POLICY BRIEF:

High School Course-Completion Patterns and Pathways in Texas: Linkages to College Attendance

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SUMMARY

To prepare students for college, much effort of policy making has been placed on high school curriculum and graduation requirements of various subject areas, hoping that students will be well equipped to face their future academic challenges. However, less is known how students meet the requirements over time, and whether and to what extent different ways to accumulate credits lead students to college.

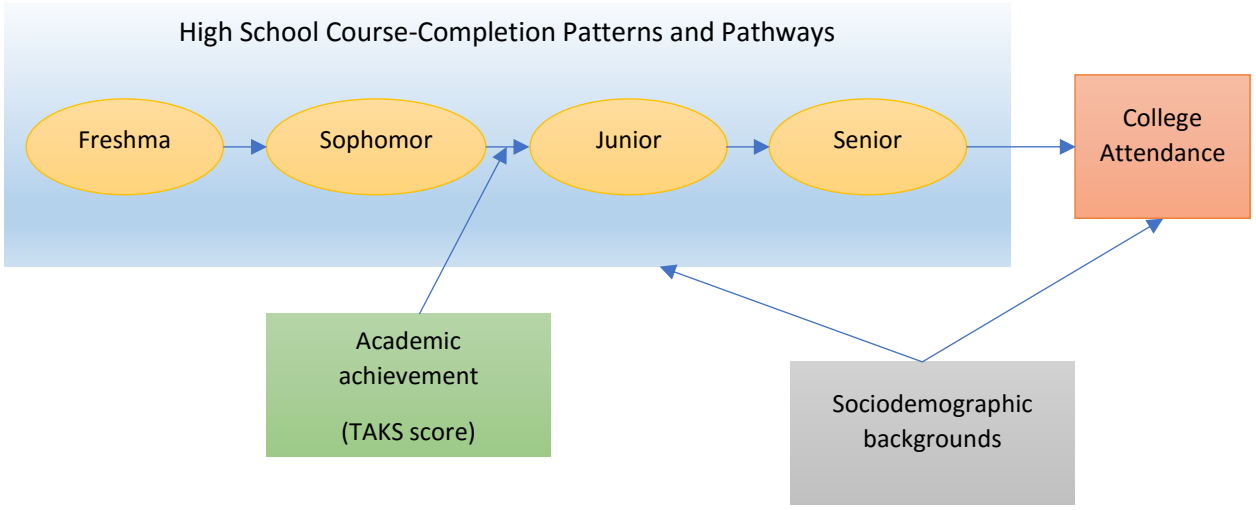
To answer these questions, the present study attempted to illustrate high school students' course-completion patterns of each academic year (AY) and pathways over time, factors related to retaining or transitioning between pathways, and the connection to college attendance. Students enrolled in public high schools in Texas in Fall 2004 as first-time ninth graders were the target population, and the number of completed Carnegie units in seven subject areas (English, mathematics, science, social studies, foreign language, art, and computer science [CS]) documented in the transcript records were analyzed.

Study Overview

Context and Importance of the Problem

College education becomes increasingly important for individuals' career prospect. For example, more than half of the new positions in manufacturing, which employs nearly one in ten workers in Texas, will require some college education (Carnevale et al., 2013; US Census Bureau, 2014). However, only about 55% of high school graduates in Texas attended a four- or two-year institution (THECB, 2012), and the number of Texas residents with some college education or above merely grows 2.2% between 2010 and 2014 (US Census Bureau, 2014). Cultivating competent, college-educated talents is therefore particularly urgent.

However, many students enter college academically unprepared (Jackson & Kurlaender, 2014). As a response, high school curriculum is tasked as the gatekeeper of students' academic proficiency that equips students with essential knowledge and skills for postsecondary education (Attewell & Domina, 2008). Recent research tends to study these students' coursework and academic achievement in math, such as the highest-level math course students complete in high school, whether students have taken advanced courses in math, and students' math score from standardized test (Attewell & Domina, 2008; LeBeau et al., 2012; Rask, 2010). Nevertheless, students must also be proficient in other subjects to succeed in college, or their academic pursuit could be delayed. Some scholars treated other subjects as covariates, while some neglected the pathways where students' longitudinal experience culminates in the highest-level course (Adelman, 1999; Long et al., 2012). Hence, it is necessary to understand the step-by-step progress students make in every academic year (AY) and their academic pathways across high school, and to identify factors shaping these coursework pathways that lead to postsecondary attendance (see the path diagram below).



Study Population and Variables of Interest

A random sample of students enrolled in Texas public high schools as first-time ninth graders in 2004 and who also stayed on track throughout high school were targeted (n = 21,141; 5.5% of the target population). There were 50.9% female, and 53.4% of the students identified themselves as racial/ethnic minority. Most students were identified proficient in English (95.5%), and almost 40% of them came from economically disadvantaged household (39.6%).

- **Outcome variable: College attendance, 2008-2016 AY**. Students' enrollment in the highest level of postsecondary institution within nine years after high school graduation (i.e., from May 2008 to May 2017) based on the National Student Clearinghouse data, separated into enrollment in four-, two-year institutions, and no attendance.
- **Key independent variable: Course-completion pattern.** Students' course-completion patterns of each AY and pathways across AYs from 2004-05 to 2007-08 AY, based on the number of completed Carnegie units separated into seven subject areas (English, math, science, social studies, foreign language, art, and computer science [CS]; Adelman1999), were derived from the transcript records. Classes designated as advanced placement, international baccalaureate, advanced level, or dual credits were not included.
- **Moderators: TAKS scale score**. Students' 10th-grade standardized TAKS scale scores in English, math, science, and social studies were included to moderate transitions of course-completion groups between 10th and 11th grade.
- **Covariates**. Students' gender, race/ethnicity, status of being economically disadvantaged, and level of English proficiency were controlled for.

Key Findings

Key findings include:

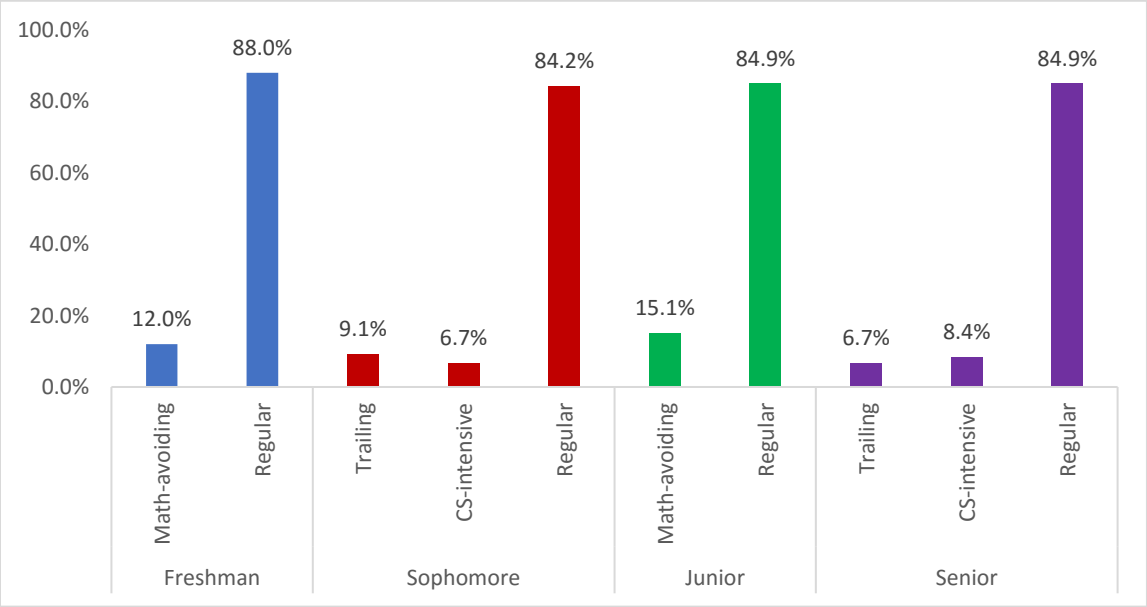
- In each AY, there were multiple patterns of course-completion that differed in the average number of credits in each subject area between patterns.
- Linking course-completion patterns across years together, approximately 66.7% of the high school students undertook similar course-completion pathways throughout high school, another 11.6%

specifically completed more courses in CS area, and still another 21.7% has lagged behind their peers (in math or overall) in at least one AY.

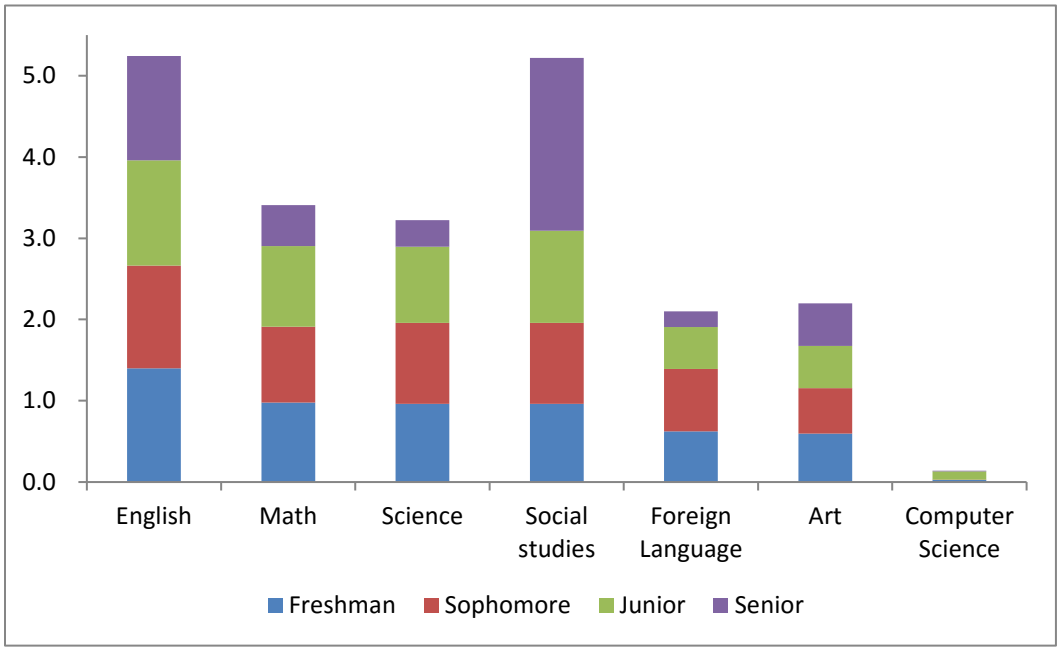
- Students who fell behind their peers in terms of the number of completed Carnegie units in the previous AY would have 11.7%-32.3% chance to still fall behind their peers in one or multiple subject areas in the next AY. However, between sophomore and junior year, students who had a higher TAKS math scale score in sophomore would have a greater chance to make progress to catch up with their peers in junior.
- In freshman and sophomore year, male and White students were more likely to lag behind their female and racial/ethnic minority peers. Similarly, students with limited English proficiency and those from economically disadvantaged household tended to complete fewer credits.
- Generally, students who fell behind their peers academically in freshman, even though some of them caught up with the peers afterward, tended to have a lower chance to enter college.
- Staying on track of curriculum since freshman, taking more CS courses, and improving students' performance in math would be the optimal ways to ensure college attendance.

The findings demonstrated the complexity and fluidity of students' coursework patterns and pathways, the critical role of students' academic performance in math in altering students' course-completion trajectories longitudinal, and the importance of staying on track of high school curriculum since freshman to ensure later academic achievement and college attendance. Practitioners should consider the necessity of tracing students' academic progress in all subjects longitudinally, especially for math and the role of CS courses.

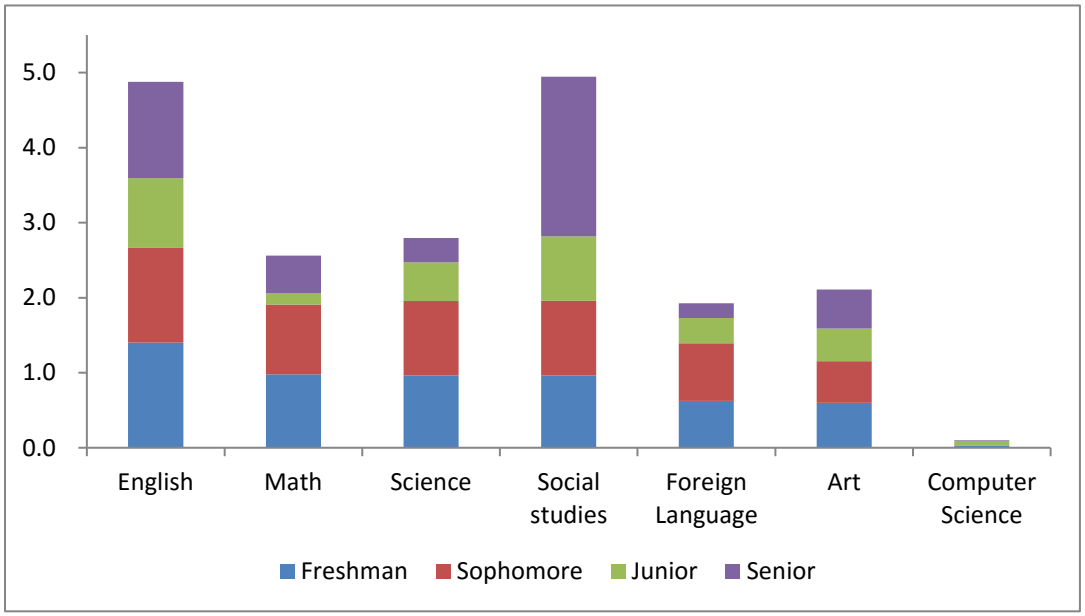
Latent profile analysis and latent transition analysis showed that in each AY, there were multiple patterns of course-completion. While most students accumulated Carnegie units on par with their peers, in each AY a small number of students exhibited different course-completion patterns. For example, 12.0% students completed fewer Carnegie units than their peers in freshman (i.e., the *Math-avoiding* group). In sophomore year, about 9.1% of the students accumulated few Carnegie units in almost all subject areas (i.e., the *Trailing* group) than those in the *Regular* group, while another 6.7% of students specifically completed a larger number of credits in CS. (i.e., the *CS-intensive* group):



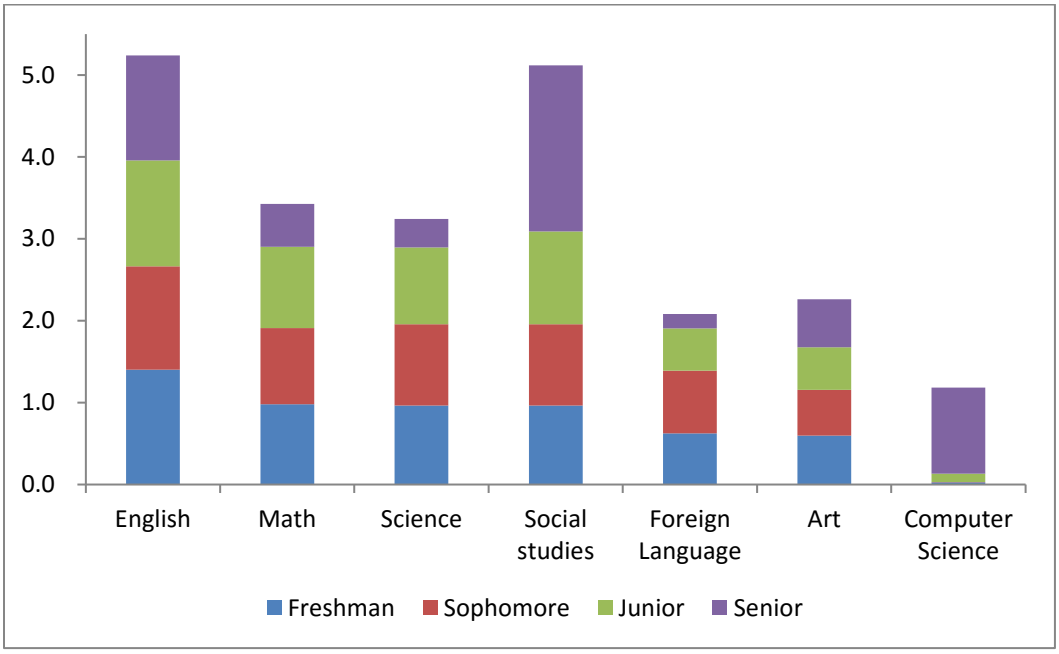
There are 36 different pathways in total. The top five pathways account for 79.7% of the study sample. Most students (66.7%) followed a similar route throughout high school. They accumulated a similar number of Carnegie units from freshman to junior, but in senior year they completed fewer credits in math, science, and foreign language with a surge of credit accumulation in social studies. Notably, compared with other subject areas (i.e., English, social studies), students do not complete many credits in math after satisfying the minimum requirement of high school graduation:



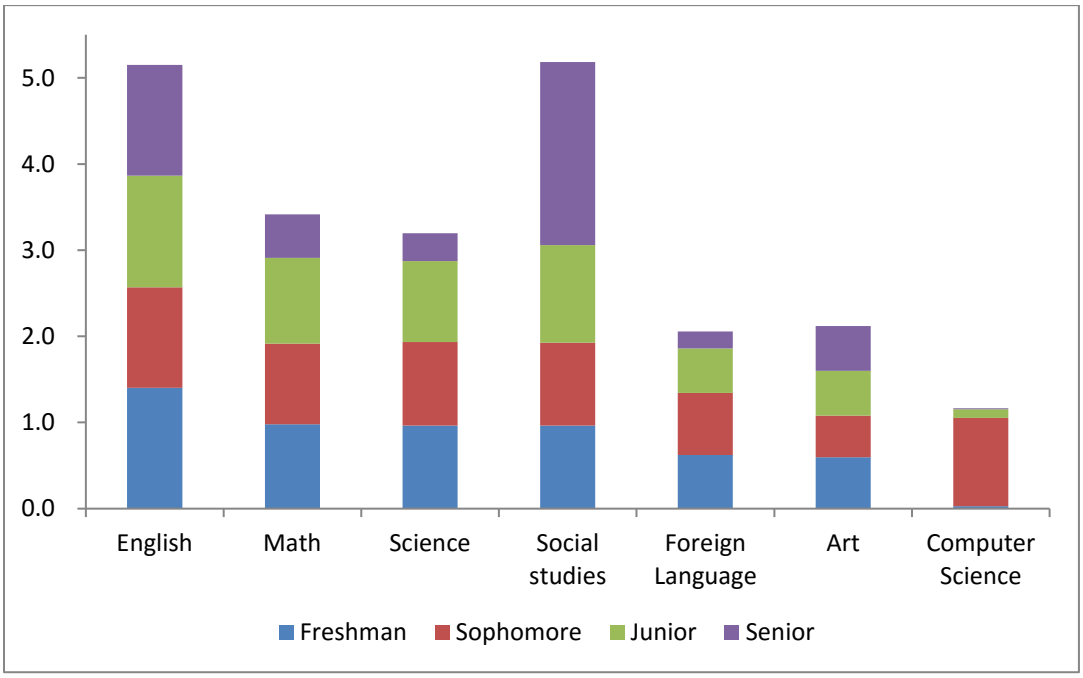
The second-largest group (6.7%) includes students who faltered in junior, particularly in math and science, but were on par with other peers in the other three AYs. Overall, their cumulative credits barely met the minimum graduation requirement (3 credits):



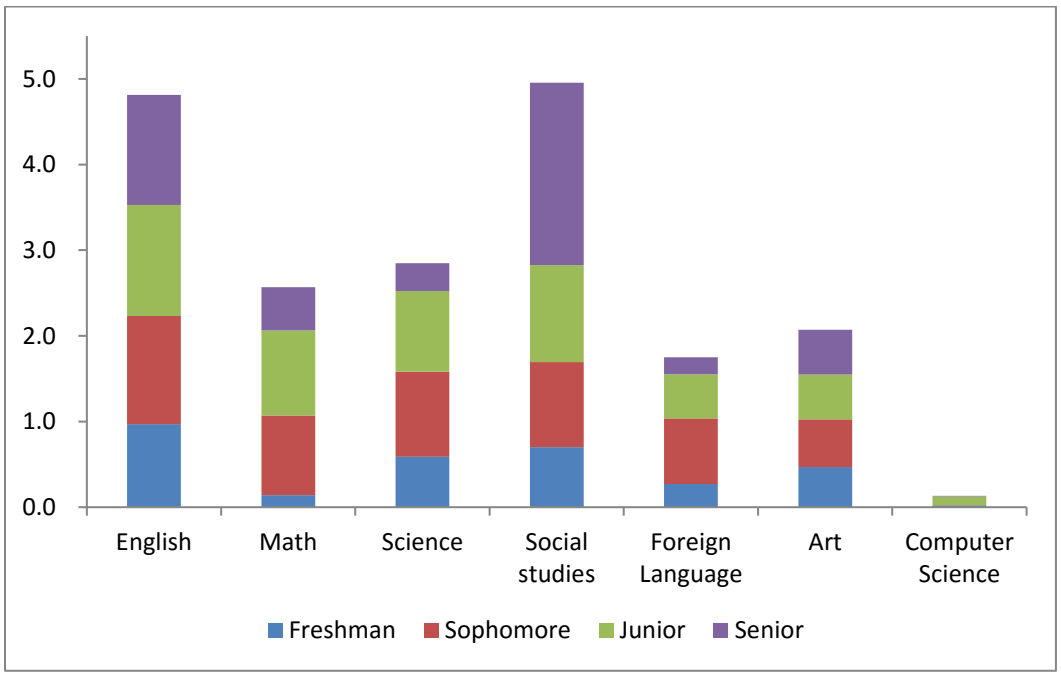
The third-largest group (6.6%) features students who specifically took and completed more CS-related courses at the end of high school when accumulating a similar number of credits in other subject areas to students in the largest group:



Some students (5.1%) tried and completed more CS-related courses than their peers in sophomore, which is the fourth-largest group:



Students in the fifth-largest group (4.0%) lagged behind their peers in freshman in nearly all subject areas before they caught up with their peers in the rest three years. As a result, they barely met the graduation requirement in certain subject areas (e.g., math):



Taken together, while 66.7% of the high school students undertook similar course-completion pathways throughout high school, 21.7% has lagged behind their peers (in math or overall) in at least one AY. Another 11.6% completed more CS courses than most students.

In addition, students in various course-completion groups differ in their sociodemographic background. In freshman and sophomore year, male and White students were more likely to lag behind their counterparts (54.6%-61.2%). Similarly, students with limited English proficiency and those from economically disadvantaged household tended to complete fewer credits than their peers (55.9%-64.5% to be profiled in the *Trailing* or *Math-avoiding* group).

Changing one's course-completion pattern in the future is not always easy. Students who fell behind their peers in the previous AY would have 11.7%-32.3% chance to keep falling behind their peers in one or multiple subject areas in the next AY. The largest probability lies in students in the *Trailing* group in 10th grade having 32.3% chance to be grouped in the *Math-avoiding* pattern in 11th grade, meaning that nearly one in three students in the *Trailing* group were not able to complete similar coursework as others in the next year. To beat the odds, a higher TAKS math scale score would provide the greatest aid to help students keep up with their peers later: by scoring one standard deviation higher in the scale score of 10th-grade TAKS math test, the probability of falling behind their peers in 11th grade would drop 36.7%. In addition, high academic performance in both reading and math could help sustain students' academic achievement if they were already making the steady academic pace like their peers: by scoring one standard deviation higher in the scale score of 10th-grade TAKS reading and math test, the probability of falling behind their peers in 11th grade would drop 27.5%-47.9%.

Finally, the analysis shown that students who completed more courses would have a better chance to enter college. If the students were grouped in the *Regular* profile throughout high school (i.e., the largest group in this study), they would have 76.7% chance to enter college. Students profiled in the *CS-intensive* group at least once and *Regular* group in the rest of high school had an even higher chance to attend a college (80.0%-83.9%). A strong start is also necessary: students who fell behind their peers academically in freshman tended to have a lower chance to enter college, even though some of them caught up with the peers afterward.

Policy Recommendations

To promote students to college, the multiple ways students navigate through high school curriculum provide a useful lens to prepare students for college. On one hand, the preparation for college should start in 9th grade that if the students steadily follow the curriculum throughout high school, then they would have a much higher chance to attend a college (76.7%) than the general population (around 55%; THECB, 2012). Students who lag behind their peers in 9th grade, even though they later catch up with their peers and graduate from high school in four years, only have an average probability to attend a college (53.7%). It is likely that the experience of academic success or failure impact later academic endeavor and achievement, forming an upward or downward spiral. Teachers and parents should help students accomplish a strong start of high school. To break the downward spiral, one potentially plausible method is to improve students' academic achievement in reading and math.

On the other, introducing students to CS courses may be another possibly effective way to encourage high school students to aspire to college. Though no causal interpretations could be made from the current study, it is likely that students who take more CS courses are more academically ready and motivated to attend college, evident in the high probability of college attendance (greater than 80%). To prevent this group of students from falling behind their peers, teachers and students could work on both reading and math proficiency, instead of math alone, to sustain a good level of academic endeavor and bar them from being left behind.

Future research could focus on the various combinations of courses across different subject areas, such as dual credits and advanced placement courses, students take and complete particularly in junior and senior. It is likely that in junior and senior years, students have a greater freedom to explore different types of classes to meet their intellectual and career interests. The current focus on regular courses on academic subject areas does not provide such information, and it is plausible that such exploration guides students to postsecondary education.

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