

## Do students who take AP or Dual Credit coursework during their final year of high school graduate within 4 years from an NDUS Regional or Research institution more often than students who do not?

### Introduction

The primary goal of this study was to determine whether or not there is a difference in 4-year graduation rates at NDUS Regional and Research institutions between groups of students who took Dual Credit and/or Advanced Placement (AP) courses in high school. Comparisons were made between similar students, based on students' high school GPA and ACT Composite score. Students without an ACT Composite score were not considered during this study.

To study this question, data was collected from North Dakota high school graduates who enrolled in an NDUS Regional or Research institution in the fall immediately following their high school graduation. Fall 2009, 2010, and 2011 NDUS enrollments were used. NDUS Regional institutions are Dickinson State University, Mayville State University, Minot State University, and Valley City State University. NDUS Research institutions are North Dakota State University and University of North Dakota.

### Data Summary

Students were split into one of four groups based on whether or not they took an Advanced Placement course (as identified by state course codes), a Dual Credit course, both, or neither in their final year of high school.

Category	Student Count	4 Year Grads	4 Year Grad Rate	Avg. ACT	Avg. GPA
Neither AP/DC	1717	317	18.5%	22.01	3.22
AP	746	214	28.7%	25.84	3.57
Dual Credit	724	227	31.4%	23.12	3.50
Both AP/DC	182	61	33.5%	24.91	3.59

Table 1: Summary Information for Student Groups

The group consisting of students who took both Advanced Placement and Dual Credit courses was not used in further testing, due both to the small size of the group and the interest in comparing the effectiveness of AP and Dual Credit coursework in North Dakota separately.

### Methodology

While Table 1 seems to indicate that AP and Dual Credit students may enjoy a healthy boost in 4 year graduation rates when compared to students who take neither AP nor Dual Credit coursework, that alone is not enough to answer the question at hand. Notice that the AP and Dual Credit groups also consist of students with a noticeably higher average ACT Composite score and high school GPA.

To isolate the effects (as much as possible) of taking advanced coursework from the baseline academic level of a student, propensity score matching was used to match students with similar ACT Composite scores and high school GPA across groups of interest. In this way, tests to assess for the effect of advanced coursework can be done on very similar groups of students. Three tests, held to a familywise error rate of .05 (individual tests held to 0.01695 using Šidák's correction), were performed to determine if was a statistically significant difference in the graduation rates between the following pairs of groups:

- Dual Credit vs. No Dual Credit/Advanced Placement
- Advanced Placement vs. No Dual Credit/Advanced Placement
- Dual Credit vs. Advanced Placement

### Comparing Dual Credit to Non-AP/DC

The first two groups for comparison will be the group of students who took Dual Credit coursework during their final year of high school and the group that took neither AP nor Dual Credit coursework during their final year of high school. Propensity score matching between the two groups yielded 719 successful matches of students across groups with similar ACT and GPA values, out of a possible 724 (the total number of Dual Credit students). The matched group diagnostics are shown in Table 2 and Figure 1 below.

	Avg. ACT	Avg. GPA
Dual Credit	23.09	3.50
Non-AP/DC	23.08	3.49

Table 2: Summary Results for Dual Credit and Non-AP/DC Matching

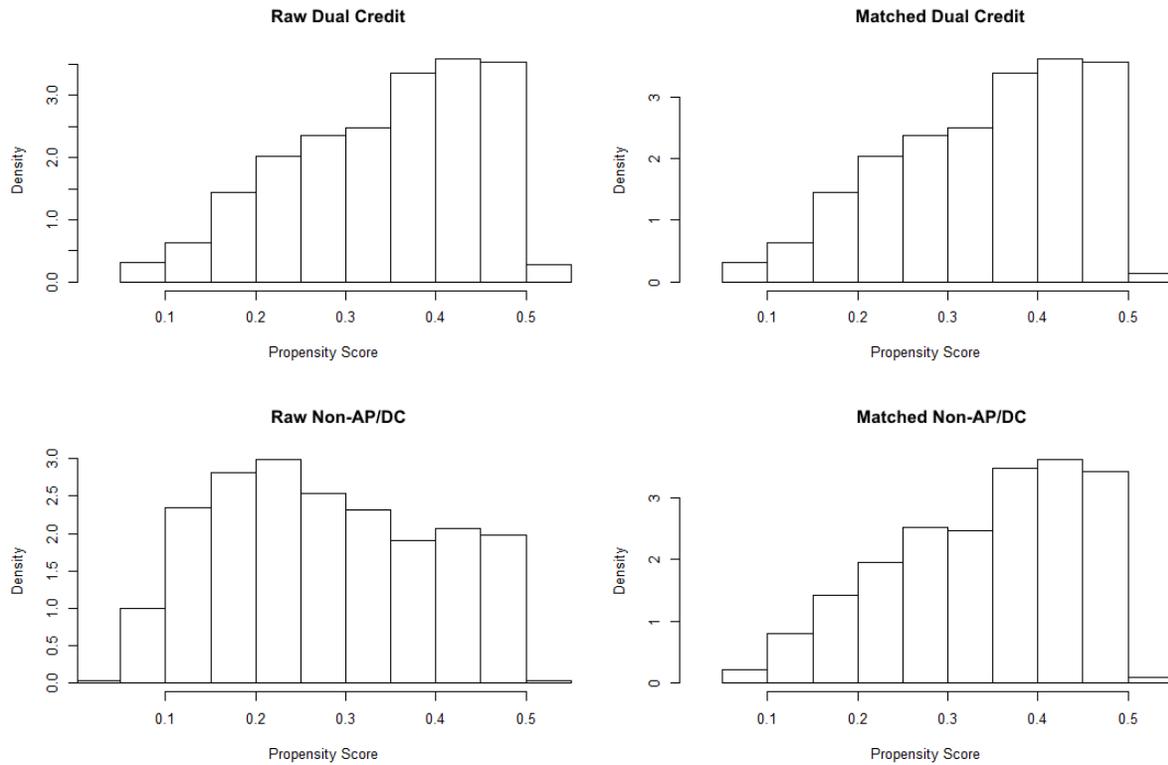


Figure 1: Propensity Score Distributions for Dual Credit and Non-AP/DC Groups

As Table 2 and Figure 1 show, the results of the propensity score matching yielded very similar student groups on the basis of their ACT Composite score and high school GPA. Following the matching, each pair of students was observed to determine their outcome four years after their initial enrollment in an NDUS Research or Regional institution. Each pair had four possible outcomes:

Dual Credit Student	Non-AP/DC Student
Not a 4 Year Graduate	Not a 4 Year Graduate
Not a 4 Year Graduate	4 Year Graduate
4 Year Graduate	Not a 4 Year Graduate
4 Year Graduate	4 Year Graduate

Table 3: Possible Outcomes for Student Pairs

		Dual Credit Students	
		4 Yr Graduates	Non 4 Yr Graduates
Matched Non-AP/DC Students	4 Yr Graduates	68	108
	Non 4 Yr Graduates	157	386

Table 4: Matched Dual Credit and Non-AP/DC Outcomes

Following the tabulation of outcomes for matched pairs of Dual Credit and Non-AP/DC students, to determine if a statistically significant difference existed between the four-year graduation rate of the matched groups, McNemar's test for related samples was used. The results are as follows:

$$4 \text{ Year Graduation Rate for Dual Credit Students} = \hat{p}_1 = \frac{68 + 157}{719} = 31.3\% \quad (1)$$

$$4 \text{ Year Graduation Rate for Non-AP/DC Students} = \hat{p}_2 = \frac{68 + 108}{719} = 24.5\% \quad (2)$$

$p_1$  is established to be the proportion of students who take Dual Credit coursework in their final year of high school and graduate within 4 years of initial enrollment in an NDUS Research or Regional institution.  $p_2$  is established to be the proportion of students with similar ACT and GPA figures to their Dual Credit counterparts in  $p_1$  who took neither Dual Credit nor Advanced Placement courses in their final year of high school and graduated within 4 years of initial enrollment in an NDUS Research or Regional institution.

Since, entering this study, it seems reasonable to presume that students who take Dual Credit coursework may graduate within 4 years at a rate higher than that of students who do not, due to Dual Credit students accumulating post-secondary credit while still in high school, the following setup and procedure was used for McNemar's test:

$H_o : p_1 = p_2$  : The proportion of students graduating within 4 years is the same between academically similar groups of Dual Credit and Non-AP/DC students.

$H_a : p_1 > p_2$  : The proportion of students graduating within 4 years is higher for Dual Credit students when compared to academically similar students who do not take AP or Dual Credit courses.

$$z_{test} = \frac{108 - 157}{\sqrt{108 + 157}} = -3.01 \quad (3)$$

$$p = 0.0013 \quad (4)$$

$$\text{Estimate of effect of Dual Credit} = 31.3\% - 24.5\% = 6.8\% \quad (5)$$

$$98.3\% \text{ Confidence Interval for effect} = [0.0204, 0.1159] \quad (6)$$

#### *Conclusions for Dual Credit vs. Non-AP/DC*

With a test p-value of 0.0013, the conclusion can be reached, on the basis of this data, that the proportion of students graduating within 4 years of initial enrollment in an NDUS Research or Regional institution is higher among students who take Dual Credit coursework during their final year of high school when compared to academically similar students who did not take either AP or Dual Credit coursework during their final year of high school.

The resulting 98.3% confidence interval for the effect of taking Dual Credit over neither Dual Credit or AP courses implies that students who take Dual Credit courses in their final year of high school can be expected to graduate within 4 years at a rate somewhere between 2.04 and 11.59 percentage points higher than academically similar students who do not take Advanced Placement or Dual Credit courses during their final year of high school.

### Comparing Advanced Placement to Non-AP/DC

The next two groups for comparison are the group of students who took an Advanced Placement course during their final year of high school and the group of students who took neither AP nor Dual Credit during their final year of high school. The procedure followed was exactly the same as during the comparison of the Dual Credit and Non-AP/DC groups.

Again, to isolate the effects of interest, propensity score matching was performed to match one-to-one students with similar ACT and GPA values from the Advanced Placement group to the Non-AP/DC group. 624 successful pairs of students were formed out of a possible 746. Summary diagnostics for the matched groups are shown below.

	Avg. ACT	Avg. GPA
Advanced Placement	24.86	3.52
Non-AP/DC	24.73	3.53

Table 5: Summary Results for Advanced Placement and Non-AP/DC Matching

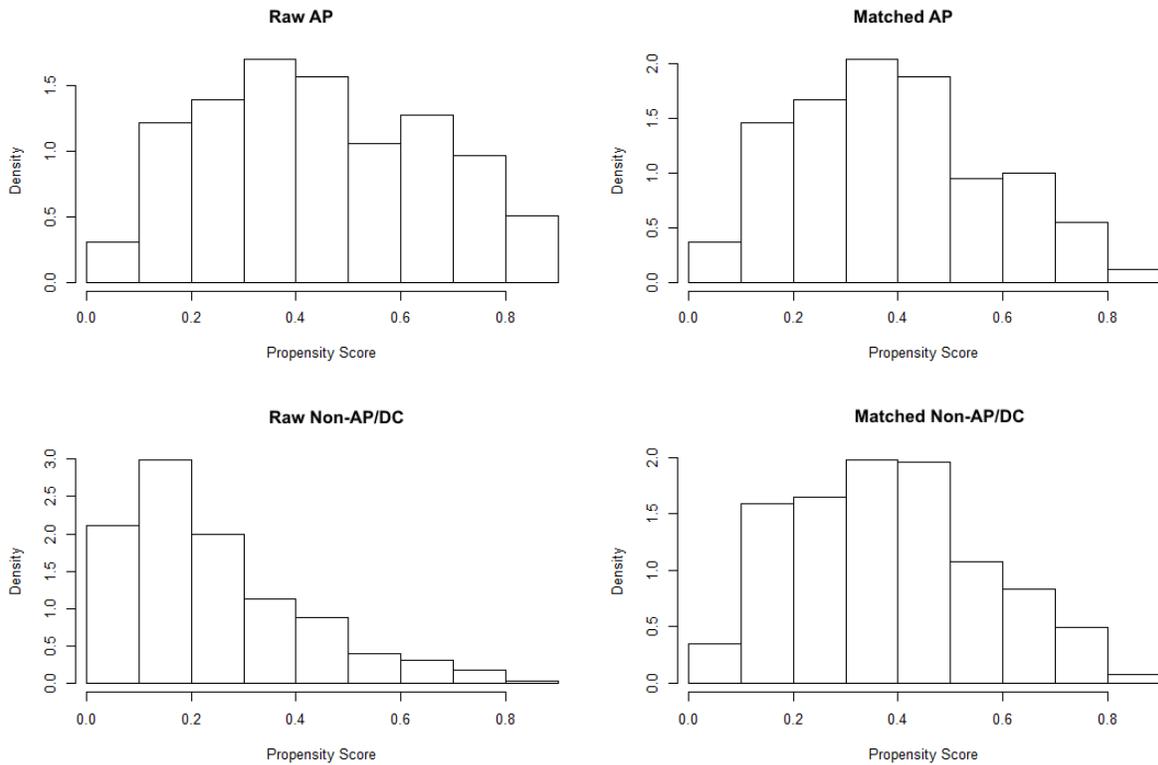


Figure 2: Propensity Score Distributions for Advanced Placement and Non-AP/DC Groups

After matching AP and Non-AP/DC students on the basis of their ACT Composite scores and high school GPA, the graduation outcomes for each pair were once again noted. The results are shown below in Table 6.

		Advanced Placement Students	
		4 Yr Graduates	Non 4 Yr Graduates
Matched Non-AP/DC Students	4 Yr Graduates	46	111
	Non 4 Yr Graduates	115	352

Table 6: Matched Advanced Placement and Non-AP/DC Outcomes

Following the tabulation of outcomes for matched pairs of AP and Non-AP/DC students, to determine if a statistically significant difference exists between the four-year graduation rate of the matched groups, McNemar's test for related samples was used. The results are as follows:

$$\text{4 Year Graduation Rate for Advanced Placement Students} = \hat{p}_1 = \frac{46 + 115}{624} = 25.8\% \quad (7)$$

$$\text{4 Year Graduation Rate for Non-AP/DC Students} = \hat{p}_2 = \frac{46 + 111}{624} = 25.2\% \quad (8)$$

$p_1$  is established to be the proportion of students who take Advanced Placement coursework in their final year of high school and graduate within 4 years of initial enrollment in an NDUS Research or Regional institution.  $p_2$  is established to be the proportion of students with similar ACT and GPA figures to their Advanced Placement counterparts in  $p_1$  who took neither Dual Credit nor Advanced Placement courses in their final year of high school and graduated within 4 years of initial enrollment in an NDUS Research or Regional institution.

Since, entering this study, it seemed reasonable to presume that students who take Advanced Placement coursework may graduate within 4 years at a rate higher than that of students who take neither AP nor Dual Credit, the following setup and procedure was used for McNemar's test:

$H_o : p_1 = p_2$  : The proportion of students graduating within 4 years is the same between academically similar groups of Advanced Placement and Non-AP/DC students.

$H_a : p_1 > p_2$  : The proportion of students graduating within 4 years is higher for Advanced Placement students when compared to academically similar students who do not take AP or Dual Credit courses.

$$z_{test} = \frac{111 - 115}{\sqrt{111 + 115}} = -0.266 \quad (9)$$

$$p = 0.3951 \quad (10)$$

$$\text{Estimate of effect of Advanced Placement} = 25.8\% - 25.2\% = 0.6\% \quad (11)$$

$$98.3\% \text{ Confidence Interval for effect} = [-0.0447, 0.0575] \quad (12)$$

#### *Conclusions for Advanced Placement vs. Non-AP/DC*

With a test p-value of 0.3951, the conclusion cannot be reached, on the basis of this data, that the proportion of students graduating within 4 years of initial enrollment in an NDUS Research or Regional institution is different among students who take Advanced Placement coursework during their final year of high school when compared to academically similar students who did not take either AP or Dual Credit coursework during their final year of high school.

The resulting 98.3% confidence interval for the effect of taking Advanced Placement over neither Dual Credit or AP courses implies that students who take Advanced Placement courses in their final year of high school can be expected to graduate within 4 years at a rate somewhere between 5.75 percentage points higher and 4.47 percentage points lower than academically similar students who do not take Advanced Placement or Dual Credit courses during their final year of high school.

### Comparing Dual Credit to Advanced Placement

The final two groups for comparison in this study are the group of students who took AP coursework during their final year of high school and the group of students who took Dual Credit coursework during their final year of high school. The procedure for comparing these two groups of students was exactly the same as the previous two comparisons of interest.

To isolate the effects of Advanced Placement and Dual Credit coursework, propensity score matching was performed to match one-to-one students with similar ACT scores and GPA values from the Dual Credit group of students to the AP group of students. 522 successful pairs of students were found out of a possible 724. Summary information for the matched group is shown below.

	Avg. ACT	Avg. GPA
Dual Credit	24.24	3.54
Advanced Placement	24.42	3.54

Table 7: Summary Results for Dual Credit and AP Matching

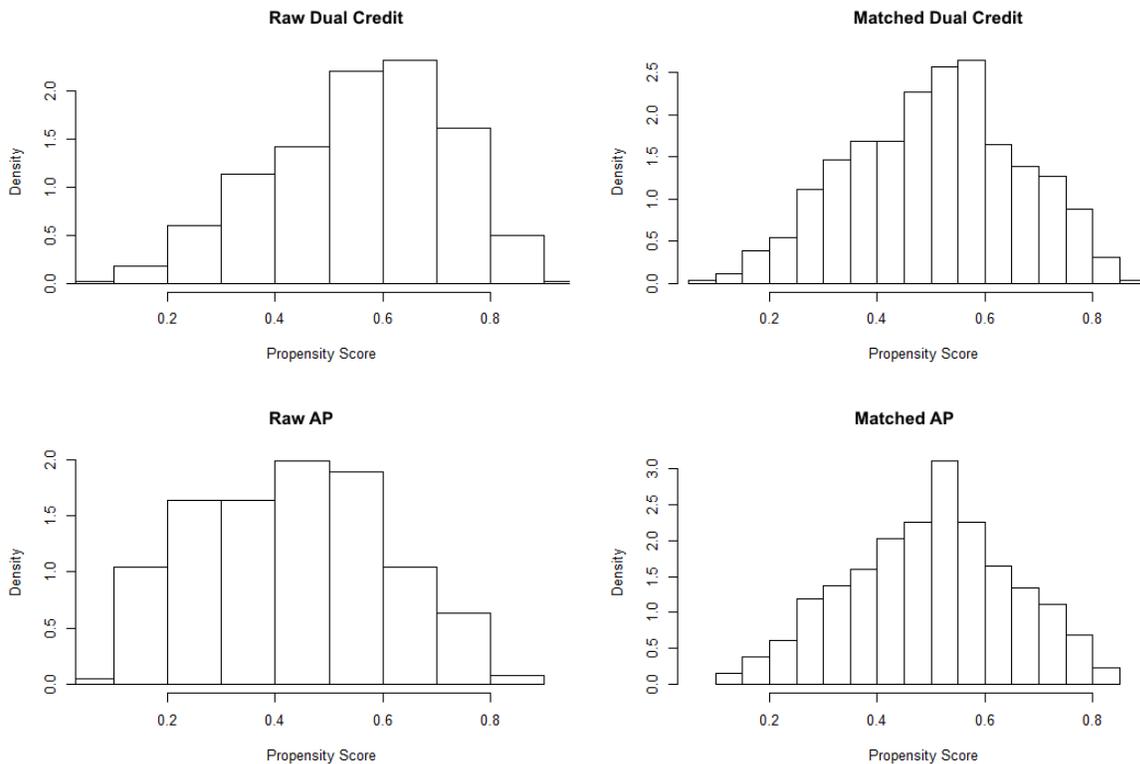


Figure 3: Propensity Score Distributions for Dual Credit and Advanced Placement Groups

After matching students one-to-one between the Dual Credit and AP groups on the basis of their ACT Composite scores and high school GPA, the graduation outcomes for each pair were noted. The results are summarized below in Table 8.

		Advanced Placement Students	
		4 Yr Graduates	Non 4 Yr Graduates
Matched Dual Credit Students	4 Yr Graduates	39	129
	Non 4 Yr Graduates	99	255

Table 8: Matched Dual Credit and Advanced Placement Outcomes

Following the tabulation of outcomes for matched pairs of AP and Non-AP/DC students, to determine if a statistically significant difference exists between the four-year graduation rate of the matched groups, McNemar's test for related samples was used. The results are as follows:

$$\text{Graduation Rate for Dual Credit Students} = \hat{p}_1 = \frac{39 + 129}{522} = 32.2\% \quad (13)$$

$$\text{Graduation Rate for Advanced Placement Students} = \hat{p}_2 = \frac{39 + 99}{522} = 26.4\% \quad (14)$$

$p_1$  is established to be the proportion of students who take Dual Credit coursework in their final year of high school and graduate within 4 years of initial enrollment in an NDUS Research or Regional institution.  $p_2$  is established to be the proportion of students with similar ACT and GPA figures to their Dual Credit counterparts in  $p_1$  who took Advanced Placement courses in their final year of high school and graduated within 4 years of initial enrollment in an NDUS Research or Regional institution.

Since, entering this study, there is no clear presumption which group may have a higher 4 year graduation rate (if either indeed does). Therefore, the following setup and procedure was used for McNemar's test:

$H_o : p_1 = p_2$  : The proportion of students graduating within 4 years is the same between academically similar groups of Dual Credit and Advanced Placement students.

$H_a : p_1 \neq p_2$  : The proportion of students graduating within 4 years is not the same for Dual Credit students when compared to academically similar Advanced Placement students.

$$z_{test} = \frac{129 - 99}{\sqrt{129 + 99}} = 1.987 \quad (15)$$

$$p = 0.0469 \quad (16)$$

$$\text{Estimate of effect of Dual Credit} = 32.2\% - 26.4\% = 5.8\% \quad (17)$$

$$98.3\% \text{ Confidence Interval for effect} = [-0.0037, 0.1186] \quad (18)$$

#### *Conclusions for Advanced Placement vs. Non-AP/DC*

With a test p-value of 0.0469, the conclusion cannot be reached, on the basis of this data, that the proportion of students graduating within 4 years of initial enrollment in an NDUS Research or Regional institution is different among students who take Dual Credit coursework during their final year of high school when compared to academically similar students who took AP coursework during their final year of high school.

The resulting 98.3% confidence interval for the effect of taking Dual Credit over AP courses implies that students who take Dual Credit courses in their final year of high school can be expected to graduate within 4 years at a rate somewhere between 11.86 percentage points higher and 0.37 percentage points lower than academically similar students who take Advanced Placement courses during their final year of high school.

### *Cautions*

Be aware of the fact that this study took under consideration simply whether or not a student was enrolled in a Dual Credit course, Advanced Placement course, or neither during their final year of high school. There was *no* consideration of whether or not the student passed the course successfully or took the Advanced Placement test in order to successfully earn post-secondary credit. This is of particular consequence for the interpretation of the Advanced Placement sections of this study, since there is no knowledge of which of the students who were enrolled actually earned a college credit for the course, potentially decreasing their time to post-secondary graduation. However, in the Dual Credit sections, it is rather *likely* that a majority of students in that group did earn college credit for simply completing the course successfully, again potentially decreasing their time to graduation. Please take these facts into consideration when interpreting these results.