

Chapter 13

National Science Foundation Systemic Initiatives:

How a small amount of federal money promotes ill-designed mathematics and science programs in K-12 and undermines local control of education

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Since its inception in 1950, the National Science Foundation (NSF) has played a strong, positive role in making American scientific research and technological application the best in the world. Through its funding of peer-reviewed, investigator-initiated research proposals, it has supported basic research in a wide variety of scientific disciplines, such as mathematics, biology, physics, chemistry, geology, astronomy, and psychology. American science owes much to the support it has received, and continues to receive, from NSF. This chapter deals with a program in the Education and Human Resources Division called the NSF Systemic Initiatives Program, not with NSF programs related directly to the support of basic research. We are highly critical of this particular NSF program. Not only do the Systemic Initiatives undermine local control of education, but, as our analysis in this chapter suggests, they also seem to lower academic standards for mathematics education and weaken the educational base for American science.

This chapter is composed of three sections. The first section, an overview of NSF Systemic Initiatives, was written by Michael McKeown. The second section, an analysis of the development and

features of the Los Angeles Systemic Initiative, was written by David Klein. The third section, an analysis of the development and features of the Texas Statewide Systemic Initiative, was written by Chris Patterson.

Problems Raised by the NSF Systemic Initiatives

A private individual comes to the principal of a school and offers to pay \$5 per student to help students improve in mathematics and science. Although this is a minuscule amount (\$100 to \$150 per classroom), it sounds appealing. But there is a catch: The donor makes it clear that he will insist on a complete revamping of the way the school teaches mathematics and science, including the choice of textbooks, the school district's academic standards, and possibly even its graduation standards. Of course, he won't buy the textbooks or allow public discussion of the methods of instruction he thinks are appropriate. He will let his money be used only if the school district undertakes to implement everything he has spelled out. Should the school take the money (about 0.1% or less of the true cost of running the school)? Of course not.

Now substitute the federal government for a private donor, and a state education agency or an urban school district for a single school, but keep all the other conditions in place, including insistence on changes in key educational policies for a minuscule financial contribution. Should the state or school district take the money? In a hypothetical world, the answer should still be "No." But in the real world, the answer has been "Yes" for 24 states and 22 major urban school districts (see Table 1). Each of these states and school districts accepted a NSF Systemic Initiative grant to make "fundamental, comprehensive, and coordinated changes in science, mathematics, and technology education through attendant changes in policy, resource allocation, governance, management, content and conduct."¹ NSF wants changes in all these areas in order for schools to achieve the kind of "systemic reform" it has in mind.

Table 1. State and Urban Systemic Initiatives*State Systemic Initiatives*

Arkansas	California	Colorado	Connecticut	Delaware
Florida	Georgia	Kentucky	Louisiana	Maine
Massachusetts	Michigan	Montana	Nebraska	New Jersey
New Mexico	New York	North Carolina	Ohio	South Carolina
South Dakota	Texas	Vermont	Virginia	

Urban Systemic Initiatives

1994

Baltimore	Chicago	Cincinnati	Detroit
El Paso	Miami	New York	Phoenix

1995

Cleveland	Columbus	Dallas	Fresno
Los Angeles	Memphis	New Orleans	Philadelphia

1996

Milwaukee	San Antonio	San Diego	St. Louis
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1998

Atlanta	Jacksonville
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The nature and scope of the policy changes that the NSF Systemic Initiatives Program is enticing state and local educational systems to adopt raise two broad questions that need far more open discussion than they have so far received. The first concerns the federal government's unpublicized assumption of what have historically been local educational responsibilities and the way in which it is assuming them. The second concerns the value or effectiveness of the science and mathematics programs, policies, and curricular materials that this NSF program expects state and local school districts to adopt as the condition for securing its funds. In this chapter, we show how the NSF Systemic Initiatives Program enables employees of a federal agency to foreclose further state and local educational decision making on matters of curriculum and pedagogy, without broad public examination and discussion of their educational philosophy. We also describe the serious deficiencies in the instructional programs and materials this program is promoting.

Foreclosing State and Local Control of Curriculum and Instruction, and Redirecting Educational Resources

School districts throughout the country, especially urban districts, are strapped for funds. Growing student populations, increases in the proportion of at risk students, increases in the services expected of schools, increasing salaries of aging teachers and administrators, and deteriorating facilities all put pressure on school budgets and on the money available for new classroom materials and continuing professional development of the teaching force. In such a situation, any money outside the usual sources of funds that may increase the available budget is highly valued. Eagerness by school administrators for additional outside money creates a great deal of leverage for those who can supply these highly coveted marginal dollars. An external funding agency seeking specific changes in a school district's educational policies, programs, and curricular materials may be able to make the granting of its funds contingent upon the district's meeting the agency's conditions.

Traditionally, education in the United States has been a responsibility of states and local school districts. The federal government played a relatively minor role in educational matters until Congress passed the National Defense Education Act in 1958 and other legislation in the 1960s as part of President Johnson's War on Poverty. Even today, it makes a small financial contribution relative to the funds raised locally to support the public schools. NSF itself has made no attempt until recently to change and redirect the entire network of educational policies in a state or school district; the mathematics and science programs that it helped develop before and after Sputnik in the 1950s were made available to the schools without strings attached.

The relationship between NSF and state and local school systems began to change in the late 1980s because the national government sought to bring about a series of changes in local school systems that it believed would improve mathematics and science education in the country. At the 1989 Education Summit attended by President Bush and all 50 governors, participants made a commitment to make U.S. students first in mathematics and science by the year 2000.² As its contribution to that goal, NSF launched its first Statewide Systemic Initiatives (SSIs) in 1991 to achieve systemic reform in a number of target states. In 1994 the first Urban Systemic Initiatives (USIs) appeared, followed by the Rural Systemic Initiatives (RSIs). Funding for the SSIs peaked in 1993,

and the bulk of funding currently goes to the USIs. In 1999, the approximate funding levels are \$21 million for the SSIs, \$86 million for the USIs, and \$10 million for the RSIs.³

In general, the SSIs contribute approximately \$2 million per year to state education departments, while the USIs contribute \$3 million per year to local districts. At first glance, a contribution of \$3 million a year to an urban school district seems a major boon, but when the actual per student support is calculated, it becomes clear how small a fraction of actual costs is covered by NSF funds. For example, in San Diego, with 130,000 students, USI funding averages \$23 per student, about one half of one percent or less of total costs. In the larger Los Angeles school district, per student support is less than \$4. This is like a 4 cent saving on a \$50 purchase. Yet, the amount seems to be large enough to seduce school districts into making substantial changes in programs and policies as the condition for receiving NSF funds. This small amount of money, in effect, enables the federal government to shape or reshape state and local educational policies and direct use of their resources even though local and state taxpayers are footing most of the bills.

The use of NSF money at the margin of the budget to leverage systemwide changes in educational policies and programs at the state or local level is not an inadvertent consequence of well intentioned programs; it is NSF's plan. Luther Williams, Assistant Director for Education and Human Resources and a microbiologist by training, made that clear in a July 1998 USI Summary Update.⁴

The NSF investment that promotes systemic reform will never exceed a small percentage of a given site's overall budget. The 'converged' resources are not merely fiscal, but also strategic, in that they help induce a unitary...reform operation. The catalytic nature of the USI-led reform obligates systemwide policy and fiscal resources to embrace standards-based instruction and create conditions for helping assorted...expenditures to become organized and used in a single-purpose direction.

Williams goes on to spell out exactly how districts have redirected other resources to meet the conditions of the USI grant: "Cleveland devoted half of its available bond referendum funding" for USI-related instructional material. "Los Angeles...is one of several cities in the USI portfolio that places all Title II funding resources under the control of the USI." "In the Fresno Unified School System, \$31 million of Title 1

funds have been realigned in support of USI activities.” It is clear that Williams both seeks and approves of use of school district funds to support Systemic Initiative programs.

It is not unreasonable, and it is often desirable, for the federal government to attach guidelines for the use of the funds it makes available to states and local communities for many purposes. That this NSF program mandates a particular direction on matters for which the federal government does not have educational responsibility—matters of curriculum and pedagogy—becomes clear when there is deviation from, or opposition to, what this program sees as fundamental components of its notion of systemic reform. These components include the *particular* sets of K-12 science and mathematics standards that this program favors: those created by the National Council of Teachers of Mathematics (NCTM), the American Association for the Advancement of Science (AAAS), and the National Research Council (NRC). The problem is not that this program requires school districts across the country to use academic standards in the redesign of science and mathematics programs for K-12. The problem is that this NSF program implicitly if not explicitly mandates the use of certain sets of standards instead of others (including those developed by the states themselves), as well as certain curricular, instructional, and classroom management practices instead of others.

That this NSF program is attempting to impose its administrators’ beliefs about what they think is best for the students in our public schools with respect to standards, pedagogy, and curriculum was clearly revealed in 1997 when the California Board of Education adopted a new set of statewide mathematics standards.⁵ As we discuss below in the context of the Los Angeles Systemic Initiative, these grade-by-grade standards are clear, demanding, and free of pedagogical mandates. That is, they are open to a complete range of pedagogical strategies. They are also easily measured and enjoy widespread support from the public as well as from mathematicians and scientists. Nevertheless, in December 1997, Williams sent a sharply worded letter to the California Board of Education with an implicit threat to withdraw \$50 million worth of NSF funding to districts in the state unless the Board rejected this set of mathematics standards (Appendix A). California’s Board refused to yield to Williams’ threat, and his superior, Neal Lane, Director of the National Science Foundation at the time, sent a letter in January 1998 reinterpreting and downplaying Williams’ threats (Appendix B), possibly

in response to questions raised about Williams' letter in the press and in Congress.

Although California's Board of Education stood firm against Williams' attempt to direct state policy on matters of pedagogy, curriculum, and standards, in other states NSF-funded programs are clearly in control of the development of educational components that have traditionally been state and local responsibilities. For example, in Texas, the SSI not only uses its \$2 million per year to develop the state mathematics and science frameworks, it "assumed responsibility for the management and redesign of the state's discretionary K-12 Eisenhower Program," and it explicitly and specifically mirrors the NSF itself by creating "novel incentive programs to encourage (1) school districts to redeploy their Title 1 and Compensatory Education funds to support implementation of Standards-compatible integrated math, science and literacy curricula; and (2) higher education faculty to link their educational activities more closely to the state's reform agenda." In Texas, NSF has empowered a new bureaucracy that is using the leverage of NSF money not only to take charge of state education programs and policies but also to steer the state, school districts, and the faculty at the state's universities in particular educational directions with respect to pedagogy and curriculum.⁶ The third section of this chapter offers further details on the Texas SSI.

Thus, without public discussion and with little fanfare, NSF Systemic Initiatives have turned on its head the process by which state and local school policy decisions on matters of standards, curriculum, and pedagogy are made. Whereas decisions were previously made in states and local districts by local citizens subject to election and recall, they are now made by federal employees who are essentially anonymous and not accountable to the people who are most affected by their actions.

Promoting Educational Policies and Programs of Unproven Efficacy

The reforms "encouraged" by the NSF Systemic Initiatives program bear as close examination as does the way in which its state, urban, and rural initiatives use their funds to leverage control of decision making on what have traditionally been state and local educational matters. There are good reasons even for those favoring a larger role for the national government in the effort to improve mathematics and science education

in this country to oppose the particular educational components promoted by the Systemic Initiatives program.

Like most educational programs, the Systemic Initiatives began in response to real problems and serious problems, in this case the low academic performance of American students in mathematics and science, and the notable achievement gap between certain minority students (chiefly African American and Hispanic) and other students. Although the general educational philosophy underlying the Systemic Initiatives program had long been supported by NSF, the initial SSIs were given substantial freedom to develop their own strategies for reform. As the program evolved, the guidelines became more and more explicit, culminating in 1996 with the release of what NSF calls the “Six Drivers” of systemic reform:⁷

Driver 1: Rigorous, standards-based instruction for all students, and the curriculum, professional development, and assessment systems to support that instruction.

Driver 2: A unified set of policies that facilitate and enable Driver 1.

Driver 3: A unified application of all resources to facilitate and enable Driver 1.

Driver 4: Mobilization of the full community of stakeholders on behalf of facilitating and enabling Driver 1.

Driver 5: Increased student attainment in science, mathematics, and technology.

Driver 6: Reduction in attainment differences between those traditionally underserved and their peers.

Taken at face value, it is hard to disagree with these “drivers,” especially Drivers 5 and 6, the long-range educational goals. Of the other four items, Driver 1 is the primary operational statement, all the rest support Driver 1. Thus it is critical to understand exactly what is meant by Driver 1 in order to understand the nature of the Systemic Initiatives program. Fortunately, this release elaborates what it means by “standards-based instruction,” as well as what it views as effective instructional practice, allowing the public to judge if the NSF educational vision is what it wants. It contains the following pedagogical beliefs “based on an understanding that learning is an active process wherein the learner is the full participant, not a passive recipient:”

- All children can learn by using and manipulating scientific and mathematical ideas that are meaningful and relate to real-world situations and to real problems.

- Mathematics and science are learned by doing rather than by passive methods of learning such as watching a teacher work at the chalkboard. Inquiry-based learning and hands-on learning more effectively engage students than lectures.
- The use and manipulation of scientific and mathematical ideas benefits from a variety of contributing perspectives and is, therefore, enhanced by cooperative problem-solving.
- Technology can make learning easier, more comprehensive, and more lasting.
- This view of learning is reflected in the professional standards of the National Council of Teachers of Mathematics, the American Association for the Advancement of Science, and the National Research Council of the National Academy of Sciences.

As these statements make clear, NSF expects Systemic Initiative awardees to implement programs that emphasize group-based discovery learning, the use of “manipulatives” (items such as blocks, beads, and dice in mathematics class), and the use of technology, such as calculators. Although this list of pedagogical desiderata is devoid of reference to actual mathematical or scientific content, the final bulleted item makes clear that the NSF view of appropriate pedagogy comes from, or is supported by, the standards documents put out by NCTM, as well as AAAS and NRC. In order to judge the quality of this NSF program, therefore, we need to know more about both the instructional methodologies it endorses and the quality of the standards it uses to define academic content.

From NSF’s willingness to mandate specific instructional practices, one might be tempted to conclude that there is a clear consensus among cognitive psychologists, supported by well-designed, large-scale studies, that these practices are head and shoulders above all others. This is not the case. Not only is there no research-based consensus to this effect, cognitive psychologists do not believe there are substitutes in mathematical learning for practice and for a well thought through sequence for instruction based on the structure of the discipline, not events in the outside world or students’ idiosyncratic interests. As Steven Pinker, a noted neuroscientist at MIT, discussed in his book *How the Mind Works*:⁸

The...way to get to mathematical competence is similar to the way to get to Carnegie Hall: practice. Mathematical concepts come from snapping together old concepts in a useful new arrangement. But those old concepts are assemblies of still older concepts. Each subassembly hangs together by the mental rivets called chunking and automaticity: with copious practice, concepts adhere into larger concepts, and sequences of steps are compiled into a single step. Just as bicycles are assembled out of frames and wheels, not tubes and spokes, and recipes say how to make sauces, not how to grasp spoons and open jars, mathematics is learned by fitting together overlearned routines. Calculus teachers lament that students find the subject difficult...because you can't do calculus unless algebraic operations are second nature, and most students enter the course without having learned the algebra properly and need to concentrate every drop of mental energy on that. Mathematics is ruthlessly cumulative, all the way back to counting to ten.

The ascendant philosophy of mathematical education in the United States is constructivism, a mixture of Piaget's psychology with counterculture and postmodernist ideology. Children must actively construct mathematical knowledge for themselves in a social enterprise driven by disagreements about the meanings of concepts. The teacher provides the materials and the social milieu but does not lecture or guide the discussion. Drill and practice, the routes to automaticity, are called "mechanistic" and seen as detrimental to understanding.

(Constructivism) ignores the difference between our factory-installed equipment and the accessories that civilization bolts on afterward. Setting our mental modules to work on material they were not designed for is *hard*. Children do not spontaneously see a string of beads as elements in a set, or points on a line as numbers...and without practice that compiles a halting sequence of steps into a mental reflex, a learner will always be building mathematical structures out of the tiniest nuts and bolts, like the watchmaker who never made subassemblies and had to start from scratch every time he put down a watch to answer the phone.

Not only does the NSF program directive explaining Driver 1 ignore, if not downgrade, all traditional forms of learning such as practice, it also ignores, if not downgrades, the benefits of teacher-directed whole class instruction. Nevertheless, reviews of mainstream research that include 1) studies comparing alternative teaching methods, 2) basic research in cognition, learning, and other areas of cognitive psychology, and 3)

international comparisons suggest that methods other than those encouraged by NSF are more effective. These more effective methods include teacher-directed whole class instruction, clarity in the goals of each lesson and the key points of the lesson, clarity in presentation, review, repetition, rapid feedback, and practice.⁹ Whether or not NSF-advocated methods are effective in some situations, there is no research-supported consensus establishing them as integral components of a de facto national curriculum in mathematics and science education, never mind as the sole components.

Just as the NSF Systemic Initiatives Program has chosen to endorse a particular set of instructional methods and effectively excluded all others, it has chosen to endorse particular sets of “standards” to address the content of science and mathematics. In mathematics, as we have seen, NSF puts the NCTM standards on a pedestal. This endorsement has led to a particularly confusing situation. Advocates of “systemic reform” in mathematics usually use the words “standards-based” to refer not just to the disciplinary content of the NCTM standards but also to the pedagogical principles recommended in this standards document. These pedagogical principles emphasize the value of guessing rather than getting right answers, favor learning based on student interest and inquiry instead of on direct instruction, and de-emphasize the learning of mathematical content in favor of empty reasoning processes. Thus, a phrase that once had a limited but clear meaning pointing mainly to disciplinary content in mathematics has come to refer to an educational philosophy encompassing particular pedagogical approaches and curricular configurations. This is what the “standards-based” learning promoted in Driver 1 now entails. This confusion can, intentionally or unintentionally, mislead educated people into supporting “standards-based” programs that they might not favor if they understood everything “standards-based” brings in its wake. As the standards wars in California have demonstrated, many people can support a K-12 curriculum in mathematics based on a set of clear and demanding content standards and at the same time reject a curriculum promoting only the specifics of Driver 1.

As the above discussion suggests, it is important to note some of the details of the NCTM standards because they define the content of NSF-advocated mathematics programs. The NCTM standards are striking in a number of ways.¹⁰ First, they differ substantially from previously accepted ideas about needed mathematical content. This is most notable

in the “less emphasis” lists. These are lists of mathematical content that NCTM feels should be given “less emphasis” in school mathematics. These de-emphasized items include the teaching of traditional algorithms for basic arithmetical operations, paper and pencil calculation, logical deduction and proof, and analytical methods in general. The actual content standards of the standards also contain few clear statements about what students should know, do, and understand at any level. They apply to gradespans, not individual grades, virtually guaranteeing curricular differences from school to school and from program to program. The content standards that are there tend to be loosely worded and speak in broad generalities rather than mathematical specifics. Finally, the NCTM standards are dedicated to inquiry-based learning and the constructivist philosophy described under Driver 1 and in Pinker’s comments. Just as the classroom practices promoted by Driver 1 have been criticized, so, too, have the NCTM standards been criticized, by parents,¹¹ mathematicians,¹² and others knowledgeable about mathematics education.¹³ In striking contrast, as we noted earlier, California’s new Mathematics standards offer standards that are specific to each grade, clear as to mathematical content, and devoid of pedagogical imperatives.¹⁴

What the NSF vision for mathematics means in the classroom can be seen in the textbooks and instructional programs that it “encourages.” Table 2 lists “NSF-approved” programs for the New York City USI,¹⁵ as well as additional programs advocated by the Los Angeles USI. Nearly all of these programs are committed to an extreme version of discovery learning, a constructivist philosophy, and a radical interpretation of the NCTM standards, including constant availability of calculators starting at kindergarten, extreme de-emphasis of paper and pencil calculation, and de-emphasis of analytical and deductive methods. Although these programs are strongly supported by some teachers, they have also generated significant public outcry from parents, especially those who actually know mathematics and use it in the real world.¹⁶

For example, *MathLand*, an elementary school program, lacks student texts and does not present standard algorithms for multiplication and division in any of the elementary school grades. It relies heavily on calculators, and has a near total commitment to discovery learning, including “invented algorithms” for multiplication and division.¹⁷ When it was implemented in the Department of Defense Overseas Schools, which serve approximately 81,000 students, there was an immediate and

Table 2. NSF-Approved Mathematics Curricula as Reported by the New York City USI**Elementary**

Investigations in Number, Data, and Space (Dale Seymour Publications)
VOYAGER, A Mathematical Journey Using Science and Language Arts (Voyager Expanded Learning, Inc.)
Everyday Mathematics (Everyday Learning Corporation)
MathLand (Creative Publications)
Real World Mathematics (Addison Wesley Longman)

Middle School

Grade 7 Algebra
Connected Mathematics Program (Dale Seymour Publications)
Seeing and Thinking Mathematically, MathScape (Creative Publications)
Math in Context: A Connected Curriculum (Britannica Educational Corporation)
Six Through Eight Mathematics (STEM) Math Themes (McDougal-Littell/Houghton Mifflin)
Mathematics Through Applications Projects (IRL, MMAP Project)

High School

Applications/Reform in Secondary Education (ARISE) (Consortium for Mathematics and Applications)
Interactive Mathematics Project (IMP) (Key Curriculum Press)
Core-Plus Mathematics Project (Everyday Learning Corporation)
Math Connections (The Learning Team)

Additional High School Programs Approved for Use by the Los Angeles USI

College Prep Math (CPM) (College Prep Math)
Integrated Math (McDougal-Littell/Houghton Mifflin)

significant drop in student performance across all ethnic groups and an *increase* in the gap between the scores of white and Asian students and those of students of other ethnic groups.¹⁸ A similar drop in test scores took place after the introduction of *MathLand* into the Santa Barbara, California schools. *Investigations in Number, Data and Space*, another elementary school program, also lacks student texts, is completely committed to discovery learning and invented algorithms, and does not teach second grade students how to do such critical mathematical operations as borrowing and carrying when adding and subtracting.¹⁹

At the middle school level, NSF-approved programs continue to be committed to discovery or project-based learning and give students insufficient or inadequate materials with which to acquire the skills and

knowledge necessary for success in algebra 1, the key course in a high school mathematics program. *Connected Mathematics Program* is one such middle school program. Although some key topics that are prerequisites for algebra receive some coverage, the amount of time spent on irrelevancies (such as writing in journals about imaginary bicycle trips) is so high that the depth and practice of what is important is limited. The program's worth is further eroded by the constant availability of calculators, which eliminates the need for students to understand key concepts and manipulations.²⁰ The threat of introducing this program contributed to a parent uprising in at least one school district.²¹

At the high school level, there is a continuing emphasis on discovery learning and a significant de-emphasis of algebraic skills and logic. Indeed, one program, *Interactive Mathematics Project*, has candidly noted that all items listed for "less emphasis" in the NCTM standards, such as manual calculation and proof, were completely eliminated.²² Many key topics are presented in ways that are unlikely to lead to a high level of mastery, while introduction of the quadratic formula, a topic fundamental to high school algebra, is delayed until the twelfth grade.²³ *Integrated Math 1, 2 and 3* has been criticized as being seriously lacking in key content areas, ill-designed for mastery learning, full of contrived problems, and unlikely to prepare students for mathematics-based science courses or college mathematics.²⁴ The *Core-Plus Mathematics Project* generated massive resentment among the students who were the experimental subjects during early implementation. Many students found themselves ill-prepared for college, even though they came from highly educated homes and had a high likelihood of success.²⁵

What Accounts for the Support of Unproven Educational Ideas?

The emphasis on constructivist pedagogical methods by NSF and NCTM, as well as by the authors of Systemic Initiative-approved instructional programs, raises the question why so many people in so many groups can support them in the absence both of a large body of consistent evidence from high quality research *and* a national consensus on what is educationally effective. If, as we suggest, these methods are flawed, why do they receive so much support from so many educators? An analogy with the attitudes of many educators toward the constructivist counterpart in reading instruction—Whole Language—may be useful. An approach to beginning reading that

encourages context-based guesswork, Whole Language was strongly supported by reading educators in the schools and teachers colleges in the 1980s and became the favored approach to beginning reading in schools of education by the 1990s, to judge by the conference proceedings, professional publications, and public pronouncements of the International Reading Association and the National Council of Teachers of English, the two major organizations for reading teachers. Whole Language came to be seen as an ill-advised approach to beginning reading only after a whole generation of children fell short in reading skills and a large number of mainstream reading researchers and linguists showed not only that its theoretical base was flawed but also that there was little methodologically sound research to support it. Even so, many educators continue to stress a Whole Language approach and downplay the usefulness of systematic phonics instruction in beginning reading.²⁶ Thus, we note that many educators have been advocating and implementing constructivist pedagogical methods in other subject areas as well in mathematics and science education without a body of sound research evidence to support them.

Although one cannot read the minds of others, there are reasons why constructivist ideas about learning are promoted so regularly and enthusiastically in this country. As E.D. Hirsch notes, romantic ideas about how children learn have a century-long history in our education schools.²⁷ America is particularly partial to constructivist ideas in education because the image of the creative and even iconoclastic individual is very much a part of our national identity. What could be more American and more liberating than discovering for oneself, in one's own way, the great ideas of mathematics and science? That this philosophy fails in the classroom and leaves students unprepared for truly creative problem solving at high levels does not seem to reduce its appeal.

A second reason for the strength of constructivist methods in education is more disturbing. A current strain of thought suggests that non-Asian minorities and women need to be taught in ways involving less emphasis on deductive and analytical methods and more emphasis on inductive, intuitive, constructivist methods because of gender and racial/ethnic differences in learning. As one example, in a radio discussion associated with NCTM's 1996 annual meeting, Jack Price speaking in his role as NCTM President commented that "women, for example, and minority groups do not learn the same way" as "Anglo

male(s).” “(T)hey learn differently.” In clarification of his remarks, Price went on to reinforce stereotypic views of men, women, and minorities: “males, for example, learn better deductively in a competitive environment...the kind of thing that we have done in the past...we have found with gender differences, for example, that women have a tendency to learn better in a collaborative effort when they are doing inductive reasoning.”²⁸

Price is not alone in his stereotypic views, disguised as they may be in academic jargon. For example, educational researchers have also come up with broad stereotypes of African Americans, as suggested by a report on “African American students’ mathematical problem solving” by two researchers in mathematics education. As they note: “Studies of learning preferences suggest that the African American students’ approaches to learning may be characterized by factors of social and affective emphasis, harmony with their communities, holistic perspectives, field dependence, expressive creativity, and nonverbal communication... Research indicates that African American students are flexible and open-minded rather than structured in their perceptions of ideas.”²⁹ These characteristics imply that African Americans cannot engage in rigorous analytical thinking and articulate their ideas in academic prose. Similarly, a writer on American Indian education asserts that Native Americans are “right brained” and implies that they cannot engage in structured forms of learning because the “functions of the left brain are characterized by sequence and order while the functions of the right brain are holistic and diffused.”³⁰

The author of an article in a March 1999 issue of *The New Republic* suggests that at least some African American educators themselves reject constructivist methods and assumptions.³¹

Many pipeline programs are driven by untested ideological premises, such as the idea that black students can learn only from black teachers or that their “learning style” is somehow fundamentally different from that of other kids. It doesn’t help that most of the efforts are poorly evaluated, if at all.

Still, a few things are known. The programs that are most successful at producing black scientists are at historically black colleges and universities. Though they enroll only 25 percent of black college students, these schools grant 40 percent of black science and engineering degrees, and they account for six of the ten undergraduate schools that send the largest number of blacks on to earn science doctorates. Private and public, small and large, these colleges vary enormously--

making it difficult to generalize. Yet, if Xavier University of Louisiana is any guide, the key is an emphasis on basics—both the basics of science and the basics of how to get through college.

A small school with a modest endowment and entering freshmen who are relatively poorly prepared, Xavier combines support services with rigorous academic standards. Introductory chemistry and biology courses set the tone. The faculty members have created their own textbooks, which walk students step by step through subjects, introducing basic vocabulary, emphasizing and deemphasizing key concepts, even dictating exactly how to work problems. “These kids need to learn some basic things before branching out,” pre-med adviser J.W. Carmichael explains. “I don't leave anything out. I take them through every single detail...People say we're hand-holding. Yeah, we are, particularly in the early years.”

Summing Up

NSF's Systemic Initiatives seem to be designed to enable the federal government to foreclose further local decision making on policies, programs, and materials for mathematics and science education. In order for state and local education agencies to secure NSF funds for improving mathematics and science education, they must be willing (at least implicitly) to adopt particular academic standards, instructional methods, textbooks, curricular configurations, and classroom management practices that are, at best, controversial and unsupported by a national consensus on their efficacy. At worst, these specific program components, like the use of Whole Language as a beginning reading methodology, exclude the use of other, effective methods for meeting children's educational needs.

In order to provide a national perspective on NSF's Systemic Initiatives Program, we turn first to a description of the development and consequences of the Los Angeles Systemic Initiative, an example of a systemic initiative at the local level.

The Los Angeles Systemic Initiative

Instituted in 1995, the second year of the National Science Foundation Urban Systemic Initiative Program, the Los Angeles Systemic Initiative (LASI) exerts a powerful influence on a district whose 1997-1998 budget exceeded \$5.8 billion. At \$3 million per year, NSF contributes, through

funds for its Urban Systemic Initiative (USI), only about one twentieth of the school district's budget. Yet, for a mere \$3.79 per student, NSF has been able to make fundamental and, as we will show, damaging changes in the nation's second largest school district. The ambitious scope of the Los Angeles Systemic Initiative is described in its Project Summary:

The Los Angeles Unified School District, in partnership with Los Angeles professional, business, scientific, and education communities and through the vehicle of the Los Angeles Systemic Initiative, has reformed the content, delivery, and learning of mathematics, science, and technology in its 722 schools, affecting more than 792,000 students.³²

In order to lay the foundation for deep systemic changes within the Los Angeles Unified School District (LAUSD), LASI solicited the support of powerful local and national organizations at its inception. Los Angeles Mayor Richard Riordan's office agreed to act as one of its public relations arms. Mike Roos, chief executive officer of LEARN (the Los Angeles Educational Alliance for Restructuring Now), was enlisted as an advisory board member, along with representatives from many other organizations, including several universities in the Los Angeles area. In concert with Bruce Alberts, president of the National Academy of Sciences, and educators from two other California cities, LASI planned the creation of a "California Coalition" to implement a total reform of science education in the state. LASI also gained access to resources within LAUSD, including ten science and technology centers for professional development of teachers, as well as to KLCS Channel 58 television.

Gaining Control

The first task for LASI was to institutionalize academic standards in LAUSD that facilitated NSF's goals for its systemic initiatives. LASI was singularly successful. LAUSD's official adoption of academic standards reflecting NSF's educational philosophy in 1996 was a watershed event in the LASI strategem. A 1998 NSF report boasted that, "in Los Angeles, USI accountability became the framework for a major policy initiative establishing benchmarks and standards in all subject areas for the entire school system."³³

With its mathematics standards adopted in Los Angeles, the next step for LASI was to implement NSF-approved curricula. One clear reason

for LASI to insist on NCTM-based mathematics standards is that they comport with the weak mathematics curricula advanced by the LASI project. But even with LASI-supported standards in place, further systemic changes were necessary in LAUSD in order to implement all the components of NSF's educational philosophy. The 1997 LASI annual report makes this clear:

LAUSD's urban systemic initiative is well under way with its efforts to renew and unify districtwide instruction using standards-based curricula. These curricula are characterized by hands-on, inquiry based, problem-solving, integrated/coordinated, student-teacher interactive instruction in math, science, technology for grades K-12. These efforts are supported and strengthened by needs-based staff development, increased communication among teachers and staff, changes in administrative policies that are essential for student access to the systemic benefits, and checks on progress and process at preselected gates in the system's superstructure.³⁴

LASI and NSF versus California

While NSF was institutionalizing NCTM-based mathematics standards in Los Angeles, flanked by stratospheric proclamations, the state of California was moving resolutely in the opposite direction. In December 1997, the California Board of Education adopted the Mathematics Academic Content Standards, developed with the assistance of four Stanford mathematics professors, Gunnar Carlsson, Ralph Cohen, Stephen Kerckhoff, and James Milgram.³⁵ The California state mathematics standards were broadly supported by the California mathematics community. An open letter directed to the chancellor of the California State University system, circulated by David Klein, was endorsed by one hundred California college and university mathematics professors, including the chairs of mathematics departments at leading universities and several world-renowned mathematicians. Jaime Escalante, of "Stand and Deliver" fame also added his personal endorsement to this open letter calling on California State University Chancellor Reed "to recognize the important and positive role California's recently adopted mathematics standards can play in the education of future teachers of mathematics in the state of California."³⁶

In addition, in March 1998, the Thomas B. Fordham Foundation published an independent review of the mathematics standards from 46

states and the District of Columbia as well as Japan. California's mathematics standards received the highest score, outranking even those of Japan.³⁷ The American Federation of Teachers (AFT) also conducted a study of K-12 academic standards for all states, the District of Columbia, and Puerto Rico. California was the only state in its November 1998 report to receive a perfect score of check marks under the statements “clear, specific, and grounded in content” for standards in the four content areas: mathematics, science, English, and social studies.³⁸

Immediately after the California Board of Education adopted its new mathematics standards in December 1997, leaders of NSF's Systemic Initiative in Los Angeles counterattacked. They recognized that their ideological house of cards could be toppled by California's evolving content-focused educational policies. LAUSD Superintendent Ruben Zacarias, with assistance from LASI in “framing...the issues,” released an Informative to LAUSD board members, dated December 8, 1997, asserting that “the LAUSD standards include and go beyond the State Board standards” (see Appendix C). The Informative further explained that:

The high expectations for student achievement set forth by the [LAUSD] school board and the Superintendent will be met by implementing the standards-based curriculum recommended by the Los Angeles Systemic Initiative.

and

If textbooks are written to meet, but not surpass, the expectations in the State Board standards, then LAUSD teachers will be forced to supplement the programs to deliver the rigorous, challenging mathematics program our students deserve.

As we can see from this response, the NCTM-based LAUSD standards were defended as more demanding than the content standards approved by the California Board of Education. NSF's Assistant Director for Education and Human Resources, Luther Williams, also joined in the counterattack against California's K-12 academic standards. Serving also as head of the Systemic Reform office, Williams wrote a letter, dated December 11, 1997, to the California Board of Education excoriating the new California mathematics standards (see Appendix A). Williams explained that the Board's decision to adopt the mathematics standards

“vacates any serious commitment to elevating problem-solving and critical thinking skills....” He charged that: “The Board action is, charitably, shortsighted and detrimental to the long-term mathematical literacy of children in California.” Citing NSF support in excess of \$50 million for systemic initiatives in California, including the one in Los Angeles, Williams warned that the NSF might terminate its support, and, speaking for the National Science Foundation, he chastised, “We view the Board action in California with grave disappointment and as a lost opportunity for the cities we support—indeed, for the entire state.”

In the year following the state adoption of the new California mathematics standards, members of Mathematically Correct and others tried unsuccessfully to persuade the LAUSD Board of Education to replace its inferior mathematics standards with the new California standards.³⁹ The state’s standards are voluntary for school districts, although yearly STAR (Standardized Testing and Reporting) examinations and state-approved textbooks are to be based upon them. Transcripts of the relevant board meetings are available on the Mathematically Correct website and they record unbending support for the LAUSD mathematics standards by the LASI advisors to the LAUSD Board. At the request of one board member, David Tokofsky, two of the authors of this chapter, together with other mathematicians, developed a detailed comparison of the LAUSD mathematics standards with the California standards. The comparison established beyond any possible doubt the superiority of the California standards and the almost comical shortcomings of its LASI-supported rival.⁴⁰

Dumbing Down the Standards and the Curriculum

What are the weaknesses of the LAUSD mathematics standards? Beyond the canonical rhetoric, they have little mathematical content. In addition, they are redundant between grade levels and vague.⁴¹ For example, with no elaboration whatsoever, one typical LAUSD benchmark requires students to “make connections among related mathematical concepts and apply these concepts to other content areas and the world of work.” The LAUSD mathematics standards stipulate the use of calculators and other “appropriate technology” before the end of third grade, thus undermining mastery of arithmetic. The word “triangle” does not appear at all in the document, only one of many key terms that are missing. By design, trigonometry and all other algebra II

topics do not appear in any grade level benchmarks. The intentional omission of these topics from the LAUSD mathematics standards was eventually acknowledged in an Informative dated June 4, 1998 from LAUSD Superintendent Ruben Zacarias to the LAUSD School Board, and it demonstrates the vacuity of LASI platitudes.⁴² The low level of LASI standards belies NSF's superlatives about critical thinking, real-world applications, "standards-based" education, and "world-class" standards. The original LASI grant proposal even gushed, "We further believe that the conceptual understanding of algebra and physics can and must begin with the entry of that student in kindergarten."

The high intensity verbiage surrounding NSF's educational philosophy can be disarming to an unsuspecting public. But parents and mathematical scientists in Los Angeles found common cause in pointing out the importance of basic skills—missing in the LAUSD mathematics standards—for laying the foundation for deeper scientific understanding. Glamorless necessities like elementary addition and subtraction facts find little support in a NSF-supported education program which, without a trace of irony, can advocate "conceptual understanding of algebra and physics" for entering kindergarten students.

The mathematics curricula supported explicitly by LASI are as deficient as its standards. Indeed, the "standards-based curriculum recommended by the Los Angeles Systemic Initiative" explicitly includes some of the worst mathematics programs in existence. In a letter critical of California's new mathematics standards, dated January 21, 1998, Superintendent Ruben Zacarias wrote: "*MathLand*, which was highly recommended by the California Instructional Resources Evaluation Panel, is one of the LASI recommended curricular programs" (see Appendix D)

The 1997 LASI annual report also affirmed LASI's support of *MathLand* and the *Connected Mathematics Program*, described in the first section of this chapter, for elementary and middle school programs. LASI explicitly endorses shallow curricula at the high school level as well. The goal is to purge LAUSD of algebra I, geometry, and algebra II/trigonometry, referred to as "traditional math," and replace it by a mish-mash known as "integrated math." At a June 15, 1998 meeting held at Nobel Middle School in LAUSD, LASI unveiled its plans to an audience of approximately 100 skeptical parents and a few journalists.⁴³ Using overhead projectors, LASI personnel explained that within five years all middle and high schools in LAUSD would be teaching integrated mathematics only, using one of the following series: *Core-*

Plus Mathematics Project, Interactive Mathematics Project, College Preparatory Math, or Integrated Math. The plan is not to allow the more logically organized “traditional math” at all. According to Robert Hamada, mathematics coordinator for the district's Los Angeles Systemic Initiative, integrated mathematics had already been instituted in the majority of LAUSD schools by the summer of 1998. Objections to “integrated math” by parents in attendance on the grounds that the top performing schools in LAUSD—including national Academic Decathlon champions—teach only traditional mathematics were brushed aside by LASI personnel.

The incompatibility of traditional mathematics curricula with the NSF-sponsored variety was acknowledged in the 1997 LASI report:

Math teachers want credit for both absolute and comparative growth. They have analyzed their staff development model and revised it to include coaching for the 3-year integrated, comprehensive math program that bumps heads with the algebra-geometry tradition. They anticipate that test scores may fall a bit before they rise and stay up because it takes 3-5 years to see real effects of curricular reform that builds from lower grades to higher.

The last sentence of this quotation from the LASI report is a tactical finesse designed to fight off evidence-based criticisms. Test scores might fall, we are told, in advance of the “real effects of the curricular reform.” But how is anyone to know whether student performance is getting worse in ways that will lay the groundwork for later improvement, or whether student performance is getting worse because the programs are worse and it will never get better? The near absence of mathematical content in the NSF-sponsored curricula weighs heavily in favor of the latter contingency.

Protecting Mediocrity

LASI also created evaluation strategies to curb teacher resistance. According to its grant proposal:

Teacher performance will be evaluated by pre- and post-program surveys designed to identify changes in the following: instructional strategies and the amount of classroom time spent in direct lecture, student activities, investigations, demonstrations, cooperative learning, and direct textbook work.

In addition, teachers are encouraged to develop their own systems for self-monitoring, using portfolios and journals to record their professional growth.

With the imminent STAR exam tied to the demanding California mathematics standards, classroom teachers have felt pressure to improve test scores, and some worry that the LASI program won't do it. This was acknowledged in a grant proposal to the California State University Chancellor's office from the Northridge campus, undertaken with LASI collaboration. The funded grant proposal to retrain middle school mathematics teachers warned: "There is general panic about the SAT 9 [STAR exam] and teachers are reverting to traditional methods of teaching rather than uncovering the mathematics in the curriculum they currently have." "[U]ncovering the mathematics" in the NSF-sponsored "curriculum they currently have" would be more easily carried out by magicians than mathematicians, as it is nearly invisible.

LASI's influence on education extends to the state level in other ways. The selection process for district representatives to the California State Science Curriculum Framework Committee is a case in point. This committee is charged with writing a state guide for the implementation of the science standards; the guide deals with pedagogical issues and serves as a blueprint for textbooks. The committee consists of K-12 teachers and members of other public constituencies.

Douglas Lasken, an LAUSD elementary school teacher and union chapter chair for his school, sought permission from the district to apply for a position on the Science Curriculum Framework Committee based on his understanding and strong support of the new California Science Standards and his experience giving inservice science lessons for other teachers. He needed a district administrator's signature on his application indicating that LAUSD would pay for a substitute teacher when he attended required meetings in Sacramento. The signature would have been perfunctory if Lasken had embraced the teaching philosophies of LASI. But LASI personnel had testified against the state science standards before they were approved, and Lasken had supported those standards.

However, the district administrator, who was associated with LASI, refused to give Lasken the signature until dozens of Lasken's supporters requested help from LAUSD Board member David Tokofsky. The district administrator then signed Lasken's application, which was submitted to the appropriate state agency. It was only later that Lasken learned that this administrator had secretly rescinded the signature,

signaling the state agency that no substitute teachers were available. Meanwhile, other LAUSD candidates sympathetic to LASI's educational philosophy proceeded with their applications unimpeded. Lasken was prevented from participating on the Framework Committee. Other teachers who supported the new science standards and who applied to the Framework Committee, had experiences similar to Lasken's.

Thus, a single Urban Systemic Initiative Program, like LASI, not only has the power to impose the NSF agenda on a local school district, including weak standards and curricula, it can even influence educational policies at the state level. As the next section of this chapter demonstrates, influence in the reverse direction can be of greater consequence. The Texas Statewide Systemic Initiative is the prototypical example. It imposed its leadership on the entire state education apparatus, affecting every school district in the state.

The Texas Statewide Systemic Initiative

In 1994, the National Science Foundation (NSF) awarded Texas a four-year grant of \$2,000,000 annually to implement a Statewide Systemic Initiative (SSI). For the matching funds required by NSF, the Texas Legislature approved an Appropriations Bill designating \$1,000,000 annually to the SSI. The legislation clearly defined the parameters intended for the SSI. Funding was to be provided for discrete mathematics and science programs in the schools contingent on evaluations by the Commissioner of Education demonstrating their success.⁴⁴ Legislators did not suspect that they were funding a federally directed program that would replace the state's authority in education, supersede community control of schools, and construct a system wielding the most centralized control over educational policy ever established in the state.⁴⁵

Over the past four years, the SSI has come to direct a variety of state programs, provides leadership for a vast array of agency partnerships, and influences all aspects of education in Texas. Curricula, instructional practices, textbooks, assessment, professional development of teachers, teacher evaluation, teacher certification, and preservice teacher education all now fall under the purview of the Texas SSI. The Texas SSI also claims to exert influence over the largest and most important sources of money for education in the state "in ways that reflect our mission."⁴⁶ It does not exaggerate when describing itself as "wearing the mantle of

leadership in Texas” and playing a “central role in the reform of education” in its Program Effectiveness Reviews of 1997 and 1998.

The changes in classroom instruction, state policy, and educational governance now being implemented in Texas by the SSI reflect the design for the nationwide system of educational policies and programs created by the federal legislation passed in 1994: *Improving America’s Schools, Goals 2000, and School-to-Work*.⁴⁷ This legislation promotes comprehensive change in state educational systems based on the constructivist standards created by national professional and educational organizations in the late 1980s and early 1990s. To encourage states to adopt uniform educational policies and programs based on these standards, NSF was charged to assist the U.S. Department of Education.⁴⁸ When the federal legislation was passed in 1994, NSF had a ready-made vehicle—its Statewide Systemic Initiatives Program—for conveying specific policies and programs to the states. Originally created in 1991 to help states improve mathematics and science education, the Statewide Systemic Initiatives Program was redesigned to deliver the Department of Education’s particular vision of standards-based educational reform to the states.

The changes in classroom instruction, state policy, and educational governance introduced by the Texas SSI define the form and content of what federal agencies, schools of education, and others refer to as “standards-based systemic reform.” The means used by the SSI to acquire authority over educational policy and programs in Texas, and the outcome of these efforts so far, reflect a vision of education and government that is very different from the one we have traditionally enjoyed.

Acquiring the Three R’s: Respectability, Relationships, and Resources

In 1994, the Texas SSI was established in the Charles A. Dana Center, a research facility of the College of Natural Sciences at the University of Texas at Austin. The director of the Dana Center became and remains the SSI’s Principal Investigator and Executive Director. The executive director of the Texas Business and Education Coalition agreed to serve as vice chairman of the SSI’s board. For over ten years, the Coalition has been recognized as the most powerful non-governmental force in state education. Because the University of Texas at Austin is highly respected as a center for educational research, these initial associations assured

public reception of the Texas SSI and created an image for this initiative as a legitimate leader in the state, serving education with academic independence and scholarly objectivity.

The SSI was initiated into state educational policy through contracts with the Governor's Office and the Texas Education Agency (TEA). The SSI forged an intimate relationship with the TEA by naming the state commissioner of education as Co-Principal Investigator of the SSI.⁴⁹ In 1995, the TEA awarded the SSI the contract to develop new state curriculum standards for mathematics and science.⁵⁰ Later, the TEA contracted with the SSI to develop services and products to support the new curriculum standards and, in 1998, the TEA designated the SSI as the Center for Educator Development in Mathematics and Science.⁵¹

Since 1995, the SSI has brokered formal working relationships with the Texas Higher Education Coordinating Board, the State Board for Educator Certification, the Texas Legislature, the Texas Ed Flex Committee, the College Board in Texas, the Texas Education Network, the Texas Business and Education Coalition, the 20 Education Region Centers, the Texas Engineering Foundation, the Southwest Educational Development Laboratory, regional School-to-Work Partnerships, the Texas Educational Productivity Council, the Alliance School Network (Texas's 22 largest school districts), various citizen groups, and professional associations of mathematics and science teachers, school boards, principals, and superintendents. According to the Texas SSI's Annual Reports for 1997 and 1998, it has established partnerships with almost every state agency and organization focusing on education in Texas. These relationships enable the SSI to coordinate its work across the various components of state education. Today, the Texas SSI is:⁵²

- Directing the state-sponsored professional development of all primary and secondary teachers in mathematics and science;
- Developing guidelines for state teachers colleges preservice programs for teachers of mathematics and science, funding teachers colleges to implement the guidelines, and conducting preservice mathematics and science programs.
- Assisting the TEA in the development of state assessments (TAAS and end-of-course exams) for primary and secondary education;
- Creating services and products for schools to support mathematics and science reform;

- Managing the state's K-12 Eisenhower Program funds for TEXTTEAM, which trains teachers to be catalysts for reform in their schools;
- Working in cooperation with the State Board for Educator Certification to revise rules governing new teacher evaluation and certification; and
- Managing the state's Comprehensive Assistance Center for Elementary and Secondary Education Act Programs (STAR) in directing the expenditure of state and federal compensatory education funds.

In addition, according to its 1998 Program Effectiveness Review, the SSI is coordinating its activities across the myriad of state initiatives managed by the Dana Center and mobilizing the resources of all initiatives in support of SSI objectives. Initiatives managed by the Center include: Texas Head Start, the TERC School-to-Career Program, the Texas Education Network, the Center for Community Engagement and Volunteerism, Title I School Improvement Project, Homeless Education, AmeriCorps, and the Accelerated Schools Program. Coordination between the SSI and the Dana Center has blurred operational boundaries and confounded public perception of organizational distinctions. This ambiguity has been meticulously cultivated by the SSI. Publications, such as its 1998 Program Effectiveness Review, advise the public to view the SSI within the broad context of the Dana Center. Many publications identify various functions of the SSI and Dana Center as the combined organization, Dana Center/SSI. Integrated with a state agency and surrounded by a variety of state programs, the SSI has successfully masked its federal identity and the source of its particular objectives.

Since a core purpose of the NSF programs is providing minority and economically disadvantaged students what NSF believes is educational equity,⁵³ gaining acceptance by minority communities is fundamental to success. For the Texas SSI, securing this support has been especially important because Hispanics and African-Americans compose 55% of the student population. The 1997 Annual Report published by the SSI declared its commitment to access and equity, promising to reduce the achievement gap between student populations. One of the SSI's primary means for conveying "standards-based reform" to minority students has been the Title 1 Schools Improvement Program, which has furnished grants to over 100 schools in the state with high concentrations of disadvantaged students. Through other initiatives described as public

service, the SSI has garnered even more minority support and involvement for programs based on constructivist standards. An illustrative program, Emerging Scholars, was featured in a nationally syndicated column in the *Washington Post*, in which William Raspberry compared the SSI's executive director with Jaime Escalante (given fame as a hero for minority education by the movie *Stand and Deliver*). A relationship with the Intercultural Development and Research Association, a statewide organization devoted to the educational advancement of Hispanic and economically disadvantaged students, has furnished the SSI with direct access to minority policy-makers and the opportunity to engage them in a reform of mathematics and science education based on the constructivist standards NSF is promoting. Publishing articles in the Association's monthly newsletter, the SSI has widely disseminated the message that instruction based on constructivist standards is specifically designed to meet the special educational needs of minority students.⁵⁴

While developing the strategic relationships and programs required to influence state-level changes, the Texas SSI simultaneously works as a self-described "catalyst for change" in all local school districts. As noted in the SSI's 1997 Annual Report, "the implementation of a standards-based curriculum in every classroom, for every child" is its driving objective. Various strategies to accomplish this goal are described by the report. A cadre of trainers is deployed by the SSI to serve as intermediaries with schools in the development and maintenance of changes based on constructivist standards, introducing programs, influencing policy, and training teachers. The 800 member cadre (recruited from regional centers, the largest school districts, Urban Systemic Initiatives, Rural Systemic Initiatives, and teachers associated with *Connected Mathematics Project*) has trained almost 4,000 teachers across Texas to use instruction based on constructivist standards. The SSI also introduces mathematics and science programs developed by NSF. Offering incentive grants, the Texas SSI has implemented NSF-developed curricula in 609 schools in the state. The SSI is working to introduce all NSF-developed curricula throughout the state, but it is presently concentrating on scaling up the *Connected Mathematics Project* in Texas as the prototype of a middle school curriculum based on constructivist standards.⁵⁵

The SSI has assembled a network of almost 100,000 individuals in Texas (trainers, activists, action team members, associates, and

subcontractors) to work in all of the 1044 school districts.⁵⁶ Nearly one-third of Texas's 3,700,000 students use instructional materials sponsored by the NSF.⁵⁷ The SSI anticipates that efforts to introduce NSF-endorsed programs into every classroom in Texas will be increasingly successful because "as the newly designated Center for Educator Development for both mathematics and science, we are in an ideal position to promote and prepare districts for adoption of curricula."⁵⁸

The SSI provides direction and support for other NSF and federal Initiatives in Texas. The NSF's Urban Systemic Initiatives in Dallas, San Antonio, and El Paso, as well as the new Rural Systemic Initiative, coordinate activities and resources with the Texas SSI. Funding from the Pew Charitable Foundation enabled the SSI to develop the Working-to-Learn Summer Institutes that train teachers in the methodology required by the federal School-to-Work law, a methodology also based on constructivist standards.⁵⁹ Contracting with TERC, a Massachusetts-based research and development organization, the SSI has created a School-to-Work Team to assist School-to-Work Partnerships in developing constructivist-oriented curricula.⁶⁰ The SSI is also working with the Capital Area Workforce Development Board to introduce *Connected Mathematics Project* as a model curriculum for School-to-Work initiatives in Austin area schools.⁶¹ Helping school districts to implement the new federal Comprehensive School Reform Development Project, an initiative that specifically funds NSF-developed mathematics and science programs,⁶² enables the Texas SSI to significantly expand instruction based on constructivist standards.

How the Texas SSI Promotes and Funds Systemic Reform

The vast array of programs directed or coordinated by the Texas SSI, the innumerable programs directly influenced through partnerships or cooperative efforts, and the complex network of organizational relationships just described all contribute to systemic change. In the past four years, the Texas SSI has worked to coordinate all policies, programs, agencies, organizations, funding, personnel, and materials into a coherent framework promoting a constructivist approach to learning. The coordination or alignment of all the components of the educational system creates a tight infrastructure, one component reinforcing another.

Textbook adoptions by the schools in the next few years will serve to measure the influence of the systemic reform introduced by the SSI. In 1998, its influence became evident with the SSI's effort to constrict the

adoption of mathematics textbooks to a NSF-developed program. In Texas, the purchase of textbooks by school districts is underwritten by the state if the textbook selected meets the expectations for learning established by the state curriculum standards. The TEA reviews textbooks and publishes a list of textbooks meeting the instructional objectives established by the state mathematics curriculum standards. In the fall of 1998, immediately prior to the State Board of Education adoption of the textbook list, the Texas SSI published a list of mathematics textbooks for schools listing only NSF-sponsored textbooks and developed a state conference to showcase these textbooks, most of which were not included on the state textbook list.⁶³ The SSI also issued a newsletter to schools that identified the SSI as the state's Center for Educator Development (CED) with responsibility for helping schools implement the state curriculum standards, and emphasized the necessity of selecting the appropriate textbooks.⁶⁴ This newsletter advises schools that selecting textbooks on the state's list might not be the best choice, offers the assistance of SSI-trained staff at Education Region Centers, and encourages schools to use the SSI guideline in selecting textbooks.⁶⁵ The SSI's *Instructional Materials Analysis and Selection* guideline opens with advice for schools to select textbooks based on NCTM standards and provides a checklist that includes criteria based on these standards that textbooks should contain to qualify for selection.⁶⁶

While the direct influence over textbook selection is enormous, the indirect influence is far more extensive. Every education policy in the state has been shaped by the SSI to reinforce the selection of textbooks based on NSF-endorsed standards. Assessment of student learning, school ratings based on student assessment, instructional approaches taught in professional development programs for teachers, instructional methods used for evaluating teachers, instructional approaches used to train prospective teachers, and teaching demonstrations required for teacher certification—all are now based on constructivist standards. The selection of a knowledge-oriented textbook would conflict with all aspects of educational policy. To help make sure that schools would make the correct choice, the SSI's 1998 Annual Report noted: "We trained more than 60 mathematics leaders from around the state to use the SSI-developed Instruction Materials Evaluation and Selection Process Manual in district textbook adoption processes so that the new textbooks adopted for the next decade will be standards-based." It

remains to be seen how many schools select NSF-endorsed mathematics textbooks.

Systemic reform of education is clearly incomplete without the alignment of fiscal resources. The Texas SSI has accomplished this by influencing the largest and most important sources of state and federal money for education “in ways that reflect our mission,” according to its 1997 Annual Report. The report claims the SSI influences the expenditure of approximately \$2 billion dollars annually of federal and state monies (designated for programs such as Head Start, Title I, Compensatory Education Program, and the Technology Infrastructure Fund). As well as aligning state and federal education monies to serve the objectives of the SSI, direct funding of almost \$18,000,000 dollars is acquired annually by the SSI from a variety of sources, including the University of Austin, NSF, local school districts, and private or corporate donations, according to the 1997 Program Effectiveness Review. Of the \$18,000,000 acquired by the SSI in 1998, more than \$4,000,000 was provided by local school districts as matching funds for SSI programs, contributed from their Title I monies for improving the education of disadvantaged students.

How the Texas Statewide Systemic Initiative Promotes Constructivist Instructional Methods

Policies, guidelines, and reports published by the SSI and partner organizations in Texas provide a clear definition of education based on constructivist standards in its application to teaching and expectations for learning. The details in the following documents identify the primary role that instruction, not curricular content, plays in systemic reform and reveal the extent to which systemic reform rigidly scripts instructional methods.

The *Mathematics TEKS Toolkit, Clarifying Activities*, published by the Texas SSI on the Texas Education Network Web Site⁶⁷ offers teachers methods to translate the state curriculum standards for mathematics into classroom instruction. Sample lessons illustrate the activities teachers should use to introduce specific state standards for grade-level instructional expectations. For example, the first state standard for kindergarten mathematics (K.1) requires students to use numbers to name quantities. The lesson furnished for this standard has students holding a handful of small objects, naming the number of each object, and recording the process of counting by adding the objects on a

calculator. This lesson incorporates several principles of systemic reform. Calculators are introduced as the first and primary method of recording and computing numbers. Numbers and counting are introduced in the context of a complex problem (for kindergartners). Students are expected to construct for themselves the meaning of numerical symbols on the calculator, as well as the algorithm of addition by counting, as the first lesson in mathematics presented in elementary school.

The *Mathematics Center for Educator Development, Mathematics and Instruction*, published by the Texas SSI on the Texas Education Network Web Site,⁶⁸ provides instructional methods for implementing the state mathematics standards. Position papers advocate constructivism, noting that students learn best when constructing their own learning instead of receiving direction or information from teachers. Ability grouping of students is identified as harmful to student learning. Cooperative grouping (where students teach one another), as well as group grading, is recommended. Teachers are advised to encourage students to use calculators (because technology removes the necessity for students to learn supposedly low-level skills). The use of concrete manipulatives is encouraged to augment the use of mathematical symbols in every grade level. Teachers are discouraged from providing students with correct answers or asking them to seek correct answers. And teachers are exhorted to avoid presenting mathematics as any sequence of mathematical knowledge or skills. As a resource for curriculum, only the specific mathematics programs developed by NSF are listed.

The *Mathematics Center for Educator Development, Mathematics Assessment*, published by the Texas SSI on the Texas Education Network Web Site, dispenses any notion that assessments are to be conducted primarily for teachers to use for evaluating student achievement. This section clarifies that assessments should be used as an instructional strategy to provide students with an opportunity to evaluate themselves. An open-ended problem (with no right answer), an investigation, a product or a product are identified as the different forms assessment should assume.

The *Guidelines for Mathematical Preparation of Prospective Elementary Teachers*, published by the Texas SSI on the Texas Education Network Web site,⁶⁹ identifies the mathematical content that preservice teachers are required to master for both classroom instruction based on the state curriculum standards and the examination for teacher

certification. It also identifies the instructional methods teachers should use. The instructional section begins with an admonition against rote memorization, mathematical rules, mathematical definitions, and mathematical formulas, and a commendation for constructivist learning. Calculators are praised for removing computational burdens. Cooperative groups and investigative projects are identified as important classroom strategies. The section concludes with a warning against teaching mathematics as a linear progression of topics and skills, thereby dismissing centuries of carefully constructed systems of mathematics developed by the best minds of every culture.

The *Mathematics Center for Educator Development, Professional Development and Appraisal System for Texas Teachers*, published by the TEA on the Texas Education Network Web Site, provides schools with a recommended plan for teacher evaluation, incorporating the criteria required by state law. This plan identifies the instructional methods that teachers must demonstrate in the classroom, including promoting students toward self-directed learning, introducing facts and skills through complex problem-solving, and connecting mathematics with other subjects and work. The degree to which teachers comply with national and state policies is also an evaluation criterion.

Equity in the Reform of Mathematics and Science Education, published in 1994 by the Southwest Educational Development Laboratory of Austin, Texas, describes the instructional methods introduced by “systemic reform” and NSF’s various Statewide Systemic Initiatives. This report begins by claiming that traditional instructional methods erect a barrier to the education of minority students, and it describes the special educational needs of minorities. The instructional strategies that supposedly hurt minorities are identified, including standardized tests, ability grouping, curricula that emphasize right answers, competitive activities, teacher-centered classrooms, and remedial instruction. And it defines the instructional methods that minorities supposedly require for educational success, including mixed ability classroom grouping, constructivist curricula, cooperative learning groups, project-based instruction, and authentic assessment. The report admits that education programs based on constructivist methods lack a substantial empirical research base to support them, but it does not suggest that this failing should logically restrict the use of these experimental methods on minority students.

The *Texas Essential Knowledge and Skills for Mathematics*, published by the TEA, lists the standards of learning for students in

kindergarten through grade 12. Instructional objectives are expressed as performances that students are expected to demonstrate at each grade (although almost one-quarter of the expectations are repeated year after year). As recommended by NCTM's standards, instructional objectives focus not on correct answers or specific facts but on process (called "higher order skills" to make thinking processes sound preferable to knowledge and as something not necessarily requiring knowledge). For example, fifth grade students are expected to "use multiplication to solve problems involving whole numbers (no more than three digits time two digits without technology)." The dominant operative verb is "use," not "solve," so students can fully comply with this instructional objective by using multiplication to solve a problem whether or not they solve it correctly. This example also demonstrates the reliance on calculators for more complex, although arduous, computations. There is not one single state standard for mathematics, from kindergarten through grade 12, that explicitly requires students to produce a correct answer. Only in three instances are students required to memorize or acquire mental automaticity of facts or skills. In kindergarten, students are required to count to 100 (although students may meet this expectation by counting incorrectly or using a calculator); in grade 2, students are required to recall basic addition facts (sums to 18); and, in grade 4, students are required to recall multiplication facts through 12×12 .

In addition, every instructional objective is expressed as an application of learning that relates to everyday experience. For example, eighth grade students are expected to "use the Pythagorean Theorem to solve real-life problems" and "use geometric concepts to solve problems in fields such as art and architecture" (although the standards do not offer any clues as to what this could mean). Approximately one-fourth of each grade-level expectation requires students to demonstrate mathematical competencies that are separate and distinct from mathematical academic content, such as these examples from grade 8: "identity and apply mathematics to everyday experience;" "validate his or her conclusions;" "select tools such as real objects, manipulatives, paper/pencil, and technology or techniques such as mental math, estimation, and number sense to solve problems;" and "use a problem-solving model that incorporates understanding the problem, making a plan, carrying out the plan, and evaluating the solution for reasonableness."

Evaluation of Systemic Reform and Constructivist Instructional Methods

The instructional methods associated with “systemic reform” represent an educational approach known as “progressivism.” Despite the inference that these methods are new, they have been used in American classrooms throughout the twentieth century under a variety of names. These instructional methods were, and continue to be, introduced as social reforms, intended to make education more equitable. A teaching guide, *Moving into the Mainstream*, published on the Texas SSI state curriculum web site, explains that they have vital importance because equal opportunity and equal access have proven inadequate in furnishing educational equity to minorities.⁷⁰ This guide claims that discovery learning (constructivism), cooperative learning, learner-focused (student-directed) classrooms, contextual (problem-solving) instruction, everyday applications (applied learning), project-based (thematic) instruction, connections (interdisciplinary learning), and authentic (performance-based) assessment have proven to be effective strategies in “leveling the playing field” to derive equal academic outcomes. To the contrary, empirical research has produced substantial evidence attesting to the harm that “progressive” instructional methods inflict on all students’ academic achievement.⁷¹ And these instructional methods most harm minority students, according to *Project Follow Through*, a 25-year study conducted by the U.S. Department of Education to determine the most effective instructional strategies for disadvantaged students.⁷²

The immediate impact of systemic reform on mathematics instruction in Texas is difficult to evaluate. Assessments of state standards conducted recently by national organizations identify Texas’s new standards as average (or mediocre, depending on the perspective). The 1999 *Education Week Quality Counts* rated Texas’s standards as B+ (although it gave an F to Iowa, the state producing the highest SAT scores in the nation). The Fordham Foundation’s 1998 *State Mathematics Standards* rated Texas’s mathematics standards as B (giving 12 states higher ratings). The Council for Basic Education’s 1998 *Great Expectations? Defining and Assessing Rigor for Mathematics and English Language Arts* rated Texas’s mathematics standards also as B (giving 15 other states a higher rating).

Because the new curriculum framework was not officially implemented until January 1999, and the first selection of textbooks aligned with constructivist standards has yet to be completed, the effect

of the new curriculum framework on student achievement cannot be evaluated at this time. It is possible, however, to review the impact of the instructional policies embedded in the NSF programs introduced to Texas over the past four years by the SSI.

Annual reports published by the Texas SSI proclaim success for the NSF programs, contending that these programs have increased student achievement in Texas. This claim should be closely examined for several reasons. Most of the individual schools employing NSF curricula use authentic assessment—non-standardized, subjective evaluations of student achievement. SSI reports rely on scores from the state academic proficiency test, TAAS (Texas Assessment of Academic Skills). With few exceptions, TAAS scores have climbed annually for every school in the state. The SSI has yet to publish data that indicates a statistically significant difference in TAAS scores between students in the 609 schools engaged in SSI programs and non-participating students. No study of Texas SSI programs has been conducted by any independent and disinterested researcher. In short, no valid and reliable data have been generated to date in Texas to support SSI's claims for academic success. The absence of quantitative data for SSI programs in Texas replicates the situation in other states. A five-year analysis of SSIs sponsored by NSF itself could not find enough test score data to support claims that NSF-endorsed mathematics and science programs raise academic achievement or reduce the achievement gap between student populations.⁷³

Student scores on national tests provide mixed news about the mathematical achievement of primary and secondary school students in Texas. Although a 1998 study of NAEP data indicates significant mathematical gains for Texas fourth and eighth grade students from 1992-1996, with a significant narrowing of the achievement gap between minority and white students,⁷⁴ only 25% of fourth grade students and 21% of eighth grade students score at or above the proficiency level. Although the TEA also reports regular improvements in TAAS scores across the grades, and a significant shrinking of the achievement gap since 1995, two research studies conducted independently in 1998 revealed serious flaws in the TAAS grade 8 mathematics test; it assesses content and difficulty about two grades below grade 8 and in effect does not assess performance in the top half of the achievement curve.⁷⁵ A third study published in 1999 confirmed that the standards for mathematical learning in Texas are one to two years lower than most

states in grade equivalence.⁷⁶ Although both NAEP and TAAS scores show a closing of the achievement gap between student populations, the combined SAT score for Texas remains unchanged at 995 since 1996, and the achievement gap slowly widens. Since 1996, mean SAT scores for Hispanics and African Americans in Texas have declined two points, and combined SAT scores in 1998 place Texas as the seventh lowest state in the nation. The disparity between the scores on the SAT, a college preparatory exam, and the scores on TAAS, a minimum proficiency exam, strongly suggests that educational practices in Texas constrain high-level achievement, especially in the higher grades and most especially for minorities.

How the Texas Statewide Systemic Initiative Is Challenging Communities and the State for Control of Education

The curricula and methods of instruction for mathematics and science being implemented as part of systemic reform in Texas are supported by a new infrastructure of policy and governance created by the SSI.⁷⁷ Operating as the axis of this infrastructure, the SSI prescribes specific educational practices, specific uses for educational dollars, and specific educational policies in the state. As a result, systemic reform has compromised the ability of parents, teachers, and elected public officials to shape day-to-day classroom instruction or develop alternative educational policies and programs. The following examples illustrate how the Texas SSI constrains informed or independent local and state educational decision-making. The first deals with its behind-the-scenes influence on Texas's standards.

In late 1996, the state released drafts of the revised standards for K-12, allowing Texans 30 days for review prior to State Board of Education adoption. The public was not officially notified of the review until several weeks into the scheduled time period, and then only because of a letter to Texas newspapers written by a teacher on one of the state writing teams. Public outcry ensued. Criticisms were levied against both the abbreviated time for review and the extreme vagueness of the proposed standards, especially in mathematics. Several members of the State Board requested public review be extended and experts consulted. The Governor subsequently described the proposed standards as "mush" and extended time for public review. In the months following, and continuing until the standards were adopted in late 1997, the State Board of Education was deluged with citizen testimony criticizing the influence

of national standards documents on the new Texas expectations for learning. Much public concern was voiced that national organizations, such as the National Center for Education and the Economy, worked with writing teams assembled by the TEA to shape state standards according to the standards developed by NCTM and other national professional organizations. Much public concern was voiced that Goals 2000 funding had influenced the new state standards for learning. The TEA denied that the proposed standards were based on national standards and denied any influence on the proposed standards by the state's Goals 2000 Plan, any national organization, or any federal agency. The TEA repeatedly stressed that the new standards were written by Texans for Texas.

Representing concerns of their constituents, several members of the State Board of Education continued to press the TEA for information about these influences and their adverse impact on state expectations for learning. Newspapers throughout the state published the TEA's description of these inquiries as a reflection of paranoia about a federal conspiracy. High profile legislators threatened to draft bills replacing the elected board with an appointed board if these board members persisted in what was described as obstructing education reform.

In the meantime, attribution of the Texas SSI as contract writer for the state standards in mathematics and science (listed on the first public draft) was removed from subsequent drafts. Then, in response to a request by the State Board of Education for a list of the writers responsible for the standards, a list was provided that identified the SSI only indirectly; it designated specific members of the Dana Center as contributing writers working with a selected group of Texas teachers. Not until late 1998 were facts available to the public; the SSI, funded by Goals 2000 for the express purpose of developing the mathematics and science components of the state's Goals 2000 Plan,⁷⁸ had indeed designed the state's standards, based on guidelines developed by NCTM and the National Research Council.⁷⁹ Misrepresentation of the origin of the standards had caused members of the board to give false reassurance to the public and prevented some members from representing constituent interests effectively. Full disclosure might well have prevented approval of these standards as well as legislation filed in the 76th Texas Legislature to replace the elected state board of education with an appointed board (a vote is pending at this time).

Systemic reform is also disenfranchising teachers from decision making on classroom instruction in Texas. Historically, teachers have served on school textbook selection committees and furnished local school boards with recommendations best suited to student needs. In 1999, school districts either discontinued the custom or limited the authority of teachers on textbook selection committees. After distributing a review of mathematics textbooks to school district textbook selection committees throughout Texas, I received dozens of calls. Teachers across the state relayed concerns that textbook selection had been predetermined to select NSF-endorsed textbooks and described a variety of strategies used to “skew” selection: The textbook selection guideline published by the SSI ruled out any instructional materials other than NSF-endorsed textbooks; SSI-trained teachers directed school textbook selection committees; school administrators distributed a NSF-sponsored textbook analysis and advised teachers that those with the highest ratings met Statewide and Urban Systemic Initiative goals; school administrators advised teachers that the Urban Systemic Initiative would withdraw funding if the NSF-endorsed textbooks were not selected; and one school board provided teachers with a notice from an Urban Systemic Initiative identifying the two acceptable choices for adoption. These teachers also reported little or no support for these NSF-endorsed textbooks.

Systemic reform is eroding the ability of parents to participate in informed ways in local school decisions as well. In early 1998, a group of parents in Plano asked their local school board for permission to withdraw their children from the *Connected Mathematics Program*, a NSF-endorsed middle school mathematics program, because the children were failing to learn basic mathematic skills. The parents asked the district board to provide a traditional instructional alternative. When the district board refused, parents began an extensive investigation of the *Connected Mathematics Program*. They uncovered a report issued by the TEA indicating that the *Connected Mathematics Program* satisfies only slightly more than half of the state requirements for grade level instruction. They also discovered that its teacher’s manual warns that students may score lower on standardized tests of computational skills than students in traditional classes. The parents requested data from the SSI that would support the academic claims of the *Connected Mathematics Program* and were given only the 1998 scores from TAAS for schools using the program even though the program had been used by several schools for several years. The parents then obtained records documenting the solicitation of schools in their district by the Dana

Center/SSI to implement the *Connected Mathematics Program* as an experimental program and determined that their local school board had never reviewed or voted on the program.⁸⁰ The parents also discovered that statutory protections of parental rights in education would not apply when children participate in programs sponsored by the Texas SSI. Federal law exempts NSF from any obligation to obtain parental consent when children take part in educational experiments.⁸¹ And as an authorized agent of the Secretary of Education, the SSI is also exempt from any obligation to obtain parental consent for collecting and releasing personally identifiable information about children.⁸²

Refused the ability to withdraw their children from the SSI program by the district board and exempted from an appeal to parental rights by federal legislation, the Plano parents hired legal counsel and appealed to the State Board of Education in January 1999. The parents argued that the State Board should share responsibility for resolving their problem because the SSI is authorized by the TEA to provide educational services to school districts and to implement mathematics programs that are to be evaluated by the Commissioner of Education. They appealed to the Commissioner to conduct an evaluation of *Connected Mathematics Program* as charged by law. In response, the State Board advised the parents to resolve the problem with their school district and described the problem as one of local, not state, control, subject to the authority of the local community. No response was furnished by the Commissioner of Education, and to date, the parents have yet to be notified of any state evaluation of the *Connected Mathematics Program*.⁸³ An editorial by a Plano parent in the *Plano Star Courier* raised questions about the accuracy of the director's claim that the Dana Center does not endorse adoption of any instructional programs and noted the State Board's responsibility to ensure that schools offer a curriculum based on the state's standards.⁸⁴ Nonetheless, the Plano parents must rely on the SSI's Co-Investigator, the Commissioner of Education, to review SSI programs with objectivity. The difficulty these parents encountered in obtaining full information from the SSI or about the programs it supports suggests how the SSI views accountability to the public.

Finally, systemic reform may curtail the development of maverick educational programs that defy the constructivist approach to curricula and instruction prescribed by the Texas SSI. Arguing against replacing content-based pedagogy with experimental programs based on lower academic standards for minority students, Manuel Berriozabal, a

mathematician at the University of Texas at San Antonio, developed TexPREP in 1979. His goal was to open the door to higher education for minority students by disproving the stereotype that minority students cannot succeed in content-oriented courses. Since 1979, TexPREP has provided middle and high school students with substantive programs in mathematics and science that offer direct instruction in a structured classroom environment. In Texas today, TexPREP is offered in 23 schools and engages 3,000 students. Over the past 20 years, almost 16,000 students have enrolled in TexPREP. The high school graduation rate for TexPREP students is 99%, 93% of TexPREP students are admitted to college, and 87% graduate from college.⁸⁵ Although TexPREP has proven the most successful educational program for minority students in Texas, and eight other states have replicated the program, TexPREP is now struggling to secure fiscal resources. Its state funding has regularly decreased in recent years, and its future is uncertain in Texas.

The common threads in the experiences of these parents, teachers, and elected officials in the examples above indicate that the Texas SSI has little or no responsibility to the public. The SSI, in fact, has no statutory obligation to provide full and factual disclosure of information, to implement programs that reflect public interest, and to engage constituents in decision-making. Without statutory accountability, the SSI can bypass established processes of educational governance and effectively diminish the authorities of individuals statutorily (or customarily) invested with educational decision-making, described in Texas as “local control.”

In Texas, local control means decisions are made by locally elected officials with knowledge needed to represent the unique interest of their communities. Over the past decade, legislators in Texas have reduced the authority of state officials and agencies in order to locate primary control of education in communities. Legislation pared regulations from the Texas Education Code, trimmed both staff and responsibilities from the TEA, and sheared authorities from the State Board of Education. Having established new K-12 standards and graduation requirements, the principal state authority for public education is now limited to enforcing school accountability for academic results, while school districts wield authority for classrooms and day-to-day learning.

Reduction of state authority in Texas was intended to augment and strengthen the authority of local communities for educational decision-making. The Texas SSI, however, found that deregulation had created a

political environment “ideally suited for systemic reform,” as noted in its 1998 *Annual Report and Strategic Plan*. The SSI’s 1997 Annual Report boasts “We have built, in a state known for its spirited resistance to centralized leadership and central control, a powerful structure” and explains how the transition of power from state to community left Texas vulnerable. “Rapid and dislocating changes in the system’s loci of power and authority have created unprecedented opportunities to shape and reshape instructional practice, to influence allocation of resources, and to develop new...policy at the state and local levels.” The new role of parents, teachers and elected officials on school boards is to support NSF’s vision of systemic reform, according to *A Report on the Evaluation of the National Science Foundation’s Statewide Systemic Initiatives*. It frankly admits that “systemic reform calls for districts and schools to jettison their traditional role as regulators of local practice and assume the new role of technical assisters.”

Transferring authority from a locally elected board to a federal initiative is not a choice that people in Texas or any other state would probably make consciously. A 1997 national opinion poll conducted by the Center for Education Research in Washington found that over 70% of Americans supported little or no involvement of the federal government in public education.⁸⁶ And a national poll conducted in 1998 by Public Agenda, a non-profit, non-partisan research organization, indicated that only 22% of Americans think decisions about curricula and instruction should be made by the federal government, while only 14% think officials in Washington make good educational decisions.⁸⁷

Public opinion research also indicates that the vast majority of Americans oppose the curricula and instructional practices endorsed by the SSI and systemic reform. A series of national polls conducted from 1996 to the present by Public Agenda has documented overwhelming public support (exceeding 85%) for schools to devote more time for mathematics instruction and to increase the emphasis on mathematical facts and calculation by hand. It has also documented corresponding opposition to the supposedly new teaching methods endorsed by the SSI programs, especially in mathematics where 90 % of the public rejects the use of calculators and believes that teaching should focus more on mathematical facts.⁸⁸ NSF has acknowledged that the efforts of SSIs to gain public support for its vision of systemic reform has enjoyed limited success, and increased public awareness has, in fact, provoked considerable public opposition, such as in California.⁸⁹

Concluding Remarks

In this chapter we have examined the National Science Foundation Systemic Initiatives Program and the role it is now playing in K-12 mathematics and science education in this country. In the first section, we examined this program's goals and educational philosophy, quoting directly from documents written or authorized by Luther Williams, Assistant Director of the Education and Human Resources Division of NSF and head of the office for Systemic Reform. We also pointed out the limitations in the mathematics standards and textbooks it endorses, as well as the sudden declines in student achievement in instructional programs using these textbooks. In the second section, we described the development and components of a prominent Urban Systemic Initiative, documenting weaknesses in the policies, standards, programs, and materials it has implemented in this large school district. In the third section, we examined the components of a Statewide Systemic Initiative, documenting its ongoing efforts to consolidate educational authority and policy in the state, to promote its educational philosophy in every aspect of education in the state, and to limit informed and meaningful participation by teachers, parents, and elected officials in decision-making on matters of curriculum and instruction. These three sections demonstrate the many flaws in the design of this NSF program and how these flaws are efficiently carried to the states and local school districts that participate in the program.

Our analysis of the NSF Systemic Initiatives Program raises two issues that require scrutiny by governors, Congressional and state legislators, state boards of education, local school boards, and parents, as well as by others seeking to improve the quality of mathematics and science education in this country. The first is the desirability of this program's purposes and goals, the second is the warrant for the educational philosophy it is promoting.

NSF has clearly spelled out its plan to reshape and control the total network of state and local educational policies that determine a school district's academic standards, assessment mechanisms, classroom management practices, curriculum configurations, instructional methods, textbook choices, preservice and inservice teacher training programs, and teacher certification requirements through the conditions it applies to the granting of modest amounts of money to school districts and states and through the ensuing infrastructure it sets up. Yet, there have been no

local, state, or national discussions on how this NSF program is affecting the principle of local and state control of education. Is the small amount of money it offers worth the significant loss in autonomy and educational flexibility it seems to entail? NSF's educational policies seem to have been decided upon by only a very small number of appointed officials in the U.S. Department of Education and the National Science Foundation.

In addition to its attempt to direct the use of local educational resources and local decision-making without informed discussion in the local community, NSF has promoted standards and programs in science and mathematics that are not supported by a broad-based consensus among professional experts or knowledgeable members of the public. They are in fact not supported by any body of research evidence, are contrary to the findings of mainstream research, and may lower, not improve, student achievement in science and mathematics.

We urge a discontinuation of the Systemic Initiatives Program and the use of its funds for other programs in mathematics and science education. We particularly urge that NSF drop its unwarranted reliance on a dogmatic and exclusionary educational philosophy and encourage—and evaluate—a multitude of approaches to mathematics and science education.

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- ⁴⁵ *A Report on the Evaluation of the National Science Foundation's Statewide Systemic Initiatives Program*, SRI International, 1998, p.53. It is contended in Texas that the SSI is not a federal initiative; this document confirms that it is a SSI. An article on this report, entitled "Mixed Grades for NSF's Bold Reforms of Statewide Education," by Jeffrey Mervis, appears in the December 4, 1998 issue of *Science*.
- ⁴⁶ *Annual Report*, Texas Statewide Systemic Initiative, Austin, TX, 1997, p.6.
- ⁴⁷ *Preparing Students for the Twenty-first Century*, National Governors' Association Issue Brief, Education Policy Studies Division, April 13, 1998, p.1 (<http://www.nga.org/Pubs/IssueBriefs/default.asp>).
- ⁴⁸ *Public Law 103-227. Goals 2000: Educate America Act*, Title 2. National Education Reform Leadership, Standards, and Assessments, Sec.232. Federal Leadership. The testimony of Richard Riley, Secretary of Education, to the Committee on Science, U.S. House of Representatives, July 23, 1997 describes the collaboration between the U.S.Department of Education and the National Science Foundation (Federal Document Clearing House,1997 WL 11235230).
- ⁴⁹ *Ibid*, p.1.
- ⁵⁰ *Texas, State Profiles*, Education and Human Resources, National Science Foundation (<http://www.ehr.nsf.gov.EHR/ESR/state/profiles/tx.htm>).
- ⁵¹ *Program Effectiveness Review*, Texas Statewide Systemic Initiative, Austin, TX, 1998, p. 3.
- ⁵² *Annual Report*, Texas Statewide Systemic Initiative, Austin, TX, 1998, pp.5, 6, 9, 10, and 19; and *Annual Report*, 1997, pp.5 -9.
- ⁵³ *A Report on the Evaluation of the National Science Foundation's Statewide Systemic Initiatives*, p.37.
- ⁵⁴ *Math and Science*, IDRA Newsletter, Intercultural Development Research Association, San Antonio, March 1998.
- ⁵⁵ *Annual Report*, Texas Statewide Systemic Initiative, 1997, p.9. The SSI testified that it does not promote any specific program of instruction to school districts, State Board of Education Meeting, November 13-15, 1998.
- ⁵⁶ *Ibid*, p.7.
- ⁵⁷ *Program Effectiveness Review*, 1998, p.13.
- ⁵⁸ *Annual Report*, Texas Statewide Systemic Initiative, 1997, p.9.
- ⁵⁹ *Substate Application for Projects Funded under the School-to-Work Opportunities Act* submitted by the Capital Area School-to-Career Partnership to the Texas Workforce Commission School-to-Careers Office, Austin, TX, June 30, 1998, p.48.
- ⁶⁰ *Annual Report and Strategic Plan*,1998, p.21.
- ⁶¹ *Capital Area School-to-Work Partnership, Substate Application for Funds, 1997*
- ⁶² *Guidance on the Comprehensive School Reform Demonstration Program*, U.S. Department of Education, 1998 (<http://www.ed.gov/offices/oese/compreform>).
- ⁶³ *NSF Curriculum Showcase Conference Registration Form*, Texas Statewide Systemic Initiative, Sheraton Austin Hotel, Austin, TX, November 11-13, 1998.
- ⁶⁴ Recognizing the conflict of interest posed by the SSI's administration of the CED while promoting NSF-developed textbooks, the Commissioner of Education warned the Dana Center/SSI that these activities should be clearly separated. Correspondence of November 11, 1998.

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- ⁶⁵ *What It Means to Implement the TEKS*, Issue Brief, Texas Statewide Systemic Initiative, Vol.1, No.1, Fall, 1998.
- ⁶⁶ *Instructional Materials Analysis and Selection for K-5 and 6-8 Mathematics*, Texas Statewide Systemic Initiative, Austin, TX, 1998.
- ⁶⁷ (<http://www-tenet.edu/teks/math>).
- ⁶⁸ (<http://www-tenet.edu/teks/math>).
- ⁶⁹ (<http://www-tnet.cc.utexas.edu/ssi>).
- ⁷⁰ By P.B.Campbell and N.Kreinberg.
- ⁷¹ E.D.Hirsch, Jr. *The Schools We Need, Why We Don't Have Them*, Doubleday, NY, 1996, pp 127-175.
- ⁷² Wesley Becker and Siegfried Engelmann, " Sponsor Findings from Project Follow Through," *Effective School Practices*, Vol. 15, No. 1, Winter, 1996, p.35.
- ⁷³ *A Report on the Evaluation of the National Science Foundation's Statewide Systemic Initiatives Program*. SRI International, 1998
(<http://www.sfi.com/policy/cehs/edpolicy.html>).
- ⁷⁴ David Grissmer and Ann Flanagan. *Exploring Rapid Achievement Gains in North Carolina and Texas*. Washington, D.C.: National Education Goals Panel, November, 1998.
- ⁷⁵ *Setting Higher Sights*. American Federation of Teachers, Washington, D.C.,1998; Wayne Bishop, David Klein and Paul Clopton, *Statewide Mathematics Assessment in Texas*, Tax Research Association, Houston, TX, 1998.
- ⁷⁶ Paul Clopton, Erica McKeown, et al. *Mathematics Program Reviews for Grades 2,5, and 7*. Mathematically Correct (<http://www.mathematicallycorrect.com>).
- ⁷⁷ *Program Effectiveness Review*, 1998, p.19.
- ⁷⁸ *Texas, State Profiles*.
- ⁷⁹ *Program Effectiveness Review*, the Statewide Systemic Initiative, Austin, TX, 1997, p.2.
- ⁸⁰ Letter to Susan Modisette, Principal, Haggard Middle School from Darlene Yanez, Research and Evaluation Specialist, Texas Statewide Systemic Initiative, January 29, 1998; and Testimony to the Plano Independent School District Board Hearing of the Level 1 Complaint related to the *Connected Mathematics Program* by Don Mills, January 14, 1999.
- ⁸¹ Code of Federal Regulations, Title 45 Public Welfare, Volume 3, Chapter VI National Science Foundation. Part 690.101 (a) and (b).
- ⁸² Code of Federal Regulations, Title 34 Family Educational Rights and Privacy Act, Subpart D, Section 99.31 (a) 93) (ii).
- ⁸³ Testimony to the Texas State Board of Education by Kenneth Johnson, Plano, TX, January 8, 1999; and Letter to Chris Patterson, Education Connection of Texas, from Kenneth Johnson, Plano, TX, February 1, 1999.
- ⁸⁴ Kenneth Johnson, "Connected Math curriculum should be reviewed impartially." *Plano Star Courier*, January 22, 1999; and "New Instructional Materials Approved," *Texas Education News*, Vol.15, Issue 37, November 23, 1998.
- ⁸⁵ Manuel Berriozabal, "Why Hasn't Mathematics Worked for Minorities?" *UME Trends*, San Antonio, Vol. 1, No. 2, May 1989; and *1999 Legislative Agenda*, Texas Prefreshman Engineering Program, University of Texas at San Antonio, January 1999.

⁸⁶ *National Survey of Americans' Attitudes toward Education and School Reform.*

⁸⁷ *Public Agenda Online 1998.*

⁸⁸ *Different Drummers: How Teachers of Teachers View Public Education*, Public Agenda, New York, 1997; *Given the Circumstances: Teachers Talk about Public Education Today*, Public Agenda, New York, 1996.

⁸⁹ *A Report on the Evaluation of the National Science Foundation's Statewide Systemic Initiatives Program.*

Appendix A

NATIONAL SCIENCE FOUNDATION

4201 Wilson Boulevard
Arlington, Virginia 22230

December 11, 1997

Mrs. Yvonne W. Larson
President, California State Board of Education
721 Capitol Mall, Room 532
Sacramento, CA 95814

Dear Mrs. Larson:

California appeared poised to make an important contribution to the national discussion regarding the appropriate balance of mathematical problem-solving, procedural skills, and critical thinking with the September, 1997 proposal of the Commission for the Establishment of Academic Performance and Content Standards. Instead, the decision last week by the California State Board of Education, with little or no public input, to adopt alternative standards vacates any serious commitment to elevating problem solving and critical thinking skills to K-7 mathematics standards. The Board action is, charitably, shortsighted and detrimental to the long-term mathematical literacy of children in California.

The wistful or nostalgic "back-to-basic" approach that characterizes the Board standards overlooks the fact that the approach has chronically and dimly failed. It has excluded youngsters from engaging in genuine mathematical thinking and therefore true mathematical learning, and has proposed a disproportionate mathematically illiterate citizenry.

The National Science Foundation currently maintains a portfolio exceeding \$50 million in awards to six public school systems in California (East Side Union, Fresno, Los Angeles, Oakland, Paramount, and San Diego). These districts are undertaking systemic initiatives to offer their students much greater opportunities to learn and achieve in high-quality, rigorous mathematics and science. These awards, though only moving into their second and third years of implementation, are beginning to stimulate significant gains in mathematics and science achievements. A growing body of research also shows significant learning gains elsewhere. You must surely understand that the Foundation cannot support individual school systems that embark on a course that substitutes computational proficiencies for a commitment to deep, balanced mathematical learning.

We view the Board actions in California with grave disappointment and as a lost opportunity for the cities we support—indeed, for the entire state. We have followed the debate closely. We obviously share your stated interest in improving the rigor of the mathematics instruction in the state. We disagree, decisively, with the Board's decision to systematically remove components from the standards that focus on problem solving and other elements of the rigorous and powerful use and learning of mathematics.

Sincerely,
(signed)
Luther S. Williams
Assistant Director

cc. DeLaine Eastin
Superintendent for Public Instruction

Appendix B

Office of the Director
National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230

January 8, 1998

Mrs. Yvonne W. Larsen

President, California State Board of Education
721 Capitol Mall, Room 532
Sacramento, CA 95814

Dear Mrs. Larsen:

Because science, mathematics, engineering, and technology education at all levels is an agency wide priority for the National Science Foundation, I follow media coverage of these issues on a regular basis. As you must be aware, the deliberations of the California State Board of Education on mathematics standards have received a great deal of attention. In some of the articles since the middle of December, reference was made to end quotes taken from a letter sent to you in the course of those deliberations by my colleague Luther Williams, NSF's Assistant Director for Education and Human Resources. I was concerned about some of the interpretations of this letter in the press. At my request, Dr. Williams recently shared his letter with me. I believe it can easily be and in some instances has been misconstrued. I want to be sure that there is no misunderstanding in your mind about NSF's position on two very important matters.

(1) It is NSF policy not to prescribe particular standards for mathematics and science education to NSF proposers and grantees or to the states in which they reside. NSF's K-12 mathematics and science education activities are funded through competitive programs to which interested organizations apply. The proposals made to us by states, districts, schools, and other educational organizations are evaluated based on established criteria, which usually include reference to high-quality, rigorous standards to be designed and implemented by the participating entities. NSF believes that it is the responsibility of states and local school districts to establish and implement the standards to which they hold themselves.

(2) NSF does not regard the State Board's action with respect to statewide standards as grounds for terminating funding to what we believe are critically important projects in California school districts. Dr. Williams' letter expressed his personal concern that the statewide standards you were considering could have a negative impact on the ability of the school systems listed to live up to the objectives of the cooperative agreements negotiated in the award process. Unfortunately, his letter has been interpreted as a threat to terminate the awards, if the State Board enacted the standards under consideration. Neither he nor I would countenance such an action.

Finally, my reading of the media articles surrounding the California standards for K-12 mathematics is that, while the standards have been adopted, the underlying issues remain controversial in your state, as they are in other parts of the Nation. I hope California will take the lead in initiating a broad public discussion of what is important in mathematics education that avoids the polarization of issues that has characterized much of the debate thus far. This could be vitally important to other states involved in establishing standards and in the periodic revision of standards that is expected to occur.

While the California standards are described as placing their focus on basic computational skills, I see also clear recognition on your part that the needs for mathematics education do not stop there. All students must be able to use basic skills effectively in developing means of solving more complex problems. We need to find a way to demonstrate that basic skills and the contextual framework of real-world problems or more advanced mathematics in which they can be used reinforce one another, accomplishing what we all want—a set of varied approaches that in combination provide what is best for the students.

Please feel free to contact me if I can provide any additional clarification on these matters.

Sincerely,
(signed)
Neal Lane
Director

Appendix C

INFORMATIVE

TO: Members, Board of Education

DATE: December 8, 1997

FROM: Ruben Zacarias, Superintendent

SUBJECT: Standards-Based Mathematics Curriculum

The following information is provided to inform members of the Board as to the progress towards implementation of the LAUSD Mathematics Standards, in light of the recent California Board of Education acceptance of its K-7 mathematics standards. The Division of Instructional Services' Standards and Assessment Office and Los Angeles Systemic Initiative have assisted in framing the following issues for the Board's consideration.

*Does the District need to adjust its Mathematics standards in response to the State Board standards?

No. The high expectations for student achievement set forth by the school board and the Superintendent will be met by implementing the standards-based curriculum recommended by the Los Angeles Systemic Initiative.

*Given the State Board standards, will the District continue to use its own Standards?

Yes. The LAUSD Standards include and go beyond the State Board standards.

*How will LAUSD students be affected by the State Board standards?

When teachers continue to provide student centered instruction, students will have the balanced program called for in the Mathematics Advisory to the State Board of Education. Such a balanced program will enhance student achievement, not only on assessments such as the State assessments which are aligned to the State Board standards but also with the District assessment program (Stanford 9, performance-based assessment, and teacher judgment component).

*How will District standards-based curriculum be impacted by the State Board standards?

Basic skills are incorporated in the all of the LA-SI recommended curricula. Instructional delivery in the implementation of these curricular tools will deliver a balance of problem solving, basic skills, and conceptual understanding.

*How will classroom instruction be impacted by the State Board standards?

LAUSD classroom teachers will continue to provide instruction which best ensures the success of all of our students. A variety of instructional strategies will be used in these classrooms.

*Specifically, what is the appropriate role of calculators in the classroom?

All teachers support the mastery of basic skills. Calculators provide students opportunities to apply and extend their mathematical skills appropriate for the "Information Age" in which they will live and work.

*Would textbooks that are aligned to the new State Board standards meet the LAUSD standards?

If textbooks are written to meet, but not surpass, the expectations in the State Board standards, then LAUSD teachers will be forced to supplement the programs to deliver a rigorous, challenging mathematics program our students deserve.

Appendix D

January 21, 1998

David Klein
Professor of Mathematics
California State University, Northridge
Northridge, CA 91330

Dear Dr. Klein:

This letter is in response to your comments to Julie Korenstein criticizing the Los Angeles Unified School District's reaction to the new math standards adopted by the State of California. The common goal that we believe is expressed in both your letter and the LAUSD mathematics standards for students to have facility with basic skills as well as the conceptual underpinnings of mathematics that make it possible for them to extend and apply these skills in many contexts, academic as well as real-world. We urge the professors whose names are attached to this letter to heed the words of Secretary of Education Richard W. Riley, as reported in the Los Angeles Times on January 21, 1998. Secretary Riley stresses the positive advances in mathematics results during the current decade. More important to this response is his urging us to move beyond the "shortsighted, politicized and harmful bickering over the teaching and learning of mathematics." Certainly we all want students graduating from LAUSD to succeed at the university level as well as in the workplace.

My comments in an informative to the LAUSD Board of Education implying a deficiency in the state board mathematics standards are consistent with statements made by well-respected mathematicians and scientists from California and other states. For example, mathematics professors Dr. Scott Farrand, California University, Sacramento and Dr. Calvin Moore, University of California, Berkeley, have stated: "The imbalance in the direction of skills that

these (state board) Standards would create is an affront to the stated Board policy of balance.” The mathematics education community has gone on record in support of the California Educational Roundtable standards for graduating seniors. This consensus document, created by a coalition of Community College, California State University, and University of California mathematicians, among others, was strongly endorsed by teachers and administrators in the LAUSD. Dr. Luther Williams, Assistant Director of Education and Human Resources for the National Science Foundation, stated in a letter to Yvonne Larson, President of the State Board of Education: “The wistful or nostalgic “back-to-basics” approach that characterizes the Board standards overlooks the fact that the approach has chronically and dimly failed. It has excluded youngsters from engaging in genuine mathematical thinking and therefore true mathematical learning.”

There is an unstated assumption present in this letter which expresses one view of school mathematics: if students have mastered (memorized) the “basics” at a lower level, then they will be able to perform better in the higher level classes taught by mathematics experts. Mathematics is not free of different philosophies and approaches. The two Stanford mathematics professors who wrote the state standards (assisted by a professor emeritus of UC Davis) certainly are entitled to their perspective of mathematics as a fixed set of facts and procedures to be learned.

However, another reknown mathematician from Stanford, the late George Polya, promoted a view of mathematics as problem solving. Polya's seminal work in this area and with classroom teachers, was very influential on the development of mathematical curricula during the 80's to the present. The LAUSD Standards maintain a balanced approach, honoring both perspectives of mathematics, as we feel most educators do.

Mathland, which was highly recommended by the California Instructional Resources Evaluation Panel, is one of the LASI recommended curricular programs. The Mathland program is not the LAUSD math standards as stated in your letter, but one of several math programs selected by school staffs. Teachers who use this program as intended, supported by District professional development, continue to stress basic skills while preparing students for the 21st century by providing them with opportunities to analyze and question data and statistics in order to fully participate in our democracy as informed citizens.

Thank you for expressing your concerns.

Sincerely,

(signed)

Ruben Zacarias

Superintendent of Schools

cc. Julie Korenstein [LAUSD Board Member]

