

Relationships Between Dual Enrollment Parameters and Community College Success in Tennessee

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The purpose of this non-experimental quantitative study was to evaluate the relationships between completion of high school dual enrollment courses and subsequent success of first-time, full-time community college students as measured by completion of an associate degree and time to completion of the degree. In addition to comparing dual and non-dual enrollment student performance, the effects of the number of dual enrollment courses completed and the subject areas of those courses were evaluated. Student subgroups reviewed included gender, race, socioeconomic status, and prior academic preparation (ACT score). Archival data from Tennessee community colleges used in this study included 62,644 students across four years (2015-2018) comprising 11,949 dual enrollment students and 50,695 non-dual enrollment students. Six research questions were answered from these data utilizing independent samples t tests, two-way contingency tables using crosstabs, Pearson correlations, logistic regression, or descriptive statistics. Findings revealed that completing just one dual enrollment course significantly increased the probability of completing an associate degree, and this finding was consistent across all subgroups studied. In addition, dual enrollment students completed associate degrees in significantly less time. Completing more dual enrollment courses tended to further increase the probability of completing a degree and further reduce the time to completion.

Keywords: dual enrollment, community college success, degree completion

In the wake of the *Every Student Succeeds Act*, more emphasis has been placed on ensuring that America's workforce receives some level of education beyond high school (Darling-Hammond et al., 2016). In response, states such as Tennessee have established aggressive college completion goals, and thus college readiness continues to garner considerable attention (Meehan & Kent, 2020). Dual enrollment is an area of educational policy that has gained momentum to address college readiness as it can help students prepare for college in both academic and non-academic areas (Community College Research Center, 2012).

Students who have participated in dual enrollment and learned skills to manage the rigorous college work transition those skills to their courses in college (Fuline, 2018). As a result, dual enrollment students have demonstrated improved performance in numerous high school and college success measures. From higher grade-point averages (GPA) and graduation rates in high school (Karp et al., 2007) to a greater likelihood of enrolling, graduating, and graduating on time in college (Giani et al., 2014), dual enrollment appears to be a program with wide-reaching impact. Added to the improvement gained by simply participating in dual enrollment, research indicates that the number and types of dual enrollment courses students take are linked to college success (Giani et al., 2014). Students who accrue more dual enrollment credits demonstrate higher degrees of college success, as do students who take high-rigor core academic courses through dual enrollment. In addition, the effects of dual enrollment are often stronger for traditionally underrepresented or underserved populations (Henneberger et al., 2022). With the long list of benefits and associated improvements in college outcomes, dual enrollment continues to expand and has been labeled as the "fastest growing movement in higher education in the 21st century" (Jones, 2014, p. 24).

Statement of the Problem

Tennessee, as with several other states, has continually increased its investment in the efficacy of dual enrollment programs. In 2005, Tennessee adopted statewide dual enrollment policies to guide local school districts and higher education institutions in implementing and running dual enrollment programs (Mokher & McLendon, 2009). That same year the Dual Enrollment Grant was established. In the 17 years since, the grant has provided over \$200 million to more than 300,000 students to help pay for dual enrollment courses (Tennessee Higher Education Commission, n.d.).

In addition to providing most of the funding that students need to pay for dual enrollment courses, the state has also implemented legislation that pushes for the expansion of dual enrollment at both the community college and high school levels. In 2010, the *Complete College Tennessee Act* restructured funding for public institutions of higher education, and community colleges' funding is now partially based on the number of students dually enrolled each semester (Finney et al., 2017). This has encouraged the colleges to broaden their dual enrollment efforts. On the high school side of the aisle, legislation stemming from the *Every Student Succeeds Act* now measures Tennessee high schools by the number of early postsecondary opportunities (EPSO) each student completes by the time they graduate (Tennessee Department of Education, 2018). Dual enrollment falls into the pool of EPSOs, and according to an executive from the Tennessee Higher Education Commission, it is the most impactful of all the EPSOs (Hanemann, 2021).

Because of Tennessee's increasing investment in dual enrollment and the priority to expand the program, more and more students in Tennessee are taking dual enrollment courses. In the past decade (2012-2021), community colleges in Tennessee have seen a 51% increase in dual enrollment while experiencing an 18% decline in overall enrollment (Tennessee Board of Regents, n.d.). Tennessee's focus on dual enrollment is predicated on the underlying assumption that by starting college early, the students will be more likely to earn a college credential and earn it in a shorter timeframe, thus boosting the overall economy in the State.

The purpose of this non-experimental quantitative study was to evaluate the relationships between completion of high school dual enrollment courses and subsequent success of first-time, full-time community college students in Tennessee as measured by completion of an associate degree and the time it took to complete the associate degree. The guiding questions for this research were the following:

1. When comparing dual enrollment and non-dual enrollment students, is there a significant difference in college completion rates and time to completion?
2. For dual enrollment students, is the number of dual enrollment courses completed in high school significantly related to college completion and time to completion?
3. For dual enrollment students, is there a significant difference in college completion rates based on the dual enrollment subjects completed in high school?

Definition of Dual Enrollment

Dual enrollment is a program that allows high school students to take college courses and earn college credit while still in high school (Bailey & Karp, 2003). These courses can be taught at the high school, on the college campus, or online and may be academic, career-technical, or student success focused (Cassidy et al., 2011; Edwards et al., 2011). Students earn postsecondary credit for the coursework by passing the course. The students may or may not earn high school credit simultaneously (Cassidy et al., 2011).

Literature Review

Although originally designed as a strategy to increase course rigor and accelerate the progress of advanced high school students (Kim et al., 2006), dual enrollment has morphed into a credit-based transition program that is no longer just for high-achieving college-bound youth (Bailey & Karp, 2003). Today's dual enrollment programs are used as a strategy to improve college access and success for middle- to low-performing students as well as students from populations traditionally underrepresented in postsecondary education (Bailey & Karp, 2003; Struhl & Vargas, 2012). By participating in college-level classes, high school students gain an understanding of the financial, academic, psychological, and social demands of college (Bailey & Karp, 2003). Exposure to the increased rigor of college courses better prepares students academically and provides them with more realistic information about the skills they will need to succeed in college.

Dual Enrollment Participation and College Success

When comparing students who participated in dual enrollment courses to those who did not, dual enrollment students tend to outperform their non-dual enrollment peers. Research indicates that dual enrollment students perform better in multiple college-success metrics including college enrollment, persistence, completion, and time to completion. This holds true even when considering the potential for self-selection bias regarding dual enrollment students.

College Enrollment and Persistence

In a longitudinal study of more than three million students over 11 years in Texas, Villarreal (2018) detected that participation in at least one dual enrollment course increased application, admission, and enrollment at four-year colleges. Studies that tracked students through six years of postsecondary education in Colorado and Texas revealed that dual enrollment students were 1.25 to 2.21 times more likely to attend any college than their non-dual enrollment peers (Morgan et al., 2018; Struhl & Vargas, 2012). Dual enrollment students in Maryland and Illinois attended community college at rates of 22 to 28 percentage points higher than non-dual enrollment students (Henneberger et al., 2022; Taylor, 2015).

In addition to attending college at higher rates, dual enrollment students are also retained at higher rates. In one Tennessee community college, students who had participated in dual enrollment stayed at college until their second year at a rate of 76% compared to only 49% of non-dual enrollment students (Hunter & Wilson, 2019). Similar results were detected in Colorado and Texas, where dual enrollment students were 1.16 to 2.0 times more likely to return for their second year (Morgan et al., 2018; Struhl & Vargas, 2012). In contrast, Jones (2014) discovered that dual enrollment had a significant, positive relationship to persistence at the university level but not at the community college level.

College Completion

Research in the area of college completion is very consistent, indicating that dual enrollment students are more likely to complete a college degree than their non-dual enrollment peers. Researchers in Illinois, North Carolina, and Maryland documented that dual enrollment students were 7 to 15 percentage points more likely to attain any postsecondary credential and seven to eight percentage points more likely to attain a bachelor's degree (Blankenberger et al., 2017; Ganzert, 2014; Henneberger et al., 2022; Taylor, 2015). At the national level, An (2013a) found that students who completed at least one dual enrollment course were nine percentage points more likely to attain a bachelor's degree, and Hughes (2016) observed that dual enrollment students were 2.07 times more likely to earn a bachelor's degree.

In contrast to the abundance of research indicating a positive correlation between dual enrollment and subsequent college success, Speroni (2011) tracked two cohorts of students through college for six years in Florida and detected no significant difference between dual and non-dual enrollment students in the areas of college enrollment or degree completion. A smaller study at one community college in Mississippi yielded similar results when Lawrence (2017) discovered that dual enrollment participation did not significantly increase the likelihood of

attaining an associate degree.

Time to College Completion

Although most research concerning dual enrollment participation addresses college completion, researchers have shown that students who took dual enrollment classes in high school were more likely to graduate within benchmark timeframes than their non-dual enrollment peers. At one community college in Tennessee, dual enrollment students were 25% more likely to graduate within two years of enrollment and 28% more likely to graduate within three years (Grubb et al., 2017). This is consistent with statewide studies in Texas and Mississippi where researchers found dual enrollment students were 1.83 to 2.51 times more likely to graduate with an associate degree within three years than their non-dual enrollment peers (Oakley, 2015; Struhl & Vargas, 2012). Similar results emerged in Colorado, where students who participated in dual enrollment were 1.26 times more likely to graduate with any degree within six years (Morgan et al., 2018), and in Texas, where dual enrollment students were 1.46 times more likely to complete a four-year degree in six years (Struhl & Vargas, 2012).

Results from a study by the Southern Regional Education Board (SREB) that tracked time to degree completion among its 16 member states indicated that dual enrollment students were earning associate degrees in an average of 2.9 years versus 4.6 years for their non-dual enrollment peers (Marks & Lord, 2011). Likewise, dual enrollment students were earning their four-year degrees in an average of 4.6 years versus 5.0 years for the non-dual enrollment students. Similarly, in a national-level study, Hughes (2016) showed that participation in dual enrollment reduced students' time to bachelor's degree by an average of two months.

Self-Selection Bias

One concern surrounding dual enrollment research is the issue of self-selection bias. Some people believe that students who choose to take dual enrollment classes while in high school tend to be students who perform well academically and would be successful regardless of dual enrollment participation. Therefore, it is logical to think that the evaluation of dual versus non-dual enrollment students presents a self-selection bias that may confound the results.

The potential for self-selection bias has been addressed in several quantitative studies using propensity score matching (PSM) to "equalize observed characteristics between treatment and control groups removing observed bias from the comparison" (Grubb et al., 2017, p. 86). After using this technique to match student characteristics in the dual enrollment and non-dual enrollment groups, researchers found that students who participate in dual enrollment are more likely to succeed in college despite any preexisting tendencies to do so (An, 2013a; Blankenbarger et al., 2017; Giani et al., 2014; Grubb et al., 2017; Henneberger et al., 2022; Hughes, 2016; Struhl & Vargas, 2012; Taylor, 2015). In addition to these quantitative studies, Ozmun (2013) conducted a series of interviews with dual enrollment students and noted that high college and academic self-efficacy were not factors in students' decisions to participate in dual enrollment.

Number of Dual Enrollment Courses and College Success

As students complete additional dual enrollment courses, the benefits continue to accrue (Giani et al., 2014). Although fewer studies have examined the relationship between the number of dual enrollment courses a student completes and subsequent college success, researchers have shown a positive relationship at various levels of study. An eight-year longitudinal study of 4,600 students at a midwestern university revealed that each additional credit hour in dual enrollment had a statistically significant impact on increasing the probability of degree attainment (Burns et al., 2019). This finding is supported by a North Carolina study of over 15,000 community college students in which researchers found that the number of dual enrollment courses a student took positively related to college GPA and graduation rate (Ganzert, 2014). Similar findings in Texas and Tennessee confirmed that an increase in the number of dual enrollment credits corresponded to an increase in a student's likelihood of enrolling in and completing college (Struhl & Vargas, 2012; Villarreal, 2018; Young, 2021). The results of the study by Burns et al. (2019) also indicated that each additional credit hour in dual enrollment had a statistically significant positive effect on reducing time to graduation.

In contrast, An (2013a) conducted a national-level study and observed that most of the gain for dual enrollment students occurred for students who took two dual enrollment courses, and there was little added benefit beyond that. Additionally, Karp et al. (2007) discovered that the positive relationship between the number of dual enrollment courses and college success was dependent on which state was investigated. In Florida, the positive effects were the same regardless of the number of dual enrollment courses taken. Whereas in New York, the positive relationship was tied to taking two or more dual enrollment courses.

Dual Enrollment Subject and College Success

As researchers continue to investigate dual enrollment from all points of view, some of them have begun to dig into the impact dual enrollment subject has on student success. These researchers have uncovered a positive relationship between high-rigor core academic dual enrollment courses and subsequent college success (Giani et al., 2014; Morgan et al., 2018). However, the specific subjects that provide the most benefit are not consistent among the studies. Researchers conducting a longitudinal study in Colorado discovered that students who completed dual enrollment courses in gateway math and language arts were 1.82 to 1.86 times more likely to enroll in college than students who took dual enrollment courses in other subjects (Morgan et al., 2018). However, researchers in Texas observed that the effect of dual enrollment math courses on college enrollment was not significantly different than the average gain of taking any dual enrollment subject (Struhl & Vargas, 2012).

In terms of college completion, Morgan et al. (2018) noted that students who took dual enrollment gateway math courses were 1.78 times more likely to persist to their second year and 3.23 times more likely to graduate within six years. This aligns with work by Giani et al. (2014), which revealed that each additional dual enrollment math course increased a student's odds of attaining a bachelor's degree within six years by 60% to 90%. Similarly, Struhl and Vargas (2012) discovered that students who participated in any dual enrollment course were 1.43 times more likely to complete college than non-dual enrollment students, but if students took a dual enrollment English language arts or math course, they were 1.72 and 1.83 times more likely to graduate respectively.

In addition to the studies on core academic dual enrollment courses, researchers have also shown that participating in Career and Technical Education (CTE) dual enrollment courses is positively correlated to college success metrics (Hughes et al., 2012; Karp et al., 2007). Students who completed a CTE dual enrollment course were statistically more likely to complete college than students who had no dual enrollment (Hoffman, 2017; Struhl & Vargas, 2012) and more likely than general dual enrollment students to enroll in a four-year college and enroll full-time (Karp et al., 2007). In contrast, Giani et al. (2014) discovered little impact of dual enrollment vocational or occupational courses on students' postsecondary outcomes.

Dual Enrollment for Special Populations and College Success

Dual enrollment programs have been praised for the benefit they can provide to populations that have traditionally been underrepresented in the college-going culture; populations such as lower socioeconomic status (SES), non-White races, and first-generation college students (Henneberger et al., 2022; Latino et al., 2020). States are increasingly employing dual enrollment as a strategy to improve the transition from high school to postsecondary for all students and especially for members of these underrepresented groups (Giani et al., 2014).

In the area of student academic preparation, the positive effects of dual enrollment participation on college enrollment, first-year retention, and college GPA remained after controlling for ACT scores (An & Taylor, 2015; Lichtenberger et al., 2014). Similarly, when controlling for ACT and high school GPA, dual enrollment had a positive and statistically significant impact on increasing the probability of degree attainment and reducing the time to degree completion (Burns et al., 2019).

The research comparing male and female students presents conflicting results. Some researchers found that male students had higher GPAs and were significantly more likely to complete a degree (Karp et al., 2007; Oakley, 2015). Other researchers reported that dual enrollment provides positive effects for female students only (Ganzert, 2012) and that female dual enrollment students were more college-ready than male dual enrollment students (An & Taylor, 2015). However, some researchers observed no difference in college success when comparing male and female dual enrollment students (Morgan et al., 2018; Young et al., 2013).

Taylor (2015) noted that dual enrollment students of color enroll in college and complete college at significantly higher rates than non-dual enrollment students of color. Other researchers have reported the same positive effects when comparing dual enrollment to non-dual enrollment students in all racial categories (Struhl & Vargas, 2012). Ganzert (2012) found a statistically significant advantage in higher GPAs and graduation rates for non-White dual enrollment students when compared to their non-dual enrollment peers. Young et al. (2013) found that Black dual enrollment students had higher college GPAs than White non-dual enrollment students.

An (2013a) concluded that dual enrollment may especially benefit students in the lower SES category after finding a positive relationship at the national level between dual enrollment and degree attainment for first-generation students and students whose parents attended college but did not complete a bachelor's degree. Reinforcing this finding, researchers in Texas and Illinois observed that students from low-income families who completed dual enrollment courses were more likely to attend college, persist in college, and complete a college degree than

their peers who did not participate in dual enrollment (Struhl & Vargas, 2012; Taylor, 2015).

Although research generally indicates that dual enrollment positively affects all students, smaller effect sizes have been detected for low-income students and students of color (Taylor, 2015). Supporting this finding, Oakley (2015) observed that GPAs were lower among the lower SES students. Additionally, dual enrollment participation has not been shown to account for the gap in college GPA and remediation between low-income and moderate- to high-income students (An, 2013b). Other researchers have detected little evidence that the influence of dual enrollment differed by race (An & Taylor, 2015; Morgan et al., 2018). Oakley (2015) found that Black students had significantly lower GPAs than White students, and Hoffman (2017) showed a disproportionately lower number of Black dual enrollment students persisted in college.

Methodology

Instrumentation

Student-level administrative data were used in this study. The use of this type of data ensured that none of the students were aware of their inclusion in the study during the time periods in which data were collected. Therefore, there was no opportunity for their inclusion in the study to result in behavior modification that would have altered the results. Additionally, no surveys or interviews were conducted. Student data provided to me was de-identified; no personally identifiable information was included in the data file. Finally, data files were maintained on a password-protected computer to ensure the confidentiality and security of the data received.

Population

The population for this study included all first-time, full-time students at Tennessee community colleges in the fall semesters of 2015, 2016, 2017, and 2018 who had graduated from a Tennessee high school in the 12 months preceding their enrollment in the community college. The timeframe established to determine associate degree completion was three years from the semester that students began college as first-time, full-time students. Students who did not complete an associate degree within the three-year timeframe were recorded as did not complete an associate degree for the purposes of this study. All students were tagged as either dual enrollment or non-dual enrollment. Dual enrollment students completed at least one dual enrollment course in high school with a grade of C or better. Non-dual enrollment students completed no dual enrollment courses in high school with a grade of C or better.

Dataset

Data for this study included 62,644 student records consisting of 11,949 dual enrollment students and 50,695 non-dual enrollment students from the 13 Tennessee community colleges. Records were removed for students who had received college credits through programs other than dual enrollment to eliminate the possible confounding effects of the students' participation in other college-preparatory programs such as Advanced Placement or dual enrollment through an institution other than a Tennessee community college. Records with inaccurate or missing data

were also removed. Student characteristics are included in Table 1.

Table 1
Study Population Characteristics by Dual Enrollment Status

	Dual Enrollment		Non-Dual Enrollment		Total
	Number	Percent	Number	Percent	
Total Enrollment	11,949	19%	50,695	81%	62,644
ACT Score					
0-18	1,715	6%	27,259	94%	28,974
19+	10,234	30%	23,436	70%	33,670
Gender					
Male	4,458	16%	23,205	84%	27,673
Female	7,481	21%	27,490	79%	34,971
Race					
Asian	78	10%	697	90%	775
Black	525	5%	9,431	95%	9,956
Hispanic	394	11%	3,174	89%	3,568
White	10,579	23%	35,015	77%	45,594
Other	373	14%	2,378	86%	2,751
Socioeconomic Status					
Pell Recipient	5,161	15%	28,779	85%	33,940
Non-Pell Recipient	6,788	24%	21,916	76%	28,704

Results

To address the guiding questions of this study, a series of six individual research questions were evaluated using inferential and descriptive statistics.

Dual Enrollment Students Significantly More Likely to Complete an Associate Degree

A series of two-way contingency table analyses using crosstabs were utilized to compare associate degree completion rates between dual and non-dual enrollment students in the study population and for subgroups of ACT score, gender, race, and SES. Dual enrollment completion and associate degree completion were significantly related for each of the analyses, as depicted in Table 2. Students in the study population and in each subgroup who completed at least one dual enrollment course in high school were significantly more likely to complete an associate degree than their non-dual enrollment peers in the same group.

Table 2*Chi-Square Results and Graduation Rates for Dual versus Non-Dual Enrollment Students*

	Number of Students	Pearson chi-square	<i>p</i> value	Cramer's <i>V</i>	Dual Enrollment Graduates	Non-Dual Enrollment Graduates
Population	62,644	3484.39	<.001	.24	46%	20%
ACT Composite Score						
0-18 Group	28,974	632.83	<.001	.11	29%	13%
19+ Group	33,670	1346.81	<.001	.20	49%	28%
Gender						
Male	27,673	1412.27	<.001	.23	44%	18%
Female	34,971	1992.58	<.001	.24	47%	21%
Race						
Asian	775	6.50	.011	.09	41%	27%
Black	9,956	128.95	<.001	.11	30%	11%
Hispanic	3,568	91.76	<.001	.16	42%	20%
White	45,594	2450.78	<.001	.23	47%	23%
Other	2,751	116.17	<.001	.21	40%	16%
Socioeconomic Status						
Pell Recipient	33,940	1587.82	<.001	.22	41%	17%
Non-Pell Recipient	28,704	1587.91	<.001	.24	50%	24%

To further evaluate the relationship between dual enrollment and associate degree completion, a bivariate logistic regression was performed to determine if dual enrollment completion is significantly related to associate degree completion when controlling for ACT score, gender, race, and SES. The model was statistically significant, $\chi^2(8, N = 62,644) = 6497.67, p < .001$. The model explained 15% (Nagelkerke R^2) of the variance in college completion and correctly classified 75.7% of cases. According to the Wald criterion, each of the five predictor variables (dual enrollment, ACT score, gender, race, and SES) were significant in the model, as presented in Table 3. Dual enrollment students were 2.13 times more likely to graduate with an associate degree than their non-dual enrollment peers when controlling for ACT score, gender, race, and SES.

Table 3*Logistic Regression Analysis Results*

Predictor	β	<i>SE</i>	Wald (χ^2)	<i>df</i>	<i>p</i> -value	Exp(β) (odds ratio)
Dual Enrollment	.755	.023	1053.413	1	<.001	2.129
ACT Score	.135	.003	1970.796	1	.000	1.144
Gender	-.304	.020	227.412	1	<.001	.738

Race (categorical)						
White (contrast variable)			184.849	4	<.001	
Asian	.379	.084	20.311	1	<.001	1.461
Black	-.399	.036	125.242	1	<.001	.671
Hispanic	.070	.043	2.628	1	.105	1.073
Other Race	-.291	.052	31.642	1	<.001	.748
Pell Recipient	-.283	.020	197.388	1	<.001	.754
Constant	-3.303	.067	2447.753	1	<.001	.037

Dual Enrollment Students Exhibited Significantly Less Time to Degree Completion

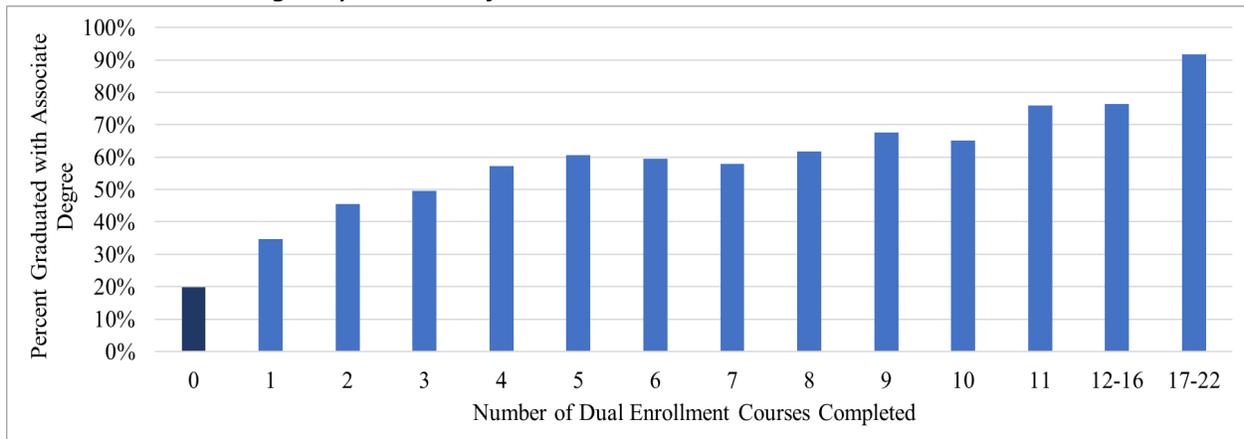
An independent samples *t* test was conducted to evaluate the hypothesis that dual enrollment students complete an associate degree in significantly less time than non-dual enrollment students. The number of semesters from first-time, full-time enrollment until graduation was the test variable and dual enrollment status (yes, no) was the grouping variable. The *t* test was significant, $t(15,562) = 34.11, p < .001$. In general, students in the dual enrollment group completed their associate degree in significantly fewer semesters ($M = 5.82, SD = 1.41$) than their non-dual enrollment counterparts ($M = 6.59, SD = 1.31$). The 0.77 semester difference in the means represents 11.6 weeks of a 15-week semester, or approximately a 3-month difference in average time to graduation. The 95% confidence interval was -0.81 to -0.73. The Cohen's *d* index was 1.34, which indicated a large effect size.

As Number of Dual Enrollment Courses Increased, Degree Completion Rates Increased

A descriptive analysis was conducted to evaluate the hypothesis that each additional dual enrollment course results in higher associate degree completion rates. Associate degree completion rate was calculated for 14 levels of dual enrollment courses (0 through 11, 12-16, and 17-22). The results indicate that students who completed just one dual enrollment course were 1.73 times more likely to graduate than students who completed no dual enrollment courses, and the trend of increased graduation rates continued with each dual enrollment course through five courses. After five courses, the graduation percentage fluctuated with each additional course, but as Figure 1 illustrates, the general trend indicates that the more dual enrollment courses students completed, the more likely they were to graduate with an associate degree.

Figure 1

Graduation Percentages by Number of Dual Enrollment Courses

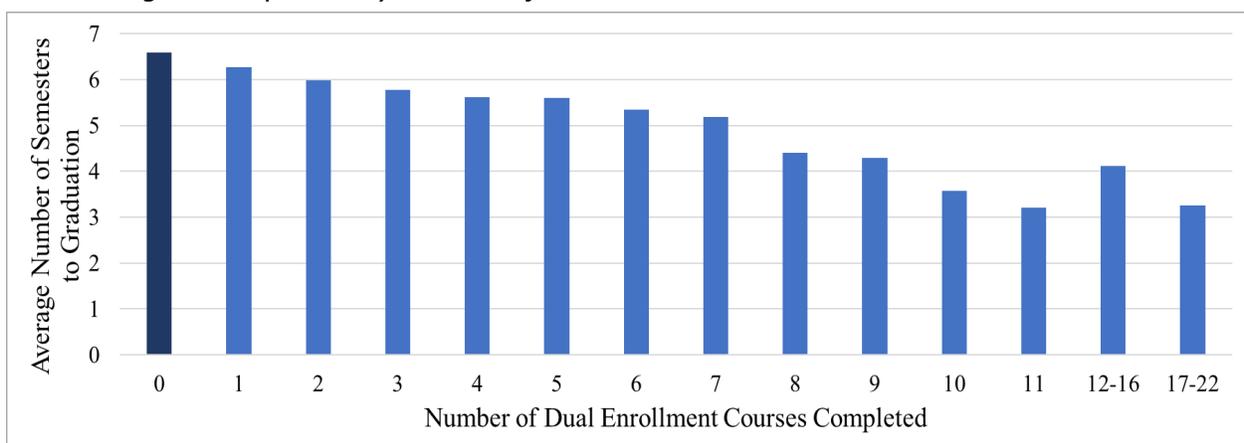


As Number of Dual Enrollment Courses Increased, Time to Degree Completion Decreased

To determine if there is a significant relationship between number of dual enrollment courses completed (1-22) and time to completion of an associate degree (1-9 semesters), a Pearson correlation coefficient was computed using the data for the community college students who graduated. The results of the correlational analysis revealed a weak negative relationship between number of dual enrollment courses ($M = 1.04, SD = 1.89$) and time to completion ($M = 6.32, SD = 1.39$) and a statistically significant correlation [$r(15,564) = -.322, p < .001$]. In general, the results suggest that when students complete more dual enrollment courses, they are likely to complete an associate degree in fewer semesters. The average time to completion ranged from 3.3 to 6.7 semesters, as represented in Figure 2.

Figure 2

Time to Degree Completion by Number of Dual Enrollment Courses



Notes: 1) The bar representing zero dual enrollment courses was added to the graph for comparative purposes but was not included in the correlational analysis. 2) Although categories with fewer than five students were grouped for presentation purposes (12-16 and 17-22), the Pearson correlation was performed using the individual student data.

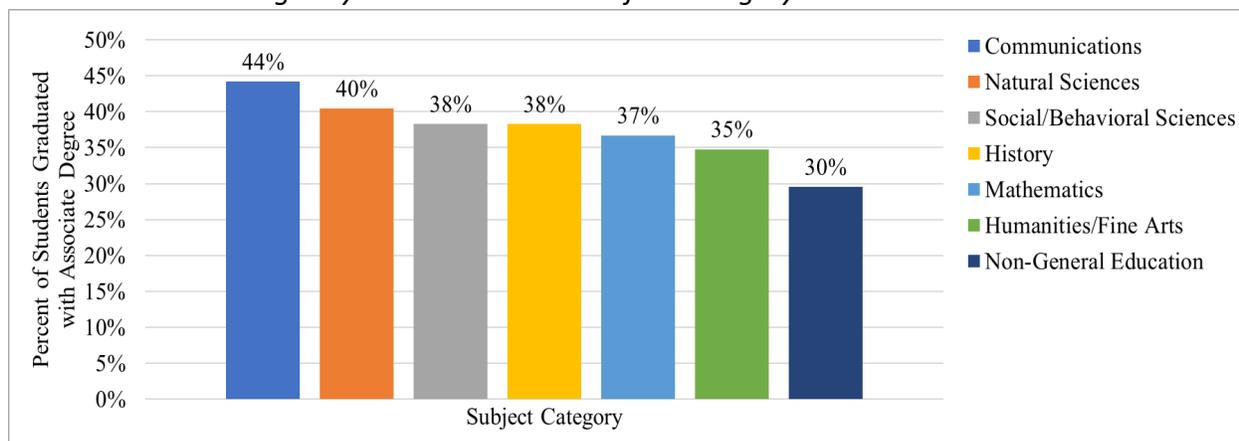
Dual Enrollment Subject Area Significantly Related to Associate Degree Completion

For this study, dual enrollment courses were divided into seven subject categories: communications, humanities/fine arts, history, mathematics, natural sciences, social/behavioral sciences, and non-general education. Communications included English composition and speech courses. Humanities/fine arts included courses such as art history, literature, and philosophy. Non-general education included any course that was not included in one of the other six general education core categories – subjects such as those in business, the medical field, or the trade skills areas.

A two-way contingency table analysis using crosstabs was conducted to evaluate whether associate degree completion is significantly different among the different dual enrollment subject areas. To reduce the confounding effects of students who completed courses in multiple dual enrollment subjects, only students who completed all dual enrollment courses in one subject area were considered for this analysis. The two variables were dual enrollment subject area at seven levels and associate degree completion at two levels (yes, no). Dual enrollment subject area and associate degree completion were significantly related, Pearson $\chi^2(1, N = 6,350) = 87.19, p < .001$, Cramer's $V = .12$. Graduation rates for students who completed all dual enrollment courses in one of the seven subject areas are presented in Figure 3.

Figure 3

Graduation Percentages by Dual Enrollment Subject Category



Discussion

When comparing dual enrollment and non-dual enrollment students, is there a significant difference in college completion rates and time to completion?

When comparing college success between dual and non-dual enrollment students, dual enrollment students came out on top in every measure. Dual enrollment students completed associate degrees at significantly higher rates than their non-dual enrollment peers, which agrees with the results of multiple prior studies concerning associate degree completion (An, 2013a;

Blankenberger et al., 2017; Ganzert, 2014; Henneberger et al., 2022; Hughes, 2016; Taylor, 2015). This finding held true for each subgroup analyzed – dual enrollment students graduated at significantly higher rates than their non-dual enrollment peers regardless of ACT score, gender, race, or SES. However, the effect sizes were smaller for students in the lower ACT score range, students of color, and low-income students indicating that dual enrollment does not lessen the achievement gap for these groups. These results support Taylor’s (2015) research that revealed smaller effect sizes for students of color and low-income students and research by An (2013b), Hoffman (2017), and Oakley (2015) that noted dual enrollment did not account for the gap in college success between low-income and middle- to high-income students nor between Black and White students. Further analysis revealed that dual enrollment students were 2.13 times more likely to graduate when controlling for ACT score, gender, race, and SES. Findings from the multiple studies that used PSM techniques to evaluate dual enrollment in relation to college completion support this finding that the effects of dual enrollment are not confounded with other student characteristics (An, 2013a; Blankenberger et al., 2017; Giani et al., 2014; Grubb et al., 2017; Henneberger et al., 2022; Hughes, 2016; Struhl & Vargas, 2012; Taylor, 2015).

Results indicated that dual enrollment students completed college in significantly fewer semesters. The difference in average time to completion between dual and non-dual enrollment students was almost three months. This supports Hughes’ (2016) finding that dual enrollment students graduated about two months sooner than non-dual enrollment students and closely aligns with results from other studies indicating reduced time to graduation for dual enrollment students (Grubb et al., 2012; Oakley, 2015; Villarreal, 2018; Marks & Lord, 2011).

For dual enrollment students, is the number of dual enrollment courses completed in high school significantly related to college completion and time to completion?

When evaluating the number of dual enrollment courses students completed, the results revealed that students who completed an associate degree completed significantly more dual enrollment courses, which agrees with the results of Burns et al. (2019), Ganzert (2014), Villarreal (2018), Struhl and Vargas (2012), and Young (2021). Further results indicated that students who completed just one dual enrollment course were 1.73 times more likely to graduate with an associate degree than students who completed no dual enrollment courses. The probability of graduation continued to increase with each additional dual enrollment course through the first five courses. After five courses, there was some fluctuation in graduation rates, but in general, the trend continued – the more dual enrollment courses a student completed, the more likely they were to graduate. This finding contradicts An’s (2013a) research which indicated that beyond two dual enrollment courses, there was little added benefit for students. However, Burns et al. (2019) discovered that each additional credit hour in dual enrollment was positively related to graduation, which aligns with the results of this study. Burns et al. also found that each additional dual enrollment credit significantly reduced the time to graduation, which supports the finding in this study that increasing the number of dual enrollment courses was associated with a significantly reduced time to degree completion.

For dual enrollment students, is there a significant difference in college completion rates based on the dual enrollment subjects completed in high school?

Evaluation of the relationship between college completion and dual enrollment subject was performed using data for students who completed all dual enrollment courses in one of seven subject areas. The analysis revealed that dual enrollment subject area and associate degree completion were significantly related. In general, students who completed all dual enrollment courses in communications were more likely to graduate with an associate degree than students who completed courses in other subjects and were 2.2 times more likely to graduate than non-dual enrollment students. Students who completed all dual enrollment courses in non-general education courses were generally less likely to graduate with an associate degree than students who completed dual enrollment in core education subjects but were 1.5 times more likely to graduate than non-dual enrollment students.

The results of this study aligned with prior research that revealed students in any dual enrollment subject are more likely to graduate than non-dual enrollment students (Hoffman, 2017; Struhl & Vargas, 2012); courses in English language arts tend to be most influential on graduation rates (Morgan et al., 2018; Struhl & Vargas, 2012; Villarreal, 2018); and vocational dual enrollment courses tend to be less impactful in terms of college completion (Giani et al., 2014). However, in the area of mathematics, the study results contradicted earlier findings that students in dual enrollment math courses were more likely to graduate than students in other dual enrollment subjects (Giani et al., 2014; Morgan et al., 2018).

Implications for Practice

The results of the study led to several implications for practice which would be most applicable to the people and students who are associated with community colleges. *First*, study data frequently to ensure the positive effects of dual enrollment continue to be realized as the dual enrollment program changes. *Second*, provide greater access to dual enrollment in regions that may not currently have the facilities or staffing needed to implement the program. *Third*, encourage students to participate in at least one dual enrollment course while in high school. *Finally*, based on the finding that students who completed just one dual enrollment course were 1.73 times more likely to graduate from college, policymakers should focus on funding fewer classes for more students (breadth) before funding more classes for fewer students (depth) when determining how to allocate the finite funds in the Dual Enrollment Grant.

Implications for Further Research

With the continuing and increasing focus on dual enrollment as a strategy to prepare students for college success, additional research is needed to further investigate the relationships between dual enrollment parameters and college success measures. *First*, evaluate dual enrollment subject relationship to college success measures at the individual subject level and for the various subject combinations. *Second*, interview community college students who completed dual enrollment courses in high school to determine which aspects of their dual

enrollment courses are most beneficial in the college setting. *Third*, replicate this study with data from four-year universities to discover how dual enrollment parameters are related to bachelor's degree completion. *Fourth*, research dual enrollment completion as it relates to student enrollment and retention at community colleges and universities. *Finally*, research the gaps in college success measures among population subgroups in relation to dual enrollment.

Conclusions

Students are faced with many choices for college preparation while in high school. To meet the goals set by states for college completion, high schools and colleges must partner to provide access to and support in college preparation strategies for high school students. Dual enrollment is an option that provides significant benefits for students, and in Tennessee, is a low-cost option because of state-provided funding. Continuous evaluation of the dual enrollment program is crucial as the program grows and changes. Ongoing research into topics such as the impact of dual enrollment subjects will aid in continuous improvements in the implementation of dual enrollment programs.

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