Staffing Up Computer Science Classes in Maryland

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Key Takeaways:

- Computer Science (CS) enrollment has surged over the past decade, requiring new strategies for schools to staff up CS classes with qualified teachers.
- Schools appear to rely on three staffing strategies: (1) increasing class sizes, (2) hiring of new teachers, and (3) reassigning existing staff.
- Comparing the three strategies, we find that schools rely more on reassignments than new hires—many of whom leave CS for other subjects over time—underscoring the need for CS-specific training and credentialing pathways to build a stable CS workforce.

What We Studied

Across the U.S., computer science (CS) education has experienced unprecedented growth at the high school level over the past several decades.[1] In Maryland, this expansion was accelerated by a 2018 state policy requiring all public high schools to offer at least one "high-quality" CS course by 2020. This study examines how Maryland high schools have addressed teacher supply and distribution challenges while expanding their CS course offerings.

Although teacher shortages affect many subjects,[2] they are particularly acute in CS, where individuals have abundant non-teaching career opportunities.[3] Given these challenges, we analyze the strategies schools employ, the varied pathways through which individuals enter the CS teaching workforce, and the diverse backgrounds these teachers bring. The findings have implications for education policy and practice, in strengthening CS teacher pipelines, valuing multiple preparation pathways, and supporting ongoing professional learning in CS.

How We Analyzed the Data

We analyzed Maryland high school course enrollment and human resources data from school years (SY) 2013–14 to 2024–25 to examine how schools staff CS classes. To understand demand, we first conducted descriptive analyses of enrollment trends, including students enrolled, courses offered, and class size changes. Using statewide course rosters and the Maryland Center for Computing Education's course definitions, we identified a broad set of CS courses and a subset of advanced or "high-quality" CS courses (e.g., AP, IB). Next, to understand teacher supply, we classified staff as follows:

1. CS teacher - if 50% or more of the teacher's annual course load was in CS
2. Advanced CS teacher - if 50% of the CS teacher's CS course load was advanced CS courses.

To study staffing patterns, we grouped CS teachers into four assignment categories based on their year-to-year teaching trajectories:

1. New entrants - CS teachers who are new to the teaching profession
2. Shifters - teachers who went from a non-CS to CS teacher status
3. Continuers - teachers who had already been teaching CS courses
4. Droppers - teachers who left CS for other subjects while continuing their teaching careers

This framework allowed us to map teacher flows into and out of CS roles. To understand the pathways into the CS teaching profession, we also examined the background characteristics (e.g., gender, race/ethnicity, license type, endorsement, degree) of new CS teachers compared to STEM and non-STEM high school teachers.

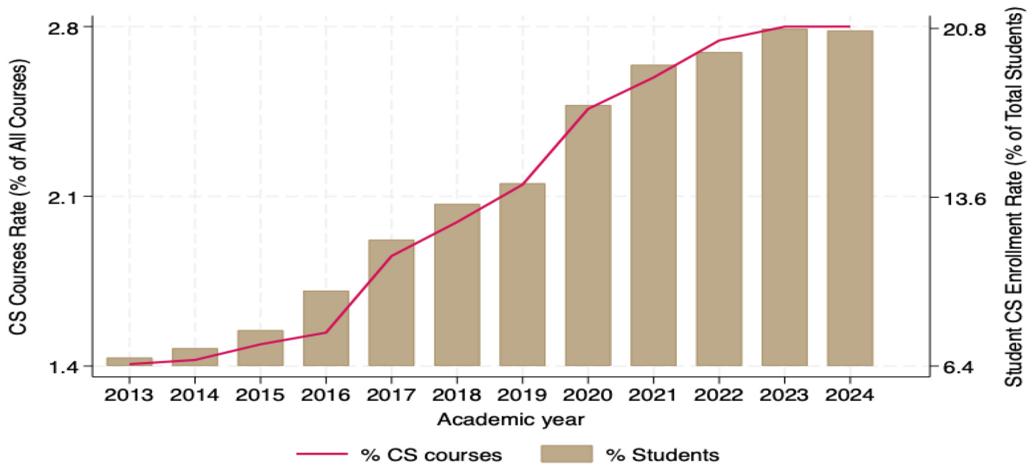
What We Discovered

Surges in CS Enrollment Over the Past Decade Outpace Staffing Capacity

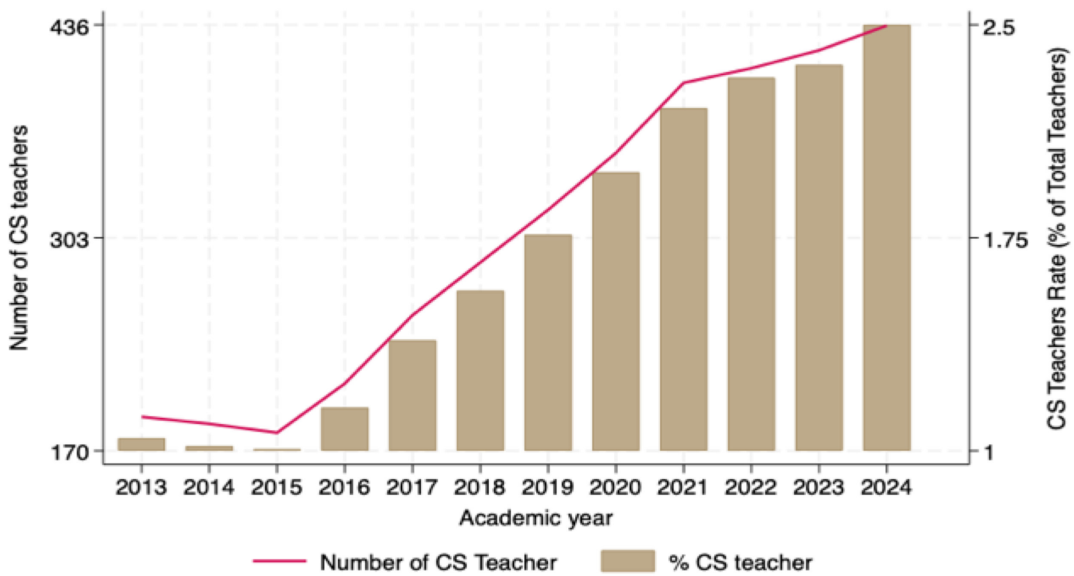
From SY 2013 to 2024, CS course offerings and enrollments expanded substantially, with the share of students taking at least one CS course more than tripling and CS courses doubling as a proportion of all offerings (Figure 1, Panel A). The CS teaching workforce also grew considerably over this period (Figure 1, Panel B). Yet, student enrollment grew (225%) at a far faster rate than the teaching workforce (140%), indicating that schools faced mounting difficulty staffing CS courses as enrollment outpaced the supply of qualified teachers.

Figure 1. Share of CS Courses, Students, and CS teachers in Maryland High Schools

Panel A: Share of CS Courses and Students



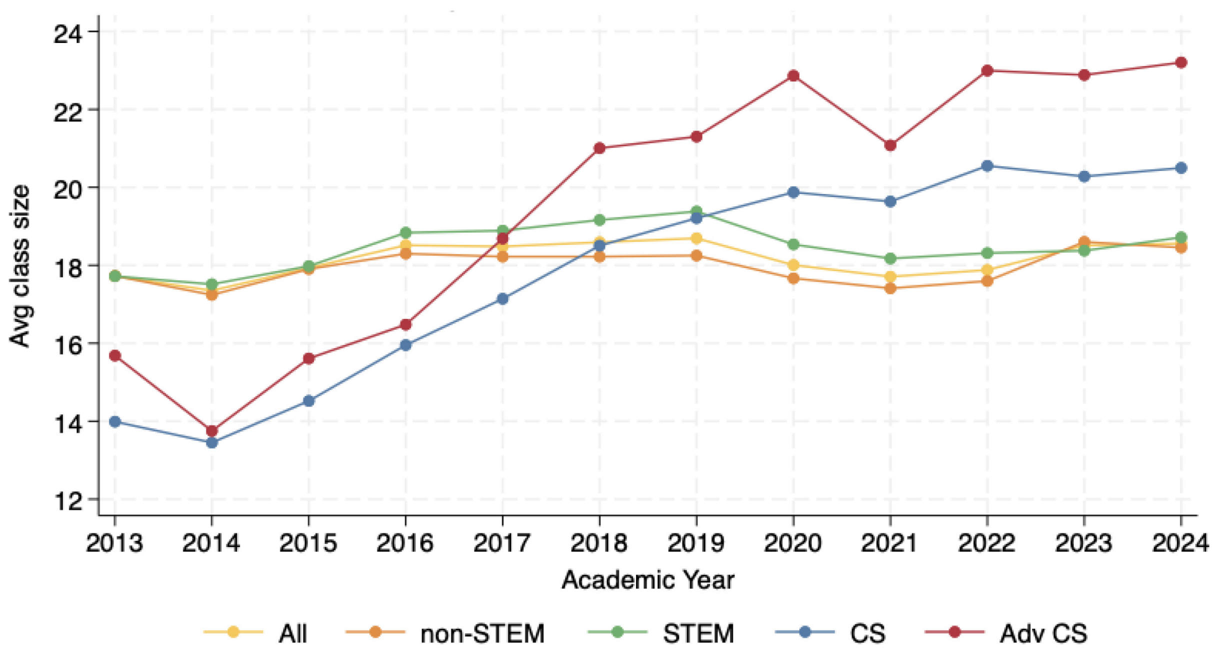
Panel B: Share and Number of CS Teachers



Three Primary Responses to CS Staffing Challenges

Schools responded to these rising CS enrollments in three ways. First, they increased class sizes. By 2024, average CS and advanced CS class sizes (20.1 and 23.1) exceeded both general high-school (18.6), and other subject-area averages (e.g. STEM, 18.8), and grew at a faster rate, suggesting schools primarily absorbed enrollment pressure by assigning more students per CS teacher (see Figure 2).

Figure 2. Average Class Size per Teacher Over Time

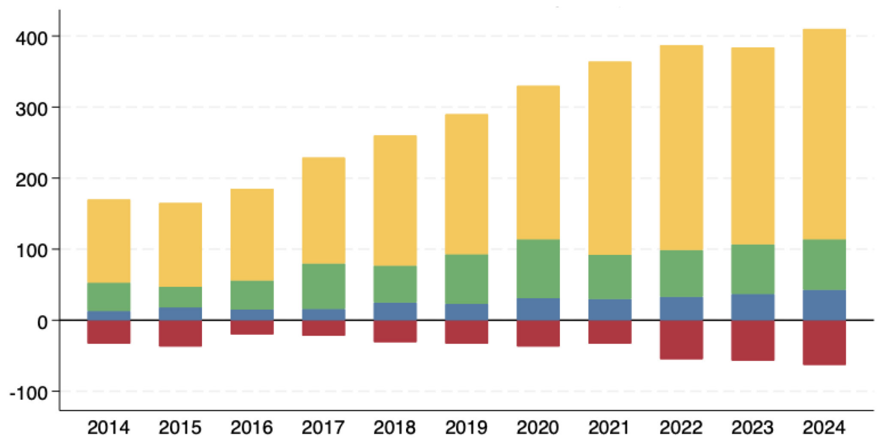


Second and third, schools expanded recruitment through hiring new teacher entrants and transitioning in-service teachers from other subjects into CS. Shifters consistently represented more than double the share of new entrants (see Figure 3, blue and green bars), indicating schools relied more heavily on internal reassignments than external hiring to staff CS courses.

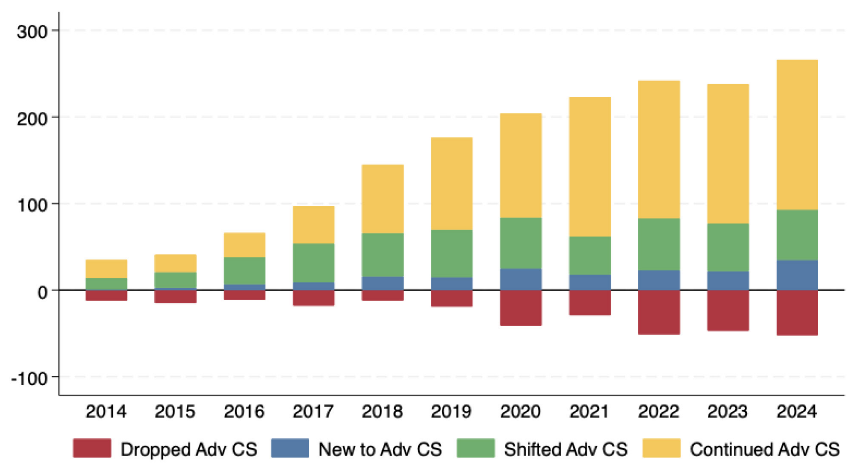
Churn to other subjects, however, remained high. On average, only 67% of CS teachers continued year to year, while 13% switched from CS to other subjects (Figure 3, blue and green bars). Advanced CS saw even greater churn, with 19% transitioning out annually, highlighting the dynamic and unstable nature of the CS teaching assignment.

Figure 3. Time Trends in Teacher Staffing Patterns

Panel A: All CS Teachers



Panel B: Advanced CS Teachers

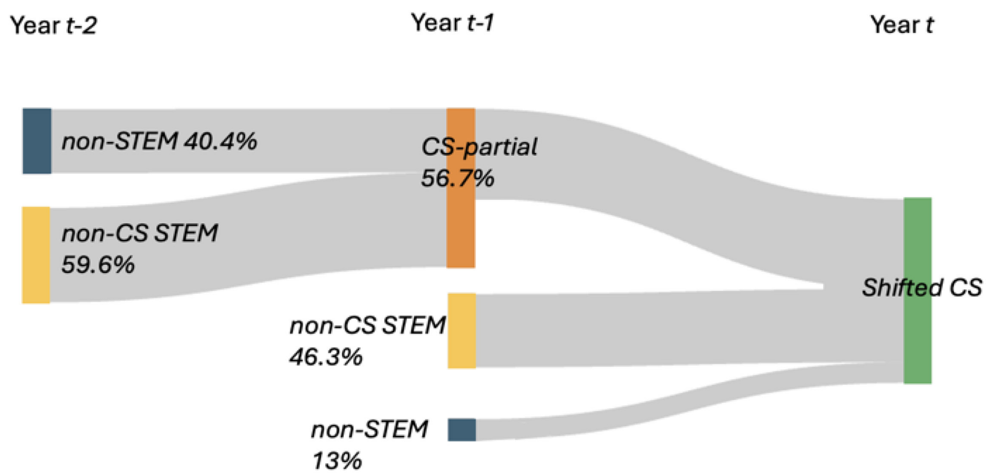


Highly Fluid Movement into and out of CS Roles

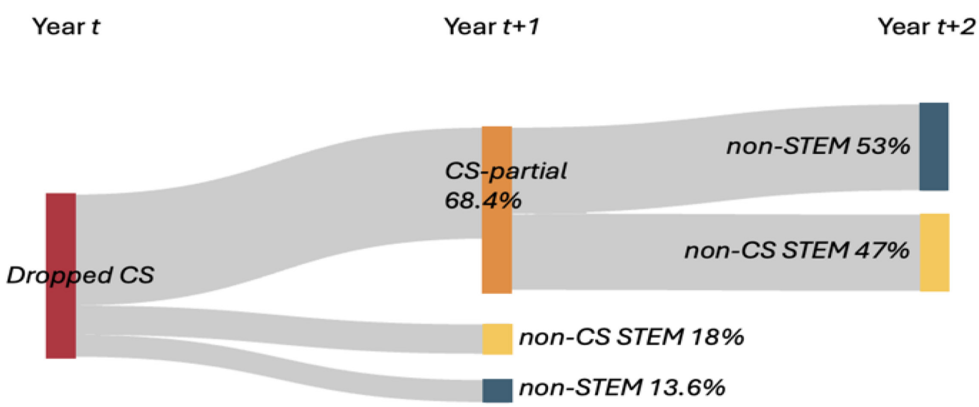
Most teachers shifting into CS came from STEM subjects, with the majority having prior but low-commitment CS experience and a smaller share from non-CS STEM fields (Figure 4, Panel A). Most who left CS remained in STEM but reduced their CS load, while smaller shares moved to non-CS STEM or left STEM entirely (Panel B). This persistent churn confirms CS staffing depends on temporary reallocations rather than a stable, dedicated workforce.

Figure 4. Trajectories Into and Out of CS

Panel A: Shifted CS Teachers



Panel B: Dropped CS Teachers



Note: CS-partial teachers have less than 50% of their workload in CS and teach more than one CS course in a year.

Distinct Pathways into the CS Teaching Profession

Finally, the demographic and credentialing profile of new CS teachers differs markedly from other teacher groups (Table 1). CS teachers are disproportionately male and Black compared to the broader high-school teaching workforce, with the latter pattern aligning with research showing Black teachers are overrepresented in CTE fields [4], where many CS courses are classified. New CS teachers are also twice as likely as other new high-school teachers to enter on conditional licenses. Only about one-quarter hold a CS-specific endorsement, while another quarter enter through Professional and Technical Education licenses that substitute professional experience for formal training and do not require a bachelor's degree. The remaining quarter hold endorsements in adjacent fields such as Business Education, Marketing, Technology Education, or math. Taken together, these patterns reveal a diverse workforce entering CS through varied pathways, each bringing distinct experience and credentials to the classroom.

Table 1. Characteristics of New Teachers

Characteristics	All	non-STEM	STEM	CS	Adv CS
		Panel A: Demographics			
Years of Experience	3.229	3.267	3.175	4.613	4.774
Age	34.534	34.534	34.533	39.663	40.247
Female	0.614	0.640	0.577	0.375	0.371
Male	0.383	0.357	0.420	0.621	0.623
Other Gender	0.003	0.003	0.003	0.003	0.006
Asian	0.051	0.032	0.077	0.080	0.103
Black	0.238	0.245	0.228	0.405	0.360
Hispanic	0.071	0.087	0.048	0.050	0.063
White	0.609	0.604	0.618	0.432	0.440
Other Race	0.031	0.032	0.030	0.033	0.034
		Panel B: License/Certification			
Traditional	0.601	0.628	0.564	0.317	0.319
Conditional	0.334	0.323	0.350	0.671	0.667
Resident Teacher	0.065	0.050	0.086	0.012	0.014
		Panel C: Degree			
HS/AA	0.030	0.034	0.024	0.080	0.034
BA	0.566	0.558	0.578	0.505	0.503
MA+	0.404	0.408	0.398	0.415	0.463
		Panel D: Entry Subject Area			
Computer Science	0.008	0.000	0.018	0.239	0.286
Professional Technical Education	0.049	0.054	0.042	0.236	0.097
Missing	0.102	0.107	0.094	0.153	0.200
Business Education/Marketing	0.022	0.018	0.028	0.090	0.120
Technology Education	0.018	0.001	0.044	0.080	0.114
Math	0.121	0.002	0.292	0.063	0.086
Elementary Education	0.023	0.023	0.025	0.017	0.023
		Panel E: Working conditions			
Avg peer teacher number	62.057	24.67	37.387	1.099	0.589
Avg class size	18.628	18.494	18.823	20.047	23.091
CS courses load	0.022	0.000	0.054	0.801	0.780
STEM courses load	0.344	0.000	0.842	0.890	0.886
Teachers	13,568	8,021	5,547	301	175

Policy and Practice Implications

Our study suggests that Maryland schools employed varied strategies to meet rising CS demand, but reliance on larger class sizes and teacher reassignments underscores the need for comprehensive workforce development policies.

First, increasing class sizes to absorb rising demand is concerning. Larger classes can mask true teacher shortages by accommodating enrollment growth without adding positions[5], while undermining instructional quality: small classes often are associated with more individualized instruction and improved student outcomes.[6]

Second, most teacher "shifters" came from STEM backgrounds, indicating that policies should formally recognize prior STEM knowledge and provide structured transition pathways via tiered certification systems, allowing in-service STEM teachers to gradually increase their CS responsibilities. However, the diverse education and credentials of CS teachers—not necessarily in CS at all—raise critical concerns about training and, hence, instructional quality.[7] Shifters have lower rates of CS endorsement compared to new entrants.

Third, we observe within-year workload fragmentation and across-year assignment instability, calling for policies to promote stable CS teaching assignments. Research shows that teachers improve most rapidly when assignments are stable, allowing them to accumulate content- and grade-specific teaching knowledge.[8] Schools and districts could therefore work toward minimum CS concentration thresholds and multi-year assignment commitments, supported by CS-specific retention incentives.

Finally, high year-to-year churn out of CS teaching calls for targeted retention strategies that encourage teachers to remain in CS rather than frequently shifting to other subjects. These might include sustained mentoring, CS-specific professional development, and enhanced support and compensation for teachers maintaining advanced CS concentrations, given the scarcity of specialized CS expertise.

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How to Cite this Brief

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