

**Improving Chances for College Success  
For Low Income and Minority  
High School Students**

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**By the  
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The high school diploma is no longer the credential for a lifetime and it has not been for decades. Since the 1970s, there has been a growing consensus that training or education beyond high school is necessary to qualify for "family wage" jobs, jobs that pay enough for a family to live reasonably comfortably. Despite this widespread realization, a high school diploma still does not assure that a graduate is ready for college. Further, despite years of statewide efforts to optimize education for all students, high schools continue to operate on a two-track system that is founded on the obsolete notion that many students are not and never will be "college material."

However, as dedicated school leaders and teachers have found, commitment and even resources are not enough. Many of the factors that influence academic achievement and college participation are outside the control of educators. Research has shown and logic tells us that majority students from middle and upper income families whose parents have college degrees are more likely than others to take a college preparatory curriculum in high school, enter college directly after graduation, and obtain a bachelor's degree. The challenge is to identify success factors for low income and minority students whose parents did not attend college.

This paper summarizes the results of efforts to identify academic factors that can make a difference for students of all backgrounds. In 2003, with support from the Illinois Board of Higher Education through a Higher Education Cooperation Act grant, the Center for the Study of Education Policy at Illinois State University began a multi-faceted study of the course-taking patterns and other characteristics of juniors in Illinois high schools and their performance on the Prairie State Achievement Examination (PSAE). This summary draws upon the reviews of the literature and research conducted by faculty and graduate students in the Center.

**Academic Achievement and College Success**

As described by Edward Hines and Shawn Wick, this research was founded on previous studies that had examined the factors that have been shown to improve college access for minority and low income high school students. School factors include curriculum, tracking policies, teacher quality, and classroom features. Non-school factors include socio-economic status, culture, poverty, and neighborhood and community issues. Some studies have shown that the segregation of schools makes a difference in students' performance. There is also considerable evidence that both the number and

content of courses taken in high school make a difference in the performance in college entrance examinations, college participation, and college success for all students including minority and low-income students.

In a 2004 review of the literature, Erica Bumpers noted that “achievement among poor and minority students has been one of the most controversial and misunderstood areas of inquiry in educational research.” Many studies have shown that minority and low income students are less likely than others to persist through high school, enroll in college, and obtain a degree. However, few studies have focused on factors that contribute to academic achievement and college success for low income and minority students or attempt to determine whether the influences that affect others work in different ways for these students.

The following table provides a summary of the factors related to academic achievement and college success identified in a review of the literature by Bumpers. Personal and family characteristics are among the strongest predictors. Although these factors cannot be changed, they might be used to identify students who need particular attention in order to succeed academically.

<b>Factors Related to Academic Achievement and College Success</b>		
<b>Personal &amp; Family Characteristics</b>	<b>School Characteristics &amp; Practices</b>	<b>Academic Choices &amp; Experiences</b>
Academic ability Family income Racial/ethnic group Parents' education level Parents' involvement	School resources Adequacy of course offerings Preparation of teachers Quality of teaching Teachers' Expectations Intensity of the curriculum Tracking practices Advising	College aspirations Course-taking choices <ul style="list-style-type: none"> <li>• College preparatory</li> <li>• Accelerated &amp; honors courses</li> <li>• Advanced Placement</li> <li>• Dual college/high school courses</li> </ul>

Among those factors that can be affected by public policies are school characteristics and practices and the academic choices and experiences of students. Disparities in school resources and facilities have been noted between urban and suburban schools and between schools that serve minority populations and schools that serve majority or mixed populations. Recent studies have linked lower resources—larger class sizes, less qualified teachers, out-dated texts and technology—with lower overall student performance.

Students' performance tends to parallel teachers' expectations—high expectations are associated with high performance. Some studies have shown that expectations may be influenced by students' race or ethnicity, class, and gender and that low expectations are commonly associated with low income and minority students.

Bumpers notes that studies of tracking practices of schools have shown that minority and low-income students are generally under-represented in college preparatory courses. Frequently they are tracked into “undemanding vocational, industrial, or general programs that would not prepare these students to attend college.” The purpose of curriculum tracking policies has been to provide a “practical curriculum for those who would soon be in the workforce and not attend college.”

Taking a college preparatory curriculum has been shown to have a positive relationship with academic achievement and eventual college success for all groups of students. Despite tracking practices, students and their parents may be able to make choices about courses. In general, researchers conclude that the number and rigor of academic courses benefit minority and low-income students as well as other students. Illinois ACT scores show that students in all racial/ethnic groups benefit substantially from taking a college preparatory core (4 units of English and 3 units each of mathematics, sciences, and social studies), averaging almost four points higher on the ACT than those who did not complete a college-preparatory curriculum, although White and Asian students showed a higher gain than other groups. (ACT Profile for Illinois 2004).

Clifford Adelman’s analysis of the national “High School and Beyond” data showed that mathematics is the key and with each additional course, chances of attaining a bachelor’s degree increased. For example, students, who took calculus, regardless of socioeconomic status, were about 10 times more likely to earn a bachelor’s degree than students who took no math beyond algebra 1.

### **The Math Ladder**

To examine the relationship between course-taking patterns and achievement in Illinois schools, the Illinois State University researchers analyzed student and school characteristics and the results of the Prairie State Achievement Examination (PSAE) of 2002 juniors.

William Rau and Shawn Wick found that the math curriculum can be arranged in a hierarchy from algebra 1 to calculus, thus forming a ladder and for each additional course in mathematics, the chances of meeting or exceeding PSAE math standards increased substantially. There was a significant increase in the percentage meeting/exceeding standards between students who completed algebra 2 and those who went on to complete trigonometry. “Quite clearly and inescapably, the algebra 2/trigonometry divide separates students into mathematical haves and have-nots.” However, relatively few students reached the top of the mathematics ladder; a majority stopped at algebra 2.

Math Ladder and PSAE Performance 2002 Illinois Juniors				
Rung	Course	% Completing or Planning to Complete	PSAE Math Standards	
			% Below Standards or on Warning	% Meeting or Exceeding
1	Algebra 1	86	87	13
2	Geometry	79	77	23
3	Algebra 2	71	59	41
4	Trigonometry	44	36	63
5	Advanced Math	33	17	83
6	Calculus	21	16	84
	All Students	-	43	57

The researchers examined PSAE mathematics scores and the math ladder while controlling for differences related to gender, ethnicity, and family income. They found that the math ladder is the strongest predictor that a student will meet or exceed standards. As a predictor, math achievement exceeded all other single predictors, even including parents' educational attainment and socioeconomic status. For example, "movement from rung 1 to 6 on the math ladder adds 27 points to a student's PSAE math score whereas movement from the lowest to highest income category adds only 8.7 points."

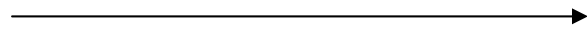
This analysis also showed that, although there were no differences in math scores based on gender, race/ethnicity made a difference. The PSAE math scores of African-American and Latino students were lower than all other students. Further, the math ladder has a weaker relationship to the performance of African-American students on the PSAE and a stronger relationship to performance of White students.

### **The Broken Ladder**

Rau and Wick investigated the relationship between the racial mix of schools and the effect of the math ladder on the performance of almost 7,000 African-American students who took the PSAE in 2002. They found that for students attending more segregated Model 4 schools (98 to 100% African American) neither the math ladder nor family income were good predictors of PSAE performance. "African American students at fully segregated schools can expect to add only 8 points to their PSAE math scores if they advance to calculus rather than stop at algebra 1 whereas their African-American peers at Model 1 (less than 10% African-American) schools gain 25 points."

It is clear that the math ladder works for African-American students attending Model 1 (less than 10% African American) and Model 2 (25%-49% African American) schools where the percentage of students meeting exceeding math standards increases with each rung of the ladder. However,

the math ladder is less effective for students attending Model 3 schools where over half of the population is black. In highly segregated Model 4 schools, the math ladder is no longer the key to meeting the PSAE math standards and obtaining the further educational opportunities that those standards suggest. Further, “not one student out of 4,000 exceeds state math standards at the all black high schools in Illinois.”

Math Ladder and PSAE Performance of 2002 African American Juniors By Racial Composition of Schools					
		Increasing Segregation 			
	Course	Model 1 <10% African American	Model 2 25-49% African American	Model 3 50-79% African American	Model 4 98-100% African American
		Percent Meeting or Exceeding PSAE Math Standards			
1	Algebra 1	5	2	4	0
2	Geometry	7	4	3	3
3	Algebra 2	21	17	8	5
4	Trigonometry	40	31	17	8
5	Advanced Math	66	57	36	14
6	Calculus	59	54	40	13

This table has been simplified for clarity. For full data, see Rau, *The Broken Ladder*.

Using an advanced analytical technique, John Ragutt compared the effects of personal characteristics (e.g. being African American) to group characteristics (e.g. attending a predominately African American high school). This analysis supported earlier conclusions. The math ladder has an effect for all students in all types of schools, but its effect is dramatically weaker for Black students than for White students. If this disparity is found in the PSAE results for subsequent years, it would indicate critical inequality in the impact of course-taking on achievement and suggest that the same courses are not taught at the same level of academic rigor in the schools serving minority students.

### College Plans and Academic Achievement

In a second component of the project, Zeng Lin's took another approach to examining factors associated with academic achievement. First, his findings supported Rau's conclusion that the math ladder is a strong predictor of success in meeting the Illinois Learning Standards (ILS), even after controlling for the effects of gender, poverty, and ethnicity. Despite its importance, however, the math ladder does not eliminate the disadvantages of poverty and ethnicity. Compared to whites, the odds of meeting the ILS are 80% lower for African-American students and 70% lower for Latino students, even after controlling for differences in course taking.

Second, Lin examined overall PSAE performance and students' plans to attend college. The analysis showed that students who planned to go to college were more likely to meet or exceed the ILS as measured by the PSAE than those who did not plan to enroll in college. 58% of all students and 70% of the college-bound students met or exceeded the standards. Lin also found that students who were eligible for school lunch subsidy, which is based on poverty levels, were 60% less likely to meet the Illinois Learning Standards. African American students were 76% less likely than all students to meet the ILS and Latinos were 67% less likely. Males were slightly less likely than females to meet the ILS. However, students who completed the math ladder were 80% more likely to meet the ILS in all subject areas, not just mathematics.

Of particular interest were two groups—students who met the PSAE standards but did not plan to enroll in college and those who did *not* meet PSAE standards but did plan to enroll in college. Lin found that twelve percent of all 2002 high school juniors, over 14,000 students, met the Illinois Learning Standards but reported that they did not plan to enroll in college after high school graduation. This group included more males than females and more Native Americans and Whites than members of other racial/ethnic groups. Family income and eligibility for a school lunch subsidy did not seem to be related to their college plans.

Lin also found that almost 27,000 students, about 20% of the 2002 juniors, planned to go to college but did not meet the ILS. These students were more likely to be female than male. Larger proportions of Black and Hispanic than other students planned to go to college but did not meet the ILS. Typically, these students plan to enroll at an Illinois community college.

### **National Studies**

The findings of this research on Illinois students are consistent with trends found in national studies. W. Paul Vogt's review of national studies found clear parallels with the Illinois studies. Between 1990 and 2000, the national High School Transcript Study found that the total number of credits earned by high school students had increased from 23.5 to 26.2, while the number of courses in core academic subjects increased from 13.7 to 15.0. Despite evidence of across-the-board grade inflation, it is clear that course-taking patterns made a difference. For example, students who took advanced math and sciences had higher grade point averages and higher scores on the National Assessment of Educational Progress (NAEP). "The number and intensity of courses taken were strongly related to scores on the NAEP science and math tests given in 2000."

Other studies have shown a relationship between math course taking and the type of college attended. Students who took calculus were more likely to attend doctoral universities, while students who took introductory algebra attended community colleges. Similarly, students who took advanced



mathematics courses were more likely than other students to complete a bachelor's or graduate degree.

Vogt's review of national studies also confirms the conclusion that course-taking patterns, academic achievement, and college success differ by race/ethnicity, family income, and gender.

### **Summary and Conclusions**

What can we do to help minority and low income students improve their chances for success in college? Researchers with the Center for the Study of Education Policy at Illinois State University are seeking answers to this question, perhaps one of the most important public policy questions of the decade.

Using various approaches, the researchers examined the courses-taking patterns and other characteristics of juniors in Illinois high schools and their performance on the Prairie State Achievement Examination. Because there is such a clear-cut progression of courses in mathematics from algebra 1 to calculus, the math ladder was the focus of the analysis which found the following:

- For each additional course in mathematics, students' chances of meeting or exceeding Illinois math standards increase.
- Moving from rung 1 (algebra 1) to rung 6 (calculus) up the math ladder adds 27 points to a student's PSAE score. Moving from the lowest to highest income categories adds only 8 points.
- Trigonometry separates the "mathematical haves" from the "have-nots." Although fewer than half of students advance past algebra 2 to take trigonometry, these students are much more likely to meet standards.
- The math ladder is effective for all racial/ethnic groups. It is more effective for White and Asian students than for Black and Hispanic students.
- The math ladder is far less effective for black students attending all-black schools. Students who advance to calculus at fully segregated schools can expect to add only 8 points to their PSAE scores. African American students at schools with less than 10% African American students gain 25 points.

The Center's researchers also examined the relationship between college plans and achievement on the PSAE in all subject areas. Key findings included:

- Students who planned to go to college were more likely than others to meeting the Illinois Learning Standards.
- 12% of the 2002 high school juniors met the Illinois Learning Standards but reported that they did not plan to go to college. This group included more males than females and more Native Americans and Whites than other groups.
- 20% of the 2002 planned to go to college but not meet the Learning Standards. Students in this group were more likely to be female, Black and Latino.

These studies provide some answers. Low income and minority students can improve their chances of meeting Illinois Learning Standards by pursuing an academically rigorous high school curriculum. The math ladder provides a clear path to academic achievement in high school and related college success. However, the researchers found that the math ladder was far less effective for students attending all-Black schools.

Further research is needed to determine why these schools are different and what can be done to assure that the math ladder and other curriculum ladders are effective for all students. Further research is also needed to identify ways to open opportunities for two groups of students—those who meet Illinois Learning Standards but do not plan to go to college and those who plan to go to college but do not meet Standards.



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