Student and School Predictors of High School Graduation in California

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By

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Abstract

Solving the dropout crisis in California requires a better understanding of the nature and causes of the problem. This report analyzes student and school predictors of high school graduation based on a sample of 1,343 California tenth grade students who attended 63 public high schools in 2002. The analysis is based on survey data collected from students, teachers, principals, and parents in 2002, and transcripts collected one year after students' expected graduation in 2004. This study identified a number of alterable student and school predictors of high school graduation, including student engagement and achievement as well as school academic climate. In all, the findings from this study support the argument that solving California's high school dropout crisis will take a multifaceted approach—it will require better preparing students *before* they enter high school, addressing their social as well as their academic needs while in high school, and it will require improving high schools themselves.

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California is facing a dropout crisis. According to data complied by the California Department of Education, only two-thirds of the 520,287 public school students enrolled in the ninth grade in 2002-03 graduated four years later (California State Department of Education., 2007). Graduation rates for minority students and for some school districts in the state are estimated to be closer to 50 percent (Orfield, Losen, Wald, & Swanson, 2004). The economic and social costs to the state are staggering. A recent study estimated that the economic losses to the state from a single group of 20-year-old dropouts exceed $46 billion (Belfield & Levin, 2007). A failure to address the problem threatens California's future welfare.

To solve the dropout crisis in California requires a better understanding of the nature and causes of the problem. Over the last forty years a considerable body of research has been conducted on high school dropouts (Rumberger, 2004). Research has identified a number of factors that increase or decrease the odds that a student will graduate or fail to graduate from high school. Many of these factors have been identified from statistical models that control for a number of other predictive factors, suggesting a direct, causal connection. Although statistical models can only suggest causal connections, not prove them, they can help identify statistically significant predictors of dropping out or graduating that can provide guidance for intervention strategies.

To better address the dropout crisis in California requires research that focuses on California students and schools. The public school population in California differs substantially from the public school population in the rest of the country. For example, California public schools enrolled a much higher proportion of racial, ethnic, and linguistic minority students than schools nationally (Sable & Hill, 2006, Table 3). California's expenditures per student are also substantially lower than the national average (Ibid, Table 7).

This study examines student and school predictors of high school graduation for a sample of 1,343 California tenth grade students who attended 63 public high schools in 2002. The data are drawn from a larger national longitudinal study of 2002 high school sophomores who were tracked until 2005 (the year following their intended year of graduation), at which time high school transcripts were collected. The transcript data was used to determine whether the students had earned a high school diploma or not. Students who had not graduated may have dropped out or they could have pursued other options, such as earning an equivalent high school diploma. We decided to focus on whether students had graduated.

The study addresses the following questions:

1. What characteristics of California tenth grade students predict whether they graduate from high school?
2. Controlling for the background characteristics of their students, what high schools in California have better than expected graduation rates and which ones have worse than expected graduation rates?
3. What school characteristics predict whether schools have better than expected graduation rates?

Previous Research

There is a substantial body of research that has been conducted on the determinants of dropping out and high school completion. This research focuses on perspectives for understanding why students drop out of school; one that focuses on the attributes of individuals, and one that focuses on the attributes of the family, school, and community settings in which students live.

Individual Perspective

The first perspective focuses on the attributes of students—such as their values, attitudes, behaviors, and school performance—and how these attributes contribute to their decision to quit school. Figure 1 provides a conceptual framework that illustrates how these attributes contribute to several, related aspects of student performance such as academic achievement (reflected in grades and test scores), graduation, or dropout. These outcomes are interrelated. For example, academic achievement has a direct effect on both graduating from school and dropping out of school (Lee & Burkam, 1992; Rumberger, 2003; Swanson & Schneider, 1999). Dropping out of high school (even temporarily), and transferring schools both represent a form of educational instability that decreases the likelihood of graduating from high school (Rumberger, 2003).

The framework identifies a number of student attributes that contribute to student performance. Some of these attributes are more proximal to high school outcomes—the values, attitudes, and behaviors of students in high school that immediately precede the decision to leave or remain in school. Other attributes are more distal to high school outcomes—they concern the values, attributes, and behaviors prior to entering high school that may either directly affect the decision to drop out, or indirectly affect the decision to drop out by influencing the more proximal attributes.

The framework views the proximal attributes of students through a particular concept—student engagement. Several theories have been developed in recent years that suggest dropping out of school is but the final stage in a dynamic and cumulative process of disengagement or withdrawal from school (Finn, 1989; Newmann, Wehlage, & Lamborn, 1992; Rumberger, 1987; Wehlage, Rutter, Smith, Lesko, & Fernandez, 1989). *Engagement* relates to students' participation and involvement in both the academic aspects of school, such as doing homework,

and the social aspects of school, such as participating in extracurricular activities. Engagement occurs in both the formal aspects of school (e.g., classrooms and school activities) and the informal ones (e.g., peer and adult relationships). Both aspects of engagement can influence the decision to withdraw from school. For example, students may withdraw from school because they quit doing their schoolwork or because they do not get along with their peers.

Engagement is often characterized as a multidimensional construct, involving three components: *cognitive*, *behavioral*, and *emotional* (Fredricks, Blumenfeld, & Paris, 2004). Cognitive engagement represents mental behaviors that contribute to learning, such as trying hard and expending effort on academic tasks. Behavioral engagement represents behaviors that demonstrate students' attachment and involvement in both the academic and social aspects of school, such as doing homework and participating in extracurricular activities like athletics or student government. Emotional or affective engagement represents positive dispositions toward school, such as having an interest in school, and being happy when in school.

Some conceptions of engagement include student attitudes, while other conceptions view student attitudes as precursors to engagement. This distinction reflects the fact that students may arrive at school with a set of attitudes, while engagement only occurs as a result of students' experiences after they arrive. For example, the National Research Council report, *Engaging Schools: Fostering High School Students' Motivation to Learn*, developed a model of academic engagement, which is manifested in behaviors and emotions and, in turn, is influenced by three psychological variables: students' beliefs about their competence and control (*I can*), their values and goals (*I want to*), and their sense of social connectiveness or belonging (*I belong*) (National Research Council, Committee on Increasing High School Students' Engagement and Motivation to Learn, 2004, Chapter 2).

The propensity to drop out may also be influenced by other experiences in high school. One of the most important involves the high school coursework or program that students pursue. Although all students must earn a specified number of credits in academic and other subjects in order to graduate (Lloyd, 2007), they also can pursue three types of educational programs or curricula in high school—college preparatory courses that are required for college entry, vocational (now more commonly referred to as career-technical education or CTE) courses that prepare students for employment directly after high school or more advanced vocational programs in community colleges, or a general curriculum. A recent study of high school graduates from 2004 found that about 26 percent had completed a college preparatory program, 18 percent had completed a vocational program, and the remaining 56 percent had completed a general curriculum (Planty, Bozick, & Ingels, 2006). Although proponents of career and technical education argue that such programs can motivate students to stay in school, critics have found that the placement in these three tracks is strongly influenced by social class background, and that students outside the college-prep track generally have more poorly-prepared teachers and receive a less rigorous curriculum (Oakes, 1986). And although some studies have found that students in some vocational tracks are more likely to drop out (Ainsworth & Roscigno, 2005), others have found that students in vocational tracks who do not pursue higher education have an advantage in the labor market (Bishop & Mane, 2004).

Another experience that may influence completion is high school employment. Several studies have found that working long hours (more than 20 hours) during high school can increase the likelihood of dropping out, and that impact does not vary among racial or socio-economic status (SES) groups (Seltzer, 1994), although it does depend on the type of job held and on the student's gender (McNeal, 1997a).

Student attitudes and engagement in high school are, in turn, influenced by more distal factors related to students' experiences at the beginning of or prior to entering high school. One reason for focusing on such factors is that they can serve as useful indicators of students who may be at-risk for dropping out and who may benefit from interventions to help them remain in school. Two recent studies have identified a series of indicators that identify students who are at-risk of dropping out of high school. One study in Chicago created an "on-track" indicator based on whether students earned at least five full-year course credits and had no more than one semester of an "F" during ninth grade (Allensworth & Easton, 2005). Forty percent of freshmen in 2003-04 were identified as on-track, and these students were more than three and a half times more likely to graduate from high school in four years than off-track students (p. 7). Another study in Philadelphia identified students at-risk of dropping out by two indicators of their performance in eighth grade: 1) whether they attended school less than 80 percent of the time, and/or 2) whether they failed mathematics or English (Neild & Balfanz, 2006). Fifty-four percent of the dropouts from the class of 2000 were at-risk in eighth grade, although they comprised only 34 percent of all eighth graders (p. 28).

Other studies have found that early academic achievement and engagement (e.g., attendance, misbehavior) in elementary and middle school predicted eventual withdrawal from high school (Alexander, Entwisle, & Horsey, 1997; Barrington & Hendricks, 1989; Cairns, Cairns, & Necherman, 1989; Ensminger & Slusacick, 1992; Currie & Thomas, 1999). Retention is another indicator of early school performance, and has been shown in most studies to significantly increase the likelihood of dropping out (for a review of the research literature, see: Jimerson, Anderson, & Whipple, 2002). Studies also show that early risk factors are

compounded: the more risk factors the students experience over their schooling careers, the greater likelihood of dropping out (Alexander, Entwisle, & Slusacick, 2001).

Finally, dropping out is associated with a number of demographic characteristics, including gender, race and ethnicity, and language background. For example, dropout rates are higher for males than for females, and higher for Blacks and Hispanics than for Whites (Snyder, Dillow, & Hoffman, 2007, Table 104). Yet after controlling for other, related factors—particularly family socioeconomic status and student achievement—race and ethnic differences are less pronounced, although in some studies they still remain significant (Goldschmidt & Wang, 1999; Swanson & Schneider, 1999; Rumberger & Larson, 1998). Using similar controls, some studies find female dropout rates remain lower, while other studies find that they are higher, even using the same datasets (Goldschmidt & Wang, 1999; Swanson & Schneider, 1999; Rumberger & Larson, 1998). Because so many of the factors that predict dropout and graduation are inter-related, whether any particular factor is a significant positive or negative predictor depends upon what other factors are taken into account or controlled in any particular study.

Institutional Perspective

While students' decisions to quit or remain in school are clearly related to their attitudes and behaviors, these factors are shaped by three settings or contexts in which students live—families, schools, and communities. Empirical research on dropouts has identified a number of factors within students' families, schools, and communities (and peers) that predict dropping out.

Family factors. A number of family characteristics have been shown to predict dropping out. Research has consistently found that *socioeconomic status*, most commonly measured by parental education and income, is one of the most powerful predictors of school achievement and dropout behavior (Bryk & Thum, 1989; Ekstrom, Goertz, Pollack, & Rock, 1986; McNeal, 1999;

Rumberger, 1983; Rumberger, 1995; Rumberger & Larson, 1998; Pong & Ju, 2000). Research has also demonstrated that *family structure* also predicts dropout behavior, independent of socioeconomic status. Specifically, students from single-parent and step families are more likely to drop out of school than students from two-parent families (Astone & McLanahan, 1991; Ekstrom et al., 1986; McNeal, 1999; Rumberger, 1983; Rumberger, 1995; Rumberger & Larson, 1998; Teachman, Paasch, & Carver, 1996). In addition to these structural factors, research has identified a number of *family practices* that characterize the relationships parents have with their children, other families, and with their children's schools—sometimes referred to as *social capital* (Coleman, 1988)—also influence whether students drop out of school (Astone & McLanahan, 1991; McNeal, 1999; Rumberger & Larson, 1998; Rumberger & Palardy, 2005; Teachman et al., 1996).

School factors. Four types of school characteristics have been shown to influence student performance: (1) structural features, (2) student composition, (3) resources, and (4) processes and practices. There are two structural features that have been shown to predict dropout and graduation rates—whether the school is public or private (Bryk & Thum, 1989), and school size (Roderick, Jacob, & Byrk, 2002; Rumberger & Thomas, 2000; Rumberger & Palardy, 2005). Several studies have found that the social composition of schools—primarily school SES—predicts school dropout rates, even after controlling for the individual effects of student background characteristics (Bryk & Thum, 1989; McNeal, 1997b; Rumberger, 1995; Rumberger and Thomas, 2000). Yet other studies have shown if peer groups (e.g., percentage of disadvantaged students in school) are treated as an endogenous factor—that is, unobserved factors both influence peer group membership and dropout—then peer groups do not exert an independent influence on dropping out (Evans, Oates, & Schwab, 1992; Rivkin, 2001). Several

studies have found that school resources—as measured by the pupil/teacher ratio—have a positive and significant effect on high school and middle school dropout rates even after controlling for a host of individual and contextual factors that might also influence dropout rates (McNeal, 1997b; Rumberger & Thomas, 2000). Finally, several studies found academic and social climate—as measured by school attendance rates, students taking advanced courses, and student perceptions of a fair discipline policy—predict school dropout rates, even after controlling for the background characteristics of students as well as the resource and structural characteristics of schools (Bryk & Thum, 1989; Rumberger, 1995; Rumberger & Thomas, 2000). However, another study (using one of the same data sets as the above, but using different sets of variables and statistical techniques, and controlling for the background characteristics of students, social composition, school resources, and school structure), found *no* effect of academic or social climate on high school dropout rates (McNeal, 1997b). A more recent study found that school social capital—as reflected in positive relationships between students and teachers—reduced the risk of dropping out, especially among high-risk students (Croninger & Lee, 2001).

Communities and Peers. Several studies have shown that having friends or siblings who have dropped out increases the likelihood of dropping out (Carbonaro, 1998; Ellenbogen & Chamberland, 1997; Rumberger & Thomas, 2000). Research has also shown that having high achieving friends can reduce the likelihood of dropping out of school (Kasen, Cohen, & Brook J.S., 1998). There is at least some empirical evidence that differences in neighborhood characteristics can help explain differences in dropout rates among communities, apart from the influence of families (Brooks-Gunn, Duncan, Klebanov, & Sealand, 1993; Clark, 1992; Crane, 1991).

How the Study was Conducted

This study utilized data from the Education Longitudinal Study (ELS), a longitudinal study of 16,252 high school sophomores who were enrolled in a national sample of public and private U.S. high schools in 2002. Participating students were administered questionnaires and standardized tests in mathematics and reading. Questionnaires were also administered to students' teachers, parents, and high school administrators. Students were resurveyed in 2004, when most were high school seniors. Transcripts were collected in the spring of 2005 for most of the original students. This study is based on a sub-sample of 1,343 tenth grade students who attended 63 public high schools in California in 2002, and for whom transcripts were collected and a valid outcome was determined. Comparisons between this sample (using sample weights) and data collected by the California Department of Education indicate the sample used in this study is representative of California students who were enrolled in the tenth grade in 2002 (see Appendix).

The primary dependent variable in this study was a measure of whether the student graduated from high school with a diploma as identified in the student's high school transcript. We decided to focus on this outcome rather than dropping out because high school graduation is the desired pathway to college and meaningful work. Students who do not graduate may have dropped out of school permanently, or they could have pursued other options, such as earning a high school equivalency or enrolling in a community college (where a diploma is not required).

A series of student, family, and school predictor variables were created based on the conceptual model and research literature reviewed earlier. We used these variables to estimate a series of statistical models in order to identify significant predictors of high school graduation. A discussion of the variables and statistical models is provided in the Appendix.

Who Graduates from High School in California?

According to the transcript data, 77 percent of California students who were enrolled in the tenth grade in the spring of 2002 graduated from high school by the spring of 2005, less than one year after their expected graduation date in 2004 (Table 1). The remaining students dropped out (nine percent), transferred and were not located (12 percent), or had some other designation on their transcript (two percent).

Gradation rates varied by demographic characteristics of students. Females had higher graduation rates than males (83 percent v. 71 percent). Graduation rates were higher for Asians (88 percent) and Whites (83 percent) than for Blacks (67 percent) and Hispanics (70 percent). And students from English-speaking backgrounds had somewhat higher graduation rates than students from non-English-speaking backgrounds (78 percent v. 74 percent).

Graduation rates also varied by family background. Graduation rates were lowest for students from low SES families (70 percent) and highest for students from high SES families (89 percent). Students who were living with both biological parents had higher graduation rates than students living in other family arrangements (82 percent v. 70 percent).

Graduation rates varied by academic background as well. We constructed three indicators of academic background: whether students were over-age based on California's kindergarten entry date of December 1 (in this study, students who were born before December 1985), which serves as a proxy measure for being held back; whether students had a low academic grade point average (GPA) in the ninth grade ("low" in this study is less than 2.0 but greater than or equal to 1.0); and whether students had failed (an academic GPA of less than 1.0) ninth grade. Forty-four percent of California tenth graders where identified as academically at-risk by at least one of these indicators: 19 percent were over-age, 26 percent had a low academic

GPA in ninth grade, and 7 percent had failed ninth grade (Table 1). Graduation rates varied greatly by whether students were academically at-risk or not at-risk—61 percent of students who were academically at-risk graduated compared to 89 percent of students who were not at-risk. Graduation rates varied among specific at-risk indicators: 61 percent of students who were over-age graduated, 64 percent of students who had a low academic GPA graduated, while only 34 percent of students who failed ninth grade graduated.

Both the incidence and consequences of being at-risk varied greatly by race/ethnicity and gender. Over half of all male high school sophomores were academically at-risk in 2002, compared to one-third of all female sophomores (Table 2). About half of all Black and Hispanic students were at-risk, compared to about one-third of Whites and one-quarter of Asians. Within each racial and ethnic group, males were more likely to be at-risk than females, with the biggest disparity among Whites: almost half of White males were at-risk compared to one-quarter of White females.

Graduation rates varied little by race/ethnicity or gender among students not at-risk. But they varied greatly among students who were at-risk. More than 70 percent of Asian and White students at-risk graduated from high school, compared to only about half of Black and Hispanic students. One reason is that Blacks and Hispanics were more likely to have failed ninth grade (10 and 11 percent, respectively), compared to Asians and Whites (2 and 4 percent, respectively), which represents the most risk for not graduating. Nonetheless, being at-risk was much more detrimental for Black and Hispanic students than for Asians and White students.

What Student Factors Predict High School Graduation

Schools cannot alter students' demographic characteristics, nor their family backgrounds; but they can alter what occurs to students once they walk in the door. Identifying alterable characteristics of students—their attitudes, behaviors, and performance—can provide guidance for designing interventions that may address those characteristics. Thus, the next step in this study was to identify more proximal predictors of whether students graduated or not.

We estimated predictors of high school graduation using a series of statistical models. The models allowed us to estimate the size and statistical significance of a number of predictors simultaneously—that is, we can determine the unique contribution of each variable in the model controlling for the effects of the other variables in the model. Although the statistical models are unable to determine whether there is a causal relationship between the predictor and the outcome variable—in this case, whether the student graduated from high school—controlling for other variables in the model allows us to rule out or control for other variables that may account for the relationship between the predictor variable and the outcome variable. This suggests, but does not prove, a causal relationship.

The estimated effects of the predictor variables are reported as odds ratios (OR). An odds ratio represents the change in odds of graduating due to a one-unit change in the predictor, where the odds equals the probability of graduating divided by the probability of not graduating. If the probability that a student graduates equals 50 percent, then the probability of not graduating also equals 50 percent, which corresponds to an odds ratio of one (sometimes referred to as *even odds*). A predictor has a positive effect if it increases the odds of graduating, and a negative effect if it decreases the odds of graduating.

An odds ratio is related to a change in probability, although the absolute change in probability due to a predictor variable depends on the initial probability. For example, a predictor that increases the odds of graduating by 1.50 or 50 percent would increase the probability of graduating from 50 percent to 60 percent, or 10 percentage points, for a student with an initial probability of 50 percent; it would also increase the probability from 90 percent to 93 percent, or 3 percentage points, for a student with an initial probability of graduating of 90 percent. That is, the higher the initial probability of graduating, the smaller the absolute improvement in the graduation rate. That is one reason to report predictors of graduation as odds ratios.

One important consideration in examining predictors is judging the strength or magnitude of the predictor. That is, how strong is the effect of the predictor? Although there are no absolute standards for judging the size of the effects, we adopted the following guidelines:[1]

- Small: Odds ratio = 1.50 (positive effects) or .67 (negative effects)
- Medium: Odds ratio = 2.00 (positive effects) or .50 (negative effects)
- Large: Odds ratio = 4.00 (positive effects) or .25 (negative effects)

The first statistical model included only individual demographic predictors: gender, race/ethnicity, and home language. This model confirmed the earlier descriptive results: the odds of graduating from high school were twice as large for girls than for boys (OR = 1.97); and the odds for Blacks (OR = .43) and Hispanics (OR = .55) were half those of Whites (Table 3). Based on our guidelines, these are considered to be medium or moderate effects. The model showed that graduation rates for Asians were not statistically different than those for Whites, and

[1] These guidelines are similar to those proposed by Cohen (1988, pp. 25-26) for effect sizes (ES): small (ES = .2), medium (ES = .5), and large (ES = .8). Odds ratios can be converted to effect sizes (see: Sanchez-Meca, Marin-Martinze, & Chacon-Moscoso, 2003), so our guidelines correspond to the following effect sizes: small (ES = .25), medium (ES = .42), and large (ES = .8).

that graduation rates for students from non-English-speaking backgrounds were not statistically different than those for students from English-speaking backgrounds.

The second model added two variables to measure the family demographic characteristics: family socioeconomic status (SES)—a composite variable based on family income, parental education, and the status (e.g., professional vs. clerical) of the parents' occupations—and whether students were living with both of their biological parents or not (non-traditional family). Both family SES (OR = 1.38) and not living with both parents (OR = .60) were small, but significant predictors of whether students graduated. Controlling for these two variables in the model also reduced the size of the predictor for Black students (from OR = .43 to OR = .52) and for Hispanic students (from OR = .55 to OR = .70). This suggests that the lower graduation rates for Blacks and Hispanics can be explained, in part, by differences in their family backgrounds.

The third model added four variables measuring students' academic backgrounds, and all of these variables were powerful predictors of whether students graduated: being over-age (OR = .41), having a low academic GPA (between 1.0 and 2.0) in the ninth grade (OR = .39), failing (less than 1.0 GPA) ninth grade (OR = .13), and having changed schools two or more times since first grade (OR = .61). Again, these results confirmed the descriptive findings reported earlier. Controlling for academic background rendered all of the race and ethnicity variables insignificant, meaning that the lower graduation rates for Blacks and Hispanics in California can be explained *entirely* by their poorer academic backgrounds. Interestingly, however, even controlling for academic background, the odds of girls graduating from high school were still eighty percent higher than for boys.

The fourth model added variables that indicated students' self-reported high school program: college preparatory, indicated by 53 percent of the students; vocational, indicated by 10 percent of the students; and general, indicated by the remaining 37 percent of the students. Controlling for other variables in the model, the odds of graduating from high school were twice as high for students in both the college prep program (OR = 2.32) and the vocational program (OR = 2.72) compared to students in the general program. We also examined whether students who were academically at-risk benefited from the college preparatory and vocational programs similarly to students who were not at-risk. It appears that both types of students benefited from these two programs.

The final model examined the effects of student engagement and academic achievement on high school graduation. Three measures of student engagement were significant predictors of high school graduation: behavioral engagement (a composite variable that measured how often students' reported that they were late for school, had cut class or were absent from school), misbehavior, and whether students participated in sports. Behavioral engagement (OR = .76) and misbehavior (OR = .72) had small effects on the odds of graduating, while participation in sports (OR = 2.27) had moderate effects. In fact, participating in sports had a larger effect than improved test scores (OR = 1.37) on whether students graduated.

Although student engagement and achievement in tenth grade mediated some of the effects of academic background, academic background still had a powerful effect on high school graduation. This suggests that while high school can improve students' high school graduation rates by improving their engagement and achievement, such improvements will not be sufficient to overcome poor academic backgrounds. This finding supports the view that reducing dropout rates and improving graduation rates requires interventions *prior* to high school.

Identifying Effective and Ineffective Schools

How effective are California high schools in improving graduation rates and reducing dropout rates? To address this question we need a way to measure school effectiveness. Federal and state accountability systems typically judge school effectiveness by using student test scores. Yet recent research suggests that schools that are effective in improving test scores are not necessarily effective in reducing dropout rates (Rumberger & Palardy, 2005). Research also shows us that to judge school effectiveness one must take into account the vast differences among schools in the characteristics of the students who enter the school—characteristics that affect student outcomes, but that are beyond the control of individual schools (Rumberger & Palardy, 2005; Rumberger & Palardy, 2004).

To identify California high schools that were effective or ineffective in improving graduation rates, we predicted the graduation rate for each of the 63 schools in our sample using a statistical model that included demographic characteristics of students, their family background, and their academic backgrounds (model three described earlier). We then compared the predicted graduation rate with the actual graduation rate (see Appendix). We defined an "effective" school as one whose actual graduation rates exceeded its predicted graduation rate by the threshold that the federal government uses to identify effective educational programs, which is equivalent to improving the odds ratio by 50 percent (U.S. Department of Education, Institute of Education Sciences, 2007). Similarly, an "ineffective" school is one whose actual graduation rate fell short of its predicted graduation rate by more than the threshold. A school that is neither effective nor ineffective was labeled as average.

Based on this procedure, 19 of the 63 schools—30 percent—in our sample were effective, 29 (46 percent) were average, and 15 (24 percent) of the schools were ineffective (see

Table 4). Of the nine schools in the sample whose principal identified them as magnet schools, four were effective in raising graduation rates above their predicted level, one was ineffective, and the remaining five were average. Of the five year-round schools in the sample, none were effective, three were average, and two were ineffective. The single alternative school was ineffective, while the single charter school was average. In the next section of this report, we examine whether any of these types of schools had a significant effect on high school graduation rates.

School effectiveness does not appear to be related to several other school characteristics, including school size, mean SES of the student body, the percent of minority students, and the student-teacher ratio. That school effectiveness is not related to student body characteristics is not surprising because we defined effectives as controlling for the student and family background characteristics.

We then addressed another question: Are schools that are effective in improving graduation rates also effective in improving test scores? To address this question we conducted a similar analysis to the one we did for estimating graduation rates, but in this case the dependent variable was tenth grade test scores.[2] That is, we predicted each school's mean test scores from a student model that controlled for demographic characteristics, family background, and academic background. An "effective" school was one whose actual mean test score exceeded its predicted test score by the same U.S. Department of Education threshold, whereas an "ineffective" school was one whose predicted mean test score fell short of the actual mean test score by more than the threshold. The remaining schools were classified as "average".

[2] Another way to measure effectiveness is with changes in test scores, say from 10^{th} to 12^{th} grade, which may be less influenced by initial ability (see Rumberger and Palardy, 2004). But because few dropouts were tested, it would be harder to measure changes in test scores. Moreover, since the models controlled for initial 9^{th} grade performance, the results reflect 10^{th} grade test scores adjusted for differences in initial ability.

Based on this procedure, only seven (or 11 percent) of the schools were effective, 50 (or 79 percent) of the schools were average, and six (10 percent) of the schools were ineffective. It is interesting to note that there are far more effective and ineffective schools based on graduation rates than based on test scores. This suggests that it is harder for schools to effectively raise test scores above the level predicted by students' academic and family backgrounds than it is to effectively improve graduation rates.[3]

The results further show that schools that are effective in improving graduation rates are not necessarily effective in improving test scores. Of the 19 high schools that were effective in improving graduation rates, only three were also effective in improving test scores; the rest were average. Of the 29 schools that made average improvements in graduation rates, two were effective in improving test scores, 24 made average improvements in test scores, and three were ineffective in improving test scores. Of the 15 schools that where ineffective in improving graduation rates, two were actually effective in improving test scores, 10 made average improvements in test scores, and three were also ineffective in improving test scores. This finding is consistent with a similar, national study that found little correlation between these two measures of school effectiveness (Rumberger & Palardy, 2005). The finding also supports recent efforts nationally and in California to include high school graduation rates as a measure of high school performance (Orfield et al., 2004; California Senate, 2007).

What School Factors Predict High School Graduation

We next examined a range of school characteristics to see which ones were significant predictors of whether students graduated from high school in California. We tested a series of

[3] These differences are reflected in the amount of variance that the student model explained in school-level graduation rates versus test scores. The student model explained only 33 percent of the variance in graduation rates, but 61 percent of the variance in test scores.

four statistical models that included a large number of individual predictors related to the four major areas described in the conceptual framework reviewed earlier—structural characteristics of schools (e.g., type of school, size), student composition (e.g., percent female, minority, low achieving), resources (e.g., mean teacher salaries, student-teacher ratio), and school policies and practices (e.g., academic press, student support). The results are shown in Table 5.

Two structural features of schools were significant predictors of high school graduation: the odds of graduating for students who attended year-round schools were half of those who attended schools on regular calendars (OF = .55), and the odds of graduating for students who attended alternative schools were one-fifth (OR = .19). Recall that our statistical models control for family and academic background of these students, so although students who attend these types of schools are often more disadvantaged than other students, our analysis suggests students who attended these schools were still less likely to graduate. Although a recent review found that districts with modified calendars generally have higher performance (test scores) than comparable districts on traditional calendars (Cooper, Valentine, Charlton, & Melson, 2003), the same review also found little effect at the secondary level. Our findings are also consistent with two recent studies of year-round schools in California that found differential resources and outcomes in multi-track, year-round schools (Mitchell & Mitchell, 2005; Ready, Lee, & Welner, 2004).

The next model examined the effects of student body characteristics. Three characteristics were significant predictors of high school graduation: the percentage of females in the school (OR = 1.20), the percentage of students who failed ninth grade (OR = .76), and the percentage of students who had frequent (two or more) school changes (OR = .75). The effect of attending a school with more female students is below the threshold of a small effect;

nonetheless, it is an interesting finding. One possible explanation is that schools with a higher percentage of girls report fewer disciplinary problems, which can have a negative effect on graduation. It is not surprising that students are less likely to graduate when they attend schools with a high proportion of low-achieving students and highly mobile students (both significant individual predictors of high school graduation as reported earlier) since exposure to such students could reduce the engagement and performance of other students through peer associations. For example, schools with higher proportions of low achieving students are also schools where students report doing less homework (correlation = -.37). Similarly, schools with higher proportions of highly mobile students are also schools where students report doing less homework (correlation = -.43).

After controlling for these student characteristics, the effect of attending an alternative school was no longer significant. This suggests that the reason students attending alternative schools have lower achievement is because of the characteristics of the students who attend them, specifically their poorer educational backgrounds. Yet the negative effect of attending year-round schools cannot be attributed to the characteristics of the students who attend them.[4]

The next model examined the effects of a number of measures of school resources on graduation rates—the student-teacher ratio, the proportion of teachers with full credentials and teachers with bachelors' degrees in the subject area that they taught, and the mean teacher salary in the school. None of the variables that we measured had any significant, independent effect on high school graduation rates. These findings are in contrast to a recent national study found that high schools with higher teacher salaries had significantly lower dropout rates (Rumberger & Palardy, 2005).

[4] Year-round schools tend to be located in overcrowded districts, which have higher proportions of disadvantaged students and may have fewer resources.

The final model examined a wide range of school policies and practices on graduation rates. This investigation yielded only three statistically significant variables: students were less likely to graduate if they attended a high school where a higher proportion of students were enrolled in vocational programs (OR = .82); students were more likely to graduate if they attended a high school where more students completed more credits in trigonometry (OR = 1.44), and students were more likely to graduate if they attended a high school with a positive academic climate (OR = 1.23). The measure of academic climate was based on student responses to questions about how much they found their classes to be interesting and challenging, and if they came to school because they were satisfied with what they were doing in class.

That students are less likely to graduate if they attend high schools where larger proportions of students are enrolled in vocational programs supports the notion that such schools are not academically rigorous. For example, in our sample of schools, the higher proportion of students in vocational programs, the lower the proportion in college preparatory programs (correlation = -.41). Yet, we found earlier that students in vocational programs, as well as college prep programs, were much more likely to graduate than students in general (non-college-prep) programs (OR = 2.72). This seemingly contradictory finding suggests that while students individually may benefit from enrolling in a vocational program, they may not benefit if they attend a school where too many students take vocational programs at the expense of the school offering and enrolling students in college-prep programs. In other words, schools may offer vocational programs as a way of engaging students, but they should not do so at the expense of also offering college-prep programs. It should also be pointed out that the school measure of vocational participation was quite weak (below the threshold for a small effect).

The finding that students are more likely to graduate if they attend schools where more students complete credits in trigonometry supports the notion that academic press has a positive impact on student achievement (Lee & Smith, 1999). Similarly, the finding that schools where students are more engaged and find the classes challenging also supports the notion of academic press, as well as the more general notion of academic climate (National Research Council, 2004).

Summary and Conclusions

Many of the findings from this study, which was based on a sample of California high school students, were consistent with the existing, national research literature on school dropouts. First, a variety of student, family, and school factors predict whether students drop out or graduate from high school in California. Among the student factors, the most powerful have to do with students' academic background, which is based both on their initial academic performance in ninth grade and on their past performance as reflected in whether students were over-age in tenth grade. More than 40 percent of California high school sophomores in the class of 2004 were academically at-risk and only three out of five of those students graduated from high school.

Both the incidence and consequences of being at risk varied by race/ethnicity and by gender, with less than half of all Black students and Hispanic males graduating from high school. Student engagement, particularly participating in sports, and student achievement in tenth grade also predicted whether students graduated. Although this study was unable to demonstrate causal relationships between the predictors and graduation, they can suggest, but not prove that efforts to improve student engagement and achievement will likely improve high school graduation rates in California. Yet this strategy is unlikely to effectively mediate the effects of

past academic performance, which suggests that improving high school graduation in California will require improving students' attitudes, behaviors, and academic preparation *prior* to entering high school.

The finding that students in both college preparatory and vocational programs were more likely to graduate supports the idea of "multiple pathways" for preparing students for future school, work, and citizenship (Oakes & Saunders, 2007).

In addition to student and family factors, the study found that schools impact students' prospects for graduation. In our sample of 63 schools we found that 30 percent were effective in improving graduation rates above the rate predicted from the background characteristics of their students, while 24 percent were ineffective. We also found that schools were generally less effective in improving test scores above the rate predicted from the background characteristics of their students. This suggests that schools have more potential to improve graduation rates than test scores. Moreover, the two measures of school effectiveness were not related, which supports the idea that schools should be evaluated on both measures of performance. The recent passage of Senate Bill 219, which adds graduation rates to the California Academic Performance Index, helps accomplish this goal (California Senate, 2007).

We found that the type of school students attend affects their prospects for graduating. In particular, students who attend year-round schools and alternative schools were less likely to graduate. Currently, 90 out of 1,165 high schools in the state are year-round, with half of those high schools in the Los Angeles Unified School District (California State Department of Education, 2007). There are also 1,154 alternative high schools in the state that enroll eight percent of all high school students (Rotermund, 2007). The results of this study suggest that these types of schools need to be dramatically improved or shut down.

We also found that the student body composition of the school also impacted graduation rates, although some of these effects were mediated by school policies and practices. But even controlling for such factors, schools with a high proportion of mobile students had lower graduation rates. Whether this was simply due to peer effects—since students with high mobility were less likely to graduate—or due to the disruptive effects of mobility to the school itself (see: Hanushek, Kain, & Rivkin, 2004) is not clear from our data. Nonetheless, the findings highlight the negative consequences of excessive student mobility.

Finally, we found that students were less likely to graduate if they attended schools where a higher proportion of students were enrolled in vocational programs. This finding suggests that while schools may offer vocational programs to help keep students engaged—since we also found that enrollment in such programs increases the odds of graduation—they should not do so to the detriment of providing a rigorous college preparatory program. Schools with more students taking trigonometry, and more students reporting interesting and challenging classes, had higher graduation rates, further supporting the idea that a strong academic press and climate can improve students' prospects for graduating from high school.

In all, the findings from this study support the argument that solving California's high school dropout crisis will take a multifaceted approach—it will require better preparing students before they enter high school, addressing their social, as well as their academic, needs while in high school, and it will require improving high schools themselves.

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Table 1
Graduation Status of 2002 California High School Sophomores by Student Characteristics

	Percent of Sample	Graduation Status (percent distribution) Graduate	Dropout	Other	Total
Total	100.0	76.5	8.6	14.9	100.0
Gender					
Female	48.1	82.6	6.7	10.7	100.0
Male	51.9	70.9	10.4	18.7	100.0
Race-ethnicity					
Asian	12.6	88.1	3.7	8.1	100.0
Blacks	8.3	67.6	10.3	22.1	100.0
Hispanic	46.2	70.3	11.3	18.4	100.0
White	27.8	83.4	5.7	10.9	100.0
Other	5.2	81.2	9.2	9.6	100.0
Language Background					
English	61.6	78.0	8.0	13.9	100.0
Non-English	38.4	74.1	9.5	16.4	100.0
Socioeconomic Status					
Low SES	36.6	70.1	12.2	17.8	100.0
Middle SES	46.1	77.1	8.4	14.5	100.0
High SES	17.3	88.5	1.7	9.7	100.0
Family Structure					
Two biological parents	58.0	81.5	6.7	11.8	100.0
Other	42.0	69.6	11.3	19.1	100.0
Academically at risk					
At risk	43.6	60.7	15.5	23.9	100.0
Overage	18.8	61.3	18.3	20.4	100.0
9th grade academic GPA<2.0&>=1.0	26.2	64.3	12.6	23.0	100.0
9th grade academic GPA<1.0	7.4	33.5	32.5	34.0	100.0
Not at risk	56.4	88.8	3.3	7.9	100.0

Table 2
Incidence and Graduation Rates of Academically At Risk,
2002 California High School Sophomores

	Percent at risk			Percent graduating					
				Not at risk			At risk		
	Total	Female	Male	Total	Female	Male	Total	Female	Male
Asians	27.1	21.5	32.3	92.4	95.2	89.5	76.6	82.2	73.1
Blacks	46.5	39.5	51.6	86.6	85.6	87.6	45.7	38.9	49.5
Hispanics	52.6	43.8	61.3	87.0	89.5	83.2	55.3	61.0	51.2
Whites	37.6	25.4	48.5	90.1	96.2	82.3	72.1	73.9	71.3
Other	32.0	24.3	38.9	86.9	92.8	80.2	69.3	82.0	62.1
Total	43.6	34.7	52.0	88.8	92.4	84.3	60.7	64.2	58.5

Table 3
Student and Family Predictors of High School Graduation reported in Odds Ratios, 2002 California High School Sophomores

	Model 1	Model 2	Model 3	Model 4	Model 5
Demographic					
Female	1.97 ***	2.03 ***	1.80 ***	1.73 ***	1.79 ***
Asian	1.60	1.75 *	1.62	1.57	1.31
Black	0.43 ***	0.52 **	0.62	0.60 *	0.58 *
Latino	0.55 ***	0.70 *	0.80	0.81	1.17
Other	0.94	1.04	1.06	1.07	0.97
Non-English background	0.89	0.92	0.97	0.98	1.03
SES		1.38 ***	1.29 ***	1.26 ***	1.19 **
SES missing		0.75	0.88	0.86	1.02
Non-traditional family		0.60 ***	0.64 ***	0.65 **	0.66 **
Academic background					
Overage			0.41 ***	0.49 ***	0.53 **
Low 9th grade			0.39 ***	0.49 ***	0.64 **
Fail 9th grade			0.13 ***	0.16 ***	0.27 ***
Change school 2+			0.61 ***	0.61 ***	0.71 *
Change school missing			0.36 ***	0.38 **	0.51 ***
Track					
College prep				2.32 ***	1.93 ***
Vocational				2.72 **	3.10 **
College prep * atrisk				0.59 *	0.63
Vocational * atrisk				0.49	0.44 *
Engagement					
Behavioral engagement					0.76 ***
Misbehavior					0.72 ***
Participates in sports					2.27 ***
Achievement					
10th grade test score					1.37 ***

* p<.10; ** p<.05; ***p<.01

NOTE: The estimated effects for continuous variables (e.g., SES) were first multiplied by their standard deviation before converting to odds ratios so that the value shown in the table represents the estimated effects of one standard deviation change in the predictor variable on the odds of graduating from high school.

SOURCE: Appendix Table A2.

Table 4

California High Schools Effective in Improving Graduation Rates by Selected Characteristics

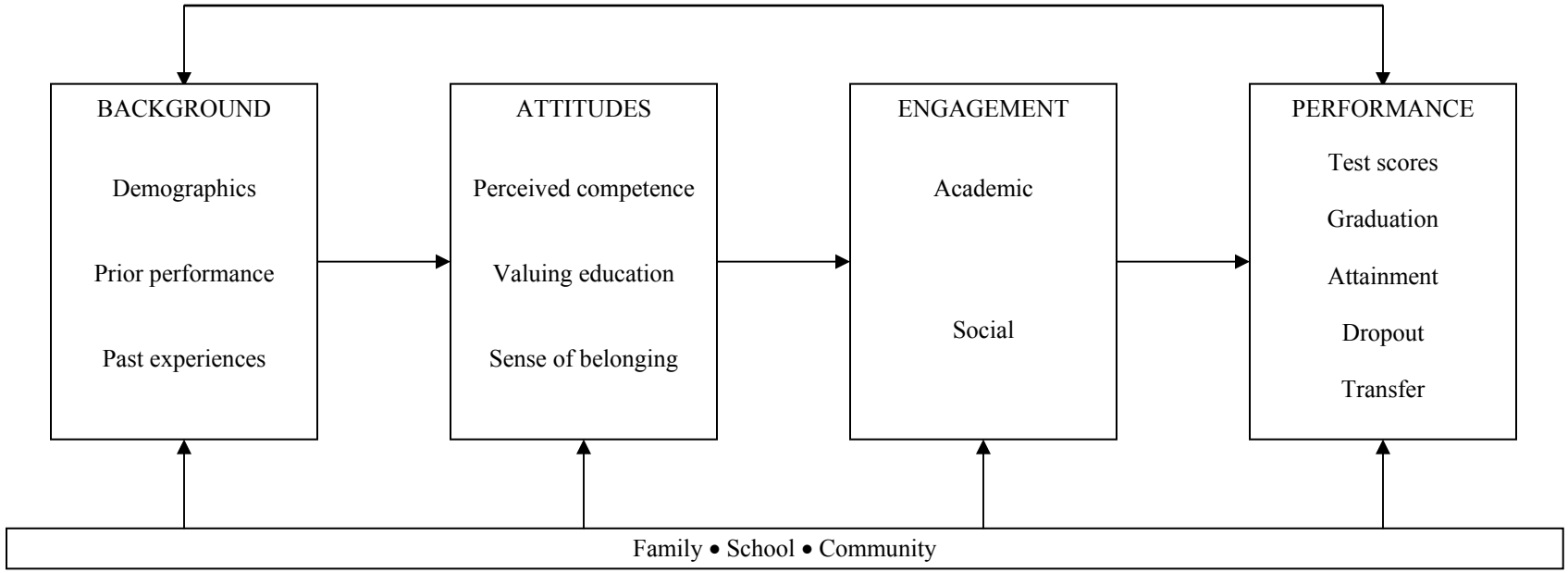
	Effective schools	Average schools	Ineffective schools	Total
Number of schools	19	29	15	63
(Percentage of schools)	(30)	(46)	(24)	(100)
Number by type				
Magnet	4	5	1	9
Year-round	0	3	2	5
Alternative	0	0	1	1
Charter	0	1	0	1
Mean school size	1787	2439	2248	2197
Mean SES	0.01	-0.1	-0.12	-0.08
Percent minority	63	63	62	63
Mean student-teacher ratio	22	24	23	23
Number by effectiveness (test scores)				
Effective	3	2	2	7
Average	16	24	10	50
Ineffective	0	3	3	6

Table 5
School Predictors of High School Graduation reported in Odds Ratios,
2002 California High School Sophomores

	Model 6	Model 7	Model 8
Structural variables			
Year round school	0.55 ***	0.54 **	0.40 ***
Alternate school	0.19 ***	1.19	1.10
Composition variables			
Proportion female students		1.20 *	1.13
Proportion students who failed 9th grade		0.76 **	0.76
Proportion mobile students		0.75 **	0.80 **
Process variables			
Proportion students in vocational program			0.82 **
Mean credits in trigonometry			1.44 ***
Academic climate			1.23 **

* p<.10; ** p<.05; ***p<.01
NOTE: Models control for student and family predictors. The estimated effects for continuous variables (e.g., SES) were first multiplied by their standard deviation before converting to odds ratios so that the value shown in the table represents the estimated effects of one standard deviation change in the predictor variable on the odds of graduating from high school.
SOURCE: Appendix Table A2.

Figure 1
Conceptual Model of High School Performance



TECHNICAL APPENDIX

Samples

Table A1
Characteristics of ELS data and CBEDS data

	ELS sample				CBEDS data	
	Unweighted		Weighted			
	Number	Percent	Number	Percent	Number	Percent
10th graders	1,343	100.0%	337,892	100.0%	459,588	100.0%
Race/ethnicity						
Asian	431	32.1%	42,474	12.6%	54,910	11.9%
Black	86	6.4%	27,985	8.3%	38,240	8.3%
Hispanic	554	41.3%	156,173	46.2%	184,120	40.1%
White	193	14.4%	93,821	27.8%	175,797	38.3%
Other	79	5.9%	17,439	5.2%	6,521	1.4%
Language background						
English learners					77,446	
FEP					83,471	
Total linguistic minority				38.4%	160,917	35.0%
Graduation status						
Graduate	**1,044**	**77.7%**	**258,537**	**76.5%**	**343,517**	**74.7%**
Fall 2003-Summer 2004	1,005	74.8%	247,652	73.3%		
Post-summer 2004	11	0.8%	2,855	0.8%		
Pre-fall 2003	19	1.4%	3,996	1.2%		
Date unknown	7	0.5%	3,365	1.0%		
Diploma with special education adjustments	2	0.1%	669	0.2%		
Dropout	**97**	**7.2%**	**29,084**	**8.6%**		
Other	**202**	**15.0%**	**50,269**	**14.9%**		
Still enrolled	9	0.7%	1,282	0.4%		
Transferred	163	12.1%	41,051	12.1%		
Left for health-related reason	1	0.1%	288	0.1%		
Withdrew	5	0.4%	1,251	0.4%		
Dismissed	4	0.3%	1,516	0.4%		
Other	20	1.5%	4,881	1.4%		

SOURCE: ELS and CBEDS (Retrieved October 20, 2007, from http://data1.cde.ca.gov/dataquest/

Variables

A number of variables were created from the ELS database to test the student-level and school-level predictors on high school graduation rates. Variable descriptions and descriptive statistics are shown in Table A2. Some of the variables were created based on factor scores; those variables are described in Table A3.

The student-level variables were based on the conceptual framework shown in Figure 1. The school-level variables fell under four distinct categories: structural, composition, resource and process. The structural variables related to the school setting (urban vs. rural), type of public school (choice, year round, vocational, alternative or magnet), the number of minority students, and the size of the school. The composition variables were based on the student-level models that included gender, race/ethnicity, whether they came from a non-English-speaking background or a two parent family, socioeconomic status, whether they were over-age for their grade level, had failed ninth grade or had a low GPA, and whether they changed schools two or more times. The school resource variables relate to the credentials, teaching experience and salary of the English and Math teachers. The process variables relate to the kinds of academic programs (college prep vs. vocational), the mean GPA, and mean number of students enrolled in advanced math classes, the school support and academic press items rated by students, teachers and administrators.

An effort was made to use all of the data for the California public school sample even though some of the variables had missing data from the student sample of 1,343 in 63 schools. First a flag was created to indicate whether the variable had missing data (1=missing), which was later tested in the HLM models to see whether the missing sample was significantly different. Next, the variables with missing data were recoded to the mean. This process allowed the full

sample to be included in the analysis while also testing for significant differences in case the missing data was not missing at random.

Table A2
Variable Descriptions and Descriptive Statistics for ELS Sample

VARIABLE NAME	MEAN	SD	DESCRIPTIONS (ELS variables)
			Level-1 (N=1,343)
Student/family variables			
Bystuwt	251.59	197.06	Student weight for all base year respondents. (BYSTUWT)
Bytxcstd	47.47	10.56	Composite math/reading scores standardized (BYTXCSTD)
Female	.50	.50	(BYSEX=2)
Asian	.32	.47	(BYRACE=2)
Black	.06	.24	(BYRACE=3)
Hispanic	.41	.49	(BYRACE=4,5)
Other/Native	.06	.24	(BYRACE=1,6)
Non-English	.49	.50	English is not student's native language (BYSTLANG=0)
Non-traditional family	.40	.49	Students do not live in household with birth mother and father (BYFCOMP=2-9)
SES	-.04	.57	Socio-economic status composite v.2 (BYSES2)
SES missing flag	.20	.40	(BYSES2=missing)
Overage	.18	.39	Born before December 1985 (BYDOB_P<198512)
Failed 9th grade	.07	.25	9th grade GPA <1 (F1RGP9<1)
Low GPA 9th grade	.23	.42	(1≤F1RGP9<2)
Changed schools	.28	.45	Changed schools 2 or more times (BYP45≥2)
At-risk	.41	.49	Overage or failed 9th grade or low GPA 9th grade
College prep			College preparatory-academic (BYSCHPRG=1)
Vocational			Vocational program (BYSCHPRG=3)
College prep*at-risk	.18	.38	College prep/at-risk interaction
Voc. program* at-risk	.05	.22	Vocational program/at-risk interaction
Behavioral engagement	.07	.25	Factor score (BYS38A, BYS38B, BYS38C)
Misbehavior	.06	.24	Factor score (BYS24D, BYS24E, BYS24F, BYS24G)
			Level 2 (N=63)
Structural			
Urban	.38	.49	School located in urban setting (BYURBAN=1)
Rural	.08	.27	School located in rural setting (BYURBAN=3)
Year round school	.08	.27	Year round school (BYA03E=1)
Year round flag	.05	.21	(BYA03E=missing)
Vocational school	.35	.48	Area vocational school/center (BYA03F=1)
Vocational flag	.05	.21	(BYA03F=missing)
Alternative school	.02	.13	Alternative/dropout prevention/continuation school (BYA03R=1)
Alternative flag	.05	.21	(BYA03R=missing)
Charter school	.02	.13	Charter school (BYA03S=1)
Charter flag	.05	.21	(BYA03S=missing)
Magnet school	.15	.35	(BYA03B=1)
Magnet flag	.05	.21	(BYA03B=missing)
Mode minority	.33	.48	Percent minority 2001/02 (40<CPO2PMIN>75)

High minority	.41	.50	Percent minority 2001/02 (CPO2PMIN>75)
Small school	.05	.21	Total school enrollment 2001/02 (CP02STEN=1-600)
Large school	.17	.38	(CP02STEN=1201-1800)
Extra large school	.35	.48	(CP02STEN=1801-2500)
Super school	.32	.47	(CP02STEN=2501+)
Composition			
Female	.49	.11	(BYSEX=2)
Asian	.30	.27	(BYRACE=2)
Black	.07	.09	(BYRACE=3)
Hispanic	.42	.27	(BYRACE=4,5)
Other/Native	.06	.06	(BYRACE=1,6)
Non-English	.48	.21	English is not student's native language (BYSTLANG=0)
Non-traditional family	.42	.15	Students do not live in household with birth mother and father (BYFCOMP=2-9)
Mean SES	-.04	.29	Socio-economic status composite v.2 (BYSES2)
SES flag	.20	.15	(BYSES2=missing)
Mean overage	.19	.12	Born before June 1985 (BYDOB_P<198506)
Mean failed 9th grade	.05	.07	9th grade GPA <1 (F1RGP9<1)
Mean low GPA	.23	.11	(1≤F1RGP9<2)
Low GPA flag	.06	.13	(F1RGP9=missing)
Mean times changed school	.30	.11	Changed schools 2 or more times (BYP45≥2)
Changed schools flag	.22	.12	(BYP45=missing)
Mean times held back	.11	.06	10th grader ever held back a grade (BYP45=1)
Held back flag	.21	.11	(BYP45=missing)
Resource			
Student/teacher ratio	23.03	2.40	Student/teacher ratio(CP02STRO)
B.A. degree English	.83	.14	Bachelor's degree held English (BYTE30C=1)
B.A. English flag	.39	.37	(BYTE30C=missing)
B.A. degree Math	.82	.14	Bachelor's degree held Math (BYTM30C=1)
B.A. Math flag	.36	.34	(BYTM30C=missing)
English teacher experience	.78	.16	Four or more years of secondary level teaching experience (BYTE26B≥4)
English experience flag	.44	.35	(BYTE26B=missing)
Math teacher experience	.83	.13	Four or more years of secondary level teaching experience (BYTM26B≥4)
Math experience flag	.38	.34	
Standard credential English	.78	.15	Regular or standard certification in English (BYTE29=1)
English credential flag	.39	.37	(BYTE29=missing)
Standard credential Math	.81	.12	Regular or standard certification in Math (BYTM29=1)
Math credential flag	.37	.34	(BYTM29=missing)
Average teacher salary	65,176	10,043	Average teacher salary (BYA26A + BYA26B)
Teacher salary flag	.24	.43	(BYA26A or BYA26B=missing)
Process			
Total hours homework	12.22	3.65	Total hours hw both in/out of school (BYS34A+BYS34B)
College expectations	.65	.15	Expect to graduate from college (BYS56≥5)

College prep program	.52	.15	College preparatory-academic (BYSCHPRG=2)
Vocational ed. program	.10	.09	Vocational-including technical/business (BYSCHPRG=3)
Mean grade 10 GPA	2.49	.38	GPA for all 10th grade courses (F1RGP10)
Mean all years GPA	2.54	.32	GPA for all courses (F1RGP)
Advanced math	.45	.47	Units of advanced math courses (F1RCAL_C+ F1RPRE_C+ F1RCAL_C)
Trigonometry units	.10	.19	Units of trigonometry (F1RTRI_C)
Pre-calculus units	.19	.17	Units of pre-calculus (F1RPRE_C)
Calculus units	.15	.21	Units of calculus (F1RCAL_C)
Academic climate	.22	.83	Mean factor score (BYS27A, BYS27B)
Academic climate flag	.07	.12	(BYS27A or BYS27B=missing)
Disciplinary climate	-.25	.78	Mean factor score (BYS21B, BYS21C)
Disciplinary climate flag	.15	.23	(BYS21B or BYS21C=missing)
School academic press	-.30	1.30	Mean factor score (BYA51D, BYA51B, BYA51E)
School academic press flag	.37	.49	(BYA51D or BYA51B or BYA51E=missing)
English teacher academic press	.13	.72	Mean factor score (BYTE44D, BYTE44E, BYTE44F)
English academic press flag	.40	.36	(BYTE44D or BYTE44E or BYTE44F=missing)
Math teacher academic press	-.08	.71	Mean factor score (BYTM44D, BYTM44E, BYTM44F)
Math academic press flag	.39	.34	(BYTM44D or BYTM44E or BYTM44F=missing)
Teacher academic press	.06	.99	Mean factor score (BYS27H, BYS20E, BYS20G, BYS20H)
Teacher/school support	.32	.90	Mean factor score (BYS20A, BYS20F, BYS20B)
Peer support	-.42	.93	Mean factor score (BYS20D, BYS20I, BYS20J, BYS20K, BYS20L)
Teacher/school relationships	.13	.90	Mean factor score (BYS20A, BYS20E, BYS20F, BYS20G)
Academic press	-.21	2.15	(Academic climate + disciplinary climate + school academic press + English teacher academic press + Math teacher academic press + teacher academic press)
Social support	-.09	.80	(Teacher/school support + peer support)
Social support 2	.03	1.43	(Teacher/school support + peer support + teacher/school relationships)

Table A3
Principal Component Descriptions, Path Loadings, and Reliability

Factor and items label	Item description	Item loading
Behavioral engagement (Cronbach's alpha = .641)		
BYS24A	How many times late for school	.81
BYS24B	How many times cut/skip classes	.77
BYS24C	How many times absent from school	.71
Misbehavior (Cronbach's alpha = .665)		
BYS24D	How many times got in trouble	.79
BYS24E	How many times put on in-school suspension	.83
BYS24F	How many times suspended/put on probation	.80
Academic climate (Cronbach's alpha = .777)		
BYS27A	Classes are interesting and challenging (reverse coded)	.90
BYS27B	Satisfied by doing what expected in class (reverse coded)	.90
Disciplinary climate (Cronbach's alpha = .538)		
BYS21B	School rules are fair	.83
BYS21C	Punishment same no matter who you are	.83
School academic press (Cronbach's alpha = .819)		
BYA51D	Learning is high priority for students	.86
BYA51B	Teachers press students to achieve	.87
BYA51E	Students expected to do homework	.84
Math teacher academic press (Cronbach's alpha = .763)		
BYTM44D	Importance of teacher's attention to student success	.80
BYTM44E	Importance of teaching methods to student success	.86
BYTM44F	Importance of teacher's enthusiasm to student success	.81
English teacher academic press (Cronbach's alpha = . 753)		
BYTE44D	Importance of teacher's attention to student success	.81
BYTE44E	Importance of teaching methods to student success	.85
BYTE44F	Importance of teacher's enthusiasm to student success	.81
Teacher academic press (Cronbach's alpha = .611)		
BYS27H	Teachers expect success in school	.65
BYS20E	The teaching is good	.73
BYS20G	Teachers praise effort	.73
BYS20H	In class often feels put down by teachers (reverse coded)	.61

Teacher/school relationships (Cronbach's alpha = .723)		
BYS20A	Students get along well with teachers	.66
BYS20E	The teaching is good	.79
BYS20F	Teachers are interested in students	.83
BYS20G	Teachers praise effort	.69
Teacher/school support (Cronbach's alpha = .557)		
BYS20A	Students get along well with teachers	.77
BYS20F	Teachers are interested in students	.76
BYS20B	There is real school spirit	.67
Peer support (Cronbach's alpha = .625)		
BYS20D	Other students often disrupt class	.59
BYS20I	In class often feels put down by students	.60
BYS20J	Does not feel safe at this school	.58
BYS20K	Disruptions get in way of learning	.69
BYS20L	Misbehaving students often get away with it	.69

Note. All variables were coded on a 4-6 point Likert scale. Factor loadings were created using the student weight (BYSTUWT) at level 1 if they were student level variables and at level 2 if they were school level variables.
All variables except for math and English teacher academic press were on a 4 point Likert scale (1=strongly agree, 4=strongly disagree).
Math and English academic press were on a 4 point Likert scale (1=extremely important, 4=not at all important).

Statistical models

Because the data used in this study were based on samples of students nested within schools, we used hierarchical linear models (Raudenbush & Bryk, 2002). And because the dependent variable in this study was a dichotomous variable indicating whether the student graduated from high school or not, it was necessary to specify both a level-one (within-school) sampling model and a level-one structural model (Raudenbush, & Bryk,, Chapter 10). For binary student outcomes, the level-one sampling model is Bernoulli:

$$\text{Prob}\,(Y_{ij} = 1 | \beta_j) = \Phi_{ij}\,,$$

and the conditional level-one structural model is:

$$\log\,[\Phi_{ij} / (1 - \Phi_{ij})] = \eta_{ij} = \beta_{0j} + \beta_{1j} X_{1j} + \ldots + \beta_{pj} X_{pj}\,,$$

where β_{1j} - β_{pj} represent *p* student-level predictors and the left-hand side of the equation is the logit link function (Raudenbush, & Bryk, pp. 293-295).

The level-two (between-school) structural model is:

$$\beta_{0j} = \gamma_{00} + \gamma_{01} W_{1j} + \ldots + \gamma_{0q} W_{qj} + u_{0j}$$

$$\beta_{pj} = \gamma_{p0}$$

where W_{1j} - W_{qj} represent *q* school-level predictors.

With an unconditional model, the expected probability of a student *i* graduating from school *j* for a given random school effect, u_{0j} , is:

$$E\,(Y_{ij} \mid u_{0j}) = 1 / [1 + \exp\,\{-(\gamma_{00} + u_{0j})\}].$$

We converted the estimated parameters into odds ratios (= exp (estimate)). Coefficients of continuous variables were first multiplied by their standard deviation so that the value represents the effect of a one standard deviation increase in the independent variable on the odds of high school graduation.