AMBIENT POSITIONAL INSTABILITY AMONG OHIO MATH AND SCIENCE TEACHERS: 2008 TO 2014

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ABSTRACT

This briefing is on teacher retention and Ambient Positional Instability (API) rates from 2008-09 to 2013-14 for math and science teachers in the state of Ohio. API is investigated in two ways; first, the retention of all math and science teachers teaching in the 2008-09 school year are followed over five years and, second, year-to-year retention is tracked over the same time period. Data analyses are presented with key findings identified. Findings include: only one in two teachers, on average, will be teaching the same subject(s) at the same school after five years; teachers in non-charter public high schools in the five largest cities in Ohio have roughly 50% higher API than those teaching in non-charter high schools outside those cities; and charter schools have the highest level of API of any of the populations of high school teachers investigated. Implications for schools and research projects targeting high schools in Ohio are discussed.

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Ohio's Teacher Retention and Ambient Positional Instability Rates

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Introduction

This briefing is on teacher retention and Ambient Positional Instability (API) rates from 2008-2009 to 2013-2014 for **math** and **science** teachers in the state of Ohio. The work is part of a project on API sponsored by the National Science Foundation and undertaken by 21PSTEM and the University of Pennsylvania. Ambient Positional Instability, as a metric, goes beyond typical measures of teacher attrition to include both those teachers who leave a school and those who remain but do not retain the same position. This second group is often ignored in policy discussions. We argue that it should not. Given our experience in educational research, in particular our experience conducting a randomized cluster trial targeting middle school science teachers[i], we have found that changes in teacher position can have a catastrophic impact on a multi-year study. Positional instability also has the potential to undermine school district initiatives where specific grades or subjects are targeted and then trained teachers are later shifted. There are many other possible effects of API, not all of which are negative. A manuscript further discussing these issues is in development[ii]. For this brief, it suffices to say that API is worth investigating.

The following material outlines our analyses and provides information about the data resources and on their integration and editing. The statistical data in the charts here is foundational. A section summarizing salient findings in words is presented followed by a brief conclusion.

Data Resources, Integration, and Editing

The data was accessed at the following public website: http://reportcard.education.ohio.gov/Pages/ Power-User-Reports.aspx. Six data files were downloaded containing all math and science teachers from the state of Ohio, one for each of the six school years from 2008-2009 to 2013-2014. The data files include five relevant fields: Unique Teacher ID (identification), District ID, School ID, School Type (elementary, middle, junior high, or high), and Course Subject Area (mathematics or science). The specificity of the publicly available Ohio data is restricted to whether a teacher teaches math or science and does not get at specific course assignment. More detailed data has been requested.

Each record in the data files represents a teacher ID associated with a single school and a single course subject area. Therefore, a teacher ID can exist more than once in a file for teachers with multiple assignments. For example, a teacher ID exists multiple times in a file if he or she teaches both mathematics and science in a given year. A teacher ID also exists multiple times if he or she teaches at multiple schools. In addition, some teachers in the files are not attached to any schools (e.g., math and science teachers attached to regional Education Service Centers that support local school districts).

In any big data project such as this, the accessible data must be edited so as to ensure understanding and coherence in its interpretation. The publicly accessible records from Ohio were edited as follows. All teachers who were not assigned to a school and all teachers who were assigned to more than one school were removed from the file. This left only teachers who taught at a single school in each of the data files. The data was then restructured so that multiple teacher records for any given ID (i.e., for those who taught both math and science) were merged into a single record. A new Subject Area field was created in the merged record with the following categories: science teacher, math teacher, and math and science teacher. The data files from the six school years were then merged and analyzed.

Analyses

Five different populations were investigated within the data. Descriptive statistics are presented for: (1) K-12 math and science teachers in the state[iii]; (2) math and science teachers at non-charter public high school schools; (3) math and science teachers at charter/community[iv] high schools; (4) math and science teachers at non-charter public high school schools in the five largest cities in Ohio; and (5) math and science teachers at non-charter public high schools outside of the five largest cities. The five largest cities are Columbus, Cleveland, Cincinnati, Toledo, and Akron.

Two types of analyses were conducted with each population: a **cohort** retention approach and a **year-to-year** retention approach. The cohort approach investigated the retention of the population of math and science teachers from the 2008-2009 school year through the 2013-2014 school year. The year-to-year approach investigated retention of all teachers from one year to the next. For instance, retention of all 2010-2011 math and science teachers into the 2011-2012 school year is reported.

Within each of these populations and analyses, retention was identified by different levels, from the least restrictive to the most. The *restrictiveness* of the level of retention relates to the specificity of a teaching position within the state. The most general classification of a teaching position is someone who teaches in the state. The position gets more specific as the district, then school, and finally subject(s) taught are associated with it. Along these lines, the least restrictive levels of retention include those teachers who are still a math or science teacher in the state (*In State*), those teachers who are still a math or science teacher in the same district (*In Same District*), and those teachers who are still a math or science teacher in the same school (*In Same School*). Rates for retention of math and science teachers in a school, independently, are also included. Our focus on those teachers who still teach the same combination of subjects—math, science, or math and science—in the same school (*In Same Subject(s) and School*) is the most restrictive category of descriptive data presented here. Much of the summary below is focused on this most restrictive category.

In the following section, the percentage of teachers who are retained is listed along with API rates. API is defined as the complement of retention. Mathematically, *API = 100% - retention%*. We emphasize API throughout, especially when looking at the most restrictive level of retention, as we believe API is a more accurate way to characterize the phenomenon at this level of specificity.

<center>**Summary of Selected Results**</center>

2008-2009 Cohort in Public Non-Charter Ohio High Schools

Let us focus first on the retention of a cohort of Ohio math and science teachers who changed in *both* school and the subjects in which they taught, ignoring any further change in the teacher's status (such as returning to the same positon and subject). Chart 1a provides this information.

From Charts 1a, we learn that of the 2008-2009 cohort of teachers in all Ohio non-charter public high schools, about 81% remained in the same school teaching the same subject in 2009-2010 (i.e., the crude API is 19%). Five years later, in 2013-2014, only 47% were teaching in the same school and in the same subject area (i.e., the API is 53%).

These rates differ if one focuses only on the teachers in the five biggest cities. In particular, of the 2008-2009 cohort in these cities, 70% were teaching the same subject in the same school in 2009-2010. The API for cities then is 30%, which is well over the API rate of 19% over all teachers in the state and 17% for teachers outside the five big cities.

In the five biggest cites, the retention in the same school and subject five years later is far lower than the state as a whole. For instance, by 2013-2014, only 25% of the original cohort in the biggest cities remained in place. The API is 75% for cities, while the API for all non-public chart schools outside of these cities is 50%.

If one allows for the fact that some teachers may leave a school or subject area and then return to the same school and subject later, the rates follow roughly the same patterns. Taking replacements into account (Charts 1b), the API magnitudes differ only slightly from API when replacement is not taken into account (Charts 1a). For instance, the retention from the base year to the next in the five biggest cities is 70% and the API is then 30%, which is the same as without replacement. The API with replacement in cities by the fifth year is nearly the same as without replacement, i.e. 71% versus 75%.

Most important, the API in cities well exceeds API in the state as a whole or the API outside of cities by a factor of 1.5 or so. This regardless of whether one takes into account teachers changing and then returning to their original alignment to school and subject.

Year-to-Year Change

Chart 2 shows that from one year to the next, in all public non-charter Ohio high schools, about 78-81% of math and science teachers remained teaching in the same school and subject. For instance, in 2011-2012, 79% of the teachers also taught in 2010-2011. In 2013-2014, 78% of the teachers in the school were in the same position in 2012-2013. The year-to-year API is then 19-22%. The rates are very similar if we look at just the non-charter public high schools outside of the five biggest cities, ranging from 20-23%.

These results are in contrast to the year-to-year rates for the biggest cities. The retention ranges from a low of 63% for the group of teachers teaching in 2010-2011 to a high of 70% for those in 2009-2010. The year-to-year API is then 30-34%. Again, the API for cities is about 1.5 times the API for the state as a whole and API for the schools outside the five biggest cities.

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Charter Schools

The proceeding discussion investigated only non-charter high schools. Charter schools are also worth investigation given their recent growth and their centrality to the national dialogue concerning public education. There are three trends to highlight with regard to the population of charter high school teachers in Ohio. First, charter high school teachers exhibit the highest API of any of the populations investigated in both cohort and year-to-year analyses. Second, the data reveal a substantial increase in the number of charter school teachers from 2008 to 2014. Third, the proportion of charter high school teacher who teach both mathematics and science is several times larger than the proportion of non-charter public high school teachers who teach both subjects.

Our main finding is that charter high school teachers were the most vulnerable population under investigation in reference to API. Regardless of type of analysis or level of retention, charter high school teachers in Ohio had the lowest retention rates and thus the highest API rates. Starting with the cohort analyses in Charts 1a, we see the retention rate of 15%, or an API of 85%, when looking at math and science teachers who kept their exact assignment over five years at charter high schools. These numbers contrast with the population of public non-charter high school teachers who have a retention rate of 47% in exact assignment, and with the population of public non-charter high school teachers from the five largest cities who have a retention rate of 25% in exact assignment. The accompanying API rates are 53% and 75%, respectively. In total, we see that charter high school teachers have an API rate that is 60% higher than their non-charter counterparts and 13% higher than their non-charter counterparts in the five largest cities.

The differences found in the cohort analyses are replicated in the year-to-year analyses, seen in Charts 2. The retention of teachers with the same assignment from one year to the next varies between a low of 55% to a high of 59% over the five year period of analysis for charter high school teachers. The retention rate in the state for public non-charter high schools is considerably higher, varying from a low of 78% to a high of 81%. As before, the teachers at public non-charter high schools in the five largest cities were between the other two populations, varying between a low of 63% and a high of 70%. On average over the five-year period, the API rates for charter high school teachers is 43%, for public non-charter high school teachers the API rate is 21%, and for the subpopulation of these teachers in the five largest cities the API rate is 34%.

The population of charter high school teachers in the 2008-09 school year was small; there were only 629 math and science teachers in the state of Ohio. The size and peculiarity of this group could have accounted for the findings in the cohort analysis. However, when looking at the year-to-year analyses, we see that the one-year retention and corresponding API rates remain somewhat constant in all populations. Therefore, looking across all of the analyses we can conclude that the charter schools had the highest incidence of API.

Secondary findings follow from the year-to-year analyses. First, we found that the number of high school charter school math and science teachers increased significantly over the five-year period of investigation. The population grew steadily from 629 in the 2008-2009 school year to 1468 in the 2013-

2014 school year, a net gain of 839 teachers. That is a 133% increase from the base year. That same time period saw a drop in the number of math and science teachers in non-charter public high schools, going from 11,353 to 10,652. That is a net loss of 701 teachers, a 6% decrease.

Second, we found a significantly higher proportion of teachers teaching both mathematics and science at charter high schools when compared to non-charter public high schools. Of the 11,353 math and science teachers at non-charter public high schools in the 2008-2009 school year, 1,156 taught both math and science, approximately 10%. Of the 629 math and science teachers at charter high schools in the 2008-2009 school year, 259 taught both math or science, approximately 41%. The average proportion of math and science high school teachers that teach both math and science from 2008 to 2014 is the same: 10% for non-charter public high schools and 41% for charter high schools. Charter high schools, therefore, have proportionally four times the number of teachers teaching across certification areas. This finding warrants further investigation.

Conclusion

Analyses have been presented from publicly available data from one state. The information presented is sobering. API for math and science teachers is high in Ohio:

- On average, only one in two teachers at non-charter public high schools retained the same position from the 2008-2009 school year to the 2013-2014 school year.
- API rates are 50% higher for city public high schools as compared to non-city schools.
- API rates are 60% higher for charter high schools compared to non-charter public high schools.

Furthermore, the publicly available data from Ohio was very coarse: teacher position was defined by general discipline (e.g., math and science). Consequently, all of the analyses underestimate the API. With higher quality data that ties teachers to specific grades and courses, the same analyses will produce higher API rates as teacher position, and changes, can be more accurately identified.

In sum, the public teacher data from Ohio provides a rough, albeit low, estimate of teacher instability in that state. Implications abound from these findings. High levels of API will impact research studies targeting teachers in schools as well as school interventions targeting particular grades and/or subject. This brief serves as a foundation by identifying base rates and showcasing the magnitude of positional instability rates in one state. Next steps include using more granular data to better estimate the phenomena, both in Ohio and in other jurisdictions, and to explore the various impacts of API on research studies and student achievement.

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1a. 2008-09 Cohort 5-Year Retention Analyses (no replacement)[v]

(1) All Schools						
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Math and Science Teachers: In State	57364	50032	44586	39426	34963	30669
	100%	**87%**	**78%**	**69%**	**61%**	**53%**
Math and Science Teachers: In Same District	57364	49474	43866	38699	34187	29795
	100%	**86%**	**76%**	**67%**	**60%**	**52%**
Math and Science Teachers: In Same School	57364	47155	40172	33856	28678	24097
	100%	**82%**	**70%**	**59%**	**50%**	**42%**
Math and Science Teachers: In Same Subject(s) and School	57364	44166	36787	30440	25434	21177
	100%	**77%**	**64%**	**53%**	**44%**	**37%**
Science Teachers: Same School	40868	32907	27789	23372	19669	16443
	100%	**81%**	**68%**	**57%**	**48%**	**40%**
Math Teachers: Same School	46801	37759	31938	26660	22381	18543
	100%	**81%**	**68%**	**57%**	**48%**	**40%**

(2) Public Non-Charter High Schools						
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Math and Science Teachers: In State	11353	9954	8917	7969	7154	6403
	100%	**88%**	**79%**	**70%**	**63%**	**56%**
Math and Science Teachers: In Same District	11353	9804	8711	7746	6908	6111
	100%	**86%**	**77%**	**68%**	**61%**	**54%**
Math and Science Teachers: In Same School	11353	9579	8256	7218	6385	5586
	100%	**84%**	**73%**	**64%**	**56%**	**49%**
Math and Science Teachers: In Same Subject(s) and School	11353	9238	7910	6917	6110	5337
	100%	**81%**	**70%**	**61%**	**54%**	**47%**
Science Teachers: Same School	6026	4980	4282	3762	3325	2916
	100%	**83%**	**71%**	**62%**	**55%**	**48%**
Math Teachers: Same School	6483	5270	4448	3857	3376	2907
	100%	**81%**	**69%**	**59%**	**52%**	**45%**

(3) Charter/Community High Schools						
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Math and Science Teachers: In State	629	426	337	249	199	155
	100%	**68%**	**54%**	**40%**	**32%**	**25%**
Math and Science Teachers: In Same District	629	376	288	209	152	111
	100%	**60%**	**46%**	**33%**	**24%**	**18%**
Math and Science Teachers: In Same School	629	376	288	209	154	112
	100%	**60%**	**46%**	**33%**	**24%**	**18%**
Math and Science Teachers: In Same Subject(s) and School	629	358	271	190	132	97
	100%	**57%**	**43%**	**30%**	**21%**	**15%**
Science Teachers: Same School	439	256	196	134	101	73
	100%	**58%**	**45%**	**31%**	**23%**	**17%**
Math Teachers: Same School	449	266	206	143	103	77
	100%	**59%**	**46%**	**32%**	**23%**	**17%**

(4) Public Non-Charter High Schools in 5 Largest Cities						
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Math and Science Teachers: In State	1465	1209	1043	903	753	635
	100%	**83%**	**71%**	**62%**	**51%**	**43%**
Math and Science Teachers: In Same District	1465	1205	1027	882	728	608
	100%	**82%**	**70%**	**60%**	**50%**	**42%**
Math and Science Teachers: In Same School	1465	1102	799	657	519	417
	100%	**75%**	**55%**	**45%**	**35%**	**28%**
Math and Science Teachers: In Same Subject(s) and School	1465	1026	728	597	469	373
	100%	**70%**	**50%**	**41%**	**32%**	**25%**
Science Teachers: Same School	847	602	423	348	270	220
	100%	**71%**	**50%**	**41%**	**32%**	**26%**
Math Teachers: Same School	892	658	476	393	312	244
	100%	**74%**	**53%**	**44%**	**35%**	**27%**

(5) Public Non-Charter High Schools outside of 5 Largest Cities						
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Math and Science Teachers: In State	9888	8745	7874	7066	6401	5768
	100%	**88%**	**80%**	**71%**	**65%**	**58%**
Math and Science Teachers: In Same District	9888	8599	7684	6864	6180	5503
	100%	**87%**	**78%**	**69%**	**63%**	**56%**
Math and Science Teachers: In Same School	9888	8477	7457	6561	5866	5169
	100%	**86%**	**75%**	**66%**	**59%**	**52%**
Math and Science Teachers: In Same Subject(s) and School	9888	8212	7182	6320	5641	4964
	100%	**83%**	**73%**	**64%**	**57%**	**50%**
Science Teachers: Same School	5179	4378	3859	3414	3055	2696
	100%	**85%**	**75%**	**66%**	**59%**	**52%**
Math Teachers: Same School	5591	4612	3972	3464	3064	2663
	100%	**82%**	**71%**	**62%**	**55%**	**48%**

1b. 2008-09 Cohort 5-Year Retention Analyses (with replacement)[vi]

(1) All Schools						
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Math and Science Teachers: In State	57364	50032	45878	41963	38467	34947
	100%	**87%**	**80%**	**73%**	**67%**	**61%**
Math and Science Teachers: In Same District	57364	49474	44994	40898	37201	33415
	100%	**86%**	**78%**	**71%**	**65%**	**58%**
Math and Science Teachers: In Same School	57364	47155	41053	35511	30919	26639
	100%	**82%**	**72%**	**62%**	**54%**	**46%**
Math and Science Teachers: In Same Subject(s) and School	57364	44166	37472	31709	27117	23071
	100%	**77%**	**65%**	**55%**	**47%**	**40%**
Science Teachers: Same School	40868	32907	28238	24230	20835	17762
	100%	**81%**	**69%**	**59%**	**51%**	**43%**
Math Teachers: Same School	46801	37759	32591	27903	24059	20462
	100%	**81%**	**70%**	**60%**	**51%**	**44%**

(2) Public Non-Charter High Schools						
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Math and Science Teachers: In State	11353	9954	9174	8452	7843	7290
	100%	**88%**	**81%**	**74%**	**69%**	**64%**
Math and Science Teachers: In Same District	11353	9804	8936	8159	7482	6832
	100%	**86%**	**79%**	**72%**	**66%**	**60%**
Math and Science Teachers: In Same School	11353	9579	8451	7568	6854	6148
	100%	**84%**	**74%**	**67%**	**60%**	**54%**
Math and Science Teachers: In Same Subject(s) and School	11353	9238	8082	7213	6502	5815
	100%	**81%**	**71%**	**64%**	**57%**	**51%**
Science Teachers: Same School	6026	4980	4359	3908	3522	3137
	100%	**83%**	**72%**	**65%**	**58%**	**52%**
Math Teachers: Same School	6483	5270	4572	4067	3647	3248
	100%	**81%**	**71%**	**63%**	**56%**	**50%**

(3) Charter/Community High Schools						
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Math and Science Teachers: In State	629	426	365	297	265	236
	100%	**68%**	**58%**	**47%**	**42%**	**38%**
Math and Science Teachers: In Same District	629	376	305	228	175	133
	100%	**60%**	**48%**	**36%**	**28%**	**21%**
Math and Science Teachers: In Same School	629	376	305	228	175	133
	100%	**60%**	**48%**	**36%**	**28%**	**21%**
Math and Science Teachers: In Same Subject(s) and School	629	358	283	205	150	114
	100%	**57%**	**45%**	**33%**	**24%**	**18%**
Science Teachers: Same School	439	256	205	147	116	89
	100%	**58%**	**47%**	**33%**	**26%**	**20%**
Math Teachers: Same School	449	266	213	153	113	88
	100%	**59%**	**47%**	**34%**	**25%**	**20%**

(4) Public Non-Charter High Schools in 5 Largest Cities						
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Math and Science Teachers: In State	1465	1209	1090	994	856	795
	100%	**83%**	**74%**	**68%**	**58%**	**54%**
Math and Science Teachers: In Same District	1465	1205	1073	967	824	757
	100%	**82%**	**73%**	**66%**	**56%**	**52%**
Math and Science Teachers: In Same School	1465	1102	832	712	574	487
	100%	**75%**	**57%**	**49%**	**39%**	**33%**
Math and Science Teachers: In Same Subject(s) and School	1465	1026	755	635	511	424
	100%	**70%**	**52%**	**43%**	**35%**	**29%**
Science Teachers: Same School	847	602	442	377	297	257
	100%	**71%**	**52%**	**45%**	**35%**	**30%**
Math Teachers: Same School	892	658	491	425	346	279
	100%	**74%**	**55%**	**48%**	**39%**	**31%**

(5) Public Non-Charter High Schools outside of 5 Largest Cities						
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Math and Science Teachers: In State	9888	8745	8084	7458	6987	6495
	100%	**88%**	**82%**	**75%**	**71%**	**66%**
Math and Science Teachers: In Same District	9888	8599	7863	7192	6658	6075
	100%	**87%**	**80%**	**73%**	**67%**	**61%**
Math and Science Teachers: In Same School	9888	8477	7619	6856	6280	5661
	100%	**86%**	**77%**	**69%**	**64%**	**57%**
Math and Science Teachers: In Same Subject(s) and School	9888	8212	7327	6578	5991	5391
	100%	**83%**	**74%**	**67%**	**61%**	**55%**
Science Teachers: Same School	5179	4378	3917	3531	3225	2880
	100%	**85%**	**76%**	**68%**	**62%**	**56%**
Math Teachers: Same School	5591	4612	4081	3642	3301	2969
	100%	**82%**	**73%**	**65%**	**59%**	**53%**

2. Year-to Year Retention Analyses: 2008-09 to 2013-14[vii]

(2) Public Non-Charter High Schools						
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Math and Science Teachers In State	11353	11306	11068	10677	10529	10652
Math and Science Teachers: In State from Previous Year		9954 **88%**	9880 **87%**	9557 **86%**	9187 **86%**	9042 **86%**
Math and Science Teachers: In Same District from Previous Year		9804 **86%**	9707 **86%**	9398 **85%**	9012 **84%**	8821 **84%**
Math and Science Teachers: In Same School from Previous Year		9579 **84%**	9335 **83%**	9117 **82%**	8818 **83%**	8582 **82%**
Math and Science Teachers: In Same Subject(s) & School from Previous Year		9238 **81%**	8988 **79%**	8799 **79%**	8488 **79%**	8239 **78%**
Science Teachers In State	6026	6030	5897	5714	5583	5566
Science Teacher Same School to Previous Year		4980 **83%**	4846 **80%**	4773 **81%**	4596 **80%**	4416 **79%**
Math Teachers In State	6483	6423	6254	6063	5998	6156
Math Teacher Same School to Previous Year		5270 **81%**	5106 **79%**	4989 **80%**	4873 **80%**	4754 **79%**

(3) Charter/Community High Schools						
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Math and Science Teachers In State	629	1066	1075	1228	1367	1468
Math and Science Teachers: In State from Previous Year		426 **68%**	753 **71%**	745 **69%**	887 **72%**	965 **71%**
Math and Science Teachers: In Same District from Previous Year		376 **60%**	687 **64%**	680 **63%**	788 **64%**	836 **61%**
Math and Science Teachers: In Same School from Previous Year		376 **60%**	687 **64%**	680 **63%**	788 **64%**	836 **61%**
Math and Science Teachers: In Same Subject(s) & School from Previous Year		358 **57%**	634 **59%**	625 **58%**	709 **58%**	752 **55%**
Science Teachers In State	439	755	738	820	945	978
Science Teacher Same School to Previous Year		256 **58%**	460 **61%**	446 **60%**	506 **62%**	533 **56%**
Math Teachers In State	449	796	790	906	994	1058
Math Teacher Same School to Previous Year		233 **52%**	504 **63%**	488 **62%**	569 **63%**	571 **57%**

(4) Public Non-Charter High Schools in 5 Largest Cities						
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Math and Science Teachers In State	1465	1446	1414	1349	1211	1258
Math and Science Teachers: In State from Previous Year		1209 **83%**	1215 **84%**	1177 **83%**	1052 **78%**	958 **79%**
Math and Science Teachers: In Same District from Previous Year		1205 **82%**	1195 **83%**	1168 **83%**	1039 **77%**	950 **78%**
Math and Science Teachers: In Same School from Previous Year		1102 **75%**	990 **68%**	1044 **74%**	952 **71%**	868 **72%**
Math and Science Teachers: In Same Subject(s) & School from Previous Year		1026 **70%**	910 **63%**	965 **68%**	871 **65%**	796 **66%**
Science Teachers In State	847	830	827	791	697	705
Science Teacher Same School to Previous Year		602 **71%**	530 **64%**	584 **71%**	516 **65%**	467 **67%**
Math Teachers In State	892	875	863	831	760	803
Math Teacher Same School to Previous Year		658 **74%**	584 **67%**	616 **71%**	582 **70%**	537 **71%**

(5) Public Non-Charter High Schools outside of 5 Largest Cities						
	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
Math and Science Teachers In State	9888	9860	9654	9328	9318	9394
Math and Science Teachers: In State from Previous Year		8745 **88%**	8665 **88%**	8380 **87%**	8135 **87%**	8084 **87%**
Math and Science Teachers: In Same District from Previous Year		8599 **87%**	8512 **86%**	8230 **85%**	7973 **85%**	7871 **84%**
Math and Science Teachers: In Same School from Previous Year		8477 **86%**	8345 **85%**	8073 **84%**	7866 **84%**	7714 **83%**
Math and Science Teachers: In Same Subject(s) & School from Previous Year		8212 **83%**	8078 **82%**	7834 **81%**	7617 **82%**	7443 **80%**
Science Teachers In State	5179	5200	5070	4923	4886	4861
Science Teacher Same School to Previous Year		4378 **85%**	4316 **83%**	4189 **83%**	4080 **83%**	3949 **81%**
Math Teachers In State	5591	5548	5391	5232	5238	5353
Math Teacher Same School to Previous Year		4612 **82%**	4522 **82%**	4373 **81%**	4291 **82%**	4217 **81%**

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[i] 21st Century Center for Research and Development in Cognition and Science Instruction (IES award# R305C080009)

[ii] Boruch, Merlino, Baker, Bowden, Chao, Park, & Porter, *in review*

[iii] Elementary teachers are identified as both math and science teachers.

[iv] Ohio charter schools are referred to as both "charter" and community" schools. For simplicity, we will refer to both types of schools as charter schools.

[v] "No replacement" means that once a teacher transfers schools or districts, he/she cannot re-enter the database at that school or district at a later date.

[vi] "With replacement" means that a teacher can reenter the database if he/she returns to his/her original school/district after leaving.

[vii] Year-to-year analysis includes all available teachers from one year and reports retention in the following year.