



JEOC REVIEW

February 12, 2018

Observations on the use of grade point average as a proxy for End-of Course (EOC) determined graduation points

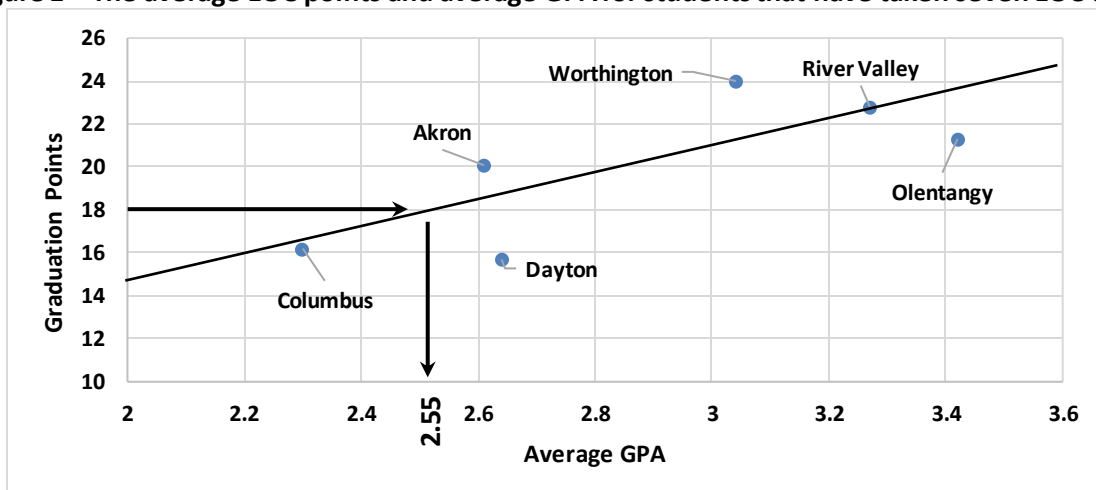
Background. Ohio law includes a provision that a student's high school senior year grade point average (SYGPA) of at least 2.5 can be one part of a substitution for diploma eligibility. The GPA, along with one of several other possible substitutes replaces the requirement to earn 18 points on the End of Course exams (EOCs) to achieve diploma eligibility. Some of the other possible substitutes that might be combined with SYGPA include attendance, a project, community service, or other performance on other tests.

Why study the Grade Point Average (GPA) provision? A student could become diploma eligible by combining attendance with community service, not including any measures of academic ability. But whatever else a student might do or not do as a high school senior, school records tend to automatically generate grade point averages (a measure of academic performance) and attendance records (a non-academic behavior measure).

If the SYGPA indicates the same latent variable in students (student ability in academic content) on the scale appropriate to the EOCs, two things should be evident in the data: (1) the GPA data should co-vary or correlate with the number of graduation eligibility points, and (2) the criterion GPA of 2.5 should be supported by evidence that it is comparable to or more difficult than the original criterion of 18 points from EOC testing.¹

Some data from the field. Six school districts supplied JEOC researchers with both GPA data (although not senior year GPA data) and EOC test performance records for students in the Class of 2018. Figure 1 shows a plot of data from the providing districts. Each point on the graph represents the average GPA of students in the class of 2018 for the district plotted against the average number of EOC points earned by students in the class of 2018 for the district.

Figure 1 – The average EOC points and average GPA for students that have taken seven EOC tests

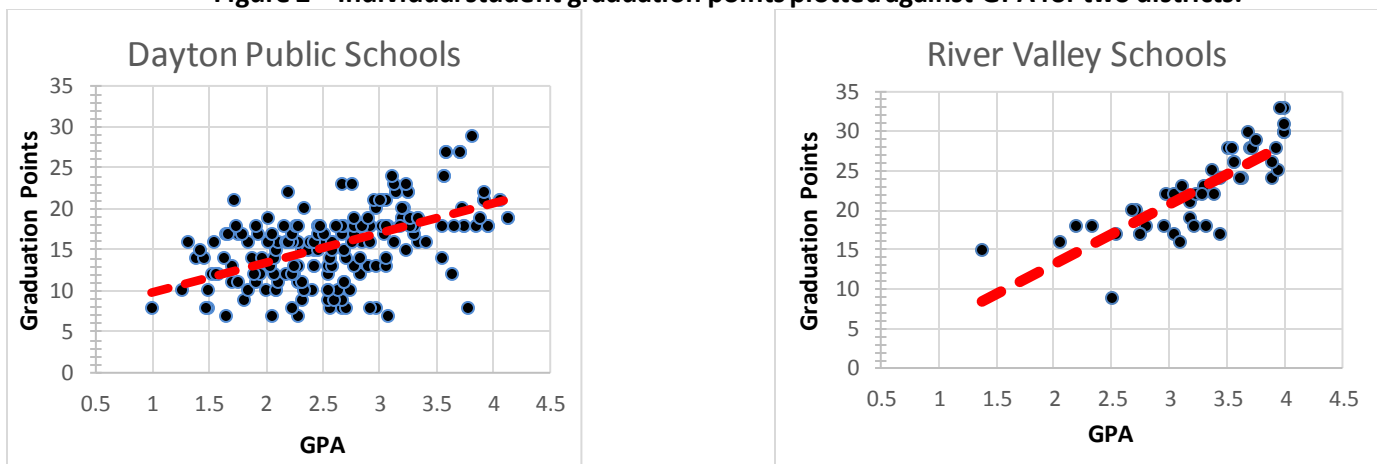


¹ The test scores (used to determine diploma eligibility) and classroom scores (used to determine GPA) have imperfect reliability and probe different content. Meeting the "comparable or more difficult" criterion means that the GPA pathway to diploma eligibility should not be easier than the EOC pathway. After all, the original criterion was established using only EOC diploma eligibility points. If the requirements of diploma eligibility were to use GPA, this could have been done from the beginning without using the tests.

In Figure 1, the diagonal line represents the best single estimate for a relationship between the grade point averages that students have prior to their senior year and the average number of graduation points that they have from seven tests (the regression line). The criterion of 18 graduation points is represented by a horizontal arrow that intersects the regression line at 2.55 for the average GPA. Thus there is some support in this small, six district data set that a cut of 2.5 GPA for diploma eligibility is similar to EOC test performance found in the field. However, it is important to note that this small sample is not representative and is weighted toward urban and suburban districts. There are some distribution requirements for the 18 graduation points but the distribution requirements are being ignored – for this analysis, it is assumed that any 18 point combination is sufficient for diploma eligibility. While it may be true that not all students who earn 18 points will be diploma eligible in the current system, many, probably most, will.

This result should not be interpreted as indicating that student GPA and graduation points are measuring the same latent student ability. For example, a student’s GPA could be higher due to graded classes in different content areas than measured by the EOCs such as physical education. Specific requirements in learned content that the state determines is important enough that a diploma can be withheld may not have been a part of the GPA (such as founding documents) or may have been part but the student performed below the 2.5 criterion in learning the content. Indeed, if graduation points correlated perfectly with GPA, no student would become eligible through GPA that was not also eligible through graduation points presuming all seven tests have been taken. Figure 2 shows individual student’s GPAs and graduation points at two schools. The chart on the left for Dayton Public Schools shows individual scores are more dispersed around the red trend line than for the River Valley Schools.

Figure 2 – Individual student graduation points plotted against GPA for two districts.

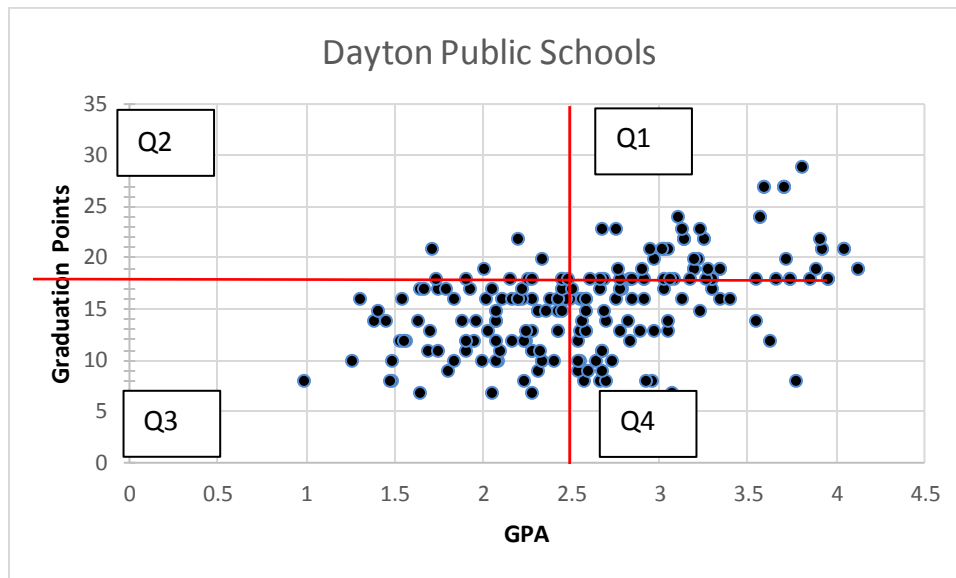


A possible interpretation of Figure 2 is that GPA is more closely related to graduation points at River Valley than at Dayton. The relationship is only half as strong at Dayton ($r^2 = 0.283$)² as at River Valley ($r^2 = 0.672$) suggesting that the student ability indicated at Dayton is comprised of more different factors than indicated by graduation points when compared to River Valley. This is evidence that GPA is not always indicating latent student ability variable the same as the graduation points. Different instruments indicate different variables and classroom assignments and classroom tests may indicate a somewhat different latent ability than is measured by the EOC tests. The observed differences between River Valley and Dayton may also be due to the differences in number of students and number of teachers in the systems.

² r^2 is sometimes called the coefficient of determination and is computed as the square of the correlation coefficient between two variables. The coefficient indicates the portion of variability in graduation points that is related to GPA. For this sample, at Dayton, 28% of the variation in graduation points is associated with by GPA – a little low. A correlation of 0.6 between measures is not an unreasonable expectation and would produce an r^2 of 0.36 (or 36%).

Figure 3 shows the same Dayton data as Figure 2 except the cut scores for graduation points (18 points) and GPA (at 2.5) are shown as a red horizontal line and a red vertical line, respectively.

Figure 3 – Consistency in classifying students identified as diploma eligible using two different methods



The red lines divide the data into four quadrants labeled Q1 through Q4. In quadrant Q1 (above and to the right of the red lines representing the cut scores), the students have both at least 18 graduation points and a GPA of at least 2.5. In quadrant Q3, students have neither the requisite graduation points nor a GPA of 2.5. In both Q1 and Q3, both methods agree on the students’ diploma eligibility. In Q4, the student becomes diploma eligible using the GPA criterion only. In Q2, the student becomes diploma eligible using the graduation points criterion only. If graduation points and GPA were indicating the same latent ability and if both graduation points and GPA were completely reliable measures, students would not be observed in either Q1 nor Q4 and there would be no need for having two separate measures.

Table 1 was prepared using the same data as Figure 3 to show the counts of students in each quadrant.

Table 1 – Counts of students in each quadrant

Q2 – EOCs only 12 students	Q1 – both GPA and EOCs 65 students
Q3 – neither GPA nor EOCs 77 students	Q4 – GPA only 51 students

In Q1, both methods agree that the students are diploma eligible and in quadrant 3 both methods agree that the students are not eligible. The rate of agreement between GPA and test score outcomes can be computed as the sum Q1 and Q3 divided by the total number of students in all quadrants:

$$\frac{Q1 + Q3}{Q1 + Q2 + Q3 + Q4} = \frac{65 + 77}{65 + 12 + 77 + 51} = 0.69 \text{ or } 69\% \text{ agreement}$$

For most of the Dayton students in Q2 (12 students), obtaining diploma eligibility using just their EOC-earned graduation points is considerably less difficult than doing so using just their GPA. However, for the 51 Dayton students in Q4, obtaining diploma eligibility using just their GPA is considerably less difficult than doing so using just their EOC-earned graduation points. Table 2 shows a summary of the data from the six districts.

Table 2 – Summary of some district supplied data from 2017 for student success at meeting diploma eligibility requirements

District	Relationship between GPA and total graduation points		Those who attempted all seven tests		GPA	
	Correlation, r	Adjusted r ²	Number of Students	Average Diploma Points	Average	Std. Dev.
Akron	0.76	0.574	1,299	20.1	2.61	0.88
Columbus	0.53	0.281	1,576	16.2	2.30	0.79
Dayton	0.54	0.283	205	15.7	2.64	0.57
Olentangy	0.42	0.174	1,444	23.1	3.42	0.65
River Valley	0.82	0.672	49	22.8	3.27	0.58
Worthington	0.67	0.447	254	24.0	3.04	0.65

Table 3 shows the rate of agreement at each of the six districts.

Table 3 – Agreement rates for districts that supplied data

District	Counts by quadrant				Agreement rate
	Q1 – GPA and EOC	Q2 – EOC only	Q3 – Neither GPA nor EOC	Q4 – GPA only	Average
Akron	604	168	408	119	78%
Columbus	407	211	673	285	69%
Dayton	65	12	77	51	69%
Olentangy	1,217	95	40	92	87%
River Valley	38	2	3	6	84%
Worthington	191	33	24	6	85%
Total count:	2,522	521	1,225	559	

The agreement rates range from 69% to 87%. One of the reasons the agreement rate is high for Olentangy is that the vast majority of students are diploma eligible by both methods. In contrast, Dayton has both a low agreement rate and a diploma eligibility rate that cuts the reported student population closer to the center so there is more ambiguity over the true ability of a larger portion of students. A student's true ability is, as statisticians might say, known only to God but is estimated from the measures.

Considerations from the data.

1. The GPA cut score of 2.5 is difficult to reject from the data. [Figure 1]
2. GPA and graduation points are indicating a similar student ability but for some schools, the relationship is not particularly strong. [Figure 2; the adjusted r² values in Table 2]
3. Diploma eligibility by GPA might be easier in practice than diploma eligibility by graduation test. [Figure 3, Table 3] While the total count for Q2 is about equal to the total count for Q4, the difference in counts for those two quadrants vary widely. It appears much easier to graduate via GPA at Dayton and Columbus than at Akron; perhaps the objectivity and fairness of the test does not extend to classroom grades.
4. By extension of consideration 3, it is not clear how students who are diploma eligible by GPA, obtain an educational benefit from the graduation test.
5. More study using a larger, more complete data set, senior year GPA, and better modelling of the EOC results is needed.