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AUTHOR	Kim, Jason J.; Crasco, Linda M.
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ABSTRACT

Under the sponsorship of the National Science Foundation, 22 urban school districts have been involved in a long-term educational reform through the Urban Systemic Initiative (USI) program since 1994. This paper presents a brief summary of findings regarding best policies and practices in the educational reform effort focusing on student achievement in mathematics and science. The USI has been based on six educational reform drivers: four process drivers and two student outcome drivers. The evaluative study team collected quantitative and qualitative data from 22 USI sites using the Key Indicator Data Collection System, a district-level data collection instrument based on a cross-site longitudinal evaluative framework. The data collection effort was supplemented by interviews, document reviews, and site visits. The evaluation confirmed positive linkages between the USI policy implementation rubrics and student outcomes. The six reform drivers provided a visionary direction for systemwide educational reform for most USI sites. The four process drivers worked dynamically together to improve the two outcome drivers—student achievement and gap elimination—that are the overarching goals of the systemic initiatives. A graphical representation shows the links among rubrics and outcomes as a "schoolhouse" in which the foundation is the Belief System. (SLD)

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Section 4- Reform and Implementation

BEST POLICIES AND PRACTICES IN URBAN EDUCATIONAL REFORM: A SUMMARY OF EMPIRICAL ANALYSIS FOCUSING ON STUDENT ACHIEVEMENTS AND EQUITY

Jason J. Kim, Ph.D.
Linda M. Crasco
Systemic Research, Inc.

BACKGROUND AND OBJECTIVE

Under the sponsorship of the National Science Foundation (NSF), 22 urban school districts have been involved in long term educational reform through the Urban Systemic Initiative (USI) program since 1994. USI has been a reform catalyst for large-scale educational change affecting standards, curriculum, assessment, professional development, partnerships, and convergence of intellectual and fiscal resources, with constant attention to improving student achievement in mathematics and science. This paper presents a brief summary of findings regarding best policies and practices in the educational reform effort focusing on student achievement in mathematics and science. *[1]

A theoretical systemic educational reform model has evolved based on the six "educational reform drivers" including four process drivers (standards-based curriculum, instruction and assessment; policy; resources; and broad-based support) and two student outcome drivers (student achievement; and improvement of historically underserved). This evaluative study explored causal inferential models among the process drivers (independent variables) and outcome drivers (dependent variables) linking policy implementation rubrics to quantitative student outcome data.

METHODOLOGY AND DATA SOURCES

The evaluative study team has designed and collected quantitative and qualitative data from 22 USI sites*[2] using the Key Indicator Data Collection System (KIDS), a district level data collection instrument based on a cross-site, longitudinal evaluative study framework. The data collection effort has been supplemented by school district document reviews, and site visits that included interviews, focus groups, classroom and professional development surveys and teacher surveys. The quantitative and qualitative data have been compiled and analyzed using statistical regression methods to link policies and practices to student outcomes.

The KIDS Part 1 Quantitative (K-1) templates collected data from the individual project from the baseline year to school year 1999-2000. K-1 includes: district-wide student demographics and selected statistics; mathematics and science gate-keeping course enrollment and completion; 12th grade students graduation data summary; high school graduation requirements; AP mathematics and science test results; SAT; ACT; assessment test results; teacher certificates and professional development (Ref. 1 & 4).

The KIDS Part 2 Qualitative (K-2) templates collected data relevant to policy implementation over the project period, including: policies promoting equal access by all students in high quality education; policies impacting the enrollment of students in challenging math and science courses; policies relevant to standards-based curriculum and instruction; policies relevant to teacher qualifications; professional development policies and practices; policies relevant to standards-based assessments; USI leadership, governance, and management; and partnerships. changes in policies and practices were tracked over the years of program implementation.

The K-2 qualitative data was further compiled as 46 rubric elements that reflect the four process drivers of systemic reform. For the development of causal inferential model, the 46 rubric elements were combined to form 14 policy rubric groups as shown in Table 1. Statistical methods, including factor analysis and regression, were used to explore the linkages between polices and outcomes (independent variables) and student achievement outcomes (dependent variables.)

Table 1
Education Reform Qualitative Rubric Groups and Elements

1. Equal Access
- 1.1 Elimination of Tracking
- 1.2 More Upper Level Courses

2. Targeted Programs
- 2.1 Strategies to Address Needs of Special Populations
- 2.2 Targeted Programs for Underrepresented Minorities

3. Graduation and Promotion Policies
- 3.1 Graduation Requirements More Rigorous than the State
- 3.2 Graduation Requirements of at Least 3 Years Mathematics and Science
- 3.3 Promotion Policy

4. Attendance and Safety Net Programs
- 4.1 Attendance Policy
- 4.2 Summer School
- 4.3 Tutoring or Saturday Academy

5. Standards-Based Curriculum
- 5.1 Standards-Based Curriculum
- 5.2 Curriculum Linked to State or National Content Standards
- 5.3 Significant and Increasing Number of Schools Implementing Standards-Based Curriculum or Materials

6. Assessment Alignment and Instructional Time
- 6.1 Assessment Adequately Aligned to Curriculum and Standards
- 6.2 More Instructional Time in Mathematics and Science

7. Teacher Certification
- 7.1 Policies Guiding Teacher Assignments
- 7.2 Uncertified Teachers Encouraged to Seek Certification
- 7.3 Teacher Certification Required by the District

8. Professional Development Content and Standards
- 8.1 Reward for Increasing Content Area Knowledge
- 8.2 Professional Development Content
- 8.3 Aligning Professional Development with Standards
- 8.4 Professional Development Offerings

9. Professional Development Participation and Follow-up
- 9.1 Professional Development Participation
- 9.2 Classroom Observation
- 9.3 Evaluation by Analysis of Student Scores
- 9.4 Professional Development Follow-Up

10. Leadership, Governance and Management
- 10.1 Superintendent's Leadership and Tenure
- 10.2 USI Project Director's Position/Tenure in District Organizational Structure
- 10.3 USI Staff

11. Collaboration, Partnerships with Parents, Higher Education, Business and Partners for Students
- 11.1 Collaboration with Other Initiatives
- 11.2 Community or Parental Involvement
- 11.3 Partnerships with Higher Education
- 11.4 Partnerships with Industry and Business
- 11.5 Partnerships Directly Linked to Students

12. Assessment Policies and Use of Results
- 12.1 Required State Assessment
- 12.2 Local Standards-Based Assessment Measures
- 12.3 Other Standard Measures Used
- 12.4 Using Assessment for Planning Instruction
- 12.5 Usage of Student Test Results for Curriculum and Instruction Enhancement

13. Accountability and Use of District Data
- 13.1 Report Card System for Stakeholders
- 13.2 Data Collection Infrastructure
- 13.3 Usage of Key Indicator Data for USI Program Interventions

14. Coordination, Leverage of Resources, and Use of Data and Technology
- 14.1 Coordination Among Existing Funding Sources
- 14.2 Leverage of Funds
- 14.3 Use of Research Results
- 14.4 Technology and Telecommunications

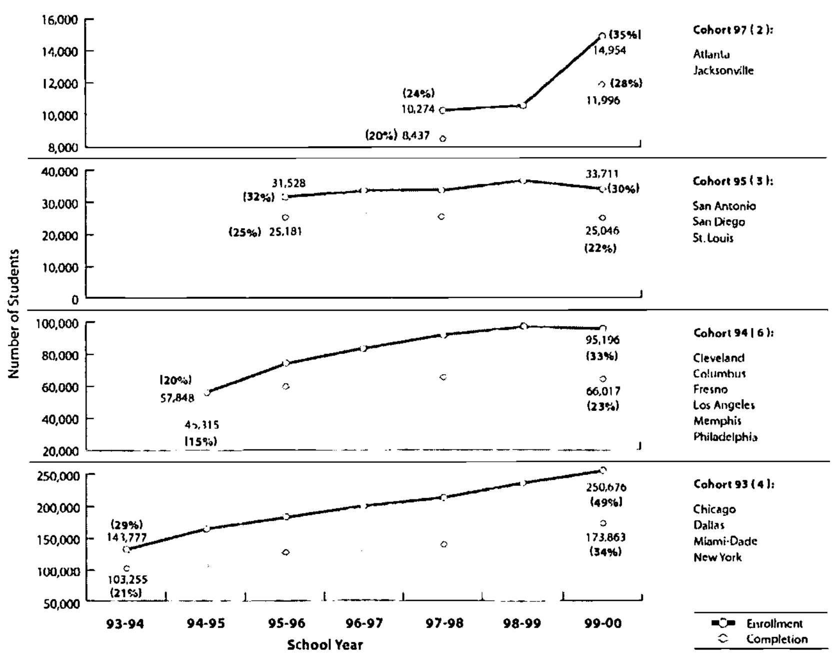
SUMMARY OF FINDINGS

Student Achievements and Equity

NSF's six drivers of systemic reform provided a framework for USI implementation, especially focusing on standards-based curriculum and instruction, policies supporting all students in high quality mathematics and science education, professional development, aligned assessment instruments, convergence of resources, leadership, and partnerships. These advances are accompanied by evidence that urban school students show gains in Mathematics and Science achievements. Among the findings from the trend analyses of 21 USI sites:

1. As shown in Exhibit I, urban students in the USI school districts have dramatically increased their enrollment rates in mathematics and science gate-keeping and higher-level courses. Larger participant gains are observed in more mature USI cohorts. For example, enrollment in gate-keeping and higher-level mathematics courses has increased in four Cohort 93 sites (Chicago, Dallas, Miami-Dade, and New York), from 29% of the total high school student population in SY 1993-94 to 49% in SY 1999-00.

Exhibit I
Mathematics Enrollment and Completion in
Grade 9-12 Gate-Keeping and Higher-Level Courses*



* Includeds Algebra I), Geometry, Calculus and Integrated Math II-IV: Data was imputed for Cleveland (SY 94-95 and 99-00) and San Diego (SY 97-98 and 99-00)

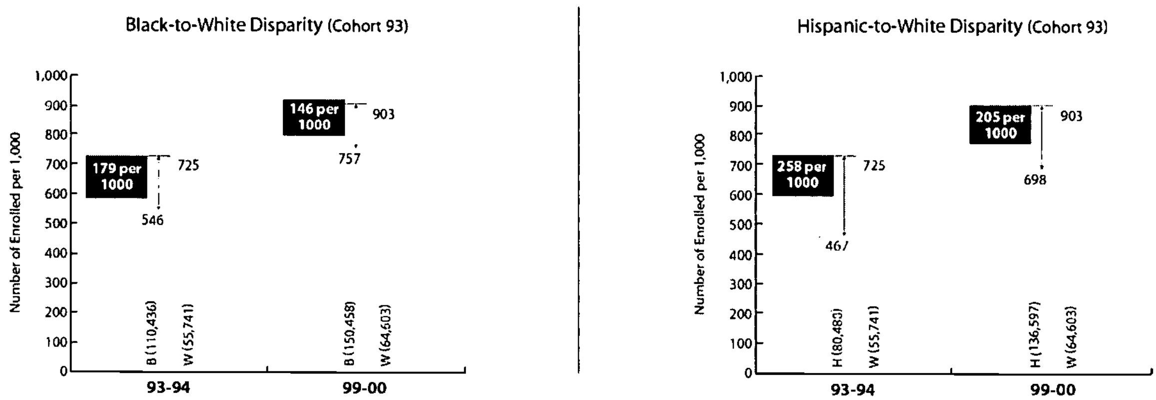
Science gate-keeping course enrollments in the same sites have experienced even higher gains over the same project period; from 59% to 80% of the total student population.

2. Underrepresented minority students made greater enrollment gains than their peers during the same period, resulting in reduced enrollment disparities as shown in Exhibit II. For example, in four Cohort 93 sites (Chicago, Dallas, Miami-Dade, and New York), the

enrollment disparity between African-American and white students in gate-keeping and higher-level science courses narrowed from 179 per 1,000 to 146 per 1,000 between SY 1993-94 and 1999-00. The Hispanic to white student disparity narrowed from 258 to 205 students per 1,000.

Exhibit II

Reduced Disparity and Increased Enrollment in Grade 9-12 Science Gate-Keeping and Higher-Level Courses*: Number of Students Enrolled in Science per 1,000 Students



* Includes Biology I, Physics I, and Integrated Science I-III. Data includes Chicago, Dallas, Miami-Dade, and New York.

3. Assessment test results show that USI students have made gains in mathematics and science achievement, while reducing achievement gaps among racial and ethnic groups. For example, passing rates in 8th grade science assessment tests improved in 15 out of the 16 sites with data available. Seven of these sites exhibited a narrowing of the passing rate gap between underrepresented minority and white students. Eighth grade mathematics assessment test results also show impressive passing rate improvements; 16 out of 17 sites experienced overall improvement with eight sites narrowing the achievement gap (Exhibit not shown here).

4. The increasing numbers of 11th and 12th grade students taking college entrance examinations indicate more students have aspirations of pursuing post-secondary education. By SY 1999-00, Cohort 93 students were taking AP mathematics and science examinations at a rate higher than the national average (in case of mathematics, 35.9 per 1,000 students compared to the national average of 22.9). Cohort 94 students also follow the same trend. SAT and ACT test-taking rates show a similar pattern. These trends are most notable in the cohorts with the longest participation in the USI program (Exhibit not shown here).

Impact of Policy Implementation

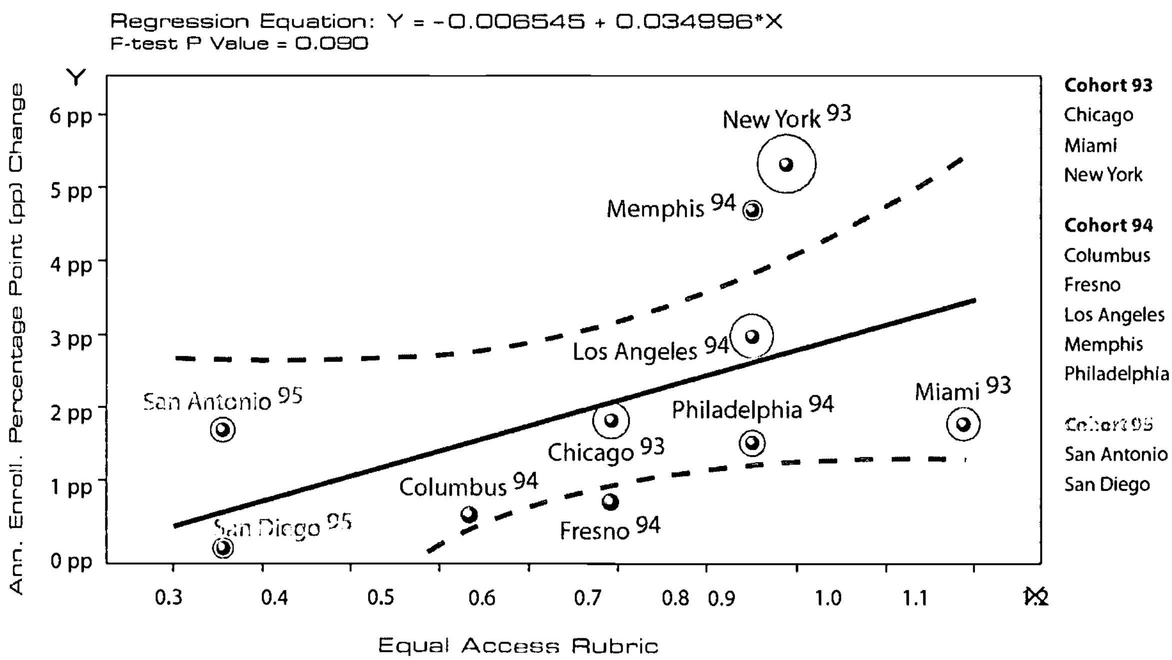
Student achievement gains were linked to policy implementation rubrics based on qualitative data from K-2, site visit, and other supplemental district level reports. As an example, Exhibit III shows the relationship between student enrollment in gate-keeping and higher-level mathematics courses, Algebra II, Geometry and Calculus (dependent variable) and the "open access" policy implementation rubric (independent variable).

The X axis represents the annualized percentage point (pp) change in mathematics enrollment. The annualized percentage point change is the average yearly change in percentage of total high school students enrolled in higher mathematics from the baseline to SY 1999-00. For example, a site with a baseline year of 1993-94 and an enrollment increase during the six years from 30% to 60% of the total high school student population will have an annualized pp increase of 5 pp. The Y axis represents the USI sites' policy rubric scores weighted by the implementation time factor. The "open access" policy rubric is a composite index of two rubric elements: elimination of tracking, and more availability of higher level courses.

The regression equation shows a positive relationship: $Y = -0.006545 + 0.034996*X$. The estimators are not statistically significant (F-test P value = 0.090) due to the limited sample size (10 sites data), however, these 10 data points represent mathematics enrollment gains among more than 3.2 million students.

Exhibit III

Higher Math Enrollment (Annualized Percentage Point Change) vs Equal Access Rubric



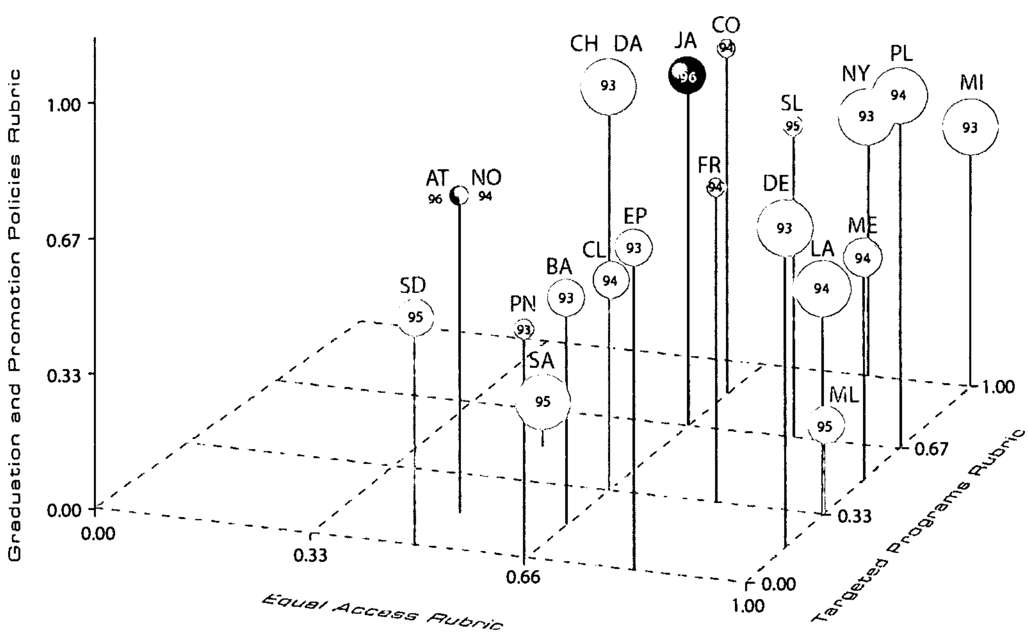
Note:

1. Size of bubble represents relative size of total high school student enrollment.
2. Higher Math: Algebra II, Geometry, Calculus, and Integrated Math II-IV.
3. The annualized percentage point (pp) change indicates the average yearly pp change in percentage of total high school students enrolled in higher mathematics from the baseline to SY 1999-00. For example, a site with a baseline year of 1993-94 and an enrollment increase during the six years from 30% to 60% of the total high school student population will have an annualized pp increase of 5 pp.
4. The rubric scores have been weighted by the implementation time factor (number of years policy in effect).

A regression analysis of student enrollment in gate-keeping and higher-level science courses and the "open access" policy implementation rubrics also indicates a positive relationship (not shown here). The regression equation is Y = 0.007413 + 0.02663*X; a positive coefficient. As with the example shown above, the estimators are not statistically significant (F-test P value = 0.2279) due to the limited sample size (12 sites data points), however, these 12 data points represent science enrollment gains among close to 3.4 million students.

When we examined the relationships among the 14 rubric groups, we observed that many rubrics groups are strongly correlated in educational reform policy implementation. For example, Exhibit IV presents the relationships among three rubric groups: Equal Access (Rubric Group 1 in Table 1), Targeted Programs (Rubric Group 2), and Graduation and Promotion Policies (Rubric Group 3) using a three dimensional bubble chart. Three axis present scores of the three respective rubrics. Each bubble represents a USI site, and the size of bubble indicates the relative size of the total district student enrollment. The majority of USI sites strongly support "equal access" and "graduation and promotion policy", while showing a wide variation in "targeted programs."

Exhibit IV
Relationship of Three Rubrics: Equal Access, Targeted Programs, and Graduation and Promotion Policies



Notes:

Size of bubble represents relative size of total high school enrollment

Cohort 93: Baltimore (BA), Chicago (CH), Dallas (DA), Detroit (DE), El Paso (EP), Miami (MI), New York (NY), Phoenix (PN)
Cohort 94: Cleveland (CL), Columbus (CO), Fresno (FR), Los Angeles (LA), Memphis (ME), New Orleans (NO), Philadelphia (PL)
Cohort 95: Milwaukee (ML), San Antonio (SA), San Diego (SD), St. Louis (SL)
Cohort 96: Atlanta (AT), Jacksonville (JA)

CONCLUSION

The preliminary study report published in June 2001 "Academic Excellence for All Urban Students- Their Accomplishment in Science and Mathematics" confirmed evidence of noteworthy gains in student achievement (Ref. 2). This report confirms positive linkage between policy implementation rubrics and student outcomes.

NSF's six drivers provided a visionary direction for system wide educational reform for most USI sites. The four process drivers dynamically work together to improve the two outcome drivers- student achievement and gap elimination- which are the overarching goals of the systemic initiatives. Based on findings from the causal inferential models discussed above, Exhibit V presents a graphical representation of "How Reform Works," linking rubrics and outcomes. In the schoolhouse diagram, the building blocks are the process and outcome drivers. While each block is an important individual component of the system, all must interact with each other in a balanced manner to support the goals of the system.

The foundation of the reform effort is the "Belief System": the expectation that all students can and must learn challenging mathematics and science content, and must be held to the same high standards. Another layer of the foundation is Policies to Support Science and Mathematics Achievement and Equity (Driver 2). These policies are key to ensuring that teachers, administrators and staff throughout the system provide the same services and resources to all students.

The pillars of the schoolhouse are four supporting building blocks, on top of the "Belief System and Supporting Policy" foundation:

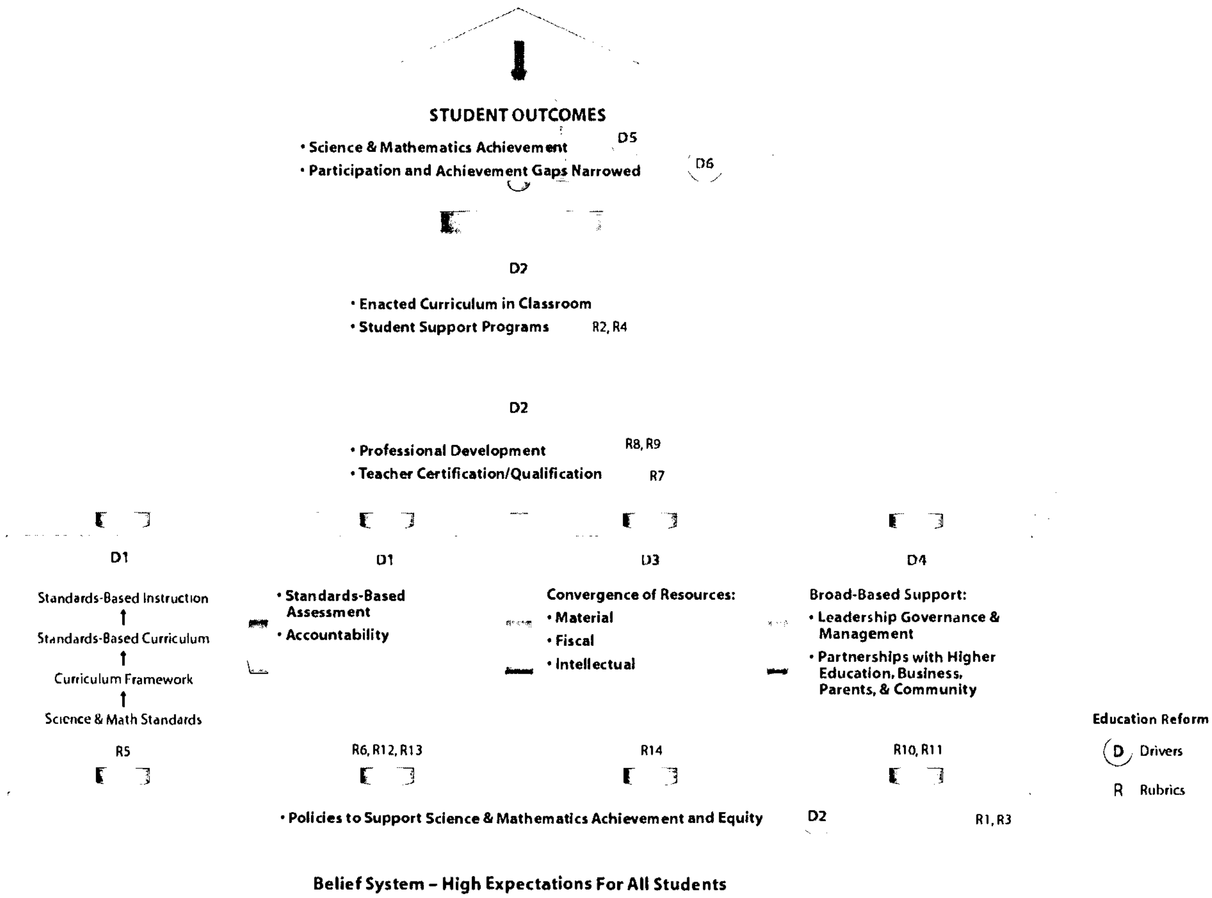
- Standards-Based Instruction, Curriculum, Curriculum Framework, and Science and Mathematics Standards (Driver 1)
- Standards-Based Assessment and Accountability (Driver 1)
- Convergence of Resources: Material, Fiscal and Intellectual (Driver 3)
- Broad-based Support: Leadership, Governance and Management; Partnerships with Higher Education, Business, Parents and Community (Driver 4)

Overlying the supporting structure is the Professional Development and Teacher Certification/ Qualification (Driver 2) building blocks. The delivery of the curriculum is accomplished through the efforts of teachers in the system. Students need to be taught by well-qualified teachers. Continued professional development is necessary as new standards and curricula are introduced, and as research demonstrates which teaching practices allow students to reach their full potential (Ref. 3 & 5).

The next level is the Enacted Curriculum in Classrooms and Student Support Programs (Driver 2). Enacted curriculum is the actual teaching of the prescribed curricula in the classroom. It consists of the content material and the methods used to present the subject matter to students. Student support systems become more important as all students are exposed to gate-keeping and higher-level courses with challenging content areas. Examples of student support systems are tutoring and summer enrichment programs.

Exhibit V

SYSTEMIC BUILDING BLOCKS FOR URBAN SCHOOL REFORM: LINKAGE OF DRIVERS, RUBRICS, AND OUTCOMES



The bell tower of our schoolhouse symbolizes the ultimate goal of school reform – Student Outcomes: Science and Mathematics Achievement and Participation and Achievement Gaps Narrowed (Drivers 5 and 6). The goal of the systemic educational reform is to prepare students for higher education and career opportunities in the area of Science, Technology, Engineering, and Mathematics (STEM). Successfully attaining this goal benefits individual students and society as a whole.

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*[2] Cohort 93 (Baltimore, Chicago, Dallas, Detroit, El Paso, Miami-Dade, New York, Phoenix); Cohort 94 (Cleveland, Columbus, Fresno, Los Angeles, Memphis, New Orleans, Philadelphia); Cohort 95 (Milwaukee, St. Louis, San Antonio, San Diego); Cohort 97 (Atlanta, Jacksonville); Cohort 99 (Houston)

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Organization/Address: **SYSTEMIC RESEARCH, INC. 150 KERRY PLACE, 2nd FL. NORWOOD, MA 02062**

Telephone: 781-278-0300 FAX: 781-278-0707

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