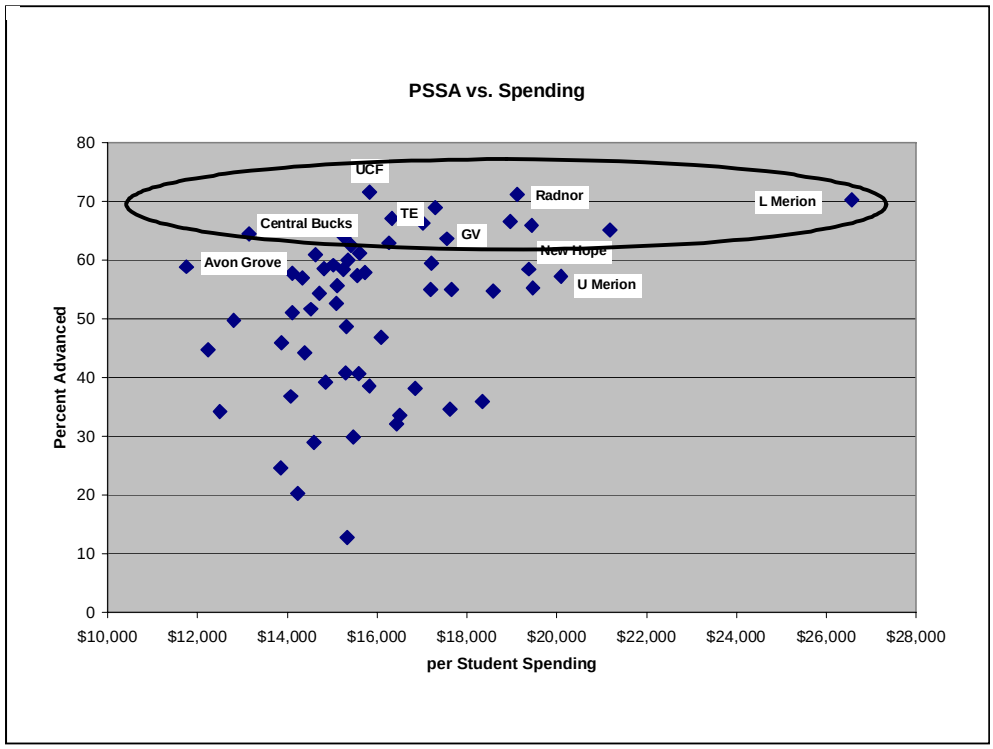
Factors Affecting Academic Performance

January 2012

This presentation contains some financial thoughts that may have a bearing on budget and contract discussions.

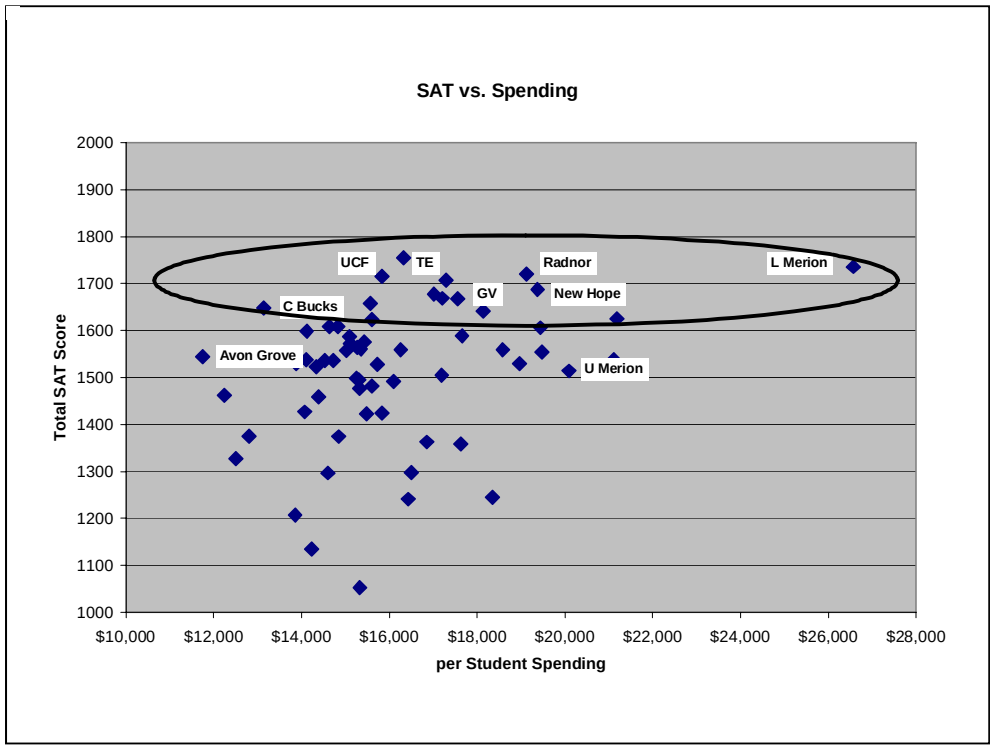


Here is a graph of per student spending on the X axis and average advanced PSSA scores (grades 3-8,11) on the Y axis for the 61 Philadelphia area districts in 2011. The districts with superior results are circled. Notice that there is little correlation between per student spending and academic achievement for these districts. We have the highest spending district (Lower Merion) and the lowest spending district (Central Bucks) achieving similar academic results even though Lower Merion spends twice as much. Further, when SAT scores are substituted for PSSA scores the graph told the same story. What gives?

For those people who advocate for increased spending, the question becomes, "What have Radnor and Lower Merion gained by their higher spending?"

For those who advocate restrained spending the question becomes, "Can we learn something from Central Bucks or Unionville Chadds Ford?"

Note: PSSA and SAT scores are not the perfect measure of education. However, they are the only universal quantitative measure of academic achievement for Pennsylvania school districts. While these measures are not perfect their use is far better than having no measures in place.



Here is a graph of per student spending on the X axis and SAT scores on the Y axis for the 61 Philadelphia area districts. Notice there is little correlation between per student spending and SAT scores for these districts.

What Drives Academic Achievement?
(PSSA & SAT Scores)

- Demographic Factors
  - Parent education (10%-72% Bachelor's degree; TE 72%)
  - Low income (3%-81% Low Income Students; TE 5%)
- School Factors
  - Student to Teacher Ratio (10-30; TE 15.9)
  - Spending per Student ($11.7K-$26.5K; TE $16.3K)
  - Average Teacher salary ($53K-$91K; TE $80K)
  - Average Teacher experience (9-19 years; TE 15)
  - Average Teacher degrees (4.3-4.9; TE 4.8) (B=4, M=5, EdD=6)

From the previous slide it doesn't look like spending is correlated with academic achievement. If not spending, what other factors might explain the wide variation in academic achievement in the 61 Phila area districts?

At one end of the spectrum only 12% of the Chester Upland students scoring in the advanced category while at the other end 71% of the UCF students are scoring in the advanced category. There are SAT scores ranging from 1052 at Chester Upland to 1754 at Tredyffrin Easttown. Each of the 61 districts has a different mix of the Demographic and School factors. Essentially, there are 61 different "experiments" running every year to see what factors matters. Statistical analysis (multi-factor regression) can be used to "tease out" the factors that are important.

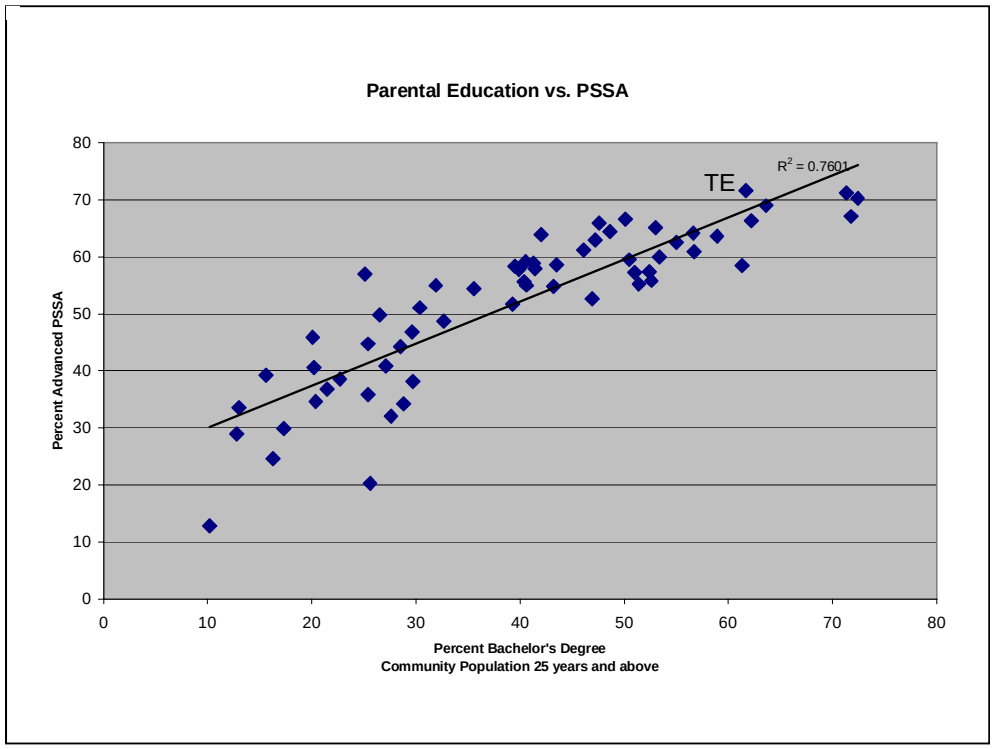
I've listed the factors that many would consider important. In parentheses are the ranges of each factor and where TE resides in that range. Note that there are demographic factors that are beyond our control and school factors that we have control over.

Here are some questions we might ask-

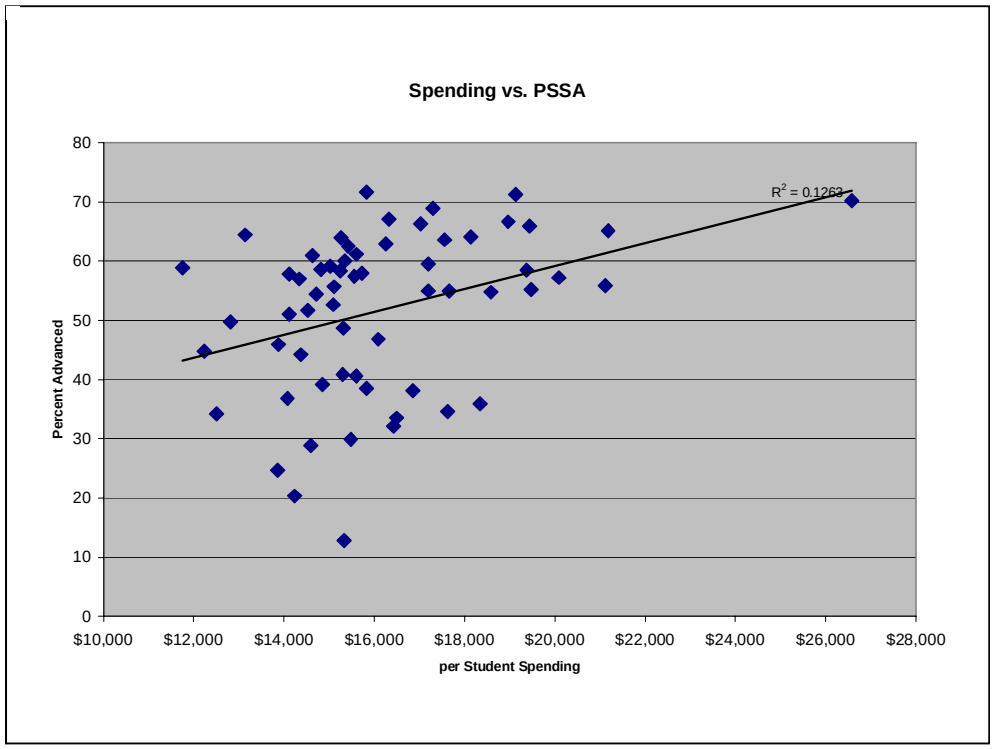
What might happen to academic achievement if we decreased spending?

If we wanted to raise test scores would it make sense to hire teachers with more experience?

What might happen to test scores if we increased the student to teacher ratio (raised class size)?

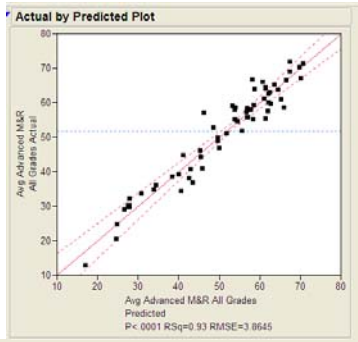


This is an example of how the a multi-factor regression statistical analysis is used to “look at” one factor that is significant. This is a graph of one factor, Parental Education, that is highly significant when trying to explain PSSA test scores. The Y axis again lists PSSA performance. The X axis lists the percentage of the over 25 population having a college degree. Notice that most of the points representing the 61 districts “hug the line”. If a district has a highly educated population they can expect to have students that perform well on the PSSA tests. The R-squared number at 76% is an indication of high correlation.



This is an example of how the a multi-factor regression statistical analysis is used to “look at” one factor that is not significant. This is a graph seen before with a factor, per Student Spending, that is not significant when trying to explain PSSA test scores. Notice that the points representing the 61 districts “are not close to the line”. There are high spending districts like Lower Merion that have high academic achievement, but there are also low spending districts like Central Bucks that, also, have high academic achievement. Increased spending is a minor factor when trying to explain student achievement. The R-squared number at 12% is an indication of low correlation. Increased spending would, most likely, have a negligible effect on student achievement.

PSSA Statistical Model (JMP)



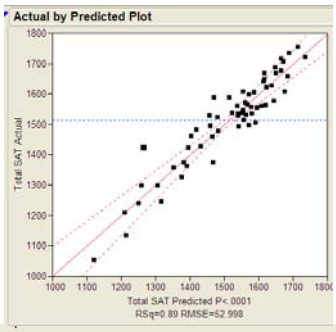
Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Pop over 25 w Bachelors or higher	1	1	609.3712	40.8033	<.0001*
Percent of Enrollment from Low Income Families	1	1	1456.7867	97.5460	<.0001*
Sal-CT	1	1	18.9736	1.2705	0.2648
Svc-CT	1	1	10.5362	0.7055	0.4047
Ed-CT	1	1	3.7982	0.2543	0.6161
Students per Classroom Teacher	1	1	3.1683	0.2121	0.6470
Current Expenditures per ADM	1	1	0.0594	0.0040	0.9499

This is a standard statistical analysis that uses the JMP software program combining all the seven factors mentioned above – per student spending, etc.. ***Only two factors are significant*** - % low income and % college education and those two factors alone can explain the bulk of the PSSA scoring. Those factors are circled in red. For those experienced in statistical analysis the F ratio and the Sum of Squares is high. Both factors, % low income and % college education, are beyond the control of the District. Notice that all other factors, the ones we have control over, are not significant – per student spending, class size, teacher salary, teacher experience, teacher education. While popular opinion might say that teachers with more experience, more degrees and higher salaries are better able to educate our children, the data from the 61 districts in the Philadelphia do not support that opinion.

In a previous slide we mentioned several high performing districts – Unionville Chadds Ford, Lower Merion, Tredyffrin Easttown, Radnor, etc. Note that all these districts have the following characteristics – low poverty (few free and reduced lunch eligible students) and high parental education.

SAT Statistical Model (JMP)



Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Pop over 25 w Bachelors or higher	1	1	74000.72	26.3462	<.0001*
Percent of Enrollment from Low Income Families	1	1	167112.79	59.4966	<.0001*
Sal-CT	1	1	1820.26	0.6481	0.4244
Svc-CT	1	1	5726.20	2.0387	0.1592
Ed-CT	1	1	7593.96	2.7037	0.1060
Students per Classroom Teacher	1	1	1345.30	0.4790	0.4919
Current Expendituresper ADM	1	1	3521.47	1.2537	0.2679

This is a statistical analysis of what factors affect SAT scores. Notice again, that only two factors are significant - % low income and % college education.

What Drives Academic Achievement?
(PSSA & SAT Scores)

- Demographic Factors
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The results of the statistical analysis are nothing new to educational researchers. They've known for years using multiple studies that parental education and poverty are the two major factors affecting academic achievement. They've also know for years that the school factors listed above, the only factors that school directors typically control, have a relatively small effect on academic achievement.

Balancing the Budget

- There is no evidence the increased spending and more teachers will result in improved academic achievement
- There is no evidence that decreased spending and fewer teachers will result in declining academic achievement

Contrary to popular belief, there is no evidence from the 61 districts that spending or the number of teachers has a measureable effect on academic achievement.

Note: PSSA and SAT scores are not the perfect measure of education. However, they are the only universal quantitative measure of academic achievement for Pennsylvania school districts. While these measures are not perfect their use is far better than having no measures in place.

Teachers

- Teachers are still the key
- The factors we measure (teacher education, teacher pay and teacher experience) are not related to teacher effectiveness

I'd be remiss if I didn't clarify the importance of our teachers. A casual interpretation of the data might suggest teachers are unimportant. Quite to the contrary!

Many might wonder why the teacher factors (teacher education, teacher pay and teacher experience) in the prior analysis are not significant when determining academic achievement. Haven't dozens of studies shown that teachers are the key to delivering an excellent education? Haven't we all experienced the magical influence that some teachers have had on our children? Haven't we seen the recent study reported in the NY Times that measures the long-term favorable student outcomes derived from an above average teacher? "Big Study Links Good Teachers to Lasting Gain"

Yes, teachers are the key to education, but the teacher factors we measure (teacher education, teacher pay and teacher experience) and the ones used in the statistical analysis are just not related to teacher effectiveness. The best teachers are not necessarily the ones that have the most degrees, the most experience and the highest pay. It's the reason the President is doing his best to encourage states to rework teacher evaluation and compensation systems to include performance based measures rather than relying on just degrees and experience. It's the reason Governor Corbett is investing in value added assessment for teacher evaluation.

District	Pct Avg Advanced M&R All Grades	Total SAT	Pop over 25 w Bachelors or higher	Percent of Enrollment from Low Income Families	Current Expenditures per ADM	Sal-CT	Svc-CT	Ed-CT	Students per Classroom Teacher
UNIONVILLE-CHADDS FORD SD	71.6	1716	61.7	0.034	$14,160	$72,807	12.2	4.8	14.7
RADNOR TOWNSHIP SD	71.2	1720	71.3	0.064	$16,994	$80,365	18.6	4.8	13.7
LOWER MERION SD	70.2	1736	72.4	0.066	$22,484	$90,524	16.4	4.9	12.8
WALLINGFORD-SWARTHMORE SD	69.0	1707	63.6	0.081	$15,182	$73,539	14.9	4.8	13.1
TREDYFFRIN-EASTTOWN SD	67.1	1735	71.8	0.048	$14,516	$80,281	15.2	4.9	15.9
COLONIAL SD	66.6	1530	50.1	0.149	$17,894	$80,829	12.6	4.8	13.2
UPPER DUBLIN SD	66.3	1678	62.2	0.078	$14,520	$72,557	13.6	4.8	13.8
ROSE TREE MEDIA SD	65.9	1606	47.6	0.105	$17,275	$73,166	15.1	4.8	13.2
JENKINTOWN SD	65.1	1626	53.0	0.085	$19,069	$83,706	19.3	4.9	13.2
CENTRAL BUCKS SD	64.4	1648	48.8	0.059	$10,797	$71,384	12.9	4.8	17.6
WISSAHICKON SD	64.1	1642	56.8	0.146	$16,756	$76,559	14.0	4.7	12.9
HATBORO-HORSHAM SD	63.9	1564	42.0	0.107	$13,922	$68,225	13.3	4.8	13.8
GREAT VALLEY SD	63.6	1668	58.9	0.076	$15,291	$75,911	13.4	4.7	14.8
GARNET VALLEY SD	63.0	1559	47.2	0.061	$13,801	$65,126	11.9	4.8	12.9
WEST CHESTER AREA SD	62.5	1576	55.0	0.098	$13,329	$68,497	12.4	4.5	15.2
METHACTON SD	61.2	1623	46.1	0.063	$13,548	$66,442	11.7	4.6	13.6
DOWNINGTOWN AREA SD	60.9	1608	56.7	0.051	$11,784	$66,429	12.5	4.6	15.2
HAVERFORD TOWNSHIP SD	60.0	1582	53.4	0.104	$13,759	$71,244	15.0	4.8	16.0
LOWER MORELAND TOWNSHIP SD	59.5	1669	50.5	0.044	$14,998	$81,269	12.7	4.9	14.5
SPRING-FORD AREA SD	59.2	1558	40.5	0.077	$12,779	$69,528	12.0	4.8	14.4
AVON GROVE SD	58.9	1548	41.3	0.197	$10,475	$61,912	12.5	4.5	17.4
NORTH PENN SD	58.6	1608	43.5	0.190	$13,736	$72,684	11.8	4.8	14.8
NEW HOPE-SOLEBURY SD	58.5	1687	61.3	0.035	$17,387	$79,616	11.0	4.8	14.6
SPRINGFIELD SD	58.4	1498	39.5	0.111	$13,239	$71,945	14.7	4.7	15.7
ABINGTON SD	57.9	1528	41.4	0.174	$14,456	$76,644	12.3	4.7	15.2
PERKIOMEN VALLEY SD	57.8	1599	39.9	0.091	$12,540	$68,514	12.9	4.8	15.4
COUNCIL ROCK SD	57.4	1658	52.4	0.047	$13,638	$91,318	14.8	4.7	14.8
UPPER MERION AREA SD	57.2	1514	51.0	0.180	$17,643	$85,550	13.9	4.9	14.5
QUAKERTOWN COMMUNITY SD	57.0	1523	25.1	0.200	$13,177	$80,273	13.2	4.7	16.6
CHELTENHAM TOWNSHIP SD	55.8	1538	52.6	0.199	$19,139	$84,989	13.8	4.9	12.6
OWEN J ROBERTS SD	55.7	1572	40.4	0.110	$12,730	$58,774	9.2	4.5	14.6
SPRINGFIELD TOWNSHIP SD	55.3	1595	51.4	0.119	$17,292	$73,939	14.6	4.8	13.0
MARPLE NEWTOWN SD	55.0	1505	40.6	0.091	$15,948	$69,447	15.0	4.6	14.4
PALISADES SD	55.0	1590	31.9	0.138	$15,802	$74,934	15.6	4.9	14.2
PHOENIXVILLE AREA SD	54.8	1560	43.2	0.204	$16,821	$70,588	13.4	4.6	13.3
SOUDERTON AREA SD	54.4	1536	35.6	0.139	$13,096	$70,331	13.4	4.8	14.7
KENNETT CONSOLIDATED SD	52.7	1587	46.9	0.372	$12,953	$62,474	12.4	4.6	16.0
PENNSBURY SD	51.7	1536	39.3	0.120	$13,482	$80,786	15.0	4.7	15.2
PENNRIDGE SD	51.1	1538	30.4	0.145	$11,979	$75,280	14.9	4.8	16.5
PENN-DELCO SD	49.8	1375	26.5	0.179	$11,474	$60,244	10.7	4.7	15.5
UPPER MORELAND TOWNSHIP SD	48.7	1478	32.7	0.200	$13,571	$76,715	12.5	4.8	16.0
NESHAMINY SD	46.8	1492	29.6	0.169	$14,858	$78,554	15.3	4.5	14.8
UPPER PERKIOMEN SD	45.9	1529	20.1	0.213	$12,767	$73,850	14.0	4.7	15.5
OXFORD AREA SD	44.7	1462	25.4	0.368	$10,449	$53,611	11.2	4.4	16.9
CENTENNIAL SD	44.2	1458	28.5	0.264	$13,055	$82,845	14.9	4.8	16.1
POTTSGROVE SD	40.8	1495	27.1	0.279	$13,820	$70,026	15.8	4.7	15.1
OCTORARA AREA SD	40.6	1483	20.2	0.288	$13,627	$65,295	12.2	4.6	13.7
INTERBORO SD	39.2	1375	15.8	0.321	$13,811	$73,592	14.3	4.8	14.0
BENSALEM TOWNSHIP SD	38.6	1424	22.7	0.390	$14,516	$79,716	15.0	4.7	15.0
COATESVILLE AREA SD	38.2	1383	29.7	0.390	$15,107	$60,989	12.5	4.6	13.9
RIDLEY SD	36.8	1427	21.5	0.249	$13,067	$77,339	11.8	4.7	15.2
MORRISVILLE BOROUGH SD	35.9	1246	25.4	0.547	$17,326	$73,017	14.8	4.7	12.5
CHICHESTER SD	34.7	1359	20.4	0.509	$14,922	$62,963	13.5	4.3	13.2
UPPER DARBY SD	34.2	1327	28.8	0.427	$11,936	$59,452	12.5	4.7	15.6
BRISTOL TOWNSHIP SD	33.5	1298	13.0	0.478	$15,599	$78,734	12.1	4.6	13.9
NORRISTOWN SD	32.1	1241	27.6	0.691	$15,648	$75,319	13.4	4.7	14.3
POTTSTOWN SD	29.9	1422	17.3	0.639	$14,426	$58,316	13.3	4.4	14.0
BRISTOL BOROUGH SD	28.9	1297	12.8	0.602	$12,862	$78,799	14.4	4.8	14.5
SOUTHEAST DELCO SD	24.7	1208	16.3	0.676	$12,967	$67,579	10.9	4.7	14.4
WILLIAM PENN SD	20.3	1135	25.6	0.754	$13,670	$66,971	12.7	4.6	16.1
CHESTER-UPLAND SD	12.8	1052	10.2	0.814	$14,169	$59,355	10.9	4.5	15.4

All data is from the Pennsylvania Department of Education with the exception of “Pop over 25 w Bachelor or higher” which is from the US Census Bureau American Community Survey