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I have been studying the Chicago public schools for the past 15 years at the Consortium on Chicago School Research (CCSR) at the University of Chicago. Chicago is a district that is 85% minority, 85% low-income, where almost all students aspire to go to college, and many students aspire to enter STEM careers. But very few of the students who have those aspirations end up making them a reality.

Chicago has attempted to improve students' achievement in science and math through a number of large-scale, bold initiatives, many of which have been followed by similar policies at the federal level. I am going to briefly talk about three. While each has the potential to improve STEM outcomes, they also each have the potential to unintentionally make them worse, particularly in schools that are struggling the most with low achievement, such as many of our urban schools serving mostly minority youth.

- 1) **Curriculum standards.** Chicago has tried to increase curricular rigor in a number of ways that have clear implications for states and districts implementing the Common Core standards. In 1997, Chicago required all students to take a college-preparatory curriculum and dramatically increased its graduation requirements. As with the Common Core, the goal was to increase equity and rigor by exposing all students to more uniformly challenging coursework. Prior to 1997, students entering high school had to complete any one science course, and many took remedial science. Beginning in 1997, students were required to take three laboratory science classes, one from each of these categories: 1) earth and space or environmental science, 2) biology or life science, and 3) chemistry or physics. Changes in science requirements were accompanied by increases in math requirements, where students could no longer take remedial math and had to take at least three courses in the math sequence, including geometry and advanced algebra (algebra 2). After the policy, there was a dramatic rise in the number of science and math classes that students took; almost all graduates received credit in full science and math sequences.

However, there were a number of unintended negative consequences as well. These negative consequences were a direct result of asking more of both students and teachers without providing them with sufficient additional supports. Under Chicago's

College Prep for All policy, most students earned very poor grades in their science and math classes—Cs, Ds and Fs. Such low grades indicate minimal engagement and very little learning; in fact, comparisons with test scores tell us that it is only students earning As and Bs that show substantial learning gains in their courses. As schools struggled to find teachers to expand high-level math and science courses to all students, high-achieving students were less likely to take physics, pre-calculus or calculus. The quality of math classes also declined for high-achieving students as classrooms now contained students with a much greater variations in skills, and teachers had a hard time teaching college-preparatory work to classes with very low-achieving students. In the end, low-skilled students had slightly higher failure rates, system-wide graduation rates declined slightly, and college entrance declined for high-skill students.<sup>1</sup>

In 2006, Chicago invested deeply in another curricular reform that exhibited some of the same challenges as College Prep for All. Through a program called Instructional Development System (IDS), Chicago implemented high-quality curricula in science, math and English, aligned with the ACT college-entrance exam, along with professional development and coaches for teachers. As with the increase in graduation requirements, there were no improvements in students' test scores or grades. In some schools, test scores actually declined, even though teachers were using high-quality curriculum with better pedagogy and aligned, formative assessments. Our evaluation of IDS found that a central challenge of the program was that classrooms became more disorderly as teachers struggled to implement the new curriculum, and learning declined.<sup>2</sup>

As the IDS and College Prep for All examples demonstrate, implementing rigorous standards is not sufficient to improve student learning, especially in schools that

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<sup>1</sup> Allensworth, Elaine M., Takako Nomi, Nicholas Montgomery, Valerie E. Lee. 2009. College Preparatory Curriculum for All: Academic Consequences of Requiring Algebra and English I for Ninth Graders in Chicago. *Educational Evaluation and Policy Analysis*, 31 (4).

Montgomery, Nicholas and Elaine M. Allensworth. 2010. *Passing Through Science: The Effects of Raising Graduation Requirements in Science on Course-Taking and Academic Achievement in Chicago*. Consortium on Chicago School Research, Chicago, Illinois.

Nomi, Takako. (2010) Unintended consequences of an Algebra-for-all policy on high-skill students: Evidence from Chicago Public Schools. Paper presented at the Association for Public Policy Analysis and Management, Boston, MA and the Society for Research on Educational Effectiveness conference, Washington DC.

<sup>2</sup> Hart, Holly, Spote, S., Correa, M. (June 9, 2009). Adopting a rigorous curriculum: Successes and challenges of Chicago's High School Transformation initiative. Paper presented at Annual Symposium of the Illinois Education Research Symposium, Champaign, IL. Spote, Sue, James Sebastian and Valerie Lee. (in progress.) Attempting Curricular Coherence: Three Years of Chicago's Instructional Development System Reforms and Developing a Framework for Assessing School Capacity: Insights from Curriculum Reforms in Chicago Public Schools.

already struggle with low levels of student engagement in their coursework. Engaging all students in more challenging work is crucial if they are to learn at high levels; however, it is important to note that such engagement requires more of both students and teachers. IDS and College Prep for All, like the Common Core, will require teachers to teach new and more challenging material to the students they serve. If schools do not have enough teachers with the content expertise to teach these new subjects, then more challenging standards can result in worse instruction and less learning. What is more, the Common Core will require that teachers be able to teach that material to students with diverse skills—including students entering their classes with skill levels so low that they have little chance of meeting standards without substantial support. If teachers don't know how to teach the standards to their students well, students learn less than they would if teachers had remained focused on material with which they were comfortable.

Implementing rigorous standards for all students is an especially difficult challenge in schools that serve large numbers of students with very weak academic skills. Schools need strategies for supporting teachers to teach more diverse learners and to provide them support. They also need systems in place to support students so that they can handle tougher material. In other words, higher standards need to be accompanied by structures that will support teachers and learners.

- 2) **Accountability.** Beginning in 1995, Chicago was one of the first districts to enact very strong accountability sanctions to schools based on standardized tests and has been active in closing and restructuring schools in response to low performance. As federal initiatives such as the No Child Left Behind Act and Race to the Top competition have increased the use of and focus on high-stakes testing, it is important to pay attention to some of the effects that accountability has had on learning generally and STEM learning in particular. High-stakes accountability in Chicago has had some benefits for low-achieving students: teachers are more likely to pay attention to students scoring below standards, and there are more resources aimed at low-scoring students through summer and after school programs. Furthermore, schools that previously were not teaching students grade level material in math in the middle grades started teaching students the material they needed to know to pass the standards.

However, there have also been adverse consequences to the strong focus on test-based accountability, especially in schools that are under the most pressure to increase test scores. In Chicago, these schools tend to be racially isolated schools where all students are African-American or Latino. One consequence has been the narrowing of the curriculum away from science and subjects other than reading and

math. Another adverse consequence has been that schools now spend extraordinary amounts of time just practicing taking tests—using up time that could be spent on improving students’ academic skills. Furthermore, test practice and drilling test problems is boring for students, and leads them to be less engaged and interested in class.<sup>3</sup>

Too much of an emphasis on tests can lead it to appear as if learning is improving, when instruction is actually being narrowly focused to better test performance. This can be seen when districts change the assessments used for school accountability. In Chicago, for example, performance declined considerably at the schools under the most pressure to improve scores when the district switched tests in 2006—these schools had been tailoring instruction too narrowly to the old test.<sup>4</sup>

When so much pressure is placed on students’ test performance, the goal of instruction becomes improving test scores, rather than making students into good learners. Ironically, test scores are not that predictive of later outcomes—including success in college. Getting students to do well on tests does not have much pay-off for students, unless it is done in a way that makes them more engaged in the subject and teaches them how to be better learners. What is much more important is the degree to which students are actively engaged and earning high grades in their science and math classes—regardless of their test scores.<sup>5</sup>

- 3) **Teacher Quality.** One of President Obama’s key STEM initiatives has been his 100Kin10, a public-private effort to recruit and train 100,000 new high-quality STEM teachers within the next 10 years. Chicago also has sought to increase the

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3 Allensworth, Elaine and Jenny Nagaoka. 2010. “The effects of retaining students in grade with high stakes promotion tests.” Chapter 20 in Judith Meece (ed.), *Handbook on Schools, Schooling, and Human Development*, Taylor & Francis.

Roderick, M., & Nagaoka, J. (2005). Retention under Chicago's high-stakes testing program: Helpful, harmful or harmless? *Education Evaluation and Policy Analysis*, 24(4), 309–340. Roderick, M., & Engel, M. (2001). The grasshopper and the ant: Motivational responses of low-achieving students to high-stakes testing. *Educational Evaluation and Policy Analysis*, 23(3), 197–227.

Roderick, M., Engel, M., & Nagaoka, J. (2003). *Ending social promotion: Results from Summer Bridge*. Chicago, IL: Consortium on Chicago School Research.

4 Luppescu, Stuart. Elaine M. Allensworth, Paul Moore, Marisa de la Torre, James Murphy with Sanja Jagesic. 2011. *Trends in Chicago’s Schools Across Three Eras of Reform*. Consortium on Chicago School Research, Chicago, Illinois. [http://ccsr.uchicago.edu/content/publications.php?pub\\_id=157](http://ccsr.uchicago.edu/content/publications.php?pub_id=157)

<sup>5</sup> Roderick, Melissa, Jenny Nagaoka, Elaine Allensworth, Vanessa Coca, Macarena Correa and Ginger Stoker. 2006. *From High School to the Future: A first look at Chicago Public School graduates’ college enrollment, college preparation, and graduation from four-year colleges*. Consortium on Chicago School Research, Chicago, Illinois.

Allensworth, Elaine M., John Q. Easton. 2005. *The On-Track Indicator as a Predictor of High School Graduation*. Consortium on Chicago School Research, Chicago, Illinois. <http://www.consortium-chicago.org/publications/p78.html>

supply of highly qualified teachers by partnering with a number of organizations to try to increase teacher quality, and the system has succeeded in hiring many more high-achieving candidates. However, teachers tend to leave schools with poor climates for learning, or where they do not feel supported by their colleagues and administration.<sup>6</sup> Getting the best teachers in the worst schools doesn't help improve the schools if they don't stay in those schools. Furthermore, highly-qualified teachers are not even very effective in schools that are not well organized to support instruction. While student achievement tends to be higher in schools with more highly-qualified teachers, there is no relationship between teacher quality and student achievement in schools with poor climates for learning—places that are disorganized and where students and teachers do not feel safe and supported.<sup>7</sup> Thus, the federal investment in training and recruiting high-quality teachers is unlikely to have a positive effect on chronically low-achieving schools without a corresponding push to improve the organizational health of schools.

What we have learned from our 20 years studying Chicago Public Schools is that we need well-organized schools to make good use of high-quality curriculum, respond to accountability standards, and retain good teachers. Otherwise, these policies do not improve student achievement. Schools that do not have the capacity to respond to the policies react in counter-productive ways.

What matters most for school improvement and high learning gains is whether they are organized to support students as learners. Two decades of research in Chicago shows that this requires building the organizational capacity of schools in five essential areas.<sup>8</sup> Schools that are strong in three of five of these areas are 10 times more likely to improve student learning in math and reading than schools that are weak in any. These include:

**Strategic school leadership.** Principals must be strategic--focused on improving the other four organizational supports, and include staff and parents in school decision-making.

**Strong professional capacity.** Teaching staff should be skilled, but more important than the qualifications of individual teachers is the degree to which faculty and staff work together to improve the learning climate and instruction in the school.

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<sup>6</sup> Allensworth, Elaine M., Stephen Ponisciak and Christopher Mazzeo. 2009. [The Schools Teachers Leave: Teacher Mobility in Chicago Public Schools](#). Consortium on Chicago School Research, Chicago, Illinois.

<sup>7</sup> DeAngelis, Karen J. and Presley, Jennifer B.(2011) 'Teacher Qualifications and School Climate: Examining Their Interrelationship for School Improvement', *Leadership and Policy in Schools*, 10: 1, 84 — 120.

<sup>8</sup> Bryk, Anthony S., Penny Bender Sebring, Elaine Allensworth, Stuart Luppescu, John Q. Easton. 2010. *Organizing Schools for Improvement: Lessons from Chicago*. Chicago: University of Chicago Press.

**Parent-community ties.** Successful schools actively involve parents as partners in children’s education and use local partners to support instruction in the school in a coordinated way.

**Student-centered learning climate.** Learning requires an environment that is safe, stimulating and supportive for all students.

**Instructional Guidance.** Student learning depends on instruction that engages them as learners, so that the focus is on students rather than on content. It also requires that curriculum be aligned across grade levels and subjects so that students are increasingly developing their skills through challenging tasks.

One of the key studies that examined these organizational supports compared reading and math improvement in 400 low-performing elementary schools in Chicago. As previously mentioned, this work showed that schools with strong organizational supports were 10 times more likely to improve learning gains over time than those with any weakness. No schools with a poor learning climate and weak professional capacity improved over the six years of the study. But half of the schools with an aligned curriculum and collaborative relationships among teachers or between teachers and parents showed large improvements in math and reading scores gains. All of these schools were high-poverty schools located in highly disadvantaged communities.<sup>9</sup>

Notably, those schools in the most disadvantaged neighborhoods were most in need of strong organizational supports to show improvements. In neighborhoods where external supports for schools were weak—where there were low levels of education and employment in the community and little participation in community or religious organizations--the internal supports needed to be stronger. In schools serving families and communities with more social and financial capital, schools could improve as long as the internal organizational supports of the school were not weak.

This suggests that for policies around standards, accountability, and teacher quality to succeed, they should be designed in ways that promote the development of the five essential supports. It is important to think about the organizational capacity that schools will need to successfully implement new policies, and whether additional resources will be needed for schools with low capacity to implement them successfully. For example:

- **Curricular Standards.** To make the new Common Core standards effective for improving learning, schools requiring the largest instructional shifts will need support for students and teachers so that learning climate does not decline with

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<sup>9</sup> Bryk, Anthony S., Penny Bender Sebring, Elaine Allensworth, Stuart Luppescu, John Q. Easton. 2010. *Organizing Schools for Improvement: Lessons from Chicago*. Chicago: University of Chicago Press.

the challenge of the new curriculum. For the new standards to result in better outcomes for students, students need to be engaged in that curriculum. Teachers need help designing instruction in ways that keep students engaged around the rigorous material, and to continuously monitor how they are doing so that they can support them as soon as they start to struggle. This is more likely to happen if there are systems in place to support teachers in instruction, classroom management, and monitoring and assessment. Potentially beneficial supports include time in teachers' schedules to work together to help each other with instructional challenges, extra staff in classrooms as partners with teachers to help students as soon as they start to struggle or withdraw, and use of technology to help monitor students' engagement and provide immediate feedback to teachers and parents when students fall behind.<sup>10</sup>

- **Accountability.** In order for accountability to lead to real progress, the indicators that are tracked need to measure progress. This means looking at average gains, rather than tracking the percentage of students that meet particular scores corresponding with state or national standards.<sup>11</sup> Furthermore, accountability metrics should include measures that are strongly associated with later outcomes, not just test scores. College acceptance rates, and whether students persist in college through graduation, are not subject to the problems associated with accountability based on test scores. Basic measures like attendance in classes, interest in math and science, and students' perceptions of challenge and support in their math and science classes are strong and valid indicators of later outcomes. These are also indicators that are easier for staff to work together to improve, and improvement in student achievement is most likely to happen when staff work together on common problems.

The money that has been invested by the federal government in data systems allows for better use of data for intervention and strategy, not just for accountability. In Chicago, high schools have been making tremendous progress in high school graduation and college enrollment by tracking indicators such as

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<sup>10</sup> In 2003, Chicago attempted to improve algebra performance for students entering high school with weak math skills by giving them twice as much instruction, and giving their teachers professional development to use the extra instructional time. While the policy only targeted students with below-average math skills, it resulted in higher test scores for all students. By giving extra support to low-skill students, they no longer held back the pacing and content of algebra classes for students with above-average skills, so that students with above-average skills also learned more (Nomi, Takako and Elaine Allensworth. 2009. "Double-Dose" Algebra as an Alternative Strategy to Remediation: Effects on Students' Academic Outcomes. *Journal of Research on Educational Effectiveness*, 2: 111–148.).

<sup>11</sup> For further discussion of this issue, see Luppescu, Stuart. Elaine M. Allensworth, Paul Moore, Marisa de la Torre, James Murphy with Sanja Jagesic. 2011. Trends in Chicago's Schools Across Three Eras of Reform. Consortium on Chicago School Research, Chicago, Illinois.  
[http://ccsr.uchicago.edu/content/publications.php?pub\\_id=157](http://ccsr.uchicago.edu/content/publications.php?pub_id=157)

student attendance, grades, college applications, and FASFA through student and school reports that are updated frequently. In Chicago, the percentage of students who are “on-track” to graduate after freshman year increased by 11 percentage points between 2002 and 2010. This improvement should result in a commensurate increase in graduation rates. Those schools that have made the most progress use the reports to get staff working together to develop strategies and help each other improve those outcomes. They use data on individual students to build partnerships between teachers and parents.

- **Teacher quality.** It is vital to have teachers who know their subject well, and who know how to teach the students in their classroom. If we expect students who have very weak academic skills to master college-ready material, this means they need the strongest teachers. More importantly, those teachers need support, high-quality professional development that is embedded in their work at their school, and colleagues who are collaborative and will help them when they need it.<sup>12</sup> It is difficult to mandate cooperation, but the government can provide resources so that teachers have the time to work together, and resources that help them use that time effectively. They can encourage the use of teacher evaluation systems that promote collaboration with colleagues and with parents.

Rigorous curriculum standards, high-stakes school accountability, and efforts to attract more teachers with strong backgrounds are all strategies that may have potential for improving student achievement; however, they have had little pay-off in Chicago’s schools. As the federal government works to implement similar strategies it would be wise to learn lessons from Chicago’s efforts and carefully consider when designing new initiatives the capacity of schools to implement those standards, respond to accountability, and keep and support strong teachers. This is especially critical if there is to be real improvement in STEM learning and STEM careers among minority youth concentrated in low-performing urban school districts.

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<sup>12</sup> Bryk, Anthony S., Penny Bender Sebring, Elaine Allensworth, Stuart Luppescu, John Q. Easton. 2010. Organizing Schools for Improvement: Lessons from Chicago. Chicago: University of Chicago Press.