causal structures across the four participating sites?
- What evidence suggests that additional drivers are causally related to achievement in general and to attainment differences specifically?
- What causal structure for interpreting the data provides a consistent, reliable, and cost-effective model for other USI sites to use in carrying out assessments of the impact of their programs on student achievement outcomes?

Study of Enacted Curriculum:

- To what degree are science and mathematics being taught in a manner consistent with local goals, state frameworks, and national mathematics and science education standards?

Policy Study:

- What is the impact on local USI reform of national, state, and local policies related to systemic reform, including assessments, standards, and professional development?
- How are resources mobilized among various constituencies such as schools, universities, business and industry, and political agencies?
- What is the role of institutional and individual leadership in this process?
- What community and district contextual characteristics are particularly important in affecting student outcomes?

A multisite, multilevel case study design was employed to provide perspectives at four levels: the school district, the school, the school's community, and school classroom sites implementing NSF-sponsored initiatives. Our array of studies and research questions allowed us to develop multiple indicators for each of the NSF drivers, to do so over a three-year period, and ultimately to execute a comprehensive analysis of multiple salient features fostering or inhibiting possible student outcomes. These included both organizational and individual level factors such as student achievement and student engagement (D5 and D6); teachers' reports of their professional development experiences, use of technology in the classroom, and involvement in decision-making processes (D1 and D3); school district assessment practices and school-level support structures (D2); teachers' classroom practices (D1); the nature of community-school partnerships and other arrangements with business and industry (D4); school climate and school leadership (D3 and the hypothesized D7). In addition, we attempted to contextualize our work by taking into account factors including local, state, and national programs and the range of important local and regional characteristics.

The case study design incorporated a variety of quantitative and qualitative research methods. The inclusion of multiple methods enhances the rigor of the research as the limitations of one method may be balanced by the strengths of others (Kromrey, Hines, Paul, and Rosselli, 1996). Further, given the complexity of systemic reform, the use of multiple methods increases the likelihood of accurately representing the myriad of influential variables at work to either undermine or sustain reform.

THE SCHOOL DISTRICTS AND CITIES

We worked with USI directors and others at each of four sites to allow comparisons among programs and to estimate the extent to

which results may be generalized. Sites vary by region, size, and predominant ethnic composition of students. Size differences are important in view of the relatively greater challenges facing large urban school systems, and because NSF funding at 15 million dollars over four years was the same in all USI-funded locations regardless of number of students served. Racial/ethnic variation addresses the importance of language, culture, and racial or ethnic discrimination as variables affecting educational performance.

At the start of our study, all four sites had operated USI programs for at least four years. Chicago and Miami-Dade are very large districts (ranking third and fourth nationally), while Memphis and El Paso are comparatively smaller. Students in Memphis and Chicago are predominantly African American (70 and 55 percent, respectively), while those in El Paso and Miami-Dade are predominantly Latino (85 and 52 percent, respectively), although of different national origins (i.e., Mexican American and Cuban American). Chicago has a substantial Latino student population (31 percent), whereas Memphis has a relatively small percentage (1 percent). Similarly, Miami-Dade has a substantial proportion of African American students (31 percent), while El Paso has relatively few (3 percent). In various combinations, therefore, all four districts have very high numbers of traditionally underserved students and all reflect high levels of family poverty and chronically low levels of student achievement. All four cities faced state-imposed mandates to improve school performance and to raise test scores of students. Below we provide a brief characterization of each of the sites.

Chicago

While Chicago's economic growth in the 1990s was somewhat less substantial than the prosperity experienced by its U.S. counterparts—New York and Los Angeles—in the global finance economy, Chicago still managed to gain both jobs and population during this period (Abu-Lughod, 1999). Currently, Chicago headquarters more of the nation's largest firms than Los Angeles and has also developed capacity to compete in global financial markets through its venerable institutions, most notably the Chicago Mercantile Exchange. Nonetheless, Chicago remains one of the most segregated cities with respect to both income and race/ethnicity. Abu-Lughod (1999) asserts that despite decades-old open housing laws, the physical isolation of blacks and, increasingly, of Latinos continues:

> Over time . . . racial segregation has persisted and, with the flight of Caucasians either beyond the city limits or into explicitly identified city

"bunker" zones, areas of minority residence have expanded without leading to greater integration. (p. 332)

Chicago's schools, in part because of an emphasis on neighborhood-based magnet programs, exhibit similar patterns of segregation as the neighborhoods in which they are located.

As the nation's third largest district, it is not surprising that Chicago Public Schools (CPS) over the past thirty years has alternately served as a model for exemplary practices and as the case-in-point for mismanagement, chaos, and abysmally poor student performance (Hess, 1991). At present, the school district's 596 elementary and high schools serve nearly 435,476 students, an increase of more than 10,000 students since 1999. In the early 1990s CPS was an ideal candidate for NSF's USI, with low student achievement, high poverty, and a diverse but racially isolated student population. During the 1990s and into the twenty-first century, both the city and the city's schools have reversed disturbing earlier patterns of population loss, with a particularly notable growth in its Latino population and a decline in numbers of youth ages five to seventeen living below federal poverty levels. This population declined from a high in 1990 of 190,000 (21.4 percent of that population) to 182,000 or 18.5 percent of youth in this age range.

The former CEO of CPS, Paul Vallas (now Superintendent for Philadelphia Public Schools), served as the school district's leader during the 1990s as an appointee of the mayor and attributes the district's success in maintaining enrollments of both low- and upper-income students to the press for high achievement for all students.

Educational Reform in Chicago. Chicago's history of educational reform is closely tied to the corporate sector, the mayor's office, local community activists, and the state legislature. The contrasts in allocation of power and influence over educational policy in the city are dramatically illustrated by the contrasting policies of two reform laws—one passed in 1988 establishing Local School Councils (LSCs) in each of the city schools and the other the June 1995 reform law enacted by state legislation, centralizing control in the mayor's office (Shipp, 1998). The latter state law concentrates management of the districts in the hands of a chief executive officer and board of trustees, all of whom are appointed by the mayor. While LSCs remain nominally in charge of budgetary priorities at the school level and retain the power to hire and fire school personnel, the more recent policies give ultimate control for systemwide initiatives and accountability systems to a centralized management team.

Yet it wasn't always so. In the 1980s, as the city's school bureaucracy grew, parents, community members, and the city's business establishment

formed a coalition linked by their strong belief that bureaucratic bloat and central office decision making were both fiscally irresponsible and highly detrimental to students' academic success (Bryk, Sebring, Kerbow, Rollow, and Easton, 1998). LSCs were created to channel community support to the school. It was believed that strengthening school autonomy and control and establishing democratic local governance through the LSC would enhance school performance. This approach was self-consciously aligned with an effective schools research agenda arguing for both site-based decision making and parental involvement as the keys to improved student achievement. Schools continue to be governed by LSCs staffed by six parent representatives, two community representatives, two teachers, one principal, and, in high schools, one student representative. However, by the mid-1990s many in the corporate sector determined that decentralization must be balanced by stronger control over the system's resources to insure success for all students.

During the early 1990s business leaders across the state created a new coalition that included the Illinois Manufacturers Association, the Illinois Business Roundtable, the Illinois State Chamber of Commerce, and the Illinois Retail Merchants Association in league with the Chicago Civic Federation and the Chicagoland Chamber of Commerce under the umbrella of the Illinois Business Education Coalition (IBEC) to improve accountability (Shipp, 1998). Together, according to Shipp:

> All could agree on stricter accountability of principals to the district and on central office leadership modeled after an up-to-date corporation as well as on reinstating unfettered mayoral discretion in the selection of the school board. (p. 177)

While the mayor received no additional funding under the reform legislation of 1995, he did enjoy considerable control of both district-wide policy initiatives and funding allocations. During the same year, the mayor appointed a new team of managers whose goal of improved classroom performance included a spectrum of school intervention programs and teacher accountability measures to improve academic instruction and adherence to standards.

Chicago Urban Systemic Initiative (CSI). The CSI builds upon and aligns management accountability in compliance with state and federal education standards. In addition, CSI was designed to be the organizing framework for all mathematics, science, and technology reform efforts within the Chicago Public Schools. CSI's goals include improving the scientific and mathematical literacy of all students in a technological

society and motivating students to pursue careers in mathematics, science, engineering, and technology. Since its inception, CSI has implemented programs and assessment tools to produce major systemwide reform in mathematics, science, and technology teaching and learning. Not unlike the implementation of USI programs in other sites, CSI program developers initiated their efforts by conducting a self-study of district mathematics and science instructional programs. The 300 schools participating in the initiative represent about half of all CPS schools. Nonparticipating schools were, nonetheless, affected through the emphasis systemwide on standards-based criteria.

El Paso

El Paso is located on the Mexican border, with a population approaching one million, and is the fourth largest city in Texas. When El Paso's population numbers are added to the 1.3 million persons residing in the sister city of Ciudad Juarez, Chihuahua, Mexico, the El Paso-Juarez area ranks as the largest binational community on any international border anywhere in the world (Anderson, 1997). The vast majority of students attending school in the three largest districts—El Paso, Ysleta, and Socorro Independent School Districts—are from low-income families and close to half of the children enter school with limited proficiency in English (Navarro and Natalicio, 1999). El Paso ranks as the fifth-poorest congressional district in the United States. Not surprisingly, educational issues in El Paso include bilingual and immigrant education, as well as professional development and teacher education, improving partnerships with parents, family, community, and businesses, and accentuating the role of leaders in participating school districts and schools. These issues become increasingly important when considered in the context of El Paso's rapid population increase in the 1990s.

The overall population in El Paso has grown by more than 8 percent during the past ten years. El Paso's youth ages five to seventeen living below federal poverty levels decreased only slightly from 48,188 to 48,661, a decline representing a change from 35 percent of this age group to 31 percent. El Paso's jobs in distribution, transportation, and the service sector represent opportunities for individuals struggling in the rural areas of the borderland, providing upward social and economic mobility for families moving across the border from Ciudad Juarez. Many of these adults have been educated primarily in Spanish, but their children find themselves in English-speaking classrooms, challenging El Paso to develop a multilingual solution to the problem of increasing student achievement. We were impressed throughout our

work in El Paso by how schools in each of the three districts we studied (El Paso, Socorro, and Ysleta) embraced students who were Mexican citizens making the trip across the city's bridges daily to attend school in the United States.

Educational Reform in El Paso.   Educational reform in El Paso has in many respects paralleled educational reform in Texas. School finance reform following an important court case (*Edgewood v. Kirby*) in 1989 preceded reforms in the 1990s aimed at increasing the achievement of all students and strengthening school accountability across the state. Following *Edgewood v. Kirby*, a more equitable system of district financing was established, resulting in improved conditions in schools throughout Texas attended by Latino and black children. In 1990 the state legislature passed a law mandating high-stakes assessment in the form of the Texas Assessment of Academic Skills (TAAS). The TAAS measures student achievement in the areas of reading, writing, mathematics, social studies, and science. In 1995 the State Board of Education adopted exit test requirements for students' graduation eligibility.

In El Paso a growing realization that existing reforms were not increasing the participation of all students in high-level courses, college and university enrollment, and graduation and other attainments prompted community leaders to create the El Paso Collaborative for Academic Excellence (Collaborative). In early 1992 the president of the University of Texas at El Paso brought together key stakeholders from El Paso's business and educational sectors. These leaders included the superintendents of the three largest school districts (El Paso Independent School District [ISD], Ysleta ISD, and Socorro ISD), the president of El Paso Community College, the heads of the two chambers of commerce, the mayor and the county judge, and the lead organizer of the El Paso Interreligious Sponsoring Organization (EPISO), a state-funded, faith-based organization, arguably the most active and effective grassroots community organization in the region. Together, they launched the Collaborative, a community-wide systemic reform effort aimed at improving the academic achievement of all students in El Paso, K–16.

Each school district participating in the Collaborative's work has continued to frame its own agenda for educational reform. For example, the Ysleta ISD, regarded as progressive and innovative, addressed the ninth grade dropout problem through a program of "small schools." In each of the district high schools teams of teachers work with groups of twenty-five freshmen that attend classes in areas of the building apart from upper classmen. In a recent year the Ysleta ISD reported dramatic results: of the 3,407 freshmen enrolled in district schools in 1999, 3,305

or 97 percent earned sufficient credits to become sophomores the following fall, compared to the Texas average of 82 percent (*El Paso Times,* 9/27/99). In the El Paso ISD parents hired as full-time employees serve as liaisons between the community and the school. El Paso ISD has seen a stunning reversal in dropout rates through an emphasis on close contact and careful monitoring by these members of the community. To develop its dropout programs, each district worked with faculty colleagues at the University of Texas at El Paso (UTEP). UTEP's visibility in the El Paso community has also been critically important to the Collaborative's work in implementing the El Paso USI.

  El Paso Urban Systemic Initiative.   The NSF's USI grant enabled the Collaborative to carry forward its commitment for systemic reform in the three largest school districts. During the summer of 1992 the Collaborative began a program of professional development activities with the establishment of the Teams Leadership Institute. The Institute brought together leadership teams for three days from the forty schools that volunteered to participate in the Collaborative. To qualify for participation, schools were required to meet conditions likely to sustain reform activities including carrying out initial assessments to determine patterns of student achievement and failure. Teams from each school were composed of seven to ten professionals including the principal, assistant principal, a counselor, and five to seven teachers. After assessing school needs, teams drafted preliminary action plans and methods for sharing information with school staff. Follow-up institutes were provided for three years. In addition, two-day institutes were held for principals and subject-matter institutes were held for teams of five to seven teachers from participating schools that also met for eight additional days during the school year. The Collaborative also provided on-site mentoring with experienced teachers sent to assist teachers in their classrooms as they introduce new curricula and make changes in their teaching practices.

  Because the Collaborative's work is administered though offices at UTEP, the three districts involved have been spared the problem of creating administrative structures for program delivery. Nonetheless, ranking district administrators in at least one of the districts, Ysleta ISD, see arrangements with UTEP as another layer in a bureaucratic system impeding the smooth and coordinated delivery of aligned programs in mathematics and science at the classroom level. It can also be argued, however, that in a context of unstable and volatile school district politics—all but one of the districts during the course of the initiative fired, suspended, or brought suit against an incumbent superintendent—the role of the Collaborative as an independent third party has been critical

in creating stability and consistency in the administration of the USI program.

Memphis

Memphis is Tennessee's largest metropolis and the eighteenth largest city in the United States. Memphis has the country's ninth-largest African American population, representing nearly 50 percent of the city's inhabitants (*Heritage Memphis Culture Guide*, p. 5). Overlooking the Mississippi River, Memphis is a major port, rail terminus, and marketing center serving the South's lumber, livestock, and cotton industries. Despite the economic decline in recent years, Memphis remains the capital of the mid-South and continues to be a magnet for economically disenfranchised people who leave their homes in the rural areas of Tennessee, Mississippi, and Arkansas.

Educational Reform in Memphis. Superintendent Gerry House implemented a multitude of reforms, including the USI, and spearheaded educational reform in Memphis from 1994 to 2000. The original reform agenda articulated in the Memphis proposal submitted to NSF to qualify for USI funding addressed the needs of both African American and white students. However, the district during this period witnessed the continued departure of white families (and students) to county school systems and the arrival of individuals and families of Latino and Asian descent. Individuals of Asian or Latino origin increased from 1.4 percent to 4.5 percent of the total population in the 1990s, and the increase is projected to continue. The students from these families bring the challenge of linguistic difference to a district that has not been focused on cultural and language variation until now. Since the mid-1990s conditions have improved for the staff and students of Memphis City Schools. The system is one of the few in the state fully accredited by the Southern Association of Colleges and Schools. Additionally, fewer children ages five to seventeen live in poverty, that number decreasing from close to 40,000 (representing 25 percent of children in this age category) to just under 39,000 or 21 percent of the overall population.

The year 2000 saw the resignation of the reform superintendent, the selection of a new superintendent who is native to the city and school district, and the initiation of a new conversation about the district's future. The departure of Superintendent House signaled a more measured approach to reform and a dramatic shift in emphasis. The new superintendent and native Memphian Johnnie Watson conducted what some viewed as a poorly designed study of the impact of school

reform models on student achievement and concluded that student performance had in some cases actually declined but at best had remained unchanged (Ross, personal communication, July 19, 2001). Beset with concerns about the large number of city schools making Tennessee's list of failing schools (twenty-six of the state's forty-eight), Superintendent Watson had little choice from his perspective but to target teaching and learning in new ways (Ross, 2001, August 19). His goals included the adoption of a districtwide curriculum to insure a similar approach to instruction in the district's schools. Although this strategy suggested a retreat from more creative and innovative approaches, it was also a hedge against negative impacts on highly mobile student populations in Memphis schools.

The Memphis Urban Systemic Initiative. The Memphis Urban Systemic Initiative (MUSI) decentralized the system's organizational structure from four subdistricts to twelve clusters containing twelve to fifteen schools coordinated by an instructional administrator reporting to the USI director. A major focus of MUSI was the elimination of all low-level science and mathematics courses, beginning at the high school level, and moving progressively down through the lower grades. Another focus was professional development for all teachers in all schools. According to Memphis reports, a total of 112,000 (100 percent) of elementary, middle, and high school students were learning mathematics and science in classrooms that were directly supported by the MUSI.

Miami-Dade County

Miami, Florida, is a city that has captured the imagination and interest of politicians, entertainers, investors, and others during much of the twentieth century, an interest that intensified in the 1990s. During this period, immigrants from Latin America and the Caribbean who settled in Miami transformed the city. The schools as well as political and economic institutions have been dramatically affected (Stepick, Grenier, Castro, and Dunn, 2003).

Immigrant power, according to Stepick and his colleagues (2003), is a reality in Miami where "Latinos' political presence combined with their economic and cultural ascendancy challenge the corporate leaders' earlier hegemony in setting the local agenda" (p. 35). By the year 2000 Miami's Latino population had "made Miami the economic and transportation gateway of the Americas" (p. 20) despite having only 5 percent of the nation's total Latino population. In fact, more than 40 percent of the largest Latino-owned businesses in the U.S. are located here.

In the wake of the 2000 national elections the U.S. president and political parties in general are reaching out to Latinos, especially those in Florida, the site of political angst and chaos in the presidential contest. This process is pervasive throughout the nation. Latino candidates ran for mayor in many of the nation's major cities in 2001, and, although they lost in the largest three (New York, Los Angeles, and Houston), this political activity sets the stage for a new generation of Latino municipal leadership. Latino candidates also campaigned for statewide offices in several states in the 2002 elections. This new centrality of Latinos to national, state, and local politics has both substantive and symbolic dimensions. Even at the symbolic level, the outreach represents a significant improvement over the neglect that Latinos have experienced in most previous elections. The current political power of Latinos is critical in understanding Miami-Dade's recent history as well as the histories of El Paso and Chicago.

The Miami-Dade County public school system is the fourth-largest school system in the nation and the largest countywide district in Florida. Miami-Dade County is home to a culturally mixed population, of which two-thirds of its citizens are of Cuban heritage. While individuals enumerated in the 1990 census came primarily from Cuba and other Spanish-speaking islands in the Caribbean, new residents hail from Brazil, Argentina, Honduras, and other countries in South and Central America. These newcomers bring diversity in cultures and lifestyles, as well as a diversity of prior educational experiences. In the 2000 census the city of Miami reported the largest percentage (61 percent) of nonnative residents of any U.S. city. In addition, Miami-Dade, like Chicago, presents a complex economic landscape with highly impoverished neighborhoods located city blocks from expensive high-rise condominiums. Although the relative size of the population of youth ages five to seventeen living below federal poverty levels actually grew from 75,703 to 91,715 between 1990 and 2000, this number actually represented a decline from 23.6 percent of that population to 22.7 percent.

A defining moment for the city of Miami came in 1959 with Fidel Castro's takeover of Cuba. Opposition to Castro's transformation of the island nation into a Marxist state led to an exodus of Cubans to Miami-Dade beginning in 1965 with U.S.-sponsored "Freedom Flights." During the spring of 1980 the Cuban Mariel Boatlift carried 125,000 refugees to the south end of Miami Beach seeking asylum and a new life, and also ushered in an unprecedented influx of refugees from Haiti, Nicaragua, and elsewhere in the Caribbean. By the end of the 1980s the Cuban refugee population dominated the city's political and social landscape. During the 1990s Miami-Dade's large Cuban population—whose countywide numbers exceeded 600,000—was actively

engaged in the political process, holding dominant positions in the city government and school district board, showing the demographic changes in Miami-Dade since the 1990 census.

Educational Reform in Miami-Dade. In 1986 Miami-Dade County Public Schools implemented a plan for school-based management and shared decision making that gave local schools increased control over their own budgeting, resource allocation, and curriculum. This restructuring was similar to efforts in site-based decision making that took place in Chicago at the same time. Indeed, structural changes in 1996 reshaped school board elections and patterns of representation. Single-member district elections enhanced the representation of African Americans on the school board and fostered a decentralization movement leading to both central office staff downsizing and school site administrator power enhancement. However, by 1989, it became clear that these decentralization reform efforts in Miami-Dade affected organizational structure much more than instructional processes. Student achievement, school completion, and attendance remained low (Rungeling and Glover, 1991).

Miami-Dade County Urban Systemic Initiative. In 1993 Miami-Dade County Public Schools applied for NSF's Urban Systemic Initiative funding, planning to involve every school and all district students in improving mathematics and science achievement by the end of the third year of the initiative. Using NSF funding in conjunction with other federal resources (for example, Title II Eisenhower mathematics and science funds), the Miami-Dade USI aimed to strengthen content and instruction, enhance student learning, coordinate resources, and establish equitable practices in school mathematics and science. It also intended to make connections with community partners to link mathematics and science learning to real-world issues and careers.

School Selection

Within each site, elementary, middle, and high schools were selected in a three-step process, in consultation with our site coordinators, our Technical Advisory Network,[1] and USI project staff at the sites. The goal of the school sampling process was to obtain samples of schools that: (1) were reasonably representative of the school district; (2) evidenced substantial variability in the extent to which the schools participated in the USI reform initiatives; and (3) were likely to present limited confounding of driver variability with variability in other, extraneous variables. A total of twenty elementary schools, fifteen middle schools, and twelve high schools across the four cities participated in our research. The forty-seven schools included in our study were

located in all parts of the four cities. In Chicago, for example, the six elementary schools were scattered throughout the city's six regions, from the South side, close to Indiana, to Uptown in the north.

Teacher Selection

Five teachers were selected for in-depth study within each of the sampled schools. Initially, we attempted to select teachers who represented subject areas of mathematics and science, who represented a variety of grade levels in each school, and who had at least five years of teaching experience at the sampled school. Ultimately, 230 teachers were selected using the following criteria: (a) teachers who had appropriate certification; (b) teachers in the original sample who had been teaching at the school for more than three years; and (c) teachers who were willing to participate in the study throughout its three-year duration. Additionally, we selected teachers to insure representation by gender and ethnicity in the sample. Finally, the research team selected teachers at grade levels three through five at the elementary level and selected teachers of algebra and biology ("gateway" courses) at the secondary level whenever possible. This was done to insure inclusion of teachers whose students were likely to be taking state- and district-mandated tests. Table 1.3 presents demographic information for participating teachers. These teachers were highly experienced; the majority had twelve or more years of teaching experience. The representation of females (70 percent) to males (30 percent), while unbalanced, reflects the distribution of the teacher population. These teachers were ethnically diverse across the sites and their diversity varied by city. For example, in El Paso, the majority (60 percent) of teachers are Latino.

Data Collection and Analysis

A variety of data collection procedures were employed in this study to obtain information from key individuals involved in the process of systemic reform, including individuals from the community, representatives from the district, school-level leaders, teachers, and students. Methods used to collect these data included classroom observations, interviews, surveys of teachers and students, experience sampling, and archival document review. We used qualitative and quantitative methods to analyze the myriad of data that was collected. Table 1.4 provides the methods of collecting data, the various sources used to collect that data, and the primary modes for analysis. See Appendix A for a detailed description of the instrumentation.

Table 1.3.
Characteristics of Participating Teachers

	Chicago		El Paso		Memphis		Miami-Dade		Total	
	n	%	n	%	n	%	n	%	n	%
Gender										
Male	18	36	19	38	10	16.7	22	31.4	69	30
Female	32	64	31	62	50	83.3	48	68.6	161	70
Total by Site	50		50		60		70		230	
Race/Ethnicity										
Caucasian	18	36	14	28	23	38.3	32	51.4	91	39.6
African American	27	54	3	6	37	61.7	22	31.4	89	38.7
Latino	2	4	31	62	0	0	12	17.4	45	19.6
Asian/Pacific Islander	0	0	1	2	0	0	0	0	1	0.4
Multiracial/Other	3	6	1	2	0	0	0	0	4	1.7
Years teaching										
1–2 Years	0	0	3	6	4	6.7	1	1.4	8	3.5
3–5 Years	2	4	6	12	6	10	9	12.9	23	10.0
6–8 Years	1	2	11	22	7	11.7	9	12.9	28	12.2
9–11 Years	3	6	3	6	3	5.0	6	8.6	15	6.5
12+ Years	32	64	25	50	34	56.7	43	61.4	136	58.3
Missing Data	10	24	2	4	6	10	2	2.9	20	9.6
Years in Present School										
1–2 Years	3	6	14	28	7	11.7	3	4.29	27	11.7
3–5 Years	2	4	12	24	18	30.0	14	20.0	46	20.0
6–8 Years	5	10	8	16	7	11.7	14	20.0	34	14.8
9–11 Years	4	14	3	6	8	13.3	9	12.9	27	11.7
12+ Years	13	26	12	24	15	25.0	29	41.4	69	30.0
Missing Data	20	40	1	2	5	8.3	1	1.4	27	11.7

Table 1.4.
Data Sources and Analysis Procedures

	Sources	*Analysis Procedures*
Documents	NSF performance evaluation reviews, NSF end of year reports, School improvement plans	District and school documents were organized and analyzed using data matrices and coded scoring criteria to inform the Structural Equation Model (SEM).
Interviews, Focus Groups, Questionnaires	District level officials, principles community members teachers, students	Interview and focus group data were audiotaped, transcribed, and analyzed long with open-ended items from e-mail correspondence with teachers using qualitative data analysis procedures (Miles and Huberman, 1994). Typically, multiple researchers read the data to identify categories, themes, and emergent patterns. In some cases, participant responses were placed on matrices to facilitate cross-case analysis. Some categories identified in this fashion cut across all sites while others were specific to an individual school or research site.
Surveys	Teachers, students	Individual surveys were analyzed using a variety of quantitative data analysis procedures that include cluster analysis, factor analysis, Rasch modeling, and Structural Equation Modeling.
Observation	Classrooms	Observations were analyzed using two instruments: the classroom observation checklist and the authentic instructional practices coding matrix.
		The checklist uses mathematics and science standards, as well as components of other instruments designed to identify five mathematics and science standards-based practices (Sykes, 1999; National Council TM, 1991; NRC, 1996). All observations were coded using the Authentic Instructional Practices Coding Matrix developed using two major sources: Authentic Instruction Classroom Observation Form (Borman, Rachuba, Datnow, Alberg, MacIver, Stringfield and Ross, 2000;

(continued)

Table 1.4.
(continued)

Sources	Analysis Procedures
	D'Agostino, 1996), and the Secondary Teacher Analysis Matrix (Simmons, Emory, Carter and Coker, 1999). This Coding Matrix is composed of four categories: classroom discourse, social support, student engagement, and lesson coherence.
Student Achievement Data	State assessments (TAAS, FCAT)

Student Achievement Data	State assessments (TAAS, FCAT)	Quantitative data obtained from the variety of sources described in this chapter were integrated into a multilevel structural equation model. The type of model employed for this analysis represents a combination of traditional structural equation modeling (used for the identification of potential causal relationships among latent variables) and hierarchical linear modeling (used for modeling relationships among nested factors).

RESEARCH ON SYSTEMIC REFORM

The research undertaken in our four urban sites with large numbers of participants at multiple school and grade levels engaged the efforts of a large and diverse team. Our approach emphasized the use of a mixed-methods design and a complex array of surveys, interviews, classroom observations, focus group protocols, and a considerable amount of time in the field in schools, classrooms, district offices, and stakeholder workplaces and homes. The result is that our findings are as rich and complex as the methodological approach we have outlined in this chapter. A major assumption underlying this work is that whole scale reform in science and mathematics requires a program of research that is multifaceted and multilevel. Thus, as shown in Table 1.4, we undertook archival research by analyzing documents including annual school improvement plans and progress reports as well as undertaking interviews with teachers, principals, superintendents, and their staffs, and community-based stakeholders in addition to carrying out extensive observations in countless classrooms in the forty-seven schools included in this study. In the remaining chapters of this volume we tell the story of how systemic reform was implemented in the four sites by considering the multiple levels and actors at each level who had a role in carrying out USI programs in their districts.