IMPressions Article

A recent analysis of SAT-9 math scores at Philadelphia's High School for Girls showed that IMP students outperformed their traditionally taught counterparts. The study was conducted by Dr. Ned Wolff of Beaver College with the support of Steven Kramer of the University of Maryland and Atenssa Cheek of La Salle University. Three different scores were examined: the composite mathematics score and its two major components, the open-ended and multiple choice scores. To account for differences in student backgrounds before enrolling in high school, the study took into consideration the students eighth grade test scores on the California Test of Basic Skills (CTBS). Using the statistical technique, Analysis of Covariance, it computed and compared the two lines (called regression lines) that best predict IMP and traditional students' eleventh grade SAT-9 scores from their eighth grade CTBS scores.

All students were included in the study as long as they did not switch math programs and the Philadelphia School District was able to supply both eleventh grade math SAT-9 scores and eighth grade math CTBS scores. The only exception was that one of the traditional students was dropped from the study. A so-called "outlier", this student did very well on eighth grade CTBS but so poorly on the SAT-9 that, if included in the study, would have appreciably lowered the overall performance of the traditional group. Remaining in the study were 27 IMP and 138 traditional students.

The graph above shows the regression lines for both the IMP and traditional students where the composite math SAT-9 scores are predicted from the CTBS scores. The fact that the IMP line is higher means that if an IMP student and traditional student had the same CTBS score, the IMP students generally got a higher SAT-9 score. The IMP gains demonstrated in this study were statistically significant ($p < .01$).

The steeper slope of the IMP regression line suggests that IMP was especially beneficial for the best students, because the further to the right you go, the greater the gap between the predicted scores of IMP and traditional students. However, the difference in slopes of the two regression lines turned out not to be significant (perhaps due to the small number of IMP students). Therefore, the study next proceeded on the assumption that the lines were parallel. The equations of the best-fit *parallel* lines were consequently

computed, and the vertical distance between these lines was found to be 9.73. That is, if an IMP and a traditional student both have the same eight-grade CTBS math scores, the IMP student's predicted eleventh grade SAT-9 math composite score would be 9.73 points higher.

To better understand the gains demonstrated by IMP students, the open-ended and multiple-choice questions were examined separately. The graph above shows the best-fit lines for the open-ended component of the test. As suggested by the figure, IMP students significantly outscored ($p < .01$) the traditional students on this portion of the test by a comparatively large margin.

Indeed, given the same CTBS scores in eight grade, an IMP student would be predicted to outscore the traditional student by 15.2 points. An examination of the multiple choice scores showed a small gain of 4.27 points for IMP students, but this gain was not statistically significant.

The SAT-9 scores analyzed above were reported on a 1 through 99 scale. Based on these scores, the School District of Philadelphia characterizes student performance as being either below basic, basic, proficient, or advanced, with the last three categories considered as passing. An analysis of the scores of all the juniors at Girls' High School (including those excluded from the above study because they did not take the CTBS in eighth grade) found that 80% of the IMP students verses 43.5% of the traditional students received passing scores. Also, although IMP students comprised only 13.6% of all juniors at Girls' High, they accounted for 35.1% of the scores in the two highest (proficient and advanced) categories.

Summary of ANCOVA study of 1998 SAT-9 Scores at Girls' High

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1) Normal curve equivalencies were used. These are reported on a 1 – 99 scale.

2) Students who started out in IMP and switched to Traditional were excluded. All other students were included as long as we could obtain complete eleventh grade math SAT-9 scores and eighth grade math CTBS scores. There were 27 IMP and 139 traditionally taught students in the study.

3) Using eighth grade CTBS math scores to control for baseline differences, we found:

a) IMP significantly improved composite math scores ($p = .001$) and open-ended math scores ($p < .001$). EMP students also did better than predicted on the multiple-choice section, but this difference was not statistically significant ($p = .137$).

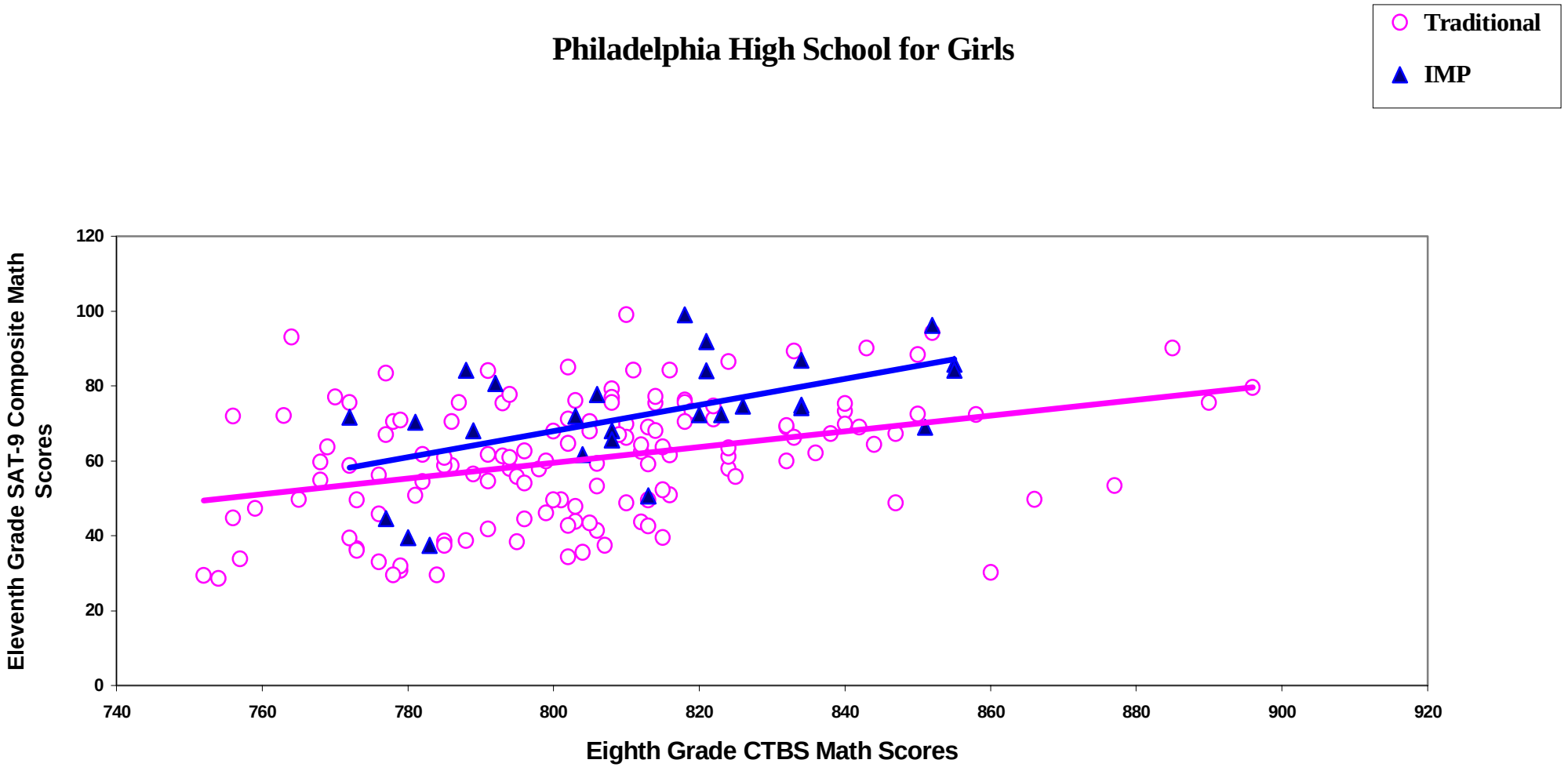
b) Using multiple regression techniques, the best-fit linear relationships for predicting SAT-9 math scores are:

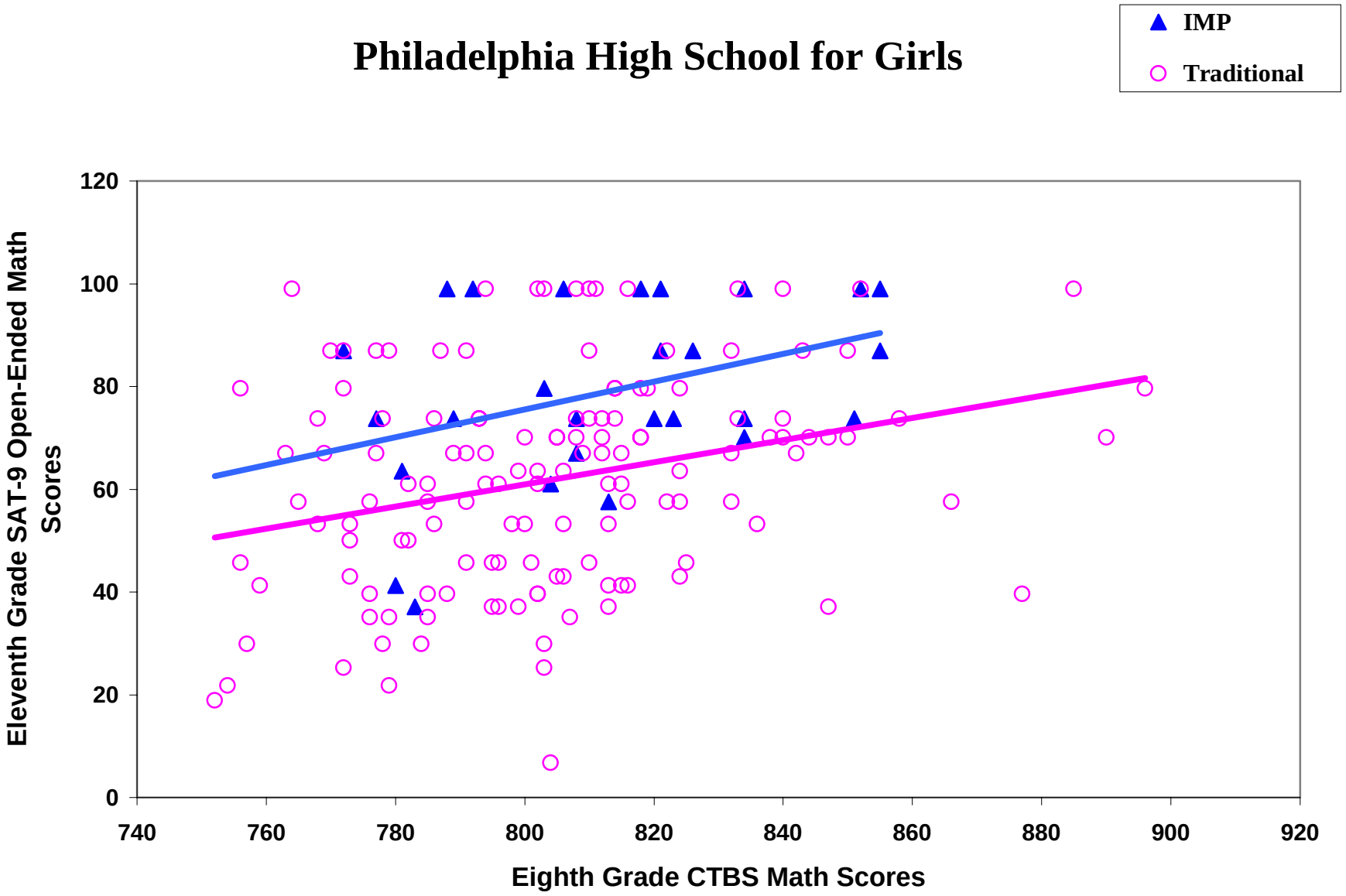
Composite-math = -122 + .227 CTBS +10.2 IMP

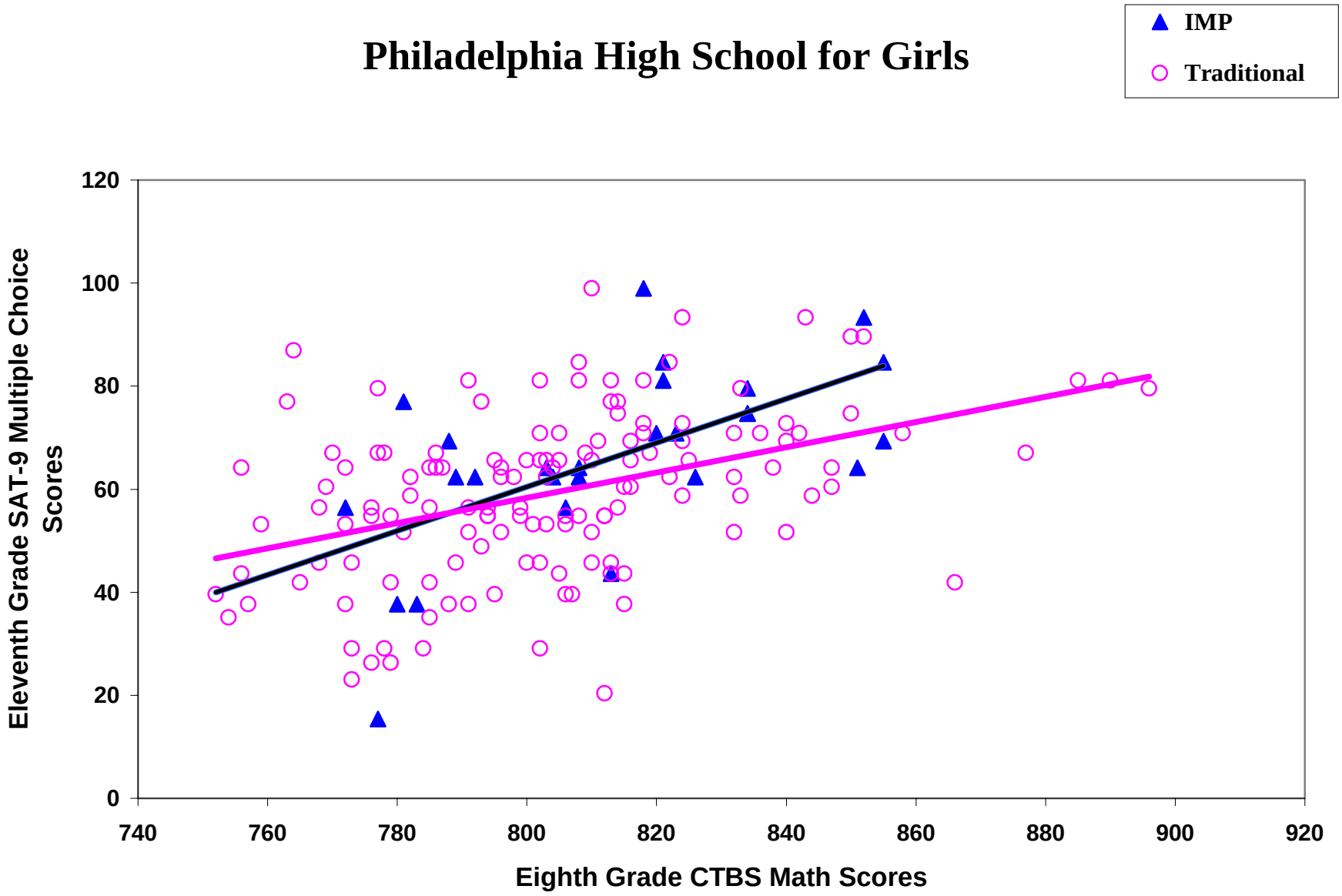
Multiple-math = -144 + .252 CTBS + 4.68 IMP

Open-math = -101 + .202 CTBS + 15.7 IMP

Here, the IMP variable takes on the value "1" for IMP students and "0" for traditional students. The coefficient in front of IMP shows the net gain of IMP students. For example, if an IMP student and traditionally- taught student have the same eighth grade CTBS scores, then the IMP student's predicted composite math score would be 10.2 points higher than the traditional student's score.


Philadelphia High School for Girls
Traditional
IMP
Eleventh Grade SAT-9 Composite Math Scores
120
100
80
60
40
20
0
740
760
780
800
820
840
860
880
900
920
Eighth Grade CTBS Math Scores


Philadelphia High School for Girls
IMP
Traditional
Eleventh Grade SAT-9 Open-Ended Math Scores
120
100
80
60
40
20
0
740
760
780
800
820
840
860
880
900
920
Eighth Grade CTBS Math Scores


Philadelphia High School for Girls
IMP
Traditional
Eleventh Grade SAT-9 Multiple Choice Scores
120
100
80
60
40
20
0
740
760
780
800
820
840
860
880
900
920
Eighth Grade CTBS Math Scores