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Student Continuity and Achievement Clustering in Hartford Public Schools, 2008-2012: A Preliminary Data Report

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<http://commons.trincoll.edu/essp>

January 18, 2013

Abstract:

Based on four years of student-level achievement and demographic data provided by the Hartford Public Schools (HPS), our quantitative analysis sought to answer two questions:

- Continuity: Who stays and leaves the HPS dataset, and are these behaviors associated with student characteristics, school composition, or neighborhood demographics?
- Clustering: Are high-achieving students widely distributed across the district, or are they more likely to be clustered with peers who have similar characteristics, or attend similar schools, or reside in similar neighborhoods?

By analyzing statistically significant patterns among over 33,000 Hartford-resident HPS students in grades 3 to 8 from 2008-09 to 2011-12, we found:

- the proportion of high-achieving students (among those with all CMT scores) increased from about 15 to 20 percent over 4 years.
- the proportion of high-achieving students who left the HPS dataset is not significantly different from the proportion who stayed, around 15 to 18 percent, over three years.
- students who attend school in HPS Zone 1 (northwest corner) are more likely to be high-achieving, with the largest increase over time, and more likely to leave the HPS dataset.
- Black students are more likely to leave the HPS dataset. Being a racial minority in one's school (such as a Hispanic student in a predominantly Black school, or vice versa) is not associated with leaving the HPS dataset.
- HPS magnet schools are more likely to have higher-achieving students, and students who are less likely to leave the HPS dataset.

- HPS district students who switched to HPS magnet schools are more likely to be high-achieving students. Overall, the proportion of HPS stayers who switched from district to magnet schools rose to over 6 % in the second year, but dipped to 4% in the third year.
- the percentage of HPS students who were exempted or did not receive all three CMT scores increased from 13% to 20% over four years, and the proportion of these leaving the HPS dataset rose significantly from 16 to 25% over three years.
- of students who stayed in the HPS dataset all four years, two-thirds of the lowest performing students improved their scores, though half did not rise into the next score category.

Data Sources, Definitions, and Methods

With the cooperation of the Hartford Public School district, we obtained four years of student-level achievement and demographic data, and masked these records to protect individual privacy, as described in our Trinity research ethics guidelines. We removed non-Hartford resident students from our analysis and geocoded all Hartford residents to identify their census block groups for neighborhood-level analysis. Our study examines only students in grades 3 through 8 due to the continuity of the fourth generation Connecticut Mastery Test (CMT) scores for these grade levels during our period of study from 2008-09 to 2011-12. All of our findings are reported in aggregated groups to maintain individual-level confidentiality.

In this study, we define "high-achieving" HPS students as those who received scores in all three CMT major subject areas (reading, writing, math), with a composite average of 4 or above. On the five-point CMT scale, 1 is "below basic," 2 is "basic," and 3 is "proficient," which we distinguished from the high-achieving scores: 4 is "goal" and 5 is "advanced." The percentage of high-achieving HPS students in our study increased from about 15 to 20 percent over four years.

Composite CMT	2008-09	2009-10	2010-11	2011-12
4 and above	15.1%	16.2%	18.5%	19.6%
less than 4	84.9%	83.8%	81.5%	80.4%

All variables in this study were derived from the HPS dataset unless noted otherwise. For example, to obtain student neighborhood characteristics, we geocoded street addresses and aggregated these into larger spatial units (Census block groups) to protect individual privacy, then matched these with American Community Survey 5-year estimates for owner-occupied housing and average household income. For CMT Goal, CMT Gain, and the racial composition of each school, we referred to data that we had previously obtained from the Connecticut State Department of Education (CSDE), as well as definitions and calculations we previously used when presenting school-level data in the SmartChoices website (see details on the "About" page of <http://SmartChoices.trincoll.edu>). Furthermore, our analysis included tests of statistical significance, and when we found differences that were significant at the 0.05 level ($p \leq 0.05$), we report these are being "more likely" or "less likely" in the text of our report, not the tables.

Which students are NOT included in this study?

This study includes only Hartford-resident students enrolled in Hartford Public Schools (both HPS-run interdistrict magnets and district schools) in grades 3 to 8. We defined this population based on the HPS student-level enrollment and achievement datasets that the district provided to us, and therefore our analysis does NOT include Hartford-resident students enrolled in other public schools, such as:

- CREC-run interdistrict magnet schools, and other non-HPS managers
- Open Choice suburban districts
- other non-HPS public schools (such as Achievement First and Jumoke charter schools)
- non-regular HPS programs (Hartford Transitional Academy, outplacement, etc.)

We have requested that CSDE provide data on all RSCO-sponsored schools, and pending that outcome, will seek cooperation from other potential data providers to broaden the analysis.

Furthermore, since the clustering analysis is based on student achievement, that portion of this report ONLY includes HPS students who received CMT scores in ALL three major subjects areas (reading, writing, and math). Students who were exempted from one or more CMT subject tests (for example, due to special education or English language learner status), or did not receive one of these major CMT scores for any reason, do not appear in the clustering portion of our study. We note that over the four-year study, the proportion of non-CMT students (lacking one or more CMT score) in HPS schools increased from 12.6 percent in 2008-09 to 20.1 percent in 2011-12. (In the future, we would like to do a clustering analysis of the non-CMT students by school.)

Important definitions that we use in this study are:

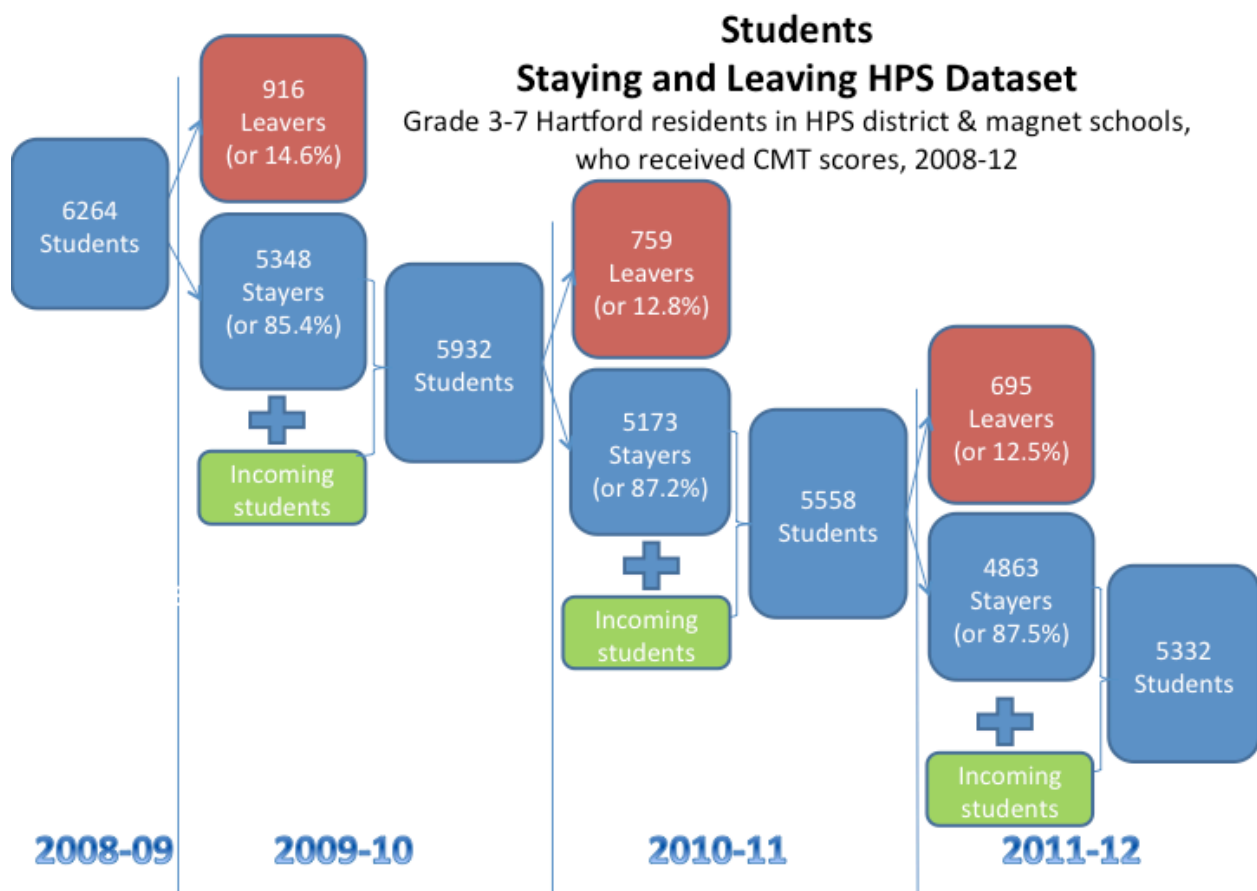
- Hartford Public Schools - any district school or inter-district magnet operated by HPS
- HPS students - Hartford-resident students enrolled in HPS-run schools (usually G3-8)
- CMT - the composite average of three major test scores (reading, writing, math)
- High-achieving students - those scoring at 4 or higher on composite CMT
- Stayers - HPS students who appear in the dataset for at least 2 consecutive years
- Four-year stayers - HPS students who remain in the dataset from 2008-09 to 2011-12
- Leavers - Students who appear in the HPS dataset, then disappear for unknown reasons (such as moving away or enrolling in a non-HPS public or private school)

Continuity analysis: Who stays in the HPS student dataset, and who leaves?

Who stays and leaves the HPS dataset, and are these behaviors associated with individual student characteristics, school composition, or neighborhood demographics? We analyzed the HPS dataset to identify "stayers" (students who appear for at least two consecutive years) and "leavers" (who appear one year, but not the next, for any reason, such as moving away, enrolling in a non-HPS public or private school, etc. over our four-year period from 2008-09 to 2011-12. Since our core study examined students in grades 3 to 8, our continuity analysis omits the last year and focuses on grades 3 to 7, in order to track students who remained in HPS the following year. For example, our dataset allows us to follow a 7th grader into 8th grade, but we do not follow a student after 8th grade.

1) Student continuity in HPS

What proportion of students stay in the HPS dataset versus those who leave -- for any reason -- between grades 3 and 7? Among HPS students who received all CMT scores, we found that the percentage leaving the HPS dataset has been relatively consistent (between 12.5 % and 14.6%) from 2008 to 2012.



2) Characteristics of leavers

Are certain student-level, school-level, or neighborhood-level characteristics associated with leaving the HPS dataset? We analyzed our data on grade 3-7 students in HPS district and magnet schools who received CMT scores in all three major subjects, and looked for statistically significant relationships with other variables between 2008-2012. In other words:

Is leaving the HPS dataset statistically associated with:

Student demographics

Gender

Race

Minority status in school

English Language Learner

High-achievement (4+ composite CMT score)

School characteristics:

Type (HPS interdistrict magnet vs. district)

School zone

Individual schools

Grade level

Percent Black student enrollment

Percent Hispanic student enrollment

Percent at CMT Goal

Percentage point CMT Gain

Neighborhood characteristics (*Note: We are still analyzing this portion of the data.*)

Regarding student-level characteristics, we found that:

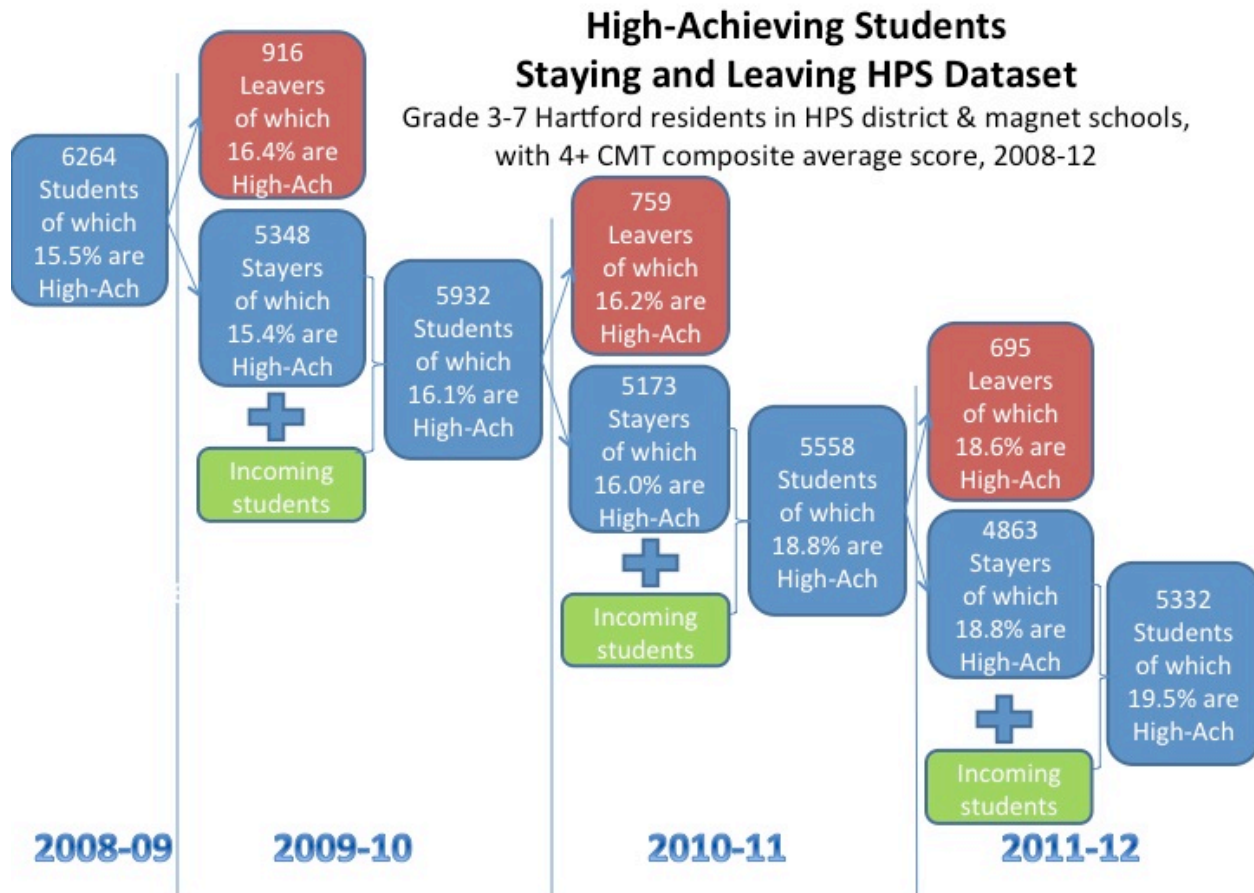
Gender does not matter, as females and males are equally likely to leave the HPS dataset.

Racial differences appeared, as Black students were more likely to leave the HPS dataset for every year of our study period. But **minority status**, or being a racial minority in one's school, does not affect leaving. This also holds true when only Black and Hispanic students were included in the analysis (i.e., Black students in predominantly Hispanic schools, and vice versa).

ELL students were less likely to leave in the first two years of our study period, with no difference in the third year.

Characteristics associated with being More Likely (>) or Less Likely (<) to Leave HPS Dataset			
Student-level	2008-09	2009-10	2010-11
Gender	not associated	not associated	not associated
Race	B>; H & W< ; A<	B&W>; H & A<	B>; W<
Minority status in school	not associated	not associated	not associated
ELL	<	<	not associated
High Achievement	not associated	not associated	not associated

High achievement was contrary to what we expected, as the proportion of high-scoring students (with composite CMT average scores of 4 or more) who left the HPS dataset is not significantly different from the proportion that stayed, for each of the three years. Both figures were around 15 to 18 percent.



When examining school-level characteristics, we found that:

School type: Students attending an HPS interdistrict magnet were less likely to leave the dataset than students attending an HPS district school, for each of the three years.

School zone: Students attending school in HPS zone 1 were always more likely to leave the dataset for all three years. Zone 2 students were more likely to leave in the first year, then became less likely to leave by the second year. Zone 3 was less likely to leave, then had no difference by year three. Zone 4 students were less likely to leave for the first two years, then more likely to leave in the third year.

Grades levels 4 and 5 were more likely to leave in all three years, while other grades varied.

Predominantly Black schools (which in this study are the same as low-Hispanic schools) had students who were more likely to leave the HPS dataset.

Percent at CMT Goal: Across all three years, students in HPS schools with low-to-middle percentages at CMT goal level are more likely to leave the dataset.

Percentage point in CMT Gain: Students enrolled at HPS schools with low CMT test gains were more likely to leave the dataset for the last two years only, but not the first year.

Characteristics associated with being More Likely (>) or Less Likely (<) to Leave HPS Dataset			
School-level	2008-09	2009-10	2010-11
Type (HPS magnet)	<	<	<
School zone (HPS 1-4)	1&2>; 3&4<	1>; 2&3<; 4<	1>; 2<; 4>
Grade level	3<; 4,5,&7>	4&5>	4&5>
Percent Black enrollment	high (80-100%) >	high (80-100%) >	high (80-100%) >
Percent Hispanic enrollment	low (0-20%) >	low (0-20%) >	low (0-20%) >
Percent at CMT goal	lower>; mid>0	mid (20-50%)>0	lowest>
Percentage point CMT gain	not associated	lower>	lowest>

We also identified individual schools with students who were more likely to leave the HPS dataset. (See next page.)

We are still analyzing neighborhood characteristics associated with being more likely to leave the HPS dataset.

HPS Schools with Students More Likely to Leave the Dataset (*) than Stay, Grade 3-7, 2008-11

Magnet schools	Code	Magnet status	2008-09	2009-10	2010-11
Breakthrough	6433	all years			
Capital Prep	6469	all years			
Classical	6464	all years			*
HMMS/HMTCA	6454	all years			
Kinsella	6411	all years			
Montessori at AnnieFisher	6437	all years	na-CMT		
Sport & Medical	6465	all years	*		
Webster	6420	all years			
District-to-Magnet					
Hooker	6409	2009-12		*	
Fisher	6425	2010-12 STEM		*	
Breakthrough II	6435	2011-12	na		
District schools					
AsianAcad/Bellizzi	6453		*		*
Batchelder	6404				
Betances	6428		*	*	*
Burns Latino Stds	6406		*		
Burr	6423				
Clark	6424		*	*	
Dwight	6407			*	na
Fox Middle	6451			na	na
Global	6436			*	
Kennelly	6410			*	*
King	6416		*	*	*
McDonough	6412			*	
MD Fox	6408		*	*	*
Milner	6419		*		*
Moylan	6432				
Naylor	6414				
Parkville	6415		*	*	*
Quirk Middle	6452		*		na
Rawson	6417		*	*	*
Rawson Mid Grades	6456		na	na	
Renzulli	6440		na	na	
Sanchez	6430				*
SAND	6401				
Simpson-Waverly	6426				*
West Middle	6421		*	*	*
Wish	6422		*	*	

Note: Bellizzi and Dwight were merged into Asian Acad, which retained the Bellizzi school code.

na = not applicable because school was not yet open, or had merged, or closed

na-CMT = not applicable because none or insufficient CMT scores (Grades 3-8) reported

3) Switching from HPS district to HPS magnet

Of the students who stay in the HPS system, how many switched from district schools to interdistrict magnet schools? In this case, we define "stayers" as the 5043 students in HPS in 2009-10 (grades 3-7) who also enrolled in HPS during the previous year, 2008-09. For example, of these 5043 students, 290 (5.8%) moved from HPS district schools in 08-09 to magnets in 09-10. Overall, the proportion of HPS stayers who switched from district to magnet schools rose to 6.7% in the second year, but dipped to 4.3% in the third year.

	2009-10	2010-11	2011-12
Stayers from prior year	5043	4900	4670
Stayers (%) switching from district to magnet schools	290 (5.8%)	326 (6.7%)	203 (4.3%)

4) Student Achievement and HPS District-to-Magnet Switching

Is there a relationship between a student's average composite CMT score and the likelihood of switching from an HPS district to an HPS magnet? Yes. As the average composite CMT increases, the proportion of students who switch to magnets increases. For example, 4.6% of those in the lowest CMT score range (in the 1s, on the 1-5 scale) switched to magnets, while 10.9% of those in the highest CMT range (4-5) switched between 2008-09 and 2009-10.

Percent of students who switched from HPS district school to HPS magnet school, by year

Average CMT score in district school year	HPS district 08-09 to HPS magnet 09-10	HPS district 09-10 to HPS magnet 10-11	HPS district 10-11 to HPS magnet 11-12
1s	4.6%	5.0%	3.7%
2s	6.4%	7.9%	5.5%
3s	7.3%	8.7%	6.8%
4s	10.9%	11.0%	5.72%
5	5.3% *	11.8%*	11.1%*
Total	6.7%	7.9%	5.5%

Note: * means two or fewer students; insufficient data to draw conclusions

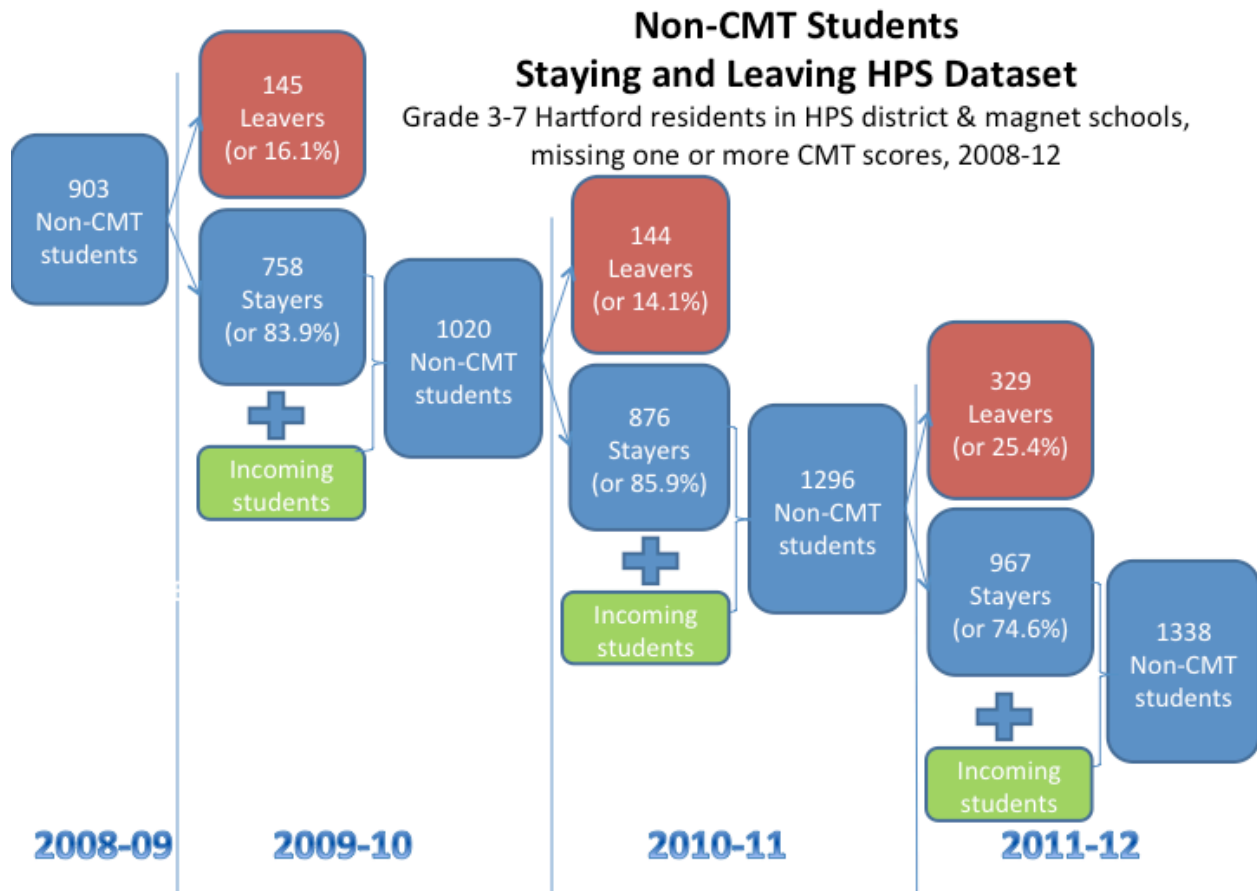
5) Non-CMT Stayers and Leavers

Were non-CMT students (who were exempted from one or more CMT tests, or did not receive all three test scores) more likely to stay or leave the HPS dataset? Among HPS grade 3-7 students, we found that the proportion of non-CMT students rose over the four years of our study from 12.6% in 2008-09 to 20.1% in 2011-12.

HPS Grades 3-7	2008-09	2009-10	2010-11	2011-12
Students	7167	6952	6859	6670
Non-CMT (%)	903 (12.6%)	1020 (14.7%)	1296 (18.9%)	1338 (20.1%)

Of these non-CMT students, the proportion that left vs. stayed were about the same for 2008-09 and 2009-10 (about 15% leaving, 85% staying). But the proportion that left in 2010-11 rose significantly to 25.4%. We do not know where leavers went. Furthermore, although a larger

proportion of non-CMT students left the HPS dataset in 2010-11, the highest percentage of non-CMT students appeared the following year in 2011-12. Therefore, the new students in 2011-12 are more likely to be non-CMT students.



6) Four-year Stayers

How many students stayed in the HPS dataset for all four years of our study? The answer is 1,921 students. Note that this question can only consider students who were enrolled in 3rd-4th grade in 2008-09, since all other students would have been eligible to be promoted to 8th grade during the four-year period.

7) CMT Score changes for Four-Year Stayers

For the students above who stayed in HPS database for all four years, did their CMT composite scores improve, decline, or stay about the same? To answer this, we extracted the non-CMT population from the 1,921 above, to identify the 1,507 students for whom all three subject scores were reported, so that we could construct their composite scores. Then we approached the question in two different ways.

First, we examined each student's composite CMT score to see if there was any change for four-year stayers from 2008-09 to 2011-12. Therefore, this table answers the question: For each student in 08-09 in the five CMT score ranges, what percentage had a lower, same, or higher

CMT score four years later? For example, a student with a 1.33 CMT score in 2008-09, followed by a 1.66 score in 2011-12, would be classified as improved. As shown below, we found that 68% of students whose original score was in the 1s range improved after four years.

Change in Composite CMT Score (e.g., 1.33) for Four-Year Stayers			
	2011-12		
2008-09 score averages	Pct Lower	Pct Same	Pct Higher
1 up to 2	13.0%	18.9%	68.1%
2 up to 3	25.5%	12.7%	61.8%
3 up to 4	34.8%	15.2%	50.0%
4 up to 5	49.3%	20.1%	30.6%
5	50.0%	50.0%	0.0%

But a second way to answer this question is to see if there was any change in the category of the student's CMT score for four-year stayers from 2008-09 to 2011-12. Therefore, the table below answers the question: For each student in 2008-09 whose CMT score fell into each category, what percentage fell into a lower category, stayed in the same category, or moved to a higher category by 2011-12? For example, using this method, a student who averaged 1.33 in 2008-09, then averaged 1.66 in 2011-12, would be classified as "same" because the scores remained in the same 1s category. Looking at the data, we see that only a little more than half of the students (53.6%) who originally scored in the 1s category moved up into a higher score category four years later. By contrast, the other students (46.4%) either stayed the same or moved up or down within the same 1s category.

Change in Composite CMT Score Categories (e.g., 1s) for Four-Year Stayers			
	2011-12		
2008-09 score categories	Pct Lower	Pct Same	Pct Higher
1s	0.0%	46.4%	53.6%
2s	17.0%	35.9%	47.1%
3s	22.0%	48.8%	29.2%
4s	34.9%	57.9%	7.2%
5	50.0%	50.0%	0.0%

Overall, for the lowest-performing students (1s and 2s combined in 2008-09), while two-thirds of them improved their scores, about half remained within the same score category (1s or 2s) or dropped to a lower category (from 2s to 1s) in 2011-12.

Clustering analysis: Are high-achieving HPS students randomly distributed?

Are high-achieving students widely distributed across the district, or are they more likely to be clustered with peers who have similar characteristics, or attend similar schools, or reside in similar neighborhoods?

For our preliminary answer to this question, we analyzed the dataset to measure whether statistically significant relationships existed between high-achieving HPS students (scoring 4 or above on composite CMTs) and other variables in our dataset over the four-year period (2008-09 to 2011-12). In other words:

Question: Is high-achievement statistically associated with:

Student demographics

Gender

Race

Minority status in school

English Language Learner

School characteristics:

Type (HPS interdistrict magnet vs. district)

School zone

Individual schools

Grade level

Neighborhood characteristics (*Note: We are still analyzing this data.*)

Residence zone

Percent of Owner-occupied housing

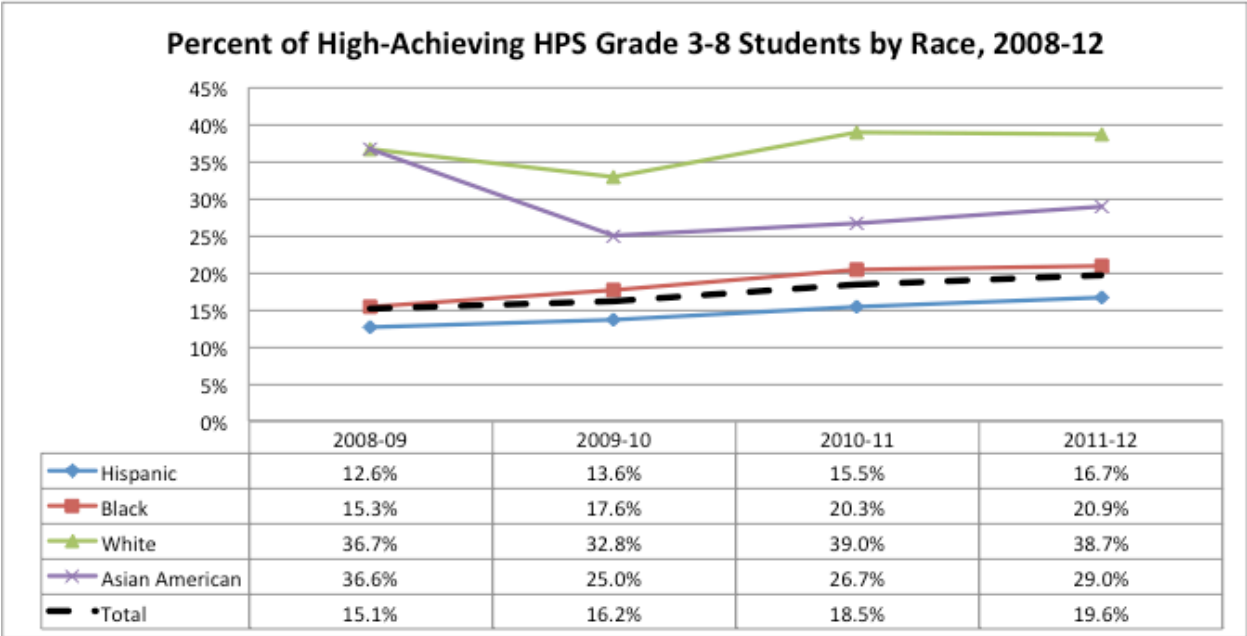
Average household income

In the near future, we plan to refine this aspect of our study by conducting spatial statistics that measure the degree of clustering, if any, which may modify our results.

Findings:

Gender: Females are more likely to be high-achieving students, and males are less likely, for each year in the study, and the difference between them has remained about the same over the four-year period.

Race: Asian Americans and Whites are more likely to be defined as high-achieving students, and Hispanics are less likely to be defined this way, for each year in the study. Black students fluctuate and are either slightly more likely to be high achieving, or equal to the overall distribution of high-achieving students, depending on the year.



Note: Does not include students exempted from or not reporting one or more CMT tests.

Minority status in school: We define students as having minority status if their racial background is different from the majority race of the school, such as a Black student in a predominantly Hispanic school, or a Hispanic student in a predominantly Black school. When we consider all four major racial groups (Blacks, Hispanics, Whites, Asian Americans), minority-status students are more likely to be high achievers for each year, most notably in 2011-12. However, since White and Asian American students are always in the minority in Hartford Public Schools, and these two racial groups are more likely to be defined as high achievers, including them skews the analysis.

High-achieving by minority status	2008-09	2009-10	2010-11	2011-12
Minority in school	18.4%	19.5%	22.2%	26.4%
Not in minority	13.8%	14.8%	17.0%	17.4%
Total	15.1%	16.2%	18.5%	20.1%

If we analyze the dataset only for Black and Hispanic students, then high achievement is not related to minority status during the first three years (2008-11). But this changes in 2011-12, when Black and Hispanic students who are in the minority status are more likely to be high-achieving students.

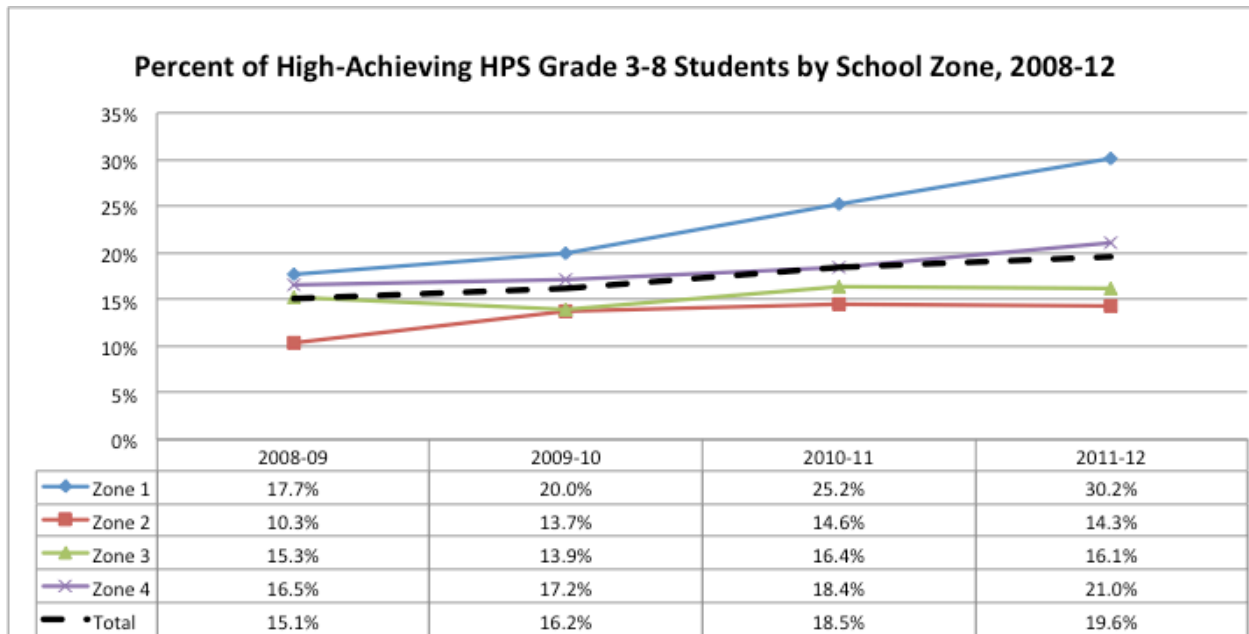
High-achieving by minority status (Black and Hispanic only)	2008-09	2009-10	2010-11	2011-12
Minority in school	14.1%	16.5%	18.7%	22.3%
Not in minority	13.8%	14.8%	17.0%	17.0%
Total	13.9%	15.2%	17.4%	18.3%

English Language Learners: ELL students are less likely to be high achieving for each year.

School type: Students enrolled in an HPS interdistrict magnet school were more likely to be high achieving than students attending an HPS district school for each year of the study. (In future analyses, we would like to break this out further, by race and grade level.)

High-achieving by school type	2008-09	2009-10	2010-11	2011-12
In HPS magnet	25.8%	27.3%	29.3%	31.3%
HPS non magnet	13.1%	13.8%	15.9%	16.7%
In all HPS	15.1%	16.2%	18.6%	19.7%

School zone: Students enrolled in schools located in HPS zones 1 and 4 tend to be more likely to be high-achieving (except for zone 4 in 2010-11), while those attending schools in zones 2 and 3 are less likely (except for zone 3 in 2008-09). Over time, the proportion of high-achieving students attending schools in zone 1 has increased most dramatically. (Note that the Achievement First school is not included in this analysis, because its data is separate from HPS.)



Note: Does not include students exempted from or not reporting one or more CMT tests.

Individual schools: For each year, HPS schools that were more likely to enroll high-achieving students are marked with asterisks below.

HPS Grade 3-8 Schools More Likely to Enroll High-Achieving Students, 2008-12

Magnet schools	Code	Magnet status	2008-09	2009-10	2010-11	2011-12
Breakthrough	6433	all years	*	*	*	*
Capital Prep	6469	all years	*	*	*	*
Classical	6464	all years	*	*	*	*
HMMS/HMTCA	6454	all years	*	*	*	*
Kinsella	6411	all years	*	*	*	*
Montessori at AnnieFisher	6437	all years	na-CMT	*	*	*
Sport & Medical	6465	all years	*	*	*	*
Webster	6420	all years	*	*	*	*
District-to-Magnet						
Hooker	6409	2009-12	*		*	*
Fisher	6425	2010-12 STEM	*	*	*	*
Breakthrough II	6435	2011-12	na			*
District schools						
AsianAcad/Bellizzi	6453					
Batchelder	6404					
Betances	6428				na-CMT	*
Burns Latino Stds	6406					
Burr	6423			*	*	*
Clark	6424					
Dwight	6407		*	*	na	na
Fox Middle	6451			na	na	na
Global	6436				*	*
Kennelly	6410		*			
King	6416			*		
McDonough	6412					
MD Fox	6408					
Milner	6419					
Moylan	6432					
Naylor	6414		*			
Parkville	6415		*	*	*	
Quirk Middle	6452				na	na
Rawson	6417		*	*	*	*
Rawson Mid Grades	6456		na	na		
Renzulli	6440		na	na	*	*
Sanchez	6430				*	
SAND	6401					
Simpson-Waverly	6426			*		
West Middle	6421		*			*
Wish	6422		*	*	*	

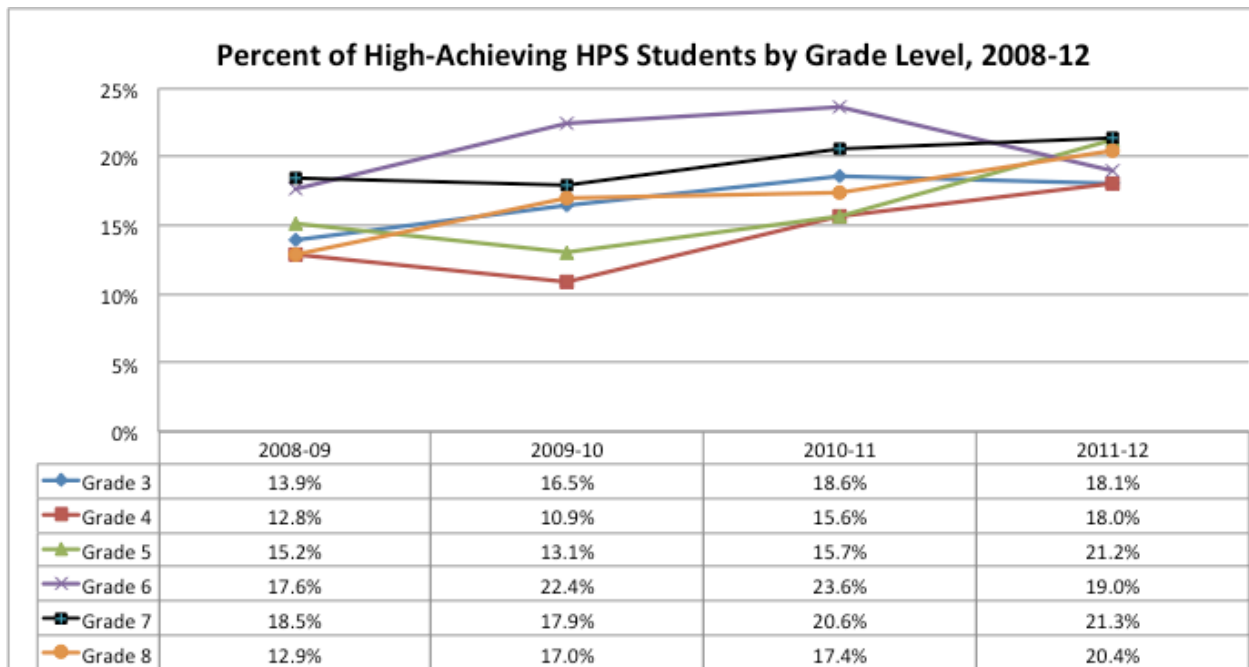
Note: Bellizzi and Dwight were merged into Asian Acad, which retained the Bellizzi school code.

na = not applicable because school was not yet open, or had merged, or closed

na-CMT = not applicable because none or insufficient CMT scores (Grades 3-8) reported

Note: Does not include students exempted from or not reporting one or more CMT tests.

Grade level: Compared to the district average, for most years students in grades 6 and 7 were more likely to be high achieving, while those in grades 3 to 5 were less likely (with exceptions for grade 6 and grade 5, which in 2011-12 followed patterns opposite to those above).



Note: Does not include students exempted from or not reporting one or more CMT tests.

Neighborhood characteristics: We are still analyzing students by neighborhood units, such as HPS zone of residence and census block groups, to determine socioeconomic characteristics (for example, average household income and the percent of owner-occupied housing), and will be conducting spatial statistics to measure the degree of dispersion or clustering. We will share findings in a future report.

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