

**Do students who take AP or Dual Credit coursework in high school graduate within 3 years from an NDUS Community College faster and/or at a higher rate than students who do not ?**

The primary objective of this study was to compare various groups of students at NDUS 2 year institutions, with the goal of determining if taking Advanced Placement courses, Dual Credit courses, or neither while in high school affected their post-secondary outcomes in the following ways:

1. Did taking Advanced Placement, Dual Credit, or neither allow a group of students to graduate on-time more often than another group?
2. Did taking Advanced Placement, Dual Credit, or neither allow a group of students to complete their degree faster than another group?

To study these two questions, data was gathered from 2,212 North Dakota high school students who enrolled for the first time in 2 year NDUS institutions between the Fall 2008 and Fall 2010 semesters. Students were considered on-time if they completed an Associate Degree within 3 years of first enrollment. Table 1 below summarizes on-time graduation information for each group, along with average State GPA and ACT Composite scores.

	On-Time	Total	On-Time Percent	ACT Composite	State GPA
Neither AP nor DC	615	1651	37.3%	19.0	2.78
AP	95	206	46.1%	23.2	3.28
Dual Credit	171	324	52.8%	20.7	3.19
Both AP and DC	14	31	45.2%	23.6	3.37

Table 1: Summary Data by AP/Dual Credit Status

While it appears that students in either the Dual Credit or AP category have a higher rate of on-time Associate Degree completion than Non-AP/DC students, they also have a higher average ACT Composite and State GPA when compared to Non-AP/DC students. Therefore, it cannot be ruled out that the underlying reason for the higher on-time graduation percentage for those groups is simply a result of having higher performing students on the average. Therefore, to attempt to remove the effects of ACT and State GPA, students were matched one-to-one within each of the three comparison groups of interest for each of the two questions:

- Dual Credit vs. No AP/DC
- AP vs. No AP/DC
- AP vs. Dual Credit

For each question, propensity score matching was used to match students from one category to a similar student from the comparison category on the basis of ACT Composite scores and cumulative senior state GPA. The category including students who took both AP and Dual Credit courses was excluded from further analysis due to a low sample size. All tests are held to a family-wise error rate of  $\alpha = 0.05$ , with an individual test alpha adjusted using a Bonferroni correction of 0.0083.

## Does one group finish on-time at a higher rate?

To determine whether or not a particular group of students finishes on-time at a higher rate than another, students were grouped one-to-one across groups using propensity score matching based on ACT Composite and GPA. Thus, similar students were selected in both groups, yielding a similar average ACT and similar GPA. After students were matched, McNemar test for related samples was used to determine if one group's proportion of on-time graduates was higher than the other.

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### *Dual Credit vs. No AP/DC On-Time Graduation Rates*

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There were 323 matched pairs of students between the Dual Credit group of students and the group of Non-AP/DC students on the basis of ACT Composite and State GPA.

		Dual Credit Students	
		On-Time	Not On-Time
Matched Non-AP/DC Students	On-Time	88	70
	Not On-Time	83	82

Table 2: Results for matched Dual Credit and Non-AP/DC Students

It seems that students who enroll in Dual Credit courses may be more likely to complete their Associate Degree on-time when compared to students who do not undertake AP or Dual Credit courses. Therefore, if we define  $p_1$  as the proportion of Non-AP/DC students who complete their Associate Degree within three years and  $p_2$  as the proportion of Dual Credit students who complete their Associate Degree within three years, we can set up the following hypotheses to test:

$$\hat{p}_1 = \frac{88 + 70}{323} = 48.92\% \quad (1)$$

$$\hat{p}_2 = \frac{88 + 83}{323} = 52.94\% \quad (2)$$

$H_o : p_1 = p_2$  (The two proportions are the same)

$H_a : p_1 < p_2$  (The proportion of Non-AP/DC students who graduate on time is significantly less than the proportion of Dual Credit students who graduate on time.)

$$z_{test} = \frac{70 - 83}{\sqrt{70 + 83}} = -1.051 \quad (3)$$

$$p = 0.1466 \quad (4)$$

With a p-value of 0.1466,  $H_o$  cannot be rejected. **The conclusion cannot be reached on the basis of this data that the proportion of Dual Credit students who complete an Associate Degree on time is higher than the proportion of non-AP/DC students who complete an Associate Degree on time.**

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*AP vs. No AP/DC On-Time Graduation Rates*

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There were 197 matched pairs of students between the AP group and the group of Non-AP/DC students on the basis of ACT Composite and State GPA.

		AP Students	
		On-Time	Not On-Time
Matched Non-AP/DC Students	On-Time	49	55
	Not On-Time	40	53

Table 3: Results for matched AP and Non-AP/DC Students

It seems that students who enroll in AP courses may be more likely to complete their Associate Degree on-time when compared to students who do not undertake AP or Dual Credit courses. Therefore, if we define  $p_1$  as the proportion of Non-AP/DC students who complete their Associate Degree within three years and  $p_2$  as the proportion of AP students who complete their Associate Degree within three years, we can set up the following hypotheses to test:

$$\hat{p}_1 = \frac{49 + 55}{197} = 52.79\% \quad (5)$$

$$\hat{p}_2 = \frac{49 + 40}{197} = 45.18\% \quad (6)$$

$H_o : p_1 = p_2$  (The two proportions are the same)

$H_a : p_1 < p_2$  (The proportion of Non-AP/DC students who graduate on time is significantly less than the proportion of AP students who graduate on time.)

$$z_{test} = \frac{55 - 40}{\sqrt{55 + 40}} = 1.539 \quad (7)$$

$$p = 0.9381 \quad (8)$$

With a p-value of 0.9381,  $H_o$  cannot be rejected. **The conclusion cannot be reached on the basis of this data that the proportion of AP students who complete an Associate Degree on time is higher than the proportion of non-AP/DC students who complete an Associate Degree on time.**

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*AP vs. Dual Credit On-Time Graduation Rates*

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There were 164 matched pairs of students between the AP group and the group of Dual Credit students on the basis of ACT Composite and State GPA.

		Dual Credit Students	
		On-Time	Not On-Time
Matched AP Students	On-Time	40	32
	Not On-Time	45	47

Table 4: Results for matched AP and Dual Credit Students

It is unknown whether or not a difference would exist between the proportion of Dual Credit students who complete their Associate Degree on time and the proportion of AP students who complete their Associate Degree on time. Therefore, if we define  $p_1$  as the proportion of AP students who complete their Associate Degree within three years and  $p_2$  as the proportion of Dual Credit students who complete their Associate Degree within three years, we can set up the following hypotheses to test:

$$\hat{p}_1 = \frac{40 + 32}{164} = 43.90\% \quad (9)$$

$$\hat{p}_2 = \frac{40 + 45}{164} = 51.83\% \quad (10)$$

$H_o : p_1 = p_2$  (The two proportions are the same)

$H_a : p_1 \neq p_2$  (The proportion of AP students who graduate on time is significantly different than the proportion of Dual Credit students who graduate on time.)

$$z_{test} = \frac{32 - 45}{\sqrt{32 + 45}} = -1.481 \quad (11)$$

$$p = 0.1385 \quad (12)$$

With a p-value of 0.1385,  $H_o$  cannot be rejected. **The conclusion cannot be reached on the basis of this data that the proportion of AP students who complete an Associate Degree on time is different than the proportion of Dual Credit students who complete an Associate Degree on time.**

## Does one group finish faster than another?

To study this question among the three groups, the distribution of the number of semesters needed to graduate was tabulated for each group in question. Rather than simply determining if the average time to completion was different between groups, a Kolmogorov-Smirnov test was used to determine if any aspect of the distributions was statistically different between the groups.

### *Dual Credit vs. No AP/DC On-Time Graduation Times*

Of the 323 matched pairs of students on the basis of ACT Composite and State GPA, Table 5 contains the distributions of semesters to graduation for students who completed their degree, regardless of whether or not they completed their degree on-time.

	Semesters to Graduation											
	3	4	5	6	7	8	9	10	11	12	13	14
Dual Credit	2	13	112	9	10	23	1	1	9	1	1	1
Non-AP/DC	0	3	89	18	12	31	3	2	4	1	0	2

Table 5: Number of Semesters to Graduation by AP/DC Status

To determine if the group of students who undertook Dual Credit coursework completed Associate Degrees at a different rate than the group of students who did not undertake AP or Dual Credit courses, a Kolmogorov-Smirnov goodness-of-fit test was used.

$H_o : F_1(x) = F_2(x)$ : The distribution functions for Dual Credit graduation times and Non-AP/DC graduation times are equal.

$H_a : F_1(x) \neq F_2(x)$ : The distribution function for Dual Credit graduation times is not equal to that of Non-AP/DC graduation times.

The Kolmogorov-Smirnov test yields a test statistic of  $D = 0.1364$ , with a p-value of  $p = 0.0792$ . **Therefore, it cannot be concluded on the basis of this data that there is a difference between the distribution of graduation times for Dual Credit and Non-AP/DC students.**

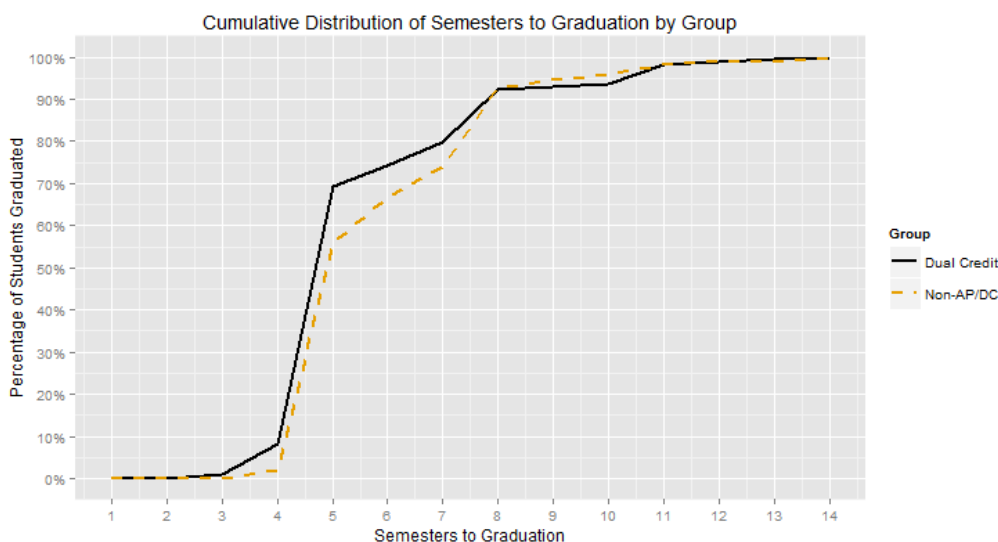


Figure 1: Cumulative Distribution of Semesters to Graduation for Dual Credit and Non-AP/DC Students

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*AP vs. No AP/DC On-Time Graduation Times*

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Of the 197 matched pairs of students on the basis of ACT Composite and State GPA, here are the distributions of semesters to graduation (for students who completed their degree).

	Semesters to Graduation											
	3	4	5	6	7	8	9	10	11	12	13	14
AP	2	2	49	9	5	18	1	3	4	0	1	0
Non-AP/DC	1	0	63	12	10	15	2	1	1	1	1	0

Table 6: Number of Semesters to Graduation by AP/DC Status

To determine if the group of students who took AP courses completed Associate Degrees at a different rate than the group of students who did not undertake AP or Dual Credit courses, a Kolmogorov-Smirnov goodness-of-fit test was used.

$H_o : F_1(x) = F_2(x)$ : The distribution functions for AP graduation times and Non-AP/DC graduation times are equal.

$H_a : F_1(x) \neq F_2(x)$ : The distribution function for AP graduation times is not equal to that of Non-AP/DC graduation times.

The Kolmogorov-Smirnov test yields a test statistic of  $D = 0.091$ , with a p-value of  $p = 0.802$ . **Therefore, it cannot be concluded on the basis of this data that there is a difference between the distribution of graduation times for AP and Non-AP/DC students.**

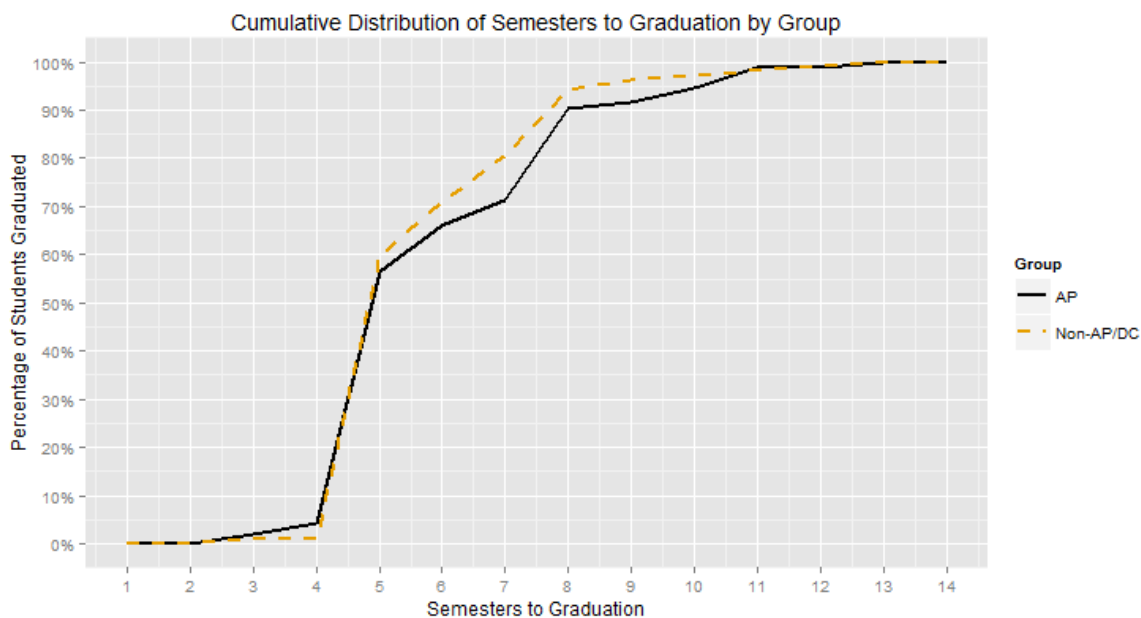


Figure 2: Cumulative Distribution of Semesters to Graduation for AP and Non-AP/DC Students

To analyze this question, 164 matched pairs of students were found on the basis of their ACT Composite score and State GPA. For each category, AP and Dual Credit, the number of semesters needed to complete an Associate Degree was determined for each student, and the distribution constructed for each category. Summer semesters were included in the calculation, i.e. if a student enrolled in the fall of a year, 5 semesters would represent the spring semester of the student's second year.

	Semesters to Graduation											
	3	4	5	6	7	8	9	10	11	12	13	14
Dual Credit	0	7	56	4	3	14	0	1	4	0	0	0
AP	1	2	41	7	5	15	0	1	4	0	1	0

Table 7: Number of Semesters to Graduation by AP/DC Status

To determine if the group of students who took Dual Credit courses completed Associate Degrees at a different rate than the group of students who took AP courses, a Kolmogorov-Smirnov goodness-of-fit test was used.

$H_o : F_1(x) = F_2(x)$ : The distribution functions for Dual Credit graduation times and AP graduation times are equal.

$H_a : F_1(x) \neq F_2(x)$ : The distribution function for Dual Credit graduation times is not equal to that of AP graduation times.

The Kolmogorov-Smirnov test yields a test statistic of  $D = 0.1364$ , with a p-value of  $p = 0.4258$ . **Therefore, it cannot be concluded on the basis of this data that there is a difference between the distribution of graduation times for Dual Credit and AP students.**

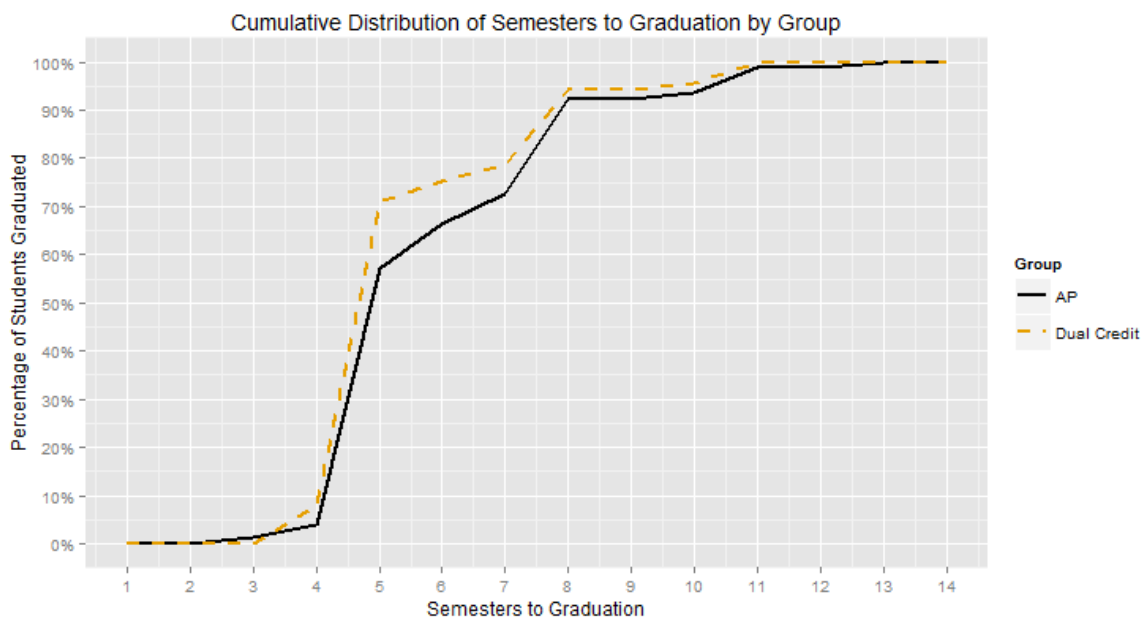


Figure 3: Cumulative Distribution of Semesters to Graduation for Dual Credit and AP Students