OUTCOMES OF JOINTLY ENROLLED STUDENTS IN IOWA

A Study of the 2011 High School Graduation Cohort

Released 2021

IOWA DEPARTMENT OF EDUCATION
COMMUNITY COLLEGES & WORKFORCE PREPARATION

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Executive Summary
Released 2021

Joint Enrollment Research Report

Outcomes of Joint Enrollment Received at Iowa Community Colleges

(Iowa HS Graduates Cohort of Spring 2011)

Joint Enrollment Benefits Students, Improves Outcomes

The Iowa Department of Education collects information on joint enrollment from Iowa's 15 community colleges. Jointly enrolled students are high school students enrolled in community college credit coursework. For the starting cohort of this report, 29,000 spring 2011 graduates of Iowa public high schools have been used. Of the 17,508 (60.4 percent of cohort) jointly enrolled students:

- 3,548 (20.3 percent) received free and reduced lunch;
- 13,963 (79.6 percent) were math and English proficient;
- 8,509 (48.6 percent) were male; and
- 1,540 (8.8 percent) were of a racial/ethnic minority.

Postsecondary Enrollment

75.5% of former jointly enrolled students enrolled in postsecondary education in the fall of their graduation year compared to **50.4%** of non-jointly enrolled students.

61.9% of former jointly enrolled students entered an Iowa community college within eight years of high school graduation compared to **49.6%** of non-jointly enrolled students.

50.4% of former jointly enrolled students received an award or transferred to a four-year college within three years compared to **35.3%** of non-jointly enrolled

Persistence & Tuition

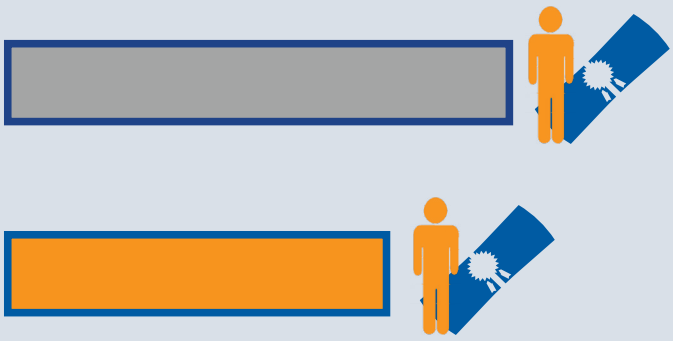
On average, students with joint enrollment experience who enroll in any postsecondary education immediately after high school graduation are **15.4%** less likely to drop out.

On average, students with joint enrollment experience who enter an Iowa community college bring **11.2 credit hours**, a potential* savings of **$1,474.04**.

Within eight years of high school graduation, 87.5% of former jointly enrolled students enrolled in postsecondary education compared to 67.0% of non-jointly enrolled students.

Notable Fact

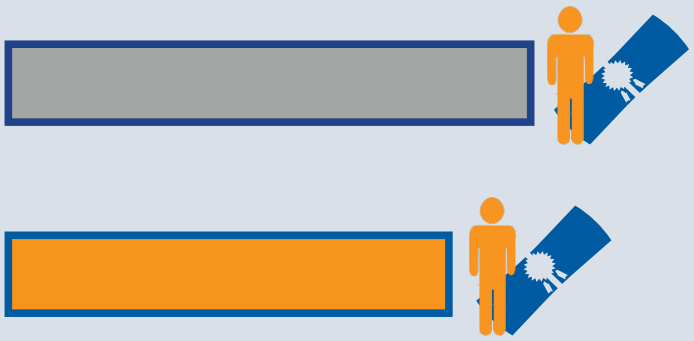
Time to Award



Fromer joint enrollment students' average time to diploma or certificate in Iowa community colleges was **2.7 years** compared to **3.1 years** for non-joint enrollment students.

Former joint enrollment students' average time to an associates degree in Iowa community colleges was **2.9 years** compared to **3.4 years** for non-joint enrollment students.

Former joint enrollment students' average time to a bachelor's degree was **4.4 years** compared to **4.7 years** for non-joint enrollment students.



Former joint enrollment students' average time to any postsecondary award was **3.7 years** compared to **4.0 years** for non-joint enrollment students.

Notable Fact

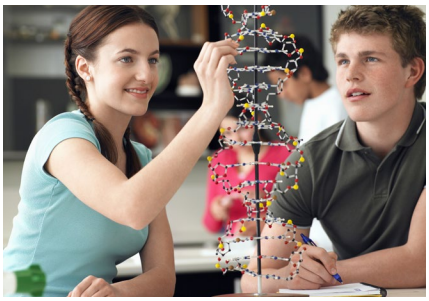
Joint enrollment students with more credit hours enroll at significantly higher rates in four-year postsecondary institutions than joint enrollment students with fewer credits. For example, 28.5% of joint enrollment students with 0.5-3 joint enrollment credits enrolled in four-year postsecondary institutions, whereas 63.8% of joint enrollment students with 30.5-33 joint enrollment credits did the same, with stable percentage growth for ranges between these two.

Joint Enrollment Research Report

COMMUNITY COLLEGES & WORKFORCE PREPARATION

*"Potential" is an amount calculated under conditions when a student transfers all joint enrollment credit. In AY11-12, when an immediate high school graduate of the starting cohort would have entered community college education, an average cost for one credit hour was $132 for in-state tution.

Contents



Introduction

As the ever-growing number of jointly enrolled students in Iowa reached 40.8 percent of total community college credit enrollment during academic year 2019-20 [17], it is vital to understand and examine the outcomes of jointly enrolled students and to explore the impact joint enrollment opportunities have on students' success.

This initial Outcomes of Jointly Enrolled Students in Iowa report analyzes the postsecondary outcomes based on the 2011 Iowa high school graduating class. High school students were followed to postsecondary education enrollments and completions for eight years following high school graduation. The student cohort was split into two groups: those who experienced joint (dual) enrollment (JE) and those who did not enroll in joint (dual) enrollment options (NJE). This study provides insight into the education outcomes by those two categories and demonstrates the impact of the joint enrollment experience on students' post-high school pathways, reflected in the rates of postsecondary enrollments, persistence in postsecondary education, rates and time to graduation from postsecondary institutions, potential cost savings for students and their families, in addition to earned credit, all in comparison with their peers without joint enrollment experience.

The 2011 high school graduating cohort was used so that students could be tracked over the eight-year, allowing for up to 200 percent time for the completion of not only a community college education, but also completion in the four-year public college/university setting. This report provides data designed to inform college administrators and policymakers as they engage in planning and program improvement.

Expected Quantitative Outcomes

Joint enrollment for Iowa's high school students has a positive impact on persistence in education, shortens their time-to-degree and provides potential savings to the student and family.

Research Questions

1. To what extent do students with joint enrollment experience enroll in postsecondary education directly following high school compared to students without joint enrollment experience?
2. How long does it take students with joint enrollment credit to finish their degree/award compared to students without joint enrollment credit?
3. What impact do credits earned through joint enrollment have on college completion?
4. If all credits earned are transferred toward a degree/award, to what extent would participating in joint enrollment help students reduce the cost of postsecondary education when compared to students without joint enrollment experience?

Defining Joint Enrollment

In Iowa, joint enrollment broadly refers to an arrangement for high school students to enroll in one or more college courses while simultaneously enrolled in high school. Nationally, this term is commonly referred to as "dual enrollment" and applies to any eligible postsecondary institution [8]. For the purpose of this research, and to reflect proper terminology used by the state, the term "joint enrollment" will be utilized.

High school students may participate in joint enrollment opportunities within three categories. These opportunities are captured through Iowa's community college management information system (MIS) in the following manner:

1. **Postsecondary Enrollment Options (PSEO)** provide high school students access to enroll in nonsectarian courses at eligible postsecondary institutions. The program is available to eligible juniors and seniors, as well as freshmen and sophomores who are identified as gifted and talented, according to the school district's criteria and procedures;
2. **Contracted Courses** delivered through agreements between community colleges and school districts. Contracted courses can be further divided into two subsets: those that meet the definition of concurrent enrollment and other contracted courses. The vast majority of contracted courses are delivered through the concurrent enrollment program. The concurrent enrollment program, also known as district-to-community college sharing, promotes rigorous academic and career and technical pursuits by providing opportunities for high school students in grades 9-12 to enroll in eligible nonsectarian courses at or through community colleges; and
3. **Courses taken independently by tuition-paying students.**

Depending on the program, the courses may be taken on a college campus, at a high school or through online/distance education. The instructors may be a college instructor or a high school instructor serving as a community college adjunct faculty member. Even though there is variation in the mechanisms available, consistency in expectations for students, instructors, school districts and postsecondary institutions is mandated by state policy (Iowa Code 281, chapter 22).

Prior Research

College credit opportunities help to bridge the gap between completing high school and starting college. Through joint enrollment opportunities, students are introduced to the rigor of college-level academic and career and technical programs and are provided with the opportunity to supplement their high school curriculum with challenging college courses that may not otherwise be available.

Once thought to be an opportunity for the most academically advanced students, joint (dual) enrollment opportunities have become an option for all students [1][5][22]. According to Bailey et al. [1], "The relationship between a rigorous high school course-load and success in postsecondary education argues for the inclusion of middle and low-achieving high school students in dual enrollment programs. Since dual enrollment can increase the intensity and rigor of the high school curriculum, challenging students through these programs could lead to high levels of college success." (p.1).

Research indicates joint enrollment opportunities ease the transition of students from secondary to postsecondary education. Students enroll and persist in postsecondary education in greater numbers because they enter college with a realistic understanding of the skills needed for success in higher education [1][4][6][19], students have higher grade point averages [4][13], are less likely to need remediation [7], potentially save money [1][2][4][6] and have increased degree completion rates over their peers with no prior joint enrollment experience [6][12][13][14][19][22].

Many researchers agree that there is a lot of work still needed to understand the outcomes among jointly enrolled students pertaining to student access and equity, gender bias, socioeconomic status or race/ethnicity. This research only scratches the surface.

Growth in Joint Enrollment

The popularity of joint (dual) enrollment has significantly increased in recent years. Reviewing the most recent published federal data, the National Center for Education Statistics [20] published a brief that stated, "in 2009, 34 percent of students took courses for postsecondary credit in high school" and "80 percent of those, most commonly took those courses at their own high school". In 2012, the Community College Research Center at Columbia University published that "national data (2002-2003) show that 71% of high schools offer dual enrollment opportunities and that 800,000 high school students take at least one college course during the school year" (para.3). Over the subsequent 15 years (2017-2018) the number of public school districts offering dual enrollment coursework grew to 82 percent [21].

The number of high school students taking postsecondary courses also saw significant growth "between the 2002-03 and 2010-2011 academic years, the number of students taking college-level courses within a dual enrollment program increased 80 percent to 1.2 million" [3]. Even more astonishing is that the 1.2 million does not include the more than 136,000 high school students who enrolled in college-level courses that same year outside of a dual enrollment program, bringing the combined total for high school enrollment in postsecondary courses close to 1.4 million students during academic years 2010-2011 [10][11].

The state of Iowa is following the national growth and popularity trend. Between academic years 2003-04 and 2019-20, participation in joint enrollment increased 146.1 percent (an average yearly increase of 5.8 percent), growing to an all-time enrollment high of 51,800 unduplicated students during academic year 2019-20 [17] from 21,050 unduplicated students reported in academic year 2003-04 [15].

Jointly enrolled students accounted for 40.8 percent of total community college enrollment in academic year 2019-2020 and over half (eight) of Iowa's 15 community colleges enrolled more jointly enrolled

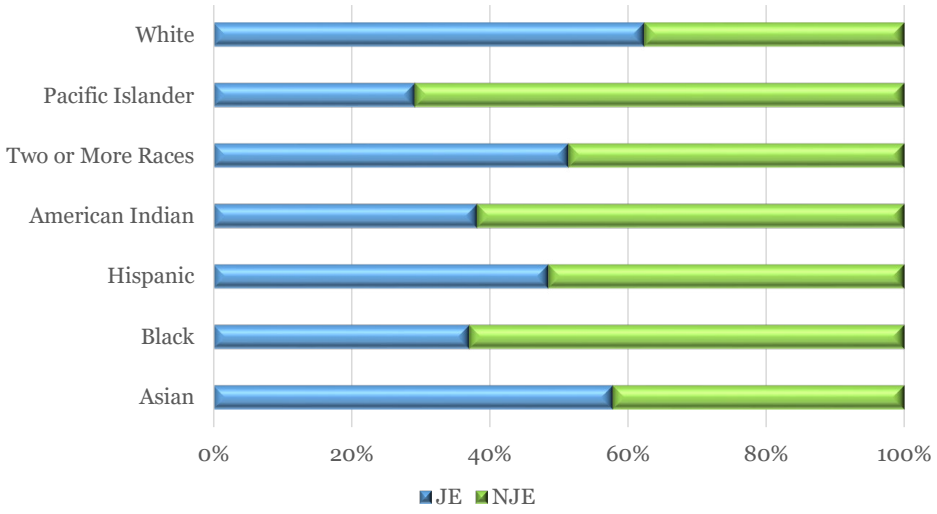
students than the state average [18]. Iowa continues to be a leader nationally, consistently maintaining the highest percentages among jointly enrolled students within a community college. "According to the most recent complete data collected from the National Center for Educational Statistics (Fall 2017) 35.0 percent of Iowa community college enrollment consisted of students under 18 years of age (the highest percentage in the nation), while the national percentage for that category was only 8.7 percent" [17].

Despite the growth, popularity and positive outcomes for students participating in joint (dual) enrollment opportunities, Fink et al., [6] indicates that "many colleges and states have not closely monitored which students participate, where they enroll in college after high school, and how many complete a college degree" (p.1). Through information presented in this Initial Outcomes of Jointly Enrolled Students in Iowa report, the state of Iowa will contribute to the much-needed monitoring and reporting of these additional student-level outcomes.

Research Cohort Demographics

The starting cohort consists of students who graduated from an Iowa high school in Spring of 2011 (N=29,000). Among the 29,000 students, 14,718 were male, 14,256 were female and 26 students did not report their gender. There were 25,624 (88.4 percent) white students, 3,349 (11.5 percent) minority students and 27 students (0.09 percent) who did not report their race/ethnicity. Of the 29,000 students in the cohort, there were 17,508 students who experienced joint enrollment (JE) while in high school. Of those, there were more female JE students (N=8,999) than male JE students (N=8,509). White JE students represent 91.2 percent of the cohort and only 8.8 percent were minority students, which is lower than the overall minority student population of 11.5 percent in the 2011 graduate cohort. Figure 1 below illustrates the proportion of the overall cohort by race (JE and NJE).

Figure 1. Percentage of JE and NJE Students by Race (2011 Cohort)



Additional data were used in the research analysis to identify whether or not confounding variables such as proficiency in math and English or economic disadvantages play a role in the outcomes of students who do or do not participate in joint enrollment programs. Over one-fourth (N=7,562 students or 26.1 percent) of students were eligible for free/reduced-price lunch and received assistance under the Free or Reduced Lunch (FRL) program, which was used as a proxy for "economically disadvantaged" in this study.

study. The presumption is that students who are either not proficient in math and English and/or economically disadvantaged, by and large, do not participate in the joint enrollment (JE) experience while in high school; however, nearly half (46.9 percent) of students who received FRL were enrolled in JE courses and using the results of the Iowa Test of Basic Skills (ITBS)* scores, one-third of students (N=8,969 or 30.9 percent) were less than proficient both in math and English and 30.3 percent of those students (N=2,717) had experienced JE during high school. More statistical findings are detailed in the regression models, ratios and t-test detailed in Appendix A.

**The State of Iowa administers a yearly annual achievement assessment to all students enrolled through the state's K-12 school districts. In 2011, the assessment utilized was The Iowa Test of Basic Skills, which measured a student's proficiency (knowledge) in the subject areas of math, English and reading.*

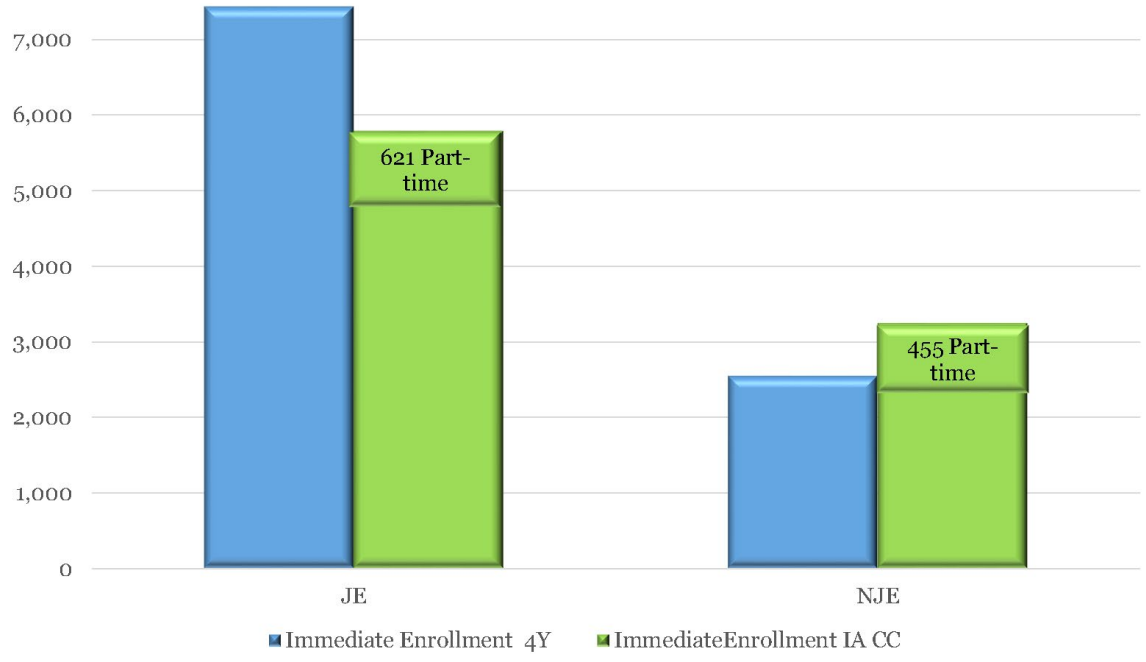
Report Findings

1. To what extent do students with joint enrollment experience enroll in postsecondary education directly following high school compared to students without joint enrollment experience?

There were 17,508 students who had joint enrollment (JE) experience while they were in high school. Of the 17,508 JE students, 13,224 (75.5 percent) immediately enrolled in college. Of those, 5,787 (44.4 percent) enrolled in an Iowa community college and 7,437 students (56.2 percent) immediately enrolled in a four-year college/university. In comparison, there were fewer non-jointly enrolled (NJE) students in total who had immediately enrolled in college following high school graduation (N=5,789); however, the percentage of those who entered the community colleges was higher at 56.1 percent (N=3,245) than that of students who immediately enrolled in a four-year college/university (43.9 percent or N=2,544). Additionally, the majority of JE students who enrolled at a community college following high school graduation attended full-time with only 621 students (10.7 percent) attending part-time and 455 (14.0 percent) of the NJE students attending part-time (Figure 2).

Logistical regression analysis was conducted to examine the relationship between joint enrollment experience and students' immediate enrollment in postsecondary education. The results revealed a number of factors contributing to higher postsecondary enrollment rates, higher academic success while in high school and ethic/racial demographics among them. Joint enrollment experience in high school, with all other factors equal, was also found among predictors for enrolling in a community college or a four-year college/university immediately after graduating from high school at higher rates compared to graduates with no joint enrollment experience. Detailed analysis can be found in Appendix A.

Figure 2. Immediate Enrollment and Enrollment Status at Community Colleges



** Data to determine full- or part-time enrollment were not available for four-year colleges/universities.*

2. How long does it take students with joint enrollment credit to finish their degree/award compared to students without joint enrollment credit?

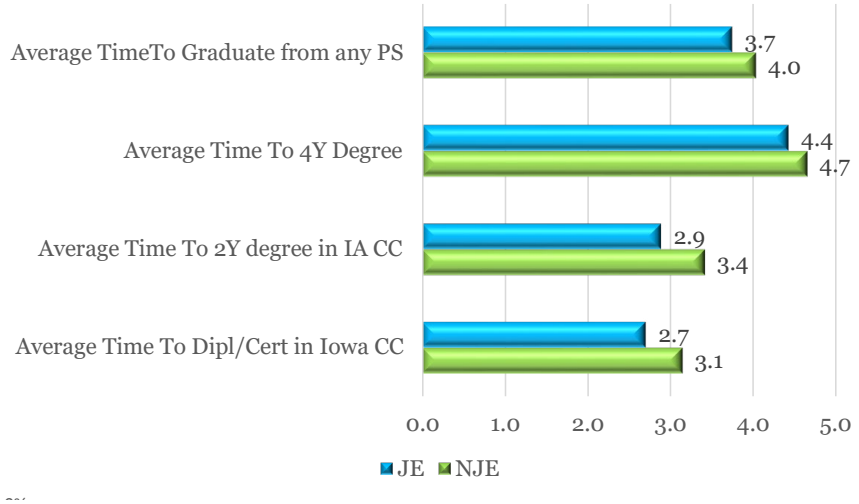
Though there are many students who receive an award prior to leaving high school, those who did not receive an award often still have a slight advantage over those who did not experience joint enrollment during high school. One indicator is the overall average time-to-degree, which was shortened for most who had experienced joint enrollment during their high school years, even if they did not receive an award prior to graduation.

> *"Time to degree has long been viewed as an important outcome for research and policy. It is an important consideration for students, parents, institutions, and states because of the financial implications the length of enrollment can have on each of these stakeholders. While the emergence of massive open online courses (MOOC) and the flexibility offered by online programs has expanded how postsecondary credentials are defined, for the most part, there is still a certain length of time perceived as the norm for receiving an associate or bachelor's degree. This expectation not only determines the length of time institutions are allowed to use to measure student success (typically, 150 percent of "normal" time), it also limits our understanding of time to degree thereby rendering students who take longer to finish invisible. As a result, when student completion rates decline, for example, it is difficult to know whether more students are actually dropping out or simply taking longer to graduate than the standard data measurement allows." (Shapiro et al., 2016, p. 22).*

A study conducted by the National Student Clearinghouse Research Center indicated that, nationally, students who were awarded an associate degree and had dual enrollment experience while in high school had a shorter time-to-degree (3.0 years) than those who had not been dually enrolled (3.5 years) [14]. This is true for Iowa students as well, as illustrated in Figure 3.

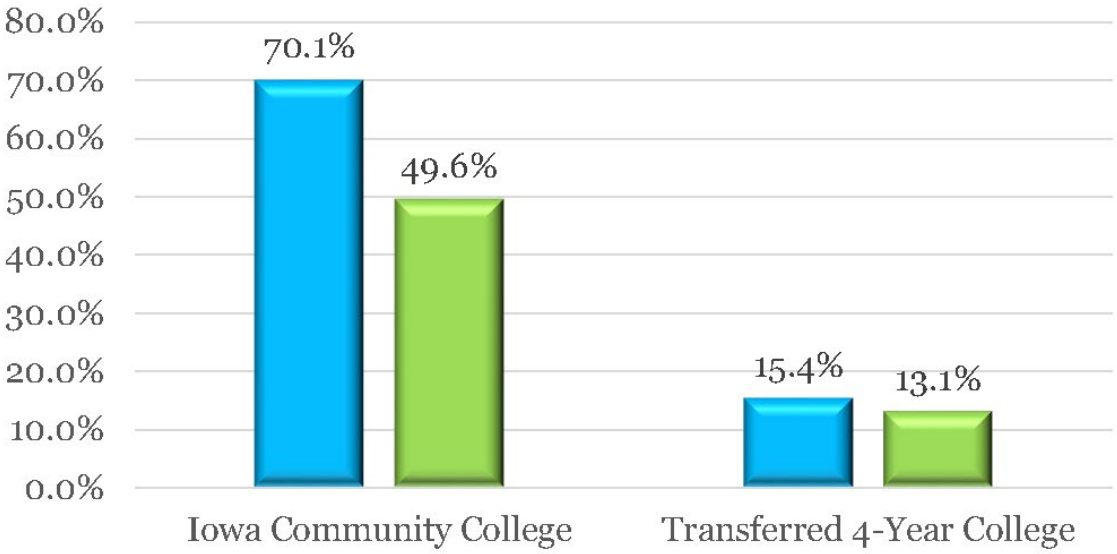
Iowa's community colleges are host to a myriad of students of both traditional and nontraditional ages, socioeconomic backgrounds, family circumstances and employment status (employed full- or part-time during their education), thus, their educational goals vary significantly. Traditionally, however, it is easy to identify two major categories: students who need technical skills for a successful employment and those who intend to transfer to four-year colleges/universities. Both categories may or may not need a community college award to achieve these goals. Immediate enrollment following graduation from high school does not apply to everyone, and the same is true for the 2011 cohort, but it was used as a starting point for calculation of the time-to-degree. With this in mind, 2011 graduates were studied using an eight-year time frame. There was a total of 23,014 students who enrolled in postsecondary education within the eight-year time frame; 15,316 had previously experienced joint enrollment (JE) and 7,698 had not (NJE). Of those, there were 2,092 JE students and 1,909 NJE students who enrolled in postsecondary education immediately after high school graduation. Overall, the average time to graduate from an Iowa community college or four-year college/university was less for the JE students than the NJE students. The time-to-degree was shortened by 0.3 years for those who completed their degree at a four-year college/university, and when measuring the time-to-degree for an associate degree, JE students completed their degree in 2.9 years compared to 3.4 years for NJE students (0.5 years shorter). The JE students' average time to a diploma or certificate was 2.7 years compared to 3.1 years for NJE students, 0.4 years shorter than their NJE peers (Figure 3). When calculating the number of years it took to complete a student's degree, JE years in high school were not taken into consideration (excluded) in the measurement.

Figure 3. Time-to-Degree by Type, JE versus NJE Student



Another measurement was utilized for students who transferred to a four-year college/university from the community college during the study period to continue their education (noted in Figure 4 below) and this time at the four-year college/university was included in time-to-degree as their education did not end in the community college setting. Post high school, the JE students transferred at a higher rate than NJE students during high school (15.4 percent to 13.1 percent, respectively).

Figure 4. Enrolled in Community Colleges and Transferred within Eight Years (not immediate enrollment)

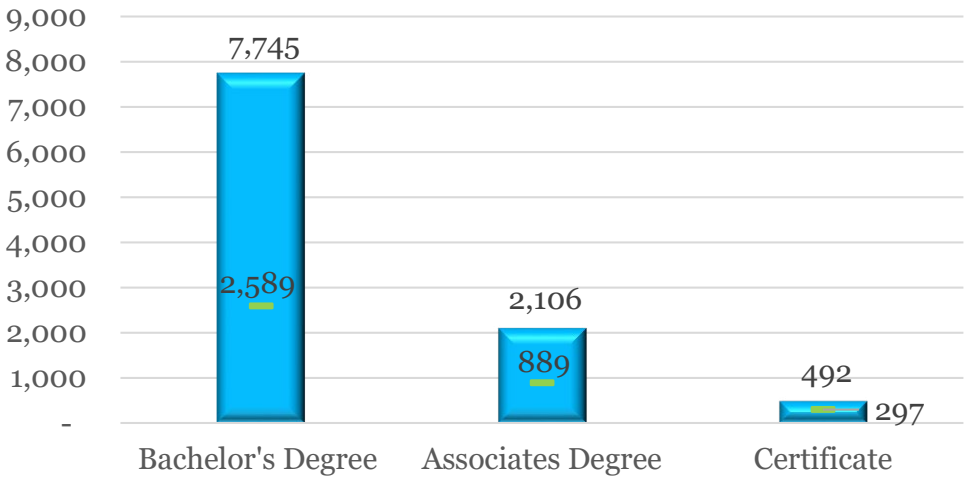


Additionally, a standard success rate (first-time, full-time students graduating or transferring with 150 percent of the time allocated for graduation) was calculated for the cohort. Among full-time JE students who entered an Iowa community college immediately after high school graduation, there were 2,603 (50.4 percent) who received an award or transferred to a four-year college/university within three years, compared to 985 (35.3 percent) of NJE students.

When analyzing the highest degree received in eight years, those with JE experience represented more students who completed a degree or award as well as 7,745 students that had completed their Bachelor's degree; 2,106 students who received their associate degree and 492 a certificate compared to the NJE students (2,589; 889 and 297 students respectively). Over half (59.1 percent) of the total JE student cohort (10,343 of

17,508) had received a postsecondary degree or certificate within the eight-year study period while only 32.8 percent of the NJE cohort (3,775 of 11,492) had received a postsecondary degree or certificate. Some students may have received multiple awards, but only the highest award is represented by Figure 5.

Figure 5. Highest Degree Received in Eight Years (JE versus NJE)



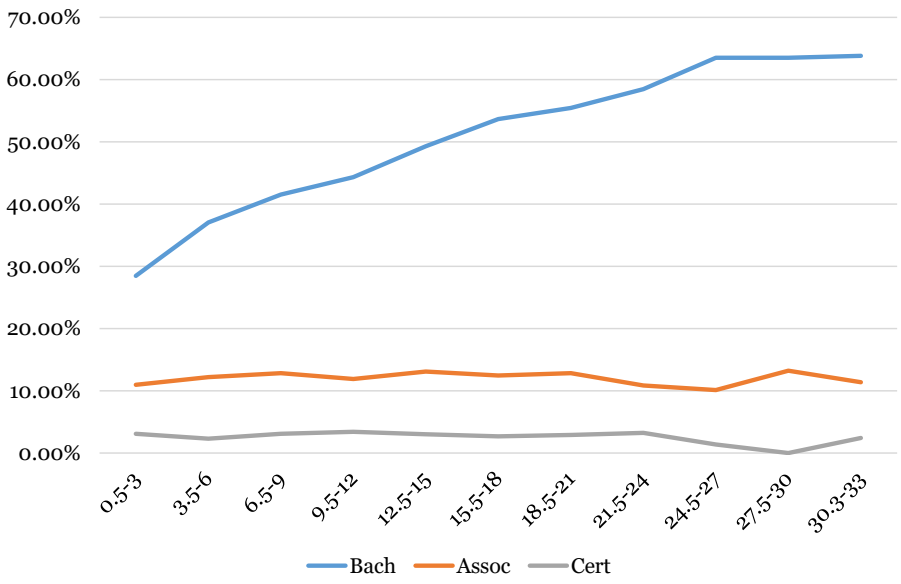
3. What impact do credits earned through joint enrollment have on college completion?

A 2011 high school graduate had spent an average of 1.5 years taking joint enrollment coursework. An aggregate total of 215,755.2 credit hours were earned by the 2011 graduating cohort while taking 71,790 courses in high school. There were 7,088 students who took only arts and science courses, 4,323 students who took only career and technical education (CTE) courses and 6,097 students who took courses in a combination of arts and sciences and CTE.

Students with more joint enrollment (JE) credits had graduated with bachelor's degrees at significantly higher rates than those with fewer credits (28.5 percent for 0.5-3 JE credits with 63.8 percent for 30.5-33 JE credits) with stable percentage growth for ranges in between the two credit ranges (the percent of those who graduated based on the number of credits is represented in the figure below). Those students who earned more than 36 credits comprised only 2.4 percent of all graduates with joint enrollment experience, and this distribution of credits and outcomes are statistically unstable due to the low numbers.

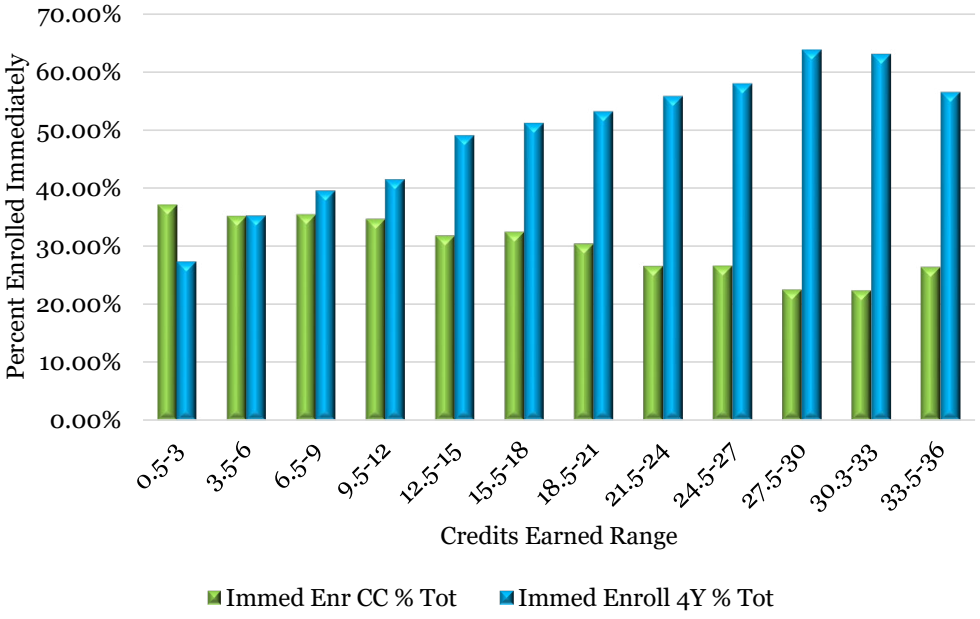
Overall, the number of joint enrollment credit hours that transferred does not significantly impact rates of completion of a certificate or associate degree as highest received award in Iowa community colleges; however, it is somewhat negatively correlated to enrollment in an Iowa community college within eight years, showing a significant negative correlation to immediate enrollment in an Iowa community college, but positively correlated to enrollment in a four-year college/university (see Figure 6 and Appendix A).

Figure 6. Joint Enrollment Outcomes by Degree Type and Number of Credits Earned



The students who earned more JE credit hours enrolled at a significantly higher rate in four-year postsecondary institutions (28.5 percent for 0.5-3 JE credits and 63.8 percent for 30.5-33 JE credits) with stable percentage growth for ranges in between the two credit ranges. Generally, the higher the number of credits earned while in high school, the higher the percentage of those who immediately enroll in a four-year college/university, as shown in Figure 7.

Figure 7. Percent Immediate Enrollment by Institution Type and Credits Earned*



** Descriptive analysis of the JE credit hour volume, distribution of credit hours by type and graduation frequencies present findings as reported. A more in-depth analysis is required to explore other contributing factors for unbiased correlation between type of credit, its volume and student success in education.*

4. If all credits earned are transferred toward a degree/award, to what extent would participating in joint enrollment help students reduce the cost of postsecondary education when compared to students without joint enrollment experience?

In academic year 2011-12, the majority of jointly enrolled students enrolled in arts and sciences postsecondary courses with the highest numbers taking courses such as Composition I or II, Introduction to Psychology and Fundamentals of Oral Communication (Figure 8). The majority, if not all, of these courses/ credits earned could transfer to four-year colleges/universities if the student earned a "C" grade or higher in the class. Criteria is solely determined by the college/university intake process and the requirements outlined for each course. In addition, community colleges also offered career and technical education (CTE) options, whereas students could enroll in courses such as Nurse Aide, Principles of Engineering or Introduction to Computers (Figure 8). These programs vary in length and could be short- or long-term, depending upon the program requirements. Students ultimately could complete a CTE program prior to graduation or could continue into further education once they graduate from high school with all credits eligible for transfer to an Iowa community college, if the program is available at the transfer location.

Figure 8. Top 30 Courses with Enrollment (Statewide) (Academic Year 2011-2012)

Common Course Number	Course Name	Arts/Sciences (A&S) or Career & Tech Ed (CTE)	Students
ENG105	Composition I	A & S	7,253
ENG106	Composition II	A & S	4,571
PSY111	Introduction to Psychology	A & S	4,566
EGT400	PLTW - Introduction to Engineering Design	CTE	2,710
SPC101	Fundamentals of Oral Communication	A & S	2,386
SOC110	Introduction to Sociology	A & S	2,031
SPC112	Public Speaking	A & S	1,994
MAT129	Precalculus	A & S	1,758
HSC172	Nurse Aide	CTE	1,459
MAT156	Statistics	A & S	1,404
MAT157	Statistics	A & S	1,262
LIT101	Introduction to Literature	A & S	1,221
CSC110	Introduction to Computers	CTE	1,193
FLS241	Intermediate Spanish I	A & S	1,077
MAT211	Calculus I	A & S	1,021
EGT410	PLTW - Principles of Engineering	CTE	1,001
PSY121	Developmental Psychology	A & S	931
HSC113	Medical Terminology	CTE	831
POL111	American National Government	A & S	795
BCA212	Introduction to Computer Business Applicatior	CTE	778
FLS242	Intermediate Spanish II	A & S	697
HIS110	Western Civilization: Ancient to Early Modern	A & S	661
ACC111	Introduction to Accounting	CTE	653
BUS102	Introduction to Business	CTE	643
HSC114	Medical Terminology	CTE	636
FIN121	Personal Finance	CTE	603
HSC120	Medical Terminology I	CTE	560
ADM259	Professional Development	CTE	533
HIS113	Western Civilization: Early Modern to Present	A & S	524
HIS112	Western Civilization: Ancient to Early Modern	A & S	515

While a precise calculation of personal savings depends on many factors and requires more data than was available, it is possible to calculate the potential savings students might experience if their college credit has been received via state-funded programs such as joint enrollment.

A student with joint enrollment experience who enters an Iowa community college has earned an average of 11.2 credit hours following high school graduation, a potential savings in tuition of $1,474.04. This "potential savings" is an amount calculated under conditions when a student transfers all joint enrollment credit. In AY 2011-12, when an immediate high school graduate would enter a community college, an average cost for one credit hour was $132 for in-state tuition. Credits earned ranged from 0.5 to 66* credits for a potential savings range of $66 to $8,712*.

Of the credits earned, the student would potentially transfer an average of 8.4 credit hours towards their first-year transcript, an average savings of $1,110.71 per student. This average savings is calculated under the same conditions as the "potential savings" above, which is the difference between total earned (transcript) credit for the first year of education in an Iowa community college (AY 2011-2012) and total number of earned course credit hours while in high school, with the assumption that the remaining credit was transferred from joint enrollment experience, and the average cost of one credit hour in an Iowa community college (AY 2012-13) was $132 for in-state tuition.

**Data (number of students/earned credits) with small numbers were suppressed in order to maintain confidentiality.*

Conclusion

Nearly every Iowa school district offers access to some form of joint enrollment opportunity; however, the depth of this access varies by district and corresponding community college service region. Regardless, the findings in this report indicate that jointly enrolled students enter postsecondary education directly following graduation at a higher rate, the time-to-degree is slightly shorter, their educational expenses are reduced and the credits earned through joint enrollment do impact the decision to enroll in four-year colleges/universities after graduation. Though this initial research helps to answer some of the many questions that have been raised regarding joint enrollment and the impact it has on students, further research is needed to address specific questions regarding the most beneficial types of offerings (courses/programs), awards prior to high school graduation and their impact on decision-making for further education, impact of credits earned and their transferability and the impact on employment opportunities will be conducted to explore in more detail how joint enrollment impacts Iowa's students.

Methodology

In order to answer the question above, multinomial logistic regression is employed. Multinomial logistic regression is an extension of binary logistic regression for nominal variables with more than two categories. In our case, there are three categories in the dependent variable, i.e., students immediately enrolled in a community college, students immediately enrolled in four-year college/university and students who are not immediately enrolled. The multinomial logistic regression estimates the log-odds of one outcome relative to the baseline category. In our study, the baseline category is the group of students not immediately enrolled. Therefore, the multinomial logistic regression in this study is the association of joint enrollment experience with the log-odds of immediately enrolled in a community college relative to not immediately enrolled in postsecondary education; the association of joint enrollment experience with the log-odds of immediately enrolled in four-year college/university is relative to not immediately enrolled in postsecondary education.

Many factors can influence students' immediate enrollment in postsecondary education. These factors include, but are not limited to, student family socioeconomic status (SES), students' grade at high school, gender and race/ethnicity, etc. For example, students from economically disadvantaged families are less likely to go to college/university immediately after graduating from high school compared to their affluent peers; and students with higher grades are more likely to enroll in postsecondary education. Given that these factors might confound the association between joint enrollment experience and the log-odds of students' immediate enrollment in postsecondary education relative to not immediate enrollment, the following variables are included in the multinomial logistic regression model:

Socioeconomic Status (SES): In our data, there are two variables indicating whether a student is eligible for free or reduced-price lunch. Eligibility for free or reduced-priced lunch is a reliable proxy for student family SES [9]. Free or reduced priced lunch were two variables in our data. For research purposes, we combined the two into one, with 0 indicating noneligibility and 1 indicating eligibility for free/reduced-price lunch.

Demographics: For other demographics information, gender (1=male, 0=female), minority-status (1=white, 0=minority).

Student Academic Achievement in High School: In our data, two variables are used to indicate students' academic achievement: students' English Assessment at 11th grade and Math Assessment at 11th grade.

Joint Enrollment Experience: In our data, there is a binary variable indicating if a student had any kind of joint enrollment experience when they were in high school. 1=student had joint enrollment experience and 0=student did not have any joint enrollment experience.

The following two equations summarize the multinomial logistic regression model in our study: the log of odds of students immediately enrolled in a community college relative to the odds of not immediately enrolled in postsecondary education is a combined effect of student gender, race, eligibility for free/reduced-price lunch, math performance, English performance and joint enrollment experience; and the log of odds of students immediately enrolled in four-year college/university relative to the odds of not immediately enrolled in postsecondary education is a combined effect of student gender, race, eligibility for free/reduced-price lunch, math performance, English performance and joint enrollment experience.

$$ln\left(\frac{p(Immediately\ Enrolled\ in\ 2-year)}{p(Not\ Immediately\ Enrolled\ in\ Post-Secondary\ Education)}\right) =$$

$$b_{10} + b_{11}Gender + b_{12}Race + b_{13}Lunch + b_{14}English + b_{15}Math + b_{16}JE\ Experience$$

$$ln\left(\frac{p(Immediately\ Enrolled\ in\ 4-year)}{p(Not\ Immediately\ Enrolled\ in\ Post-Secondary\ Education)}\right) =$$

$$b_{20} + b_{21}Gender + b_{22}Race + b_{23}Lunch + b_{24}English + b_{25}Math + b_{26}JE\ Experience$$

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Appendix A

Statistical Results

Figure A shows the odds-ratios for enrolling in a community college or a four-year college/university immediately after graduating from high school, relative to not immediately enrolling in postsecondary education. The model includes the background characteristics of gender, race, socioeconomic status and student academic performance in high school as controlling variables.

As shown in Figure A, compared to female students, male students were less likely to enroll in a community college or four-year college/university (odds-ratio=0.80, 0.54, respectively) immediately after graduating from high school. Minority status is not a significant predictor for enrolling in a community college, relative to not enrolling in postsecondary education; however, it appears that white high school graduates were less likely than minority graduates to enroll in a four-year college/university. Economically disadvantaged high school graduates were less likely than their affluent peers to enroll in community college or a four-year college/university.

Figure A. Coefficients, Standard Errors and Odds-ratios for Predictors of Immediate Enrollment in Postsecondary Education

	Immediate Enrollment in a Community College			Immediate Enrollment in a Four-year College/ University		
Variables	B	Stand Error	Exp (B)	B	Stand Error	Exp (B)
Intercept	-0.76	0.06		-3.28	0.10	
Gender	-0.23**	0.03	0.80	-0.62**	0.03	0.54
Minority Status	0.05	0.05	1.05	-0.19**	0.06	0.83
Eligibility for Free/ Reduced-Price Lunch	-0.40**	0.03	0.67	-1.22**	0.04	0.30
English Assessment	0.15**	0.03	1.16	0.78**	0.03	2.18
Math Assessment	0.16**	0.03	1.18	0.96**	0.03	2.62
Joint Enrollment Experience	0.67**	0.03	1.95	0.87**	0.03	2.38

**p<.05

The students' academic performance (both math and English) in high school were a positive and significant predictor for the odds-ratios for enrolling in a community college immediately and for enrolling in a four-year college/university immediately after graduating from high school, relative to not immediately enrolling in postsecondary education. That is to say, students who had better performance in math or English were likely to enroll in a community college (odds-ratio=1.16, 1.18 respectively) or a four-year college/university (odds-ratio=2.18, 2.26 respectively), rather than not immediately enrolling in postsecondary education.

Joint enrollment experience in high school is also a significant predictor for the odds-ratios for enrolling in a community college immediately and for enrolling in four-year college/university immediately after graduating from high school. Students with joint enrollment experience in high school are more likely to

enroll in a community college or four-year college/university rather than not enrolling in any postsecondary education.

In the first multiple regression model (Figure B), an examination of students who were immediately enrolled in a community college included 9,032 Iowa high school graduates who were immediately enrolled in community college. Among the 9,032 students, 4,575 were male, 4,454 were female and three students did not report their gender. The majority (88.7 percent) were white; 20.2 percent were eligible for free lunch and 6.9 percent were eligible for reduced-priced lunch; and 88.1 percent were enrolled as full-time students at the starting term.

Figure B displays the results of the multiple regression analyses, indicating that joint enrollment experience along with student demographics, high school academic achievement and enrollment status can explain some of the variance in the time to two-year degree ($F(8, 2588)=31.8$, $p<.05$, $R2=.09$) and some of the variance in the time to four-year degree ($F(7, 5937)=23.4$, $p<.05$, $R2=.03$).

Figure B. Results of Multiple Regression Analysis

	Time to 2-year Degree		**Time to 4-year Degree**	
	Beta	t	Beta	t
Intercept		23.79		74.91
Minority	0.04	1.97*	0.06	4.34*
Gender	-0.01	-0.75	0.08	6.39*
Free Lunch	0.09	4.86*	0.02	1.27
Reduced-Priced Lunch	0.01	0.48	-0.01	-0.79
English Assessment 11th Grade	0.01	0.53	-0.04	-2.48*
Math Assessment 11th Grade	-0.06	-2.66*	-0.01	-0.77
JE Credit hours	-0.20	-10.79*	-0.11	-8.61*
Full-Time	-0.15	-8.22*	N/A	N/A
	R2	0.09	R2	0.03
	F	31.8*	F	23.4*

*P<.05

In the second multiple regression model, students were examined who were immediately enrolled in a four-year college/university setting; the sample used in this model includes 9,880 students. Among the 9,880 students, 54.3 percent were female; 92.3 percent were white; 7.4 percent were eligible for free lunch and 3.6 percent were eligible for reduced-priced lunch.

Socioeconomic status (SES): In data, there are two variables indicating whether a student is eligible for free or reduced-price lunch. Eligibility for free or reduced priced lunch is a reliable proxy for student family SES [9]. Free or reduced priced lunch were two variables in our data. For research purposes, we combined the two into one, with 0 indicating non-eligibility and 1 indicating eligibility for free/reduced-price lunch.

Demographics: For other demographics information, gender (1=male, 0=female), minority-status (1=white, 0=minority).

Student Academic Achievement in High School: In our data, two variables are used to indicate students' academic achievement: students' English Assessment at 11th grade and Math Assessment at 11th grade.

Enrollment Status: A binary variable is used to indicate if a student was enrolled as a full-time student (1=full-time, 0=part-time). This variable is only in the two-year degree model, since the data is not available for students who were immediately enrolled in four-year college/university.

Joint Enrollment Experience: In our data, there is a variable indicating the number of joint enrollment credits a student earned.

For time to a two-year degree, the analysis shows that joint enrollment credits that a student earned have negative, but significant, predicted effects on the time to two-year degree ($B=-.21$, $p<.05$), even after controlling other confounding variables. The more joint enrollment credits a student earned, the less time s/he spent on obtaining a two-year degree. For control variables, minority ($B=.04$, $p<.05$), eligibility for free lunch ($B=.1$, $p<.05$), math assessment in 11th grade ($B=-.06$, $p<.05$) and full-time status ($B=-.16$, $p<.05$) are significant predictors of the time spent toward a two-year degree. This means white students, students who were not eligible for free lunch, students who scored higher in math assessment in 11th grade, and full-time students spent less time obtaining a two-year degree than other students.

The analysis also shows that joint enrollment credits that a student earned has a negative, but significant, predicted value of time to a four-year degree ($B=-.11$, $p<.05$), even after controlling for other confounding variables. This indicates that the more joint enrollment credits a student earned, the less time s/he spent on obtaining a four-year degree. For control variables, minority ($B=.06$, $p<.05$), gender ($B=.08$, $p<.05$) and English assessment taken in 11th grade ($B=-.04$, $p<.05$) are significant predictors of time to four-year degree. This means female students, white students and students who scored higher in English assessment in 11th grade, spent less time obtaining a four-year degree.

In the second multiple regression model (Figure C), students were examined who were immediately enrolled in a four- year college/university setting; the sample used in this model includes 9,880 students. Among the 9,880 students, 54.3 percent were female; 92.3 percent were white; 7.4 percent were eligible for free lunch and 3.6 percent were eligible for reduced-priced lunch.

Many factors can influence the time a student spends on obtaining a two-year degree. These factors include, but are not limited to, student family socioeconomic status (SES), students' grade in high school, gender, race/ethnicity, enrollment status, etc. To examine the relationship between time to postsecondary degree and joint enrollment experience, these confounding variables were used as control variables in the model.

An independent sample t-test was conducted to compare the average time-to-degree between students with joint enrollment experience and students without joint enrollment experience. The results (Figure 4) show that there was a significant difference in the time to two-year degree for students with joint enrollment experience ($M=2.6$, $SD=1.4$) and students without joint enrollment experience ($M=3.1$, $SD=1.5$), $t(1717)=-8.4$, $p<.05$. On average, students with joint enrollment experience spent 2.6 years obtaining a two-year degree, whereas students without joint enrollment experience spent 3.1 years.

The results of independent sample t-test also shows that there was a significant difference in the time to four-year degree for students with joint enrollment experience ($M=4.2$, $SD=.84$) and students without joint enrollment experience ($M=4.4$, $SD=.87$), $t(2993)=-5.3$, $p<.05$. On average, students with joint enrollment

experience spent 4.2 years obtaining a four-year degree, whereas students without joint enrollment experience spent 4.4 years.

Figure C. Results of Independent Sample t-tests

	Students with JE		Students without JE		t-test
	M	SD	M	SD	
Time to 2-Year Degree	2.6	1.4	3.1	1.5	-8.4*
Time to 4-Year Degree	4.2	0.84	4.4	0.87	-5.3*

**P<.05*

In summary, the results of multiple regression analysis and independent sample t-test converge to the point that joint enrollment experience can help students obtain two-year and four-year degrees in a shorter time.

A separate multiple regression analysis by the Iowa Board of Regents found similar time to degree effects. The Regents looked at 10,989 Iowa high school graduates who enrolled full-time at a Regent university in Fall 2012, Fall 2013, or Fall 2014 to see if having earned college credit before starting college (joint enrollment, PSEO credits, Advanced Placement, or International Baccalaureate) impacted time to degree.

Figure D displays the results of the multiple regression analyses, indicating that having earned college credit while in high school, along with student demographics (sex, race/ethnicity, Free & Reduced Price lunch eligibility) and high school GPA can explain some of the variance in the time to four-year degree.

Specifically, when controlling for other variables, students with more college credits earned while in high school, reduced their time to a four-year degree. Other factors that reduced time to degree at the Regents were being a woman, having a higher high school GPAs, not being eligible for Free or Reduced Price Lunch, and not identifying as a racial/ethnic minority.

Figure D. Results of BOR Multiple Regression Analysis

	Time to 4-year degree	
	Beta	t
Intercept		68.62
Female	-0.105	-10.8*
ACT Comp	0.027	2.35
HS GPA	-0.159	-13.23*
College Credits	0.158	-14.92*
Free or Reduced Price Lunch	0.049	4.65*
Minority	-0.105	-10.8
	R2	0.09
	F	136.27*

*P < .01