UTAH DATA RESEARCH CENTER

Prior Learning Assessments and Post-secondary Outcomes

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Abstract

This research examines the relationship between two types of prior learning assessments (PLAs), AP and CLEP, and post secondary outcomes, including first-term GPA, time-to-degree, and leaving an institution without completing a credential. This study focuses on those who graduated from a Utah high school between 2012 and 2016 and then enrolled in an associate or bachelor's degree program at a public postsecondary institution between 2012 and 2020. As hypothesized, PLA credit from AP and CLEP may facilitate a shorter time-to-degree and reduced risk of dropout or stopout in most cases. AP credit also seems to be associated with a higher first-term GPA. Other factors including demographics also significantly impact student outcomes. Factors like race/ethnicity, income, major, and college readiness can overtake the effects of PLAs, particularly for those with three to six credits from PLAs. The sample in this study does not include the years following the changes to PLA credit awards, meaning institutions may have improved the efficiencies of PLA programs. Ideally, this study would be replicated in the future to compare the current findings with the outcomes under newer policies.

Keywords

Prior Learning Assessments, Higher Education, Secondary Education, Education Policy, College Credits, Time to Degree

1 | Introduction

Students have many opportunities to gain competencies outside of degree-granting institutions, but their transcripts may not always reflect these experiences. Prior Learning Assessments (PLAs) allow students to receive post-secondary credit for experience and competencies gained outside an institution (Sherron et al., 2019; Monica, 2019; McKay et al, 2016). PLAs can include standardized tests like Advanced Placement (AP), International Baccalaureate (IB), or College-Level Examination Program (CLEP) or other experiences such as military service, language experience outside of school, or technical certifications.

PLAs may benefit students by shortening time-to-degree (Boyle & Otts, 2018), increasing the likelihood of completing a credential program (Boatman et al., 2017; Klein-Collins and Hudson, 2018; McKay et al., 2016), and reinforcing prior learning (Taylor and Marinau, 2016). However, these benefits may vary significantly by demographic group or PLA type (McKay et al., 2016; Klein-Collins and Hudson, 2018).

To better align with aims and outcomes, the Utah System of Higher Education (USHE) standardized the credits offered for AP and CLEP exam scores across the system's eight degree-granting institutions, effective starting in the 2021 academic year. This study will establish the baseline effects of AP and CLEP credits by answering the following questions for those who first enrolled in an associate or bachelor's degree program between 2012 and 2020:

1.How is participation in AP during high school related to first-term GPA?

2.How is participation in PLA programs related to the average time to complete a degree?

3.How does participation in PLA programs relate to the likelihood of separating from a postsecondary institution before completing a credential?

1.1 | Literature Review

Research on the effects of PLAs has mixed conclusions. For example, a study of more than 230,000 non-high school students at 72 institutions used propensity score matching (PSM) to study the effect of PLAs on educational outcomes. Researchers found evidence that PLAs can improve student outcomes, including credit completion and time-to-degree (Klein-Collins et al., 2020). These findings were in line with a 48-institution study by Klein-Collins (2010) found that PLA students had significantly higher seven-year graduation rates and persistence. Two studies found PLAs had outsized benefits for students of color, women, and low-income students, but Black and lower income students were less likely to use PLA programs (Klein-Collins et al., 2020, p. 30; Klein-Collins et al., 2021).

However, another study comparing PLA students to non-PLA students found that students who received PLA credit had higher completion rates. Even still, PLA did not seem to affect time-to-degree except for those with more than the equivalent of 36 credit hours (McKay et al., 2016). The sample size for the study included students from all 13 Colorado Community College institutions, but the groups of high credit hour students were relatively small (n=53 and n=48). The study did not include hypothesis tests for this part of the analysis. Therefore, the conclusions of this study need further investigation.

There are many ways students can receive PLA credit; some methods have clearer documentation than others. PLAs can include equivalency exams like AP, IB, and CLEP, and they can also include credit for less standardized experiences like technical certifications, military service, or previous language experience. The latter categories may require various types of assessments to gauge competency such as oral examinations or portfolio reviews. A report by the Council on Adult and Experiential Learning (CAEL) examined the effects of all PLAs and effects by type of PLA (Klein-Collins and Hudson, 2018). According to CAEL, persistence, defined as degree completion or continued enrollment, was about 91% for those who received PLA credit of any type (n=1,711) versus 74% persistence for those without PLA credit (n=24,411). The effect on persistence was highest for students who received credit via portfolio only (98% persistence, n=209), followed by external evaluated programs only (96% persistence, n=186). Concerning completion, those who received any PLA credit competed at a rate of 42% (n=1,711) versus a completion rate of 26% for those who did not receive any PLA credit (n=24,411) (p. 5). The effect of PLA credit seems strongest for those in the portfolio only (66% completion, n=209) and the standardized exams only (56% completion, n=529) groups.

The CAEL report grouped all standardized test options into one group, and it did not examine options like counting ACT scores as a type of PLA. However, each type of PLA has its own body of literature and limitations, especially with regards to concerns about diversity, equity, inclusion, and access. The following sections will cover the major literature on each type of PLA.

1.1.1 | Advanced Placement

AP allows high school students to take an exit exam for a high school course, and an institution may accept that exam score as equivalent to a postsecondary course, depending on the institution (College Board, n.d. a). According to the College Board (n.d. b), about 1.1 million students who

graduated from high school in 2022 took at least one AP exam, and 729,673 students scored a three or higher out of five on at least one exam, the score necessary to receive college credit. In Utah, about 32% of students who graduated in 2022 took an AP exam. About 23% of Utah students who graduated in 2022 scored a three or higher on an AP exam.

In a study of 48,230 students at six universities, researchers found that students who skipped their first course with AP credit performed similarly or better than students who did not skip (Fischer et al., 2023). This result held even at institutions that accepted lower AP exam scores for credit. This suggests that AP credit may cover the competencies of lower-level courses without affecting preparation for future courses. Additionally, a study of 1,464 students found that those who took rigorous courses, such as AP courses, had higher rates of college enrollment, persistence, and graduation (Morgan et al., 2018).

However, the benefits of the AP program may not be distributed evenly across the student population. The previously mentioned study of students who skipped an introductory course also found that systemic inequalities during high school predicted whether students earned eligible scores for credit (Fischer et al., 2023). Another study found that students in towns with a population of less than 25,000 have significantly less access to AP math courses than those in larger cities (Anderson and Chang, 2011). Additionally, previous work found significant gender (Moore et al., 2012; Morris & Slate, 2012), racial (Crusoe, 2023; Moseley, 2022; Shaw et al., 2013), and socio-economic gaps (Crabtree et al., 2019) in AP participation or scores. Finally, some evidence suggests that AP credit may not significantly improve GPA for students who attended high school in a rural, underprivileged area (Deaton, 2014).

Finally, some evidence suggests that higher AP/IB scores are associated with increased levels of stress and decreased mental health (Suldo et al., 2018). Therefore, these PLAs may present issues for those who suffer from certain psychopathologies or face other significant stressors both in- and outside of their academic life. Thus, students from certain backgrounds may gain credit from this type of PLA at a lower rate than other students.

1.1.2 | International Baccalaureate

International Baccalaureate (IB) is a standardized program that offers an internationally recognized diploma program and equivalency exams for individual courses (Laurent-Brennan, 1998). Currently, eight secondary schools in Utah offer IB diploma programs (IB Organization, n.d.), and in March 2022, IB launched a pilot of a fully online diploma program (Online DP pilot, 2023). Some universities offer credit for participation in IB courses, but it is not as standardized across universities in the US as AP credit (IB Community Blog, 2018). In 2021, USHE institutions standardized course equivalencies, and the eight degree-granting institutions use the same equivalency guidelines (n.d.). However, those guidelines do not grant credit for some core IB classes like Theory of Knowledge.

Much of the literature on IB focuses on qualitative questions about issues including self-efficacy and the history of IB (Brinkmann, 2023; Hegseth, 2023; Hill, 2018; Larson & Kurtyka, 2017). These studies suggest that students in the IB program perceive themselves as prepared for higher education because of the rigor of the program.

Like AP, some literature shows significant differences in participation in IB courses and programs by race and gender (Madden, 2022). Similar to AP, the stress induced by this program may limit students with certain disabilities and those with certain backgrounds (Suldo et al., 2018). Finally, access to these programs is more limited than that of AP; many students in Utah cannot attempt IB credit, even if they demonstrate the competencies.

1.1.3 | College-Level Examination Program and DSST

The College-Level Examination Program (CLEP) offers students an opportunity to receive credit for introductory courses on 34 subjects if they receive a passing score, typically 50/80, as determined by their institution. USHE institutions accept some CLEP scores for credit, but none of them give credit for all 34 exams. Students may take a CLEP exam on their own, or they may take it as part of a program for military members (CLEP Military Benefits, n.d.). Prior work suggests that CLEP credit awarded may improve retention rates, especially for certain demographic groups.

A regression discontinuity design (RDD) study compared those who received just passing scores to those who received barely failing scores on CLEP exams between 2008 and 2015 (Boatman et al., 2020). Those who just received CLEP credit had about a six percentage point higher associate degree completion rate. Current and former military students and students over 24 saw greater than average increases in completion rates at nine percentage points and seven percentage points, respectively. Those in the study who attempted a bachelor's degree had a one point increase in completion rate on average if they received CLEP credit. For bachelor's degree-seeking students, CLEP credit awards improved completion rates for Hispanic students and students over 24 years old

with increased rates of three percentage points each. This study also found that those who received CLEP credit saw an estimated two percentage point increase in estimated income.

CLEP has some implementation issues. While CLEP is significantly cheaper per test than most university credits, the cost may still be prohibitively expensive for low- to moderate-income families (Lopez, 2019). For students who take a CLEP exam, their institution of choice may not accept the credit for that class. As mentioned, USHE does not grant credit for all of the tests, possibly because the learning outcomes for some exams may not align with a specific class.

The US Department of Defense's Defense Activity for Non-Traditional Educational Support Subject Standardized Test (DSST) is similar to CLEP specific to the military but with more limited test offerings. There are 37 DSST subject exams (DANTES, n.d.). Exams cover subjects that may count for general education credit, such as "Introduction to Geography," but others cover highly specialized topics like "A History of the Vietnam War." For this reason, it faces the same issues with translating to institutional credit as CLEP and IB exams (Utah System of Higher Ed, n.d.). Thus, some service members may elect to take a CLEP exam when no equivelent DSST exam exists. The UDRC does not have access to data about DSST credit.

1.1.4 | Course Challenge and Language Equivalency Exams

Some institutions allow students to obtain credit for a course by taking an exam without enrolling in the course. An institution may also have a different process for language classes compared to other types of courses. For example, the University of Utah policy allows students to purchase credits for language courses based on language exam results (University of Utah: Department of Languages and Literature, n.d.). For non-language courses, students may petition to challenge a course in which they have never enrolled and that does not cover material from high school (Utah Admissions, n.d.). In both cases, students may receive pass/fail credit for the courses for which they tested out.

Whether a course challenge qualifies as a PLA depends on an institution's policies. For instance, the University of Utah's policy on non-language course challenges may not count as a PLAs, because the policy is designed for courses at another institution with limited transferability, not experience outside of higher education. However, course challenges could allow veterans to gain credit from their Joint Services Transcript (JST), equivalency credit for training during military service. In that case, the language policy could be a PLA, because language proficiencies can come from any experience outside of an academic environment.

The literature for this type of PLA is limited, and many mentions of it appear in studies of PLAs generally, not about the effects of gaining credit from course challenge specifically. For example, course challenge is mentioned as an option for credit via exam in some California institutions (Valenzuela et al., 2016). This overview of policy finds that the institutions in the study vary widely in their opportunities to receive credit with course challenge. Another study examined outcomes of learners over 25 years old in community college, but this study reported outcomes of all exam-type PLAs including AP, CLEP, and challenge exams together (Tannehill et al., 2008).

1.1.5 | Portfolio and Oral Examination

According to a 2018 report by CAEL, students who received credit via portfolio had the highest rates of persistence and completion compared to any other type of PLA (Klein-Collins and Hudson, 2018). Portfolio evaluations include scales with multiple assessors, and the requirements can be mapped to specific occupations (Sherron et al., 2019). While there is some guidance from the Department of Labor, institutions seem to be responsible for developing their own programs to conduct portfolio or oral assessments for this type of PLA. This could lead to significantly different processes between institutions, and an institution may have difficulty funding the development of a thorough portfolio program.

Further research highlights the limitations of portfolio PLAs. While this type of PLA may facilitate problem solving and critical thinking about their experience (Rust & Brinthaupt, 2017), portfolios may not provide learning benefits beyond that of other PLAs. Also, even those who receive credit for portfolios may find the process unclear as to how it connects to their education within the institution (Dolleman, 2022). Finally, some work suggests that low levels of agreement between assessors may affect validity (Stenlund, 2013).

Currently, the technical colleges are the only USHE institutions to count this type of PLA toward a credential. Competency based programs are well suited to this type of PLA, because the speed with which students move through the program is tied to students' demonstration of abilities, not necessarily the number of classes or credits on their transcript. While seven of the eight institutions offer some kind of technical certificate, the degree-granting institutions do not seem to offer this PLA.

2 | Methods

2.1 | Sample

The data for this study comes from the Utah State Board of Education (USBE) and USHE via the Utah Data Research Center (UDRC). This study focuses on those who graduated from a Utah public high school between 2012 and 2016 and later enrolled in an associate or bachelor's degree program at a USHE institution. Starting a degree program is defined here as being a first-time, non-high school student seeking either associate or bachelor's degree for at least one term between the summer term 2012 and the spring term of 2020 (N = 71,391). In all models, the sample is pulled from the first institution from which they enrolled. In the time-to-degree and drop-out/stopout analysis, the sample does not include students who later transferred away from the first institution in which they enrolled to reduce the confounding effect of transferring (N_Associates= 26,890, N_Bachelors= 30,950).

Most student demographic data including race, gender, high school low-income markers, ACT composite scores, and eligibility for select programs such as language assistance (ELL) or individualized education program (IEP), come from the USBE student database via UDRC. USHE provided additional demographic data when not available through USBE. Data including AP and CLEP credits received, the number of concurrent enrollment credits received, and other enrollment data, including Pell eligibility, degree level, Classification of Instructional Programs (CIP) major code, and institution of enrollment are provided by USHE. Institution of enrollment was included to reflect the differences in the student body and mission of each institution. Student self selection and other holistic factors may affect outcomes. The inclusion of institution of enrollment does not analyze the impact of any specific policy or procedure of a given institution. Finally, other fields were calculated based on this data including the percentage of part-time term enrollments and whether a student had a gap of more than one school year between high school graduation and enrollment in a degree program. Race has been standardized to use the IPEDS (Integrated Postsecondary Education Data System) racial and ethnic categories: Asian, Black/African American, Hispanic/Latine, American Indian/Alaskan Native, Multi-ethnic, Native Hawaiian/Pacific Islander, and white/Caucasian.

2.2 | First-Term GPA

This study uses a linear model with corrective transformations to predict first-term GPA. The predictive variables include the number of AP credits received, demographic factors, college readiness as measured by the ACT, number of CE credits, and institution:

$$y_i(first\ term\ GPA) = \ln(AP\ Credits) + \ln(ACT) + \ln(CE\ credits) + Gender + Section504 + HS\ Low\ Income + Pell\ Eligibility + Title\ I\ HS + ELL + Race_i + Part\ time\ enrollment + Institution_i + intended\ bachelor's\ degree + start\ term + enrollment\ gap + (Two - Digit\ CIP\ code) + \ln(AP) * HS\ Low\ Income + \ln(AP) * Pell\ Eligibility + \ln(AP) * Race_i$$

Equation 1: First Term GPA

The predicted outcome is the first-term grade point average (GPA) for individual *i*. This study theorizes that these variables could have decreasing marginal returns to GPA for each additional credit received. To improve fit and more accurately represent the relationship, the model uses the natural log of AP and CE credits. ACT score has a normal distribution. However, previous work has found decreasing marginal returns to achievement outcomes from standardized tests, so we hypothesize decreasing marginal returns to GPA for higher ACT scores similar to higher levels of PLA or CE credit (Driscoll et al., 2008). For this reason, the model also uses the natural log of ACT score. This model also includes interaction terms between the natural log of AP credits and: eligibility for free/reduced lunch (FARMs) during their last year of high school, eligibility for Pell Grants, and racial/ethnic identity. Previous research shows that students from minoritized racial/ethnic groups and low-income backgrounds may see additional benefits to programs like AP compared to middle- or high-income peers (Klein-Collins et al., 2020 p. 30; Klein-Collins et al., 2021). The inclusion of these interactions tests the previous findings with this sample. Table 1 lists and defines all of the independent variables in the model in alphabetical order.

After accounting for the logarithmic nature of certain variables, this model meets all of the assumptions of ordinary least-squares regression. Some variables including Pell eligibility and free/reduced lunch are correlated, but according to the tests, none of the variables are correlated to a degree that would affect the integrity of the model.

2.3 | Time-to-Degree

Cox Proportional Hazard models, a survival model, were employed to understand the relationship between variables and time-to-degree. A systematic review of PLA-related research found that only 11 of the 47 articles in the review used empirical methods to examine the effects of PLAs (Boden et al., 2021). Of those that used empirical methods, many used propensity score matching (PSM) to assess the effects of PLAs on time-to-degree and completion rates. However, some work suggests that PLAs might not be a good fit for PSM (May et al., 2014). PSM assumes that there is some overlap between the propensity scores of the treatment and control groups. However, family and demographic factors predict the likelihood of participation in programs to an extent that the propensity scores of program and

Table 1: Predictors of First-Term Grade Point Average (GPA)

	Variable Description
AP	The total number of credits that a student has received from their institution for Advanced Placement exams as reported to USHE
ACT	A student's highest score on the American College Test as reported by USBE
Concurrent Enrollment	The number of credits a student received for enrolling in an institution while also enrolled in a high school as reported by USHE
High School GPA	A student's cumulative GPA during their last enrollment period of high school as reported by USBE
Part-Time Enrollment	Whether a student is enrolled in fewer than a full-time level of credits during their first-term
Low-Income	Student was eligible for free/reduced lunch during the last year of high school as reported by USBE
Pell Eligibility	Whether a student was eligible or received a Pell Grant during any enrollment as reported by USHE
Title I High School	Whether the student graduated from a high school listed on USBE's Title I school list
Section 504	Whether a student had an IEP during their last year of high school as reported by USBE
Enrollment Gap	Whether a student enrolled at an institution during the academic year after their high school graduation as calculated based on USBE graduation and USHE enrollment data
Institution	The USHE institution where the student had their first non-high school, degree-seeking enrollment
CIP Code	The two-digit CIP family for the student's registered course of study
Intended Bachelor Degree	Whether a student is enrolled in a bachelor degree program during their first-term as reported by USHE
Starting Term	The term of year of first enrollment as reported by USHE with Fall as the default
Gender	Gender assigned by USBE as of high school graduation (Male=1, Female=0)
Race	Race assigned by USBE. If missing, then race assigned by institution as reported in IPEDS (standardized to IPEDS data type)
ELL	Whether marked as an English Language Learner as of their last year of high school as reported by USBE
AP*Low-Income	An interaction between the number of AP Credits and high school low-income marker
AP*Pell Eligibility	An interaction between AP Credits and Pell eligibility during their first-term

Table 2: Predictors of Time to Degree and Stopout/Dropout

	Variable Description
AP	The total number of credits that a student has received from their institution for Advanced Placement exams as reported to USHE
CLEP	The total number of credits that a student has received from their institution for College-Level Examination Program exams as reported to USHE
ACT	A student's highest score on the American College Test as reported by USBE
Concurrent Enrollment	The number of credits a student received for enrolling in an institution while also enrolled in a high school as reported by USHE
High School GPA	A student's cumulative GPA during their last enrollment period of high school as reported by USBE
Percent Part-time	The percentage of terms for which a student was enrolled under the full-time credit hour threshold
Low-Income	Whether a student was listed as eligible for free/reduced lunch during their senior year of high school as reported by USBE
Pell Eligibility	Whether a student was eligible or received a Pell Grant during any enrollment as reported by USHE
Title I High School	Whether the student graduated from a high school listed on USBE's Title I school list
Section 504	Whether a student had an IEP during their senior year of high school as reported by USBE
Institution	The USHE institution where the student had their first non-high school, degree-seeking enrollment
CIP Code	The two-digit CIP family for the student's registered course of study
Gender	Gender assigned by USBE as of high school graduation (Male=1, Female=0)
Race	Race assigned by USBE. If missing, then race assigned by institution as reported in IPEDS (standardized to IPEDS data type)
ELL	Whether a student was coded as an English Language Learner during their last year of high school as reported by USBE
Race*AP	An interaction between the number of AP credits received and each racial/ethnic marker
Percent Part-time*Pell Eligibility	An interaction between the percentage of part-time enrollments and Pell eligibility

non-program participants do not overlap. Therefore, this study may not meet the requirements for PSM. Consequently, this study uses survival models with covariates to predict both time-to-graduation and time to dropout/stopout. Together with hazard models, survival models can estimate the contribution of each variable while modeling the non-linear nature of the probability of an event over time without requiring groups to overlap like PSM. The function of the survival and hazard models is as follows:

$$h(t) = h_0(\mathrm{t}) * \exp\,(\ln(AP\ Credits) + \ln(CLEP\ Credits) + \ln(ACT) + \ln(CE\ credits) + Gender + Section504 + HS\ Low\ Income + Pell\ Eligibility + Title\ I\ HS + ELL + Race_i + Part\ time\ enrollment + Institution_i + intended\ bachelor's\ degree + start\ term + enrollment\ gap + (Two\ digit\ CIP_i) + \ln(AP) * Race_i + Part\ time\ enrollment * Pell\ Eligibility)$$

Equation 2: Time-to-Degree

where, t represents length of time in a degree program, and h_0 is the baseline hazard.

Time is measured in enrolled terms with three possible terms per year: summer, fall, and spring. Graduation is defined as receiving a credential for a degree for the lowest program for which a student was enrolled. If, for example, a student was enrolled in a five year bachelor's program that awarded both a bachelor's and a master's degree on the same date, only the bachelor's degree would be included. The models control for two-digit CIP codes to capture some of these program differences. Regardless of the program, this study recognizes that students may begin their enrollment at different times, or they may forego enrollment, especially during the summer term, for various reasons. Therefore, calendar time may not accurately reflect the amount of time a student spends on a credential. As a result, this study measures the number of enrollments to graduation.

The predictive models of time-to-degree include several covariates including the primary independent variables of interest, PLA participation, as well as demographic and institutional factors (see Table 2). Like first-term GPA, models of time-to-degree also include interaction terms particularly, AP credits, race, income, and part-time enrollment. Previous work suggests that some groups of students may benefit more from PLA participation than others (Klein-Collins et al., 2020). Other predictors like the percentage of part-time enrollments out of the total number of enrollments may lengthen time-to-degree, because the student may be taking fewer credit hours than expected. Previous work suggests that socioeconomic factors influence students' decision to enroll part-time, but increased aid can mitigate some of these effects (Goldrick-Rab & Han, 2011). For this reason, the model includes interactions between part-time enrollment percentage and income indicators.

2.4 | Retention

This study uses a Cox proportional hazards model to predict the factors that may affect if or when a student might dropout or stopout of a degree program. These models are related to survival models, except they predict the increased risk of an outcome based on the covariates (Martinussen, T & Scheike, T. H. 2006).

$$h(t) = h_0(\mathrm{t}) * \exp\,(\ln(AP\ Credits) + \ln(CLEP\ Credits) + \ln(ACT) + \ln(CE\ credits) + Gender + Section504 + HS\ Low\ Income + Pell\ Eligibility + Title\ I\ HS + ELL + Race_i + Part\ time\ enrollment + Institution_i + intended\ bachelor's\ degree + start\ term + enrollment\ gap + (Two\ digit\ CIP_i) + \ln(AP) * Race_i + Part\ time\ enrollment * Pell\ Eligibility)$$

Equation 3: Risk of Dropout

For this study, dropping out or stopping out is defined as not enrolling in the primary institution or another USHE degree-granting institution for more than seven terms (2.5 years). Other work on the subject uses a one academic year window (Hush et al., 2021). However, a number of Utah students who take 18 to 24 months off to serve a mission for the Church of Jesus Christ of Latter-Day Saints (The Church of Jesus Christ of Latter-Day Saints, n.d.). For this reason, dropouts or stopouts require more time to assess.

The retention models use many of the same covariates as the models predicting time-to-degree, since prior work suggests that many of the predictors may invert that relationship with respect to retention. Finally, the retention models include all of the same interaction terms for the same reasons as listed in the time-to-degree models.

2.5 | Software

The data was cleaned as part of the query of the UDRC data warehouse. Further cleaning and regression analysis used R ver 4.2.3 with the tidyverse package ver 2.0.0. The survival and hazard models were performed using the survival package ver 3.5-8, and assumptions for those models were checked using random forest models using the ranger package ver 0.16.0.

3 | Results

3.1 | Descriptive Statistics

The majority of students do not participate in PLA programs regardless of term or degree program. Tests of the model found significant skewness in the AP and CE data. The median number of AP and CLEP credits is 0.0 for all three groups (see Table 3). Students had more AP credit than CLEP credit on average. The mean number of AP credits received as 2.7, 1.4, and 5.3 credits for students in their first-term, associate degree program, and bachelor's degree program, respectively. This is compared to an average of .02 CLEP credits for students in associate

Table 3: PLA Participation and College Readiness of Students during First-Term, Associate Degree Program, and Bachelor's Degree Program

Variable	Statistic	First-Term	IGP %	Control %
AP	Mean	2.7	1.4	5.3
	Median	0	0	0
	St. Dev.	7.8	6.3	10.1
CLEP	Mean	-	0.02	2.8
	Median	-	0	0
	St. Dev.	-	0.8	9.2
ACT	Mean	21	20.2	23.4
	Median	21.7	20	23
	St. Dev.	4.7	4.3	4.7

and 2.8 CLEP credits for those in bachelor's degree programs. Despite a generally low participation rate, students in bachelor programs participated in PLAs to a greater degree given the average difference of 3.9 AP credits and 2.78 CLEP credits between students in associate and bachelor programs.

In these samples, participation in PLA programs varies based on race (see Figure 1). Students who identify as Latine or white have similar distributions to each other and the overall distribution whereas students who identify as Black, Native American, or Pacific Islander have distributions more skewed toward 0 than the other groups. The distribution for those who identify as Asian seems to have the highest proportion of students who participate in AP of any racial group. All distributions are heavily skewed toward 0 with medians at 0.

Based on ACT scores, students in bachelor's degree programs are more college-ready compared to all first-term and associate degree-seeking students (see Table 3). First-term students have an average ACT score of 21 and a median of 21.7. Students in associate degree programs have the lowest average ACT at 20.2 with a median of 20, and those enrolled in bachelor's degrees have the highest average ACT at 23.4 with a median of 23. In all cases, ACT scores are normally distributed.

With respect to enrollment factors, most students start their first-term during the fall term with 80% of students starting in Fall, 16% in Spring, and 4% in Summer term (see Table 4). The plurality of first-term students start at Salt Lake Community College (20%). Southern Utah University (SUU) had the smallest share of students in their first-term (5%). This pattern continues with students pursuing associate degrees with 29% at SLCC and less than 1% at SUU. The largest portion of students in the sample start their bachelor's degrees at Utah State University (USU) (27%), and the smallest portion (5%) start at Utah Tech University (Utah Tech).

The primary outcomes of concern in this study include first-term GPA, the number of enrollments to graduation, and the number of enrollments to dropout or stopout. Students enrolled in degree programs finish their first term with an average GPA of 2.7 (SD = 1.2).

Table 4: Enrollment Factors of Students during First-Term, Associate Degree Program , and Bachelor's Degree Programs

Variable		First-Term	Associate	Bachelor's
Term Start	Summer	4%	-	-
	Fall	80%	-	-
	Spring	16%	-	-
Institution	SLCC	20%	29%	-
	Snow	8%	17%	-
	SUU	5%	<1%	10%
	U of U	12%	-	24%
	USU	17%	6%	27%
	Utah Tech	7%	11%	5%
	UVU	18%	22%	19%
	Weber	13%	15%	15%

Figure 1: Frequency of AP Credits Awarded by IPEDS Race/Ethnicity Identifiers

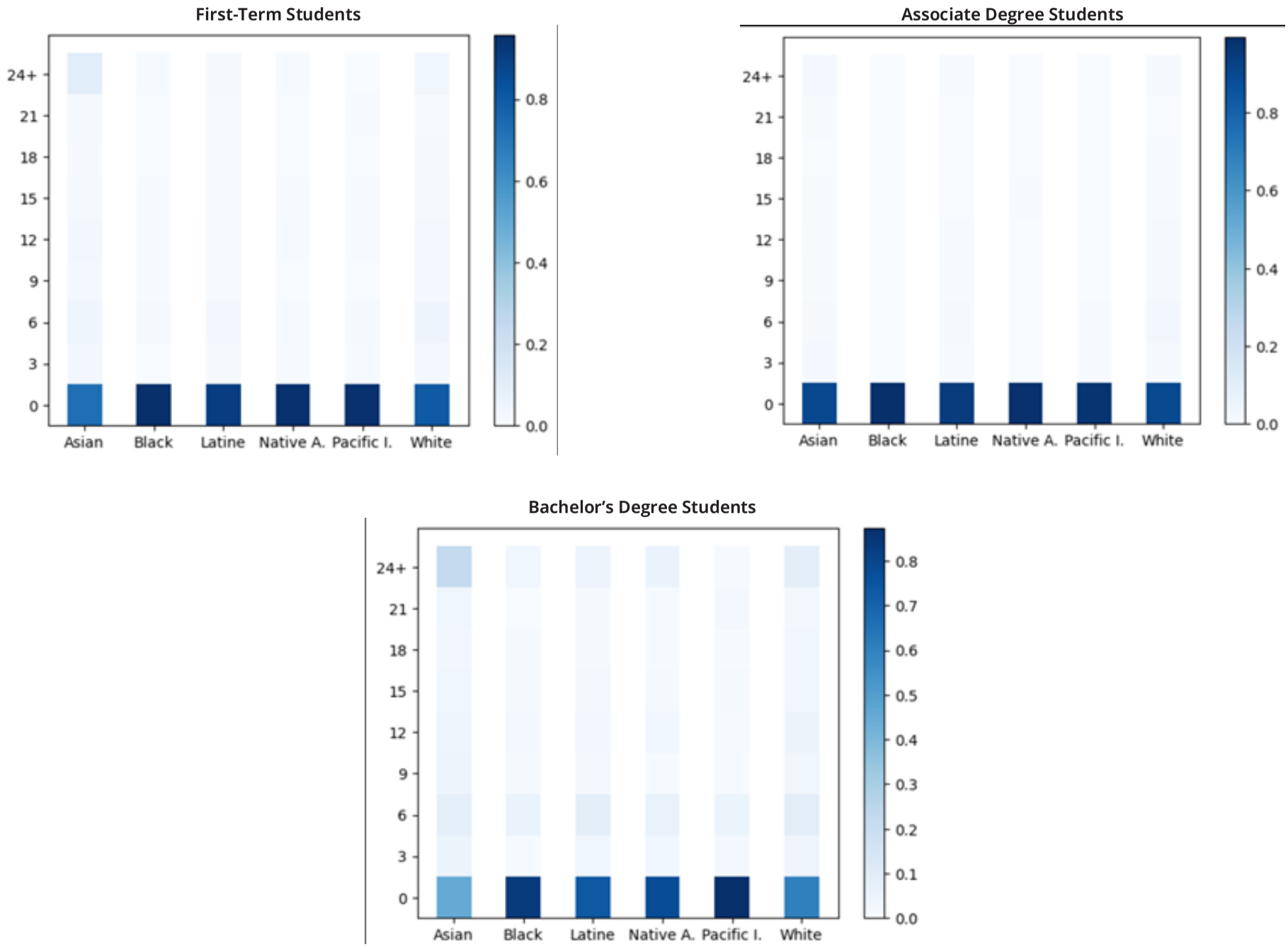


Figure 2: Density of First-Term GPA

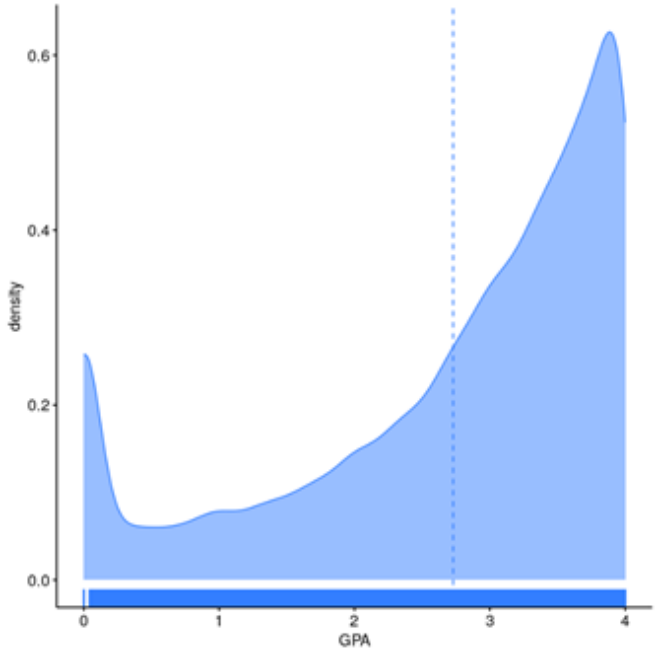
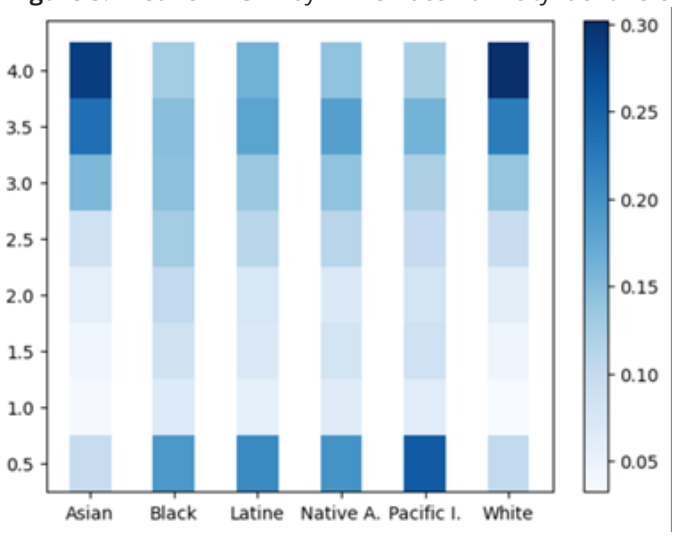


Figure 3: First-Term GPA by IPEDS Race/Ethnicity Identifiers



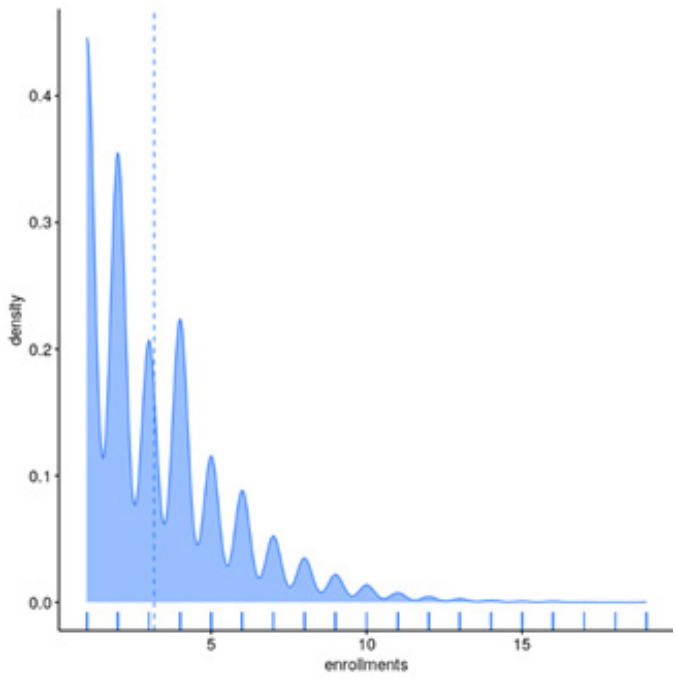
The distribution of first-term GPAs is somewhat bimodal distribution with peaks at 0 and about 3.8 (see Figure 2).The median is 3.1, 0.4 GPA points above the mean of 2.7. First-term GPA varies by ethnicity. Students in the sample who identify as Asian or white had higher median GPAs during their first-term than those who identified as Black, Latine, Native American, or Pacific Islander (See Figure 3).

Concerning the other outcomes, students in associate programs enroll for fewer terms as expected compared to bachelor's, and they are more likely to dropout or stopout of their program. Associate students enroll for an average of 3.2 terms (Median = 3.0, SD = 2.3). The variation in the number of enrollments is wide with the middle 50% of students enrolling between one and four terms. About 26% of students enrolled in an associate degree in this sample did not do more than one term at their chosen school during the study period. In contrast, students in bachelor's programs enrolled for an average of 5.9 terms during the study period (Median = 6.0, SD = 3.5), and only about 12% of students in bachelor's degree programs enrolled for just one term during the study period. Figure 4 shows the frequency of enrollment length for each degree type.

Students in associate and bachelor's programs graduated at similar rates (27%), but those in

Figure 4: Density of enrollment length by degree type (with mean enrollments)

Associate



Bachelor's

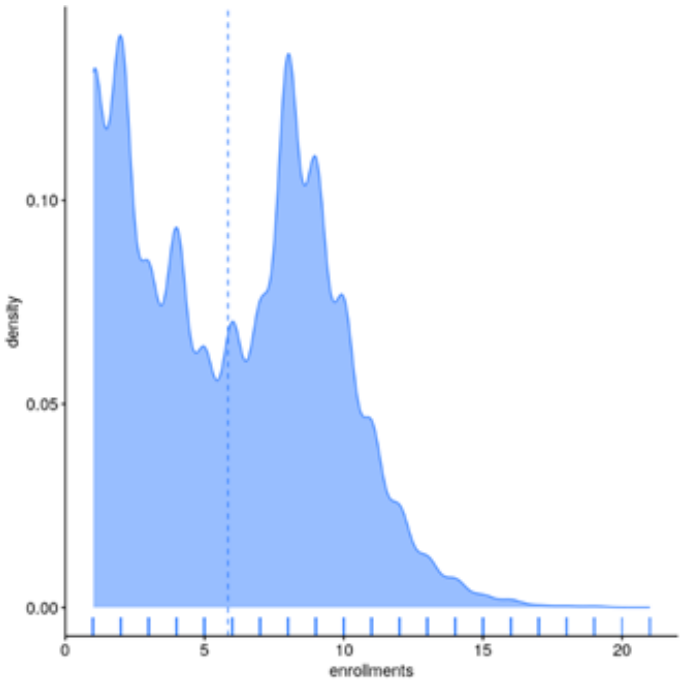


Table 5: Outcomes for Associate and Bachelor's Degree-Seeking Students

		Associate	Bachelor's
Terms Enrolled			
	Mean	3.2	5.9
	Median	3.0	6.0
	St. Dev.	2.3	3.5
Graduation Rate		27%	27%
Dropout Rate		46%	29%

associate programs were much more likely to dropout or stopout (see Table 5). About 46% of students pursuing an associate degree left or took a break of longer than 2.5 years without finishing a degree or transferring to another institution versus about 29% of bachelor's degree students during the same period.

Concerning broader demographics, students in their first term and in associate programs are generally similar, but students in bachelor's programs more frequently identify as white, male, and from a wealthier background during high school (see Table 6). Racially, student in their first-term and seeking associate degrees are 12% and 13% Latine identifying and 81% and 80% white identifying, respectively. However, 8% of students in bachelor's programs identify as Latine, and 85% identify as white. Concerning gender, 52% and 53% of first-term and associate students identify as female versus 50% of bachelor's students. Finally, 16% and 17% of first-term and associate degree students qualified for free/reduced lunch during their senior year of high school, but only 12% of students in bachelor's programs qualified for the same program. Pell eligibility does not follow this pattern however. 33% of first-term students are eligible for Pell Grants whereas 35% of associate and 41% of bachelor's degree students are Pell eligible.

Table 6: Demographic Make-up of Students during First-Term, Associate Degree Program, and Bachelor's

Variable		First-Term	Associate	Bachelor's
Total Students		71,391	26,890	30,950
Race	Asian	2%	2%	3%
	Black	1%	1%	<1%
Institution	Latine	12%	13%	8%
	Multiracial	2%	2%	2%
	Native American	<1%	1%	<1%
	Pacific Islander	1%	1%	<1%
	White	81%	80%	85%
Gender	Female	52%	53%	50%
	Male	48%	46%	50%
HS Factors	ELL	1%	1%	<1%
	Free/Reduced Lunch	16%	17%	12%
	Section 504	<1%	1%	<1%
	Title I HS	7%	7%	8%
Enrollment Factors	HS Enrollment Gap	31%	-	-
	Bachelor's Intent	50%	-	-
	Part-time Enrollment	26% in first-term	33% of enrollments	14% of enrollments
	Pell Eligibility	33%	35%	41%

Table 7: Predictors of First-Term Grade Point Average (GPA)

Effect	Estimate	*SE*	Lower Bound	Upper Bound	*t*	*p*	
(Intercept)	-0.2	0.1	-0.4	-0.01	-2.0	0.04	*
log(AP)	0.02	0.01	0.01	0.03	4.7	2.4E-06	***
Low-Income	-0.08	0.03	-0.1	-0.02	-2.8	0.005	**
Pell Eligible	-0.08	0.02	-0.1	-0.04	-4.3	1.9E-05	***
log(CE)	0.01	0.001	0.01	0.02	10.4	< 2e-16	***
log(HS GPA)	0.06	0.004	0.06	0.07	16.2	< 2e-16	***
Part-time enrollment	-0.4	0.01	-0.4	-0.4	-32.7	< 2e-16	***
Title I HS	0.06	0.02	0.03	0.09	3.6	0.0003	***
log(ACT)	1.1	0.02	1.0	1.1	44.1	< 2e-16	***
Male	-0.2	0.01	-0.2	-0.2	-25.7	< 2e-16	***
Section 504	-0.2	0.04	-0.3	-0.08	-4.0	7.4E-05	***
Intended Bachelor's Degree	0.03	0.01	0.002	0.06	2.1	0.04	*
Start term: Spring	0.04	0.01	0.01	0.06	3.2	0.002	**
Start term: Summer	0.4	0.02	0.4	0.5	17.4	< 2e-16	***
ELL	0.3	0.05	0.3	0.4	7.4	1.4E-13	***
Enrollment Gap	0.3	0.01	0.3	0.4	33.3	< 2e-16	***
log(AP):Low-Income	0.01	0.003	0.001	0.01	2.2	0.03	*
log(AP):Pell Eligible	0.01	0.002	0.002	0.01	2.7	0.006	**
Pell Eligible:Part-time	0.15	0.02	0.11	0.2	6.84	7.8E-12	***

This table contains an abbreviated output from the model of first-term GPA. Asterixis represent significance: * p<0.05, ** p<0.01, *** p<0.001. Addition covariates include the rest of the CIP codes, institution effects, racial, and certain interaction effects. See Appendix Table A-5 for a full table of results

3.2 | First-Term GPA

The model of first-term GPA shows several factors have a statistically significant effect on the outcome of interest. Concerning PLAs, the model estimates that for every one unit increase in the natural log of AP credits received, GPA is estimated to increase by about 0.02 (see Table 7).

The relationship between GPA and AP is not linear. As the number of AP credits increases, the effects to GPA are estimated to decrease for every additional AP credit (see Table 8). According to the model, this result is statistically notable (p<.001).

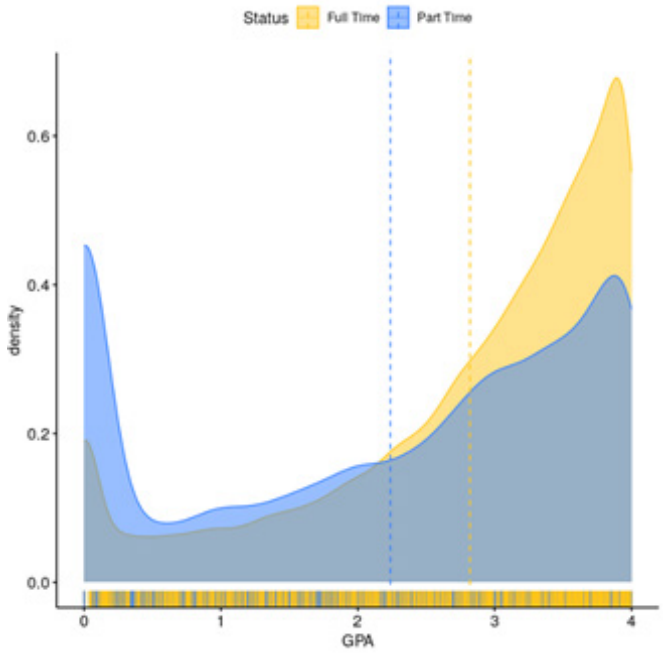
Table 8: Estimated Increase in GPA per AP Credit

# of Credits	GPA Points
3	1.062
6	1.127
9	1.197
12	1.271
15	1.350
18	1.433
21	1.522

Other high school related factors may positively effect first-term GPA. Like AP, concurrent enrollment (CE) credit also allows students to receive post-secondary credit, but CE credit has a lower estimated effect (0.01) than AP (0.02). The effect of CE was statistically significant (p<0.001). College readiness as measured by ACT score predicted first-term GPA to a significant degree with an estimated increase of 1.09 in GPA for every 1-point increase in the natural log of ACT score. Like with AP and CE, the effect is nonlinear, and the t-score indicates that the result is highly unlikely if ACT score is not a predictor of first-term GPA (see Table 7).

Participation in certain programs such as ELL, FARMs, eligibility for an IEP under Section 504, or attending a high school designated to receive Title I funding also predicted first-term GPA. According to the model, students who were designated as ELL were predicted to have a GPA that was on average 0.34 GPA points higher than other students (see Table 7). Students participating in FARMs had an average of 0.07 GPA points lower than other students, but this effect seemed to be mitigated slightly for students who also received AP credits. Students who were eligible for services

Figure 5: Density of First-Term GPA by Part-time/Full-time Status



under Section 504 were predicted to have a lower GPA their first-term, on average. Finally, those who attended a high school designated as Title I were predicted to have a slightly higher GPA than students from other high schools.

Factors like when, how, and where students enrolled in an institution also predicted first-term GPA. For instance, the model predicted that those who enrolled in an institution more than one school year after their high school graduation on average had a higher GPA by an average of 0.34 GPA points (see Table 7). Those who registered into a bachelor's degree during their first term also had higher GPAs on average, though to a lesser degree. Area of study seemed to predict first-term GPA to varying degrees with some areas like Education or Humanities being associated with higher first-term GPAs (see Appendix Table A-5). Those who began in the spring or summer terms had higher GPAs on average by 0.04 and 0.4 points, respectively, as compared to those who started in the fall term. Students enrolled part-time their first term had, on average, significantly lower GPAs than full-time students (see Figure 5). However, this effect was somewhat mitigated for part-time students who also received financial aid in the form of Pell Grants. Finally, the institution that students attended for their first-term predicted first-term GPA with students who started at USU, Utah Tech, and Weber State University having lower first-term GPAs on average than students at other schools (see Appendix Table A-5).

Lastly, students who identify with certain genders, racial groups, and socioeconomic characteristics seemed to have systematically different GPAs at the end of their first term. Specifically, those students identify as male had an average GPA 0.24 points lower than other students (see Table 7). The analysis comparing students used students who identify as Asian as the default group, this group is first alphabetically. According to that analysis, students who identify as Black, Hispanic, multiethnic, Pacific Islander, and white have lower GPAs in their first term with the largest negative effects observed in multiethnic and non-white groups, especially students who identify as Pacific Islander. AP credits did not mitigate these effects to a significant degree for any ethnic group. Finally, students who were eligible to receive Pell Grants during their first term had an average GPA that was 0.09 points lower than other students. This was somewhat mitigated for those who also received AP credit.

3.3 | Time-to-Degree

3.3.1 | Associate Degrees

The model of time-to-degree shows that PLAs, certain high school factors, enrollment, and demographic factors predict the number of enrollments before a student finishes an associate's degree.

Concerning PLAs, students who received AP credits were predicted to finish significantly faster (see Table 9). Similarly, students who received CLEP credits also finished faster than other students, though the effect was less pronounced compared to that of AP credits.

Regarding high school factors, ACT score had the highest estimated impact on time-to-degree with higher scores predicting fewer enrollments

Figure 6: Number of Enrollments to Degree (Associate)

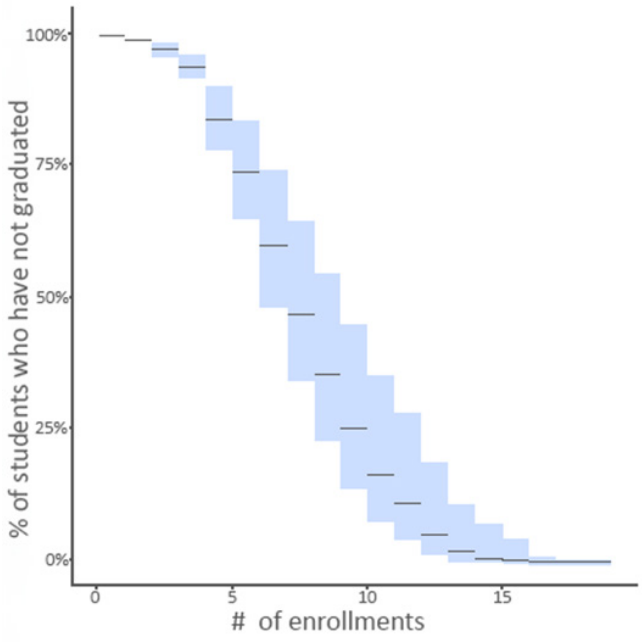


Table 9: Abbreviated Predictors of Time-to-Degree (Associate)

	Coefficient	*SE*	p	
log(AP)	7.4E-02	1.1E+00	2.1E-05	***
Black	-2.7E-01	7.6E-01	0.7	
Latine	-1.7E-01	8.5E-01	0.3	
Native American	1.4E-01	1.2E+00	0.8	
Multi-ethnic	-3.3E-01	7.2E-01	0.1	.
Pacific Islander	-3.5E-01	7.0E-01	0.4	
White	-2.1E-01	8.1E-01	0.1	
Percent Part-time	-2.1E+00	1.3E-01	< 2e-16	***
Pell Eligibility	-1.4E-01	8.7E-01	2.8E-05	***
log(CE)	5.7E-02	1.1E+00	< 2e-16	***
log(CLEP)	6.1E-02	1.1E+00	0.001	**
Low-Income	-3.3E-02	9.7E-01	0.4	
Title I HS	6.1E-02	1.1E+00	0.3	
log(HS GPA)	7.1E-02	1.1E+00	1.9E-06	***
log(ACT)	1.5E+00	4.5E+00	< 2e-16	***
Male	-2.9E-01	7.5E-01	< 2e-16	***
Section 504	-1.1E-01	9.0E-01	0.5	
ELL	4.7E-02	1.1E+00	0.9	
Percent Part-time:Pell Eligibility	1.2E+00	3.2E+00	< 2e-16	***

This table contains an abbreviated output from the model of first-term GPA. Asterixis represent significance: * p<0.05, ** p<0.01, *** p<0.001. Addition covariates include the rest of the CIP codes, institution effects, racial, and certain interaction effects. See Appendix Table A-1 for a full table of results).

to degree. High school GPA also significantly predicted time-to-degree with a magnitude similar to AP credits. Students who received concurrent enrollment credit had a shorter average time-to-degree with a magnitude similar to that of CLEP credit. Students who participated in ELL, FARMs, Section 504, or who attended a Title I high school did not seem to have systematically different outcomes than other students according to this model (see Appendix Table A-1).

Enrollment and institutional factors have some of the largest effects on time-to-degree. Several two-digit CIP families significantly predicted the number of enrollments to graduation. Students with majors in Education, Humanities, Precision Production, Psychology, Family and Consumer Sciences, and Interdisciplinary Studies finished faster on average. Students in Engineering and the Performing Arts had more enrollments to graduation (see Appendix Table A-1). As students enrolled for more terms part-time, their number of enrollments to graduation increased with the largest magnitude of all predictors in this model. This effect was mitigated by about half for part-time students who received Pell Grants. Enrollment institution also predicted time-to-degree. On average, students enrolled at other associate degree-granting institutions finishing in fewer enrollments on average than those at SLCC, the default in this model. Students at SUU and Utah Tech were predicted to finish almost one term faster.

Finally, demographic factors significantly predict graduation outcomes as well. Students identified as male were associated with more enrollments to graduation (see Table 9). Race alone was not a significant predictor of time-to-degree, but some interactions between race and AP were statistically significant. Specifically, students with AP credits who identified as white or multiethnic were associated with a slight increase in time-to-degree suggesting that the benefits diminish somewhat for these groups at high levels of AP credit. Lastly, Students eligible for or who received Pell Grants took longer to finish their associate, on average, but the interaction between part-time enrollment and Pell Grants was associated with significantly shorter time-to-degree.

3.3.2 | Bachelor's Degrees

Overall, fewer factors seemed to predict the time to bachelor's degrees compared to the model of time to associate degree.

For instance, AP credits still predicted a shorter time-to-degree, but CLEP credits were no longer

Figure 7: Number of Enrollments to Degree (Bachelor's)

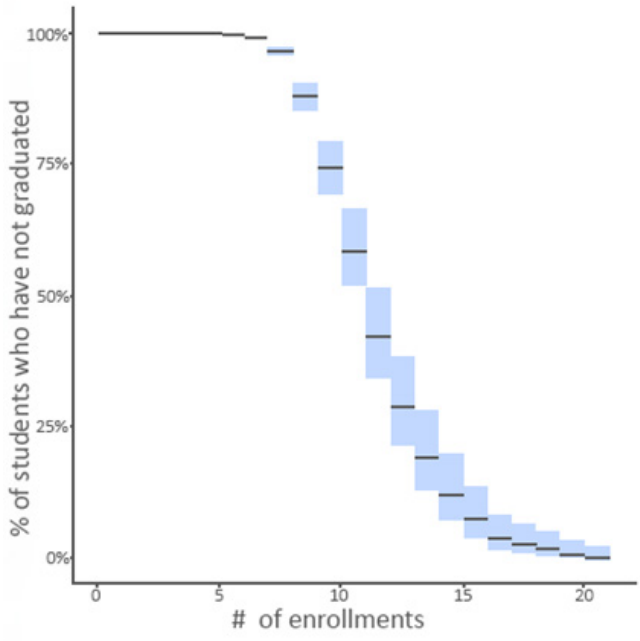


Table 10: Abbreviated Predictors of Time-to-Degree (Bachelor's)

	Coefficient	SE	p	
log(AP)	2.2E-02	9.4E-03	0.02	*
Black	-1.7E-01	2.1E-01	0.4	
Latine	7.4E-02	7.5E-02	0.3	
Native American	-1.4E-01	2.7E-01	0.6	
Multi-ethnic	1.4E-01	9.5E-02	0.2	
Pacific Islander	3.3E-01	2.6E-01	0.2	
White	1.2E-01	5.5E-02	0.03	*
Percent Part-time	-4.2E+00	1.1E-01	< 2e-16	***
Pell Eligibility	-2.5E-01	3.4E-02	1.8E-13	***
log(CE)	2.5E-02	2.1E-03	< 2e-16	***
log(CLEP)	6.6E-03	3.8E-03	0.1	.
Low-Income	9.8E-02	4.7E-02	0.04	*
Title I HS	-5.1E-02	4.9E-02	0.3	
log(HS GPA)	8.7E-03	9.4E-03	0.4	
log(ACT)	1.1E+00	8.3E-02	< 2e-16	***
Male	-1.4E-01	2.5E-02	3.8E-08	***
Section 504	-1.4E-01	1.7E-01	0.4	
ELL	-2.7E-01	2.9E-01	0.4	
Percent Part-time:Pell Eligibility	3.3E+00	1.1E-01	< 2e-16	***

This table contains an abbreviated output from the model of first-term GPA. Asterixis represent significance: * p<0.05, ** p<0.01, *** p<0.001. Addition covariates include the rest of the CIP codes, institution effects, racial, and certain interaction effects. See Appendix Table A-3 for a full table of results).

associated with fewer enrollments-to-degree to a statistically notable level. The average effect size of AP credit was less than a third of that in the model of time-to-associate degree. Also, not all groups of students benefitted from AP credits equally. Students who identify as Black or African American experienced somewhat less benefit from AP.

Some high school factors still significantly predicted time to bachelor's degree, though these too seemed to have diminished effects. Concurrent enrollment credits received predicted a shorter time to bachelor's degree to a similar degree as AP credit (b = .03, z = 12.28, p<.001). Students with higher ACT scores were predicted to finish in fewer enrollments to a similar magnitude as students seeking associate degrees (b = 1.08, z = 13.17, p <.001). Unlike the model for associate degrees, participation in FARMs was associated with a slight decrease in time to bachelor's degrees. However, variations in high school GPA, ELL, Section 504 IEP programs, or graduation from a Title I high school did not have significantly different outcomes from the rest of the sample.

Like with associate degree seekers, enrollment-related factors predict the time to bachelor's a degree. The adverse outcomes associated with part-time enrollment nearly doubled in magnitude from associate to bachelor's degrees. Two-digit CIP families seemed to have a stronger association with the number of enrollments-to-graduation than with associate degrees. Major families associated with a shorter time-to-degree on average include Business, English, Journalism, and Psychology (see Appendix Table A-3). Computer Science, Engineering, and Humanities CIP families predicted longer time to graduation. Institutions also seemed to affect time-to-degree. Bachelor's degree students at Utah State University, the University of Utah, and Utah Valley University finished in fewer enrollments on average, and those at Weber State University finished over a longer period (see Appendix Table A-3).

Finally, demographic factors have some effect on the time-to-graduation for bachelor students, though not as much as in some of the other models. Similar to the associate and first-term GPA models, students who identify as male took longer on average (see Table 10). Regarding racial and ethnic factors, students who identify as white completed their bachelor's degree in fewer enrollments than other groups, on average. Concerning socioeconomic factors, students who received Pell finished in more enrollments on average than other students. All of these results were unlikely due to chance if there was no relationship between the factors and time-to-degree.

3.4 | Drop-out/Stop-out

3.4.1 | Associate Degrees

The models predicting the likelihood of dropout or stopout showed some different influential factors compared to those of first-term GPA or time to graduation. With respect to PLAs, an increase in the number of AP credits was associated with a decreased probability of dropout/stopout, and the model predicted a similar decrease for CLEP credits received (see Table 11).

For those enrolled in associate degree programs, high school level factors seemed to predict dropout/stopout to a significant degree. College readiness as measured by ACT score and high school GPA were significant protective factors against dropout/stopout as was concurrent enrollment credit, though to a lesser extent (see Table 11). Students who had an IEP under Section 504 also seemed to be at slightly less risk of leaving the institution

Table 11: Abbreviated Predictors of Dropout/Stopout (Associate)

	Coefficient	SE	p	
log(AP)	-0.1	0.04	0.001	***
Black	1.1	0.9	0.2	
Latine	0.8	0.3	0.02	*
Native American	1.4	0.7	0.03	*
Multi-ethnic	0.8	0.4	0.05	.
Pacific Islander	1.0	0.5	0.08	.
White	0.8	0.3	0.01	*
Percent Part-time	-0.008	0.03	0.8	
Pell Eligibility	0.08	0.03	0.003	**
log(CE)	-0.03	0.002	< 2e-16	***
log(CLEP)	-0.1	0.05	0.01	**
Low-Income	0.2	0.03	< 2e-16	***
Title I HS	0.05	0.04	0.2	
log(HS GPA)	-0.04	0.008	9.6E-07	***
log(ACT)	-0.7	0.05	< 2e-16	***
Male	-0.006	0.02	0.7	
Section 504	-0.2	0.1	0.04	*
ELL	0.1	0.08	0.1	
Percent Part-time:Pell Eligibility	-0.3	0.05	7.1E-10	***

This table contains an abbreviated output from the model of first-term GPA. Asterixis represent significance: * p<0.05, ** p<0.01, *** p<0.001. Addition covariates include the rest of the CIP codes, institution effects, racial, and certain interaction effects. See Appendix Table A-2 for a full table of results).

without completing an associate degree. However, students who were classified as low-income during their last year of high school seemed to be at significantly greater risk of dropping out than other students. Neither participation in ELL nor attending a Title I high school seemed related to likelihood of dropout or stopout.

Concerning college level factors, some two-digit CIP codes including Personal and Culinary Services, Law Enforcement, and Humanities had higher probablilities of dropout or stopout, on average (see Appendix Table A-2). Only Construction had a lower likelihood of dropout. For associate degree-seekers, student enrollment at all institutions except for SLCC and SUU was associated with an increased hazard of dropout. The percentage of part-time enrollments did not seem to have a statistically notable relationship with the likelihood of dropout/stopout.

Demographic factors also predict the likelihood of dropout/stopout. Students identified as part of certain racial and ethnic groups seem to be at greater risk of dropping out of an associate degree, especially those identified as Native American or Indigenous, Hispanic, or white (see Table 11). Those who received Pell Grants were also associated with a greater risk of dropout/stopout, but some of that risk was mitigated for those who had more part-time enrollments. Finally, gender did not seem to be related to the likelihood of dropout or stopout for associate degree seeking students.

3.4.2 | Bachelor's Degrees

The predictors of dropout/stopout for bachelor's degree seekers are somewhat different from those for associate degree seekers.

Like with associate degree seekers, PLAs are protective factors against dropout/stopout. Both the natural log of AP credits and the natural log of CLEP credits were associated with a reduced risk of dropout/stopout (see Table 12).

Concerning high school factors, college preparation elements including concurrent enrollment credits, college readiness as measured by ACT, and high school GPA reduce the risk of dropout (see Table 12). Conversely, students classified as low-income during their last year of high school seemed to have a higher risk of dropping out. Participation in ELL or IEP programs or enrollment in a Title I high school did not have a statistically significant effect on dropout risk.

Enrollment and institutional factors predict the propensity to dropout. Many CIP families are

Figure 8: Risk of Dropout/Stopout (Bachelor's)

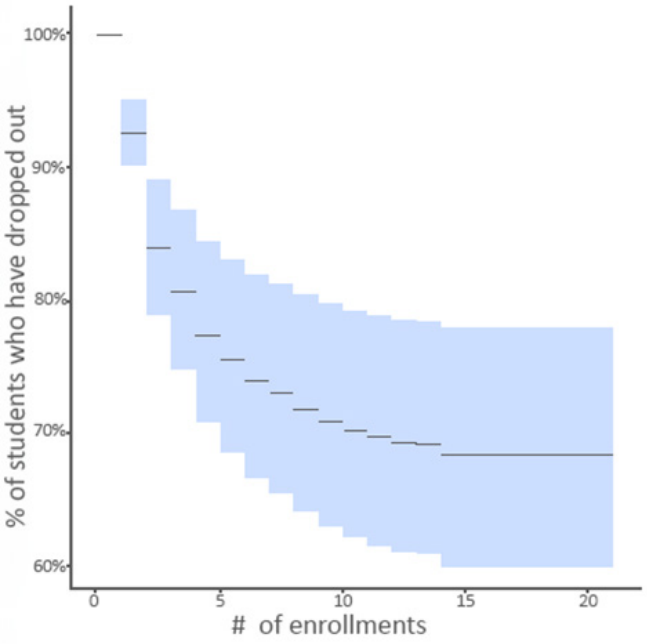


Table 12: Abbreviated Predictors of Dropout/Stopout (Associate)

	Coefficient	SE	p	
log(AP)	-5.3E-02	1.7E-02	0.004	**
Black	7.2E-01	3.6E-01	0.05	*
Latine	3.9E-01	1.7E-01	0.02	*
Native American	3.0E-01	4.9E-01	0.5	
Multi-ethnic	4.4E-01	2.2E-01	0.04	*
Pacific Islander	9.1E-01	3.7E-01	0.01	*
White	5.1E-01	1.5E-01	0.001	***
Percent Part-time	1.1E-01	4.4E-02	0.02	*
Pell Eligibility	-5.8E-02	3.0E-02	0.06	.
log(CE)	-2.5E-02	2.0E-03	< 2e-16	***
log(CLEP)	-2.4E-02	5.7E-03	3.9E-05	***
Low-Income	4.3E-01	3.2E-02	< 2e-16	***
Title I HS	5.7E-02	4.1E-02	0.2	
log(HS GPA)	-1.7E-02	8.3E-03	0.05	*
log(ACT)	-1.3E+00	6.6E-02	< 2e-16	***
Male	-3.1E-01	2.4E-02	< 2e-16	***
Section 504	2.5E-02	1.0E-01	0.8	
ELL	-2.9E-01	1.5E-01	0.05	.
Percent Part-time:Pell	-5.5E-01	6.2E-02	< 2e-16	***

This table contains an abbreviated output from the model of first-term GPA. Asterixis represent significance: * p<0.05, ** p<0.01, *** p<0.001. Addition covariates include the rest of the CIP codes, institution effects, racial, and certain interaction effects. See Appendix Table A-4 for a full table of results).

associated with a decreased risk of dropping out of a bachelor's program including Interdisciplinary Studies, Philosophy, and Journalism among many others (see Appendix Table A-4). Only Humanities was associated with an increased dropout risk. The percent of part-time enrollments also predicted an elevated likelihood of dropout/stopout, however this risk was reduced for those who received Pell Grants. Students enrolled at the University of Utah and USU seemed less likely to dropout/stopout whereas bachelor's-seekers at Utah Tech, UVU, and Weber were more likely to separate from the institution without their intended degree.

Demographic factors including gender, race, and socioeconomic status all predicted likelihood of dropout for bachelor's degree-seeking students. Students identified as male were significantly less likely to dropout as compared to other students (see Table 12). Students identified as Black, Hispanic, multiethnic, Pacific Islander, and white all had a higher likelihood of dropping out than students who identified as Asian, the default in this model. Students identified as Pacific Islander and Black or African American were at particularly heightened risk with their risk coefficient being nearly double that of white students.

4 | Discussion

According to the models, PLA credit consistently predicts the outcomes of interest at for all models in the study. Other factors including college readiness indicators, demographic factors, and institutional factors also predict outcomes to varying degrees.

4.1 | Research Questions

4.1.1 | First-term GPAs

Many factors predict first-term GPA. AP and college readiness indicators like CE, ACT, and high school GPA have some of the largest positive effects on first-term GPA though demographic and enrollment factors also contribute significantly. With respect to AP, AP credits are a significant predictor of first-term GPA, both on their own and as a factor that seems to have additional benefits for students who may have limited access to economic resources. Students who were eligible for Pell Grants during their first-term and those who were FARMs eligible during their last year of high school experienced an additional positive effect from AP credit on their first-term GPA. However, AP did not have the hypothesized additional positive effects for students from racial and ethnic minority groups. Race and ethnic identifiers seem to influence first-term GPA with non-white, non-Asian students predicted to have significantly lower GPAs than other students. However, undecided major status and part-time enrollment were the largest negative predictors of first-term GPA. The research suggests that some students attend part-time for financial reasons, because the negative effect of part-time enrollment (-0.42) was significantly reduced if a part-time student also received or was eligible for a Pell Grant (0.16) during that term. Considering the role of racial and economic background, students from diverse backgrounds seem to experience significant achievement gaps during their first-term, but programs like financial aid, college preparation, and advisement could help address disparities.

4.1.2 | Time-to-Degree

Many factors predicted time to a degree, regardless of degree type. ACT, high school GPA, and contact with college equivalent coursework via AP or concurrent enrollment predict shorter time-to-degree for both associates and bachelor's degrees.

AP credit and concurrent enrollment seem to reduce time to a degree, possibly because some of the credit from AP or CE can count toward certain degree requirements. However, the estimated benefits go beyond that of the credits received with only one course's worth of credit predicting an average of one term fewer enrollments to graduation. These findings are in line with other research that those who are more prepared for or who have experience with college level work may be in a better position to finish more quickly.

Other factors predict a longer time to degree including part-time enrollment, Pell eligibility, and gender. However, students who receive Pell Grants and also enroll part-time suffer fewer negative effects. This suggests that those students may enroll part-time for financial reasons, and aid addresses some of the need. Full-time enrolled students who receive Pell Grants may be negatively affected for reasons that are not included in the study like increased hours worked which could leave less time for school. More study is needed to understand the interaction between financial aid, part-time enrollment, and time-to-degree.

Certain factors influenced time-to-degree, but they were not consistent across degree type. Area of study seemed to affect time, depending on degree type. Certain majors have higher or lower credit requirements, and these differences can extend or shorten the time graduation.These differences can be can me more extreme for bachelor's degrees, since they are longer programs. Factors related to race, ethnicity, and income in high school also varied by degree type. However, the composition of the student body is different across degree type, and so those effects could be related differing populations within each degree type.

4.1.3 | Dropout/Stopout

While many factors that influence time-to-degree also affect dropout/stopout, the relationship between the two is not one-to-one. Specifically, demographic factors played a much larger role in predicting dropout/stopout than in determining time-to-degree. Other factors like PLAs, college readiness, and concurrent enrollment acted as protective factors against dropout/stopout for students pursuing either degree type.

In the models of time to a degree, factors related to race and ethnicity were not often related to time-to-degree. However, race and ethnicity significantly predicted students' likelihood of dropping out. Bachelor's degree-seeking students of color had particularly high risks of dropout. For example, bachelor's degree-seeking students identified as Black (0.8) or Pacific Islander (0.9) had a dropout effect that was almost double that of white students (0.5). White (0.5), Hispanic (0.4), and multiethnic (0.4) students all had similarly elevated risks compared to Asian students (0), those who have the lowest risk of dropping out in this sample. For students seeking an associate degree, students who identify as Black were not at significantly increased risk of dropping out, Hispanic (0.8) and white (0.8) students faced moderate risk, and Native American (1.4) students faced the highest risk of dropping out. Unlike some of the previous literature, AP credit did not act as an extra protective factor for students from at-risk groups in this study.

Different institutions were associated with varying risk levels of dropout or stopout depending on the degree type. For associate degrees, all institutions besides SLCC and SUU were associated with an increased risk of dropout. For bachelor's degrees, SUU, the University of Utah, and USU were all associated with a decreased risk of dropout. Some institutions including Utah Tech, UVU, and WSU were consistently associated with an increased risk of dropout/stopout. It is important to note that these are also open-enrollment institutions with different missions and different populations from other institutions. Considering this, it is interesting that SUU, another open-enrollment institution, was associated with a decreased risk of dropout/stopout. However, more investigation is needed to understand the contributors to this difference as this study does not account for all potential population variables.

However, this study accounts for enough factors to suggest that associate degree seekers may differ from bachelor's students in key ways that could put them at higher risk of dropout. For instance, associate-seekers with higher numbers of part-time enrollments had no increased risk of dropout, but bachelor's-seekers with more part-time enrollments were significantly more likely to dropout or stopout. Bachelor's students who were classified as low-income during their last year of high faced nearly twice the risk of dropping out compared low-income students in associate degree programs. Also, students who were eligible for Pell Grants during an associate degree program were more likely to dropout. In contrast, the likelihood of dropping out decreased for those seeking a bachelor's degree, though the effect did not reach statistical significance. Due to these differences, solutions many need to be tailored by degree type.

Regarding protective factors, PLAs, highschool GPA, college readiness, and concurrent enrollment predicted a decreased risk of dropout. With respect to PLAs, AP had a higher protective for associate seekers, but bachelor's degree seekers still saw a significant protective effect. CLEP followed a similar pattern with bachelor's degree students seeing about half of the effect of that of associate seekers.

However, concurrent enrollment had about the same level of protective effects for both degree levels. Pell Grants also seemed to be a protective factor for those enrolled part-time at both levels.

4.2 | Impact of PLAs

AP and CLEP credits positively impacted all outcomes of interest in all models except for CLEP credits with respect to time to bachelor's degree. While these effects seemed significant, several considerations need to be taken into account. First, the effects of PLA credit were not the main factor that predicted outcomes. Other variables like part-time enrollment, demographic, income factors, and area of study had a larger effect on outcomes in many of the models. So, while expanding PLAs could improve outcomes, it should be one of many strategies as PLAs do not address all factors that impact student success in higher education.

Next, some PLAs may be more effective than others. In all cases, AP had a larger effect than CLEP. There could be many reasons for this outcome. For instance, far fewer students had CLEP credit compared to AP credit, so wider usage of this program could change the estimates for CLEP. Additionally, AP credit is usually attached to a high school course where CLEP may not be tied to coursework. Students going through a class may benefit from preparation beyond just the credit awarded. However, a review of the literature suggests that AP classes might suffer from self-selection bias, so the population of students with AP credit may be systematically different from other students. Thus, differences in population between AP and CLEP could also account for different effects on outcomes.

Finally, this sample only includes cohorts prior to the USHE policy that standardized the credits awarded for different PLAs, specifically the mapping pf AP scores to particular classes at all USHE degree-granting institutions. For this reason, students in this sample may have received different credit amounts for the same scores on the same tests, depending on their institution. The models in this study tried to account for some of this variation by controlling for institution, and institution attended affected all outcomes. Ideally, this study would be replicated, since the changes to the policy may have affected the magnitude of both the impact of AP credits and institutional differences.

4.3 | Impact of Demographic Factors

Demographic factors, including race/ethnicity and SES, significantly impacted outcomes, though the magnitude of those impacts differed. For example, race did not influence time to a degree except in the case of white bachelor's degree-seeking students finishing in fewer enrollments on average. But for many groups, race seemed to predict first-term GPA and risk of dropout/stopout to a significant degree with many non-white, non-Asian students facing an increased risk of poor GPA or dropout. In most cases, students who received Pell Grants also had poorer outcomes also. The results suggest there may still be gaps that need to be addressed for students who face some of these risk factors.

4.4 | Limitations

This study is limited by the data available to the UDRC. This affects both the completeness and quality of the dataset. Concerning completeness, the dataset does not include students who attend private institutions or USHE students who did not attend high school in Utah. Concerning data quality, at least one institution seems to have used the CLEP field to capture AP credit in some instances, but that institution also awards CLEP credit. With the data available to UDRC at the time, the researcher could not reliably determine whether this was a widespread issue. So, the stated effects of CLEP could be partly due to AP credit. Other data quality issues may be present to an unknown degree.

More substantively, this study does not address issues of equivalency between the PLA and the institutions' version of the class. For example, one study comparing the writing abilities of those who took AP English, first-year writing, and those who did both, and, they recommended that students be required to take a university writing course, even if they already have AP credit (Hansen et al., 2006). Another study found that even those defined as college-ready via ACT score or AP exam still may not feel they meet the competencies for first year writing (Hall, 2020). USHE has taken steps to address this issue including standardizing the classes and amount of credit for each AP test, but that policy became effective after the study period.

Lastly, this study does not address how or why students participate in certain PLA options. Many factors, including parental input or advising could influence students' decision to participate in programs like AP. Other research suggests that awareness of PLAs and their benefits can significantly influence students' decisions to participate in PLA related course or seek credit for a past experience (Wesley and Parnell, 2020). Previous work by Klein-Collins et al. (2021) found that Black and low-income non-high school students are significantly more likely to complete a credential if they receive PLA credit, but they are also the groups least likely to gain this type of credit. For example, AP participation increased from 2008 to 2018, but this increase was disproportionally smaller for

students of color and low-income students (Goldstein, 2020 p. 7). Finally, previous work has found that students who enter a degree-granting institution right after high school, perform well in their first year, and participate in academic support programs are more likely to graduate within five years of their initial enrollment (Moraga-Pumarino, 2023). However, it is possible that such factors overlap significantly with race, SES, parental education, or other factors that this study does not full account for. This study tries to control for some variation stemming from these issues with the limited data available, but it cannot fully account for factors that may affect a student's ability to seek or receive PLA credit.

5 | Conclusion

As hypothesized, PLA credit from AP and CLEP may facilitate a shorter time-to-degree in most cases, and AP credit seems to be associated with a higher first-term GPA. However, other factors, including demographics, also significantly impact student outcomes. In most cases, factors like race/ethnicity, income, major, and college readiness can overtake the effects of PLAs, particularly for those with only one or two classes worth of PLA credit. For these reasons, PLAs should be considered part of a holistic set of policies to address outcomes. The sample in this study does not include the years after USHE implementation of the policy that standardized the credits awarded for the different PLA credit awards, so institutions may have already improved the efficiencies of PLA programs. Ideally, this study would be replicated to compare this study with the outcomes under newer policies.

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Appendix A

Table A-1: Predictors of Number of Enrollments to Graduation (Associate)

	Coefficient	SE	p	
log(APgr)	7.39E-02	1.08E+00	1.74E-02	***
Black	-2.69E-01	7.64E-01	7.12E-01	
Latine	-1.68E-01	8.45E-01	1.56E-01	
Native American	1.37E-01	1.15E+00	5.67E-01	
Multi-ethnic	-3.34E-01	7.16E-01	1.97E-01	.
Pacific Islander	-3.53E-01	7.03E-01	4.31E-01	
White	-2.08E-01	8.12E-01	1.35E-01	
Percent Part-time	-2.05E+00	1.29E-01	5.90E-02	***
Pell Eligibility	-1.37E-01	8.72E-01	3.27E-02	***
instSnow	5.67E-01	1.76E+00	4.29E-02	***
instSUU	7.64E-01	2.15E+00	1.80E-01	***
instUSU	4.93E-01	1.64E+00	5.81E-02	***
instUtah Tech	8.00E-01	2.23E+00	4.80E-02	***
instUVU	2.97E-01	1.35E+00	4.44E-02	***
instWeber State	1.12E-01	1.12E+00	4.37E-02	*
log(CEgr)	5.73E-02	1.06E+00	2.34E-03	***
log(CLEPgr)	6.14E-02	1.06E+00	1.89E-02	**
Low-Income	-3.34E-02	9.67E-01	3.98E-02	
Title I HS	6.05E-02	1.06E+00	5.44E-02	
log(hs_gpa_gr)	7.12E-02	1.07E+00	1.49E-02	***
log(ACT)	1.50E+00	4.48E+00	7.35E-02	***
Male	-2.87E-01	7.51E-01	2.68E-02	***
Section 504	-1.05E-01	9.00E-01	1.49E-01	
ELL	4.70E-02	1.05E+00	2.55E-01	
CIPArchitecture	-5.85E-01	5.57E-01	6.01E-01	
CIPBiology	-1.27E-01	8.81E-01	2.44E-01	
CIPBusiness	3.00E-01	1.35E+00	1.74E-01	.
CIPComms	-2.28E-01	7.96E-01	3.08E-01	
CIPComp Sci	-1.91E-01	8.26E-01	2.01E-01	
CIPConstructions	-4.12E-01	6.62E-01	2.59E-01	
CIPEducation	4.37E-01	1.55E+00	1.78E-01	*
CIPEngineering	-5.55E-01	5.74E-01	1.84E-01	**
CIPEngineering tech	-2.01E-01	8.18E-01	2.25E-01	
CIPEnglish	6.63E-02	1.07E+00	2.43E-01	
CIPFamily/Cons Sci	4.94E-01	1.64E+00	2.22E-01	*
CIPForeign Language	1.67E-01	1.18E+00	2.57E-01	
CIPHealth Prof	-2.68E-01	7.65E-01	1.69E-01	
CIPHistory	3.99E-01	1.49E+00	3.14E-01	
CIPHumanities	5.14E-01	1.67E+00	1.64E-01	**
CIPInterdisc	9.77E-01	2.66E+00	2.48E-01	***
CIPJournalism	2.58E-01	1.30E+00	2.13E-01	
CIPLaw Enforcement	2.58E-01	1.29E+00	2.00E-01	
CIPLegal	-1.63E-01	8.50E-01	4.14E-01	
CIPMath	3.21E-01	1.38E+00	4.12E-01	
CIPMechanic	2.90E-01	1.34E+00	1.95E-01	
CIPNatural Resources	-5.20E-02	9.49E-01	2.58E-01	
CIPPersonal and Culinary	1.04E-01	1.11E+00	2.27E-01	
CIPPhilosophy	NA	NA	0.00E+00	
CIPPhysical Sci	-4.68E-01	6.26E-01	3.00E-01	
CIPPrecision Prod	6.73E-01	1.96E+00	2.56E-01	**
CIPPsych	4.45E-01	1.56E+00	1.84E-01	*
CIPPublic Admin	3.55E-01	1.43E+00	2.41E-01	
CIPRecreation	9.83E-02	1.10E+00	3.91E-01	
CIPSci Tech	-1.61E-01	8.52E-01	3.07E-01	
CIPSocial Sciences	2.74E-01	1.32E+00	2.26E-01	
CIPTech Ed	-8.94E+00	1.32E-04	1.96E+02	
CIPTransportation	5.11E-01	1.67E+00	4.00E-01	
CIPVis/Perf Arts	-3.97E-01	6.72E-01	1.79E-01	*
log(APgr):raceB	-3.36E-02	9.67E-01	7.89E-02	
log(APgr):raceH	-2.69E-02	9.73E-01	1.98E-02	
log(APgr):raceI	2.22E-02	1.02E+00	6.35E-02	
log(APgr):raceM	-5.91E-02	9.43E-01	2.52E-02	*
log(APgr):raceP	-2.83E-02	9.72E-01	5.01E-02	
log(APgr):raceW	-5.49E-02	9.47E-01	1.75E-02	**
perc_pt:pell_er	1.15E+00	3.17E+00	7.48E-02	***

Table A-2: Predictors of Dropout/Stopout (Associate)

	Coefficient	SE	p	
log(APgr)	-0.119	0.036	0.000948	***
Black	1.119	0.854	0.18988	
Latine	0.779	0.339	0.021536	*
Native American	1.442	0.656	0.02795	*
Multi-ethnic	0.761	0.390	0.051133	.
Pacific Islander	0.951	0.538	0.076858	.
White	0.823	0.328	0.012039	*
Percent Part-time	-0.008	0.033	0.813178	
Pell Eligibility	0.080	0.027	0.003292	**
instSnow	0.090	0.033	0.006667	**
instSUU	0.008	0.121	0.944279	
instUSU	0.156	0.042	0.000189	***
instUtah Tech	0.494	0.034	< 2e-16	***
instUVU	0.341	0.029	< 2e-16	***
instWeber State	0.119	0.034	0.00044	***
log(CEgr)	-0.025	0.002	< 2e-16	***
log(CLEPgr)	-0.137	0.053	0.009439	**
Low-Income	0.229	0.026	< 2e-16	***
Title I HS	0.046	0.037	0.207476	
log(hs_gpa_gr)	-0.039	0.008	9.55E-07	***
log(ACT)	-0.730	0.050	< 2e-16	***
Male	-0.006	0.019	0.747174	
Section 504	-0.189	0.094	0.04462	*
ELL	0.121	0.082	0.139408	
CIPArchitecture	-0.165	0.362	0.648732	
CIPBiology	0.289	0.214	0.176538	
CIPBusiness	0.284	0.180	0.115584	
CIPComms	0.480	0.208	0.021138	*
CIPComp Sci	0.285	0.190	0.132355	
CIPConstructions	-0.646	0.226	0.004188	**
CIPEducation	0.262	0.186	0.159775	
CIPEngineering	0.173	0.186	0.351464	
CIPEngineering tech	0.346	0.199	0.081523	.
CIPEnglish	0.406	0.234	0.082409	.
CIPFamily/Cons Sci	0.217	0.230	0.344046	
CIPForeign Language	0.320	0.248	0.19688	
CIPHealth Prof	0.058	0.179	0.746681	
CIPHistory	0.119	0.320	0.709084	
CIPHumanities	0.456	0.175	0.009227	**
CIPInterdisc	-0.045	0.277	0.869847	
CIPJournalism	-0.081	0.229	0.722962	
CIPLaw Enforcement	0.453	0.186	0.014921	*
CIPLegal	0.471	0.277	0.08872	.
CIPMath	0.383	0.349	0.272493	
CIPMechanic	0.207	0.189	0.272281	
CIPNatural Resources	-0.044	0.272	0.870149	
CIPPersonal and Culinary	0.548	0.203	0.007021	**
CIPPhilosophy	2.442	1.016	0.016255	*
CIPPhysical Sci	0.355	0.251	0.157899	
CIPPrecision Prod	0.111	0.245	0.649633	
CIPPsych	0.164	0.190	0.389821	
CIPPublic Admin	0.209	0.227	0.357484	
CIPRecreation	0.196	0.289	0.498602	
CIPSci Tech	0.265	0.306	0.387039	
CIPSocial Sciences	-0.105	0.239	0.661489	
CIPTech Ed	2.281	0.418	4.76E-08	***
CIPTransportation	0.501	0.276	0.069905	.
CIPVis/Perf Arts	0.485	0.182	0.007722	**
log(APgr):raceB	0.095	0.093	0.309578	
log(APgr):raceH	0.071	0.037	0.057968	.
log(APgr):raceI	0.131	0.072	0.067445	.
log(APgr):raceM	0.074	0.043	0.088033	.
log(APgr):raceP	0.054	0.059	0.35688	
log(APgr):raceW	0.081	0.036	0.025268	*
perc_pt:pell_er	-0.291	0.047	7.08E-10	***

Table A-3: Predictors of Number of Enrollments to Graduation (Bachelor's)

	Coefficient	SE	p	
log(APgr)	2.17E-02	9.44E-03	0.021818	*
Black	-1.66E-01	2.10E-01	0.430506	
Latine	7.43E-02	7.50E-02	0.322256	
Native American	-1.40E-01	2.66E-01	0.599285	
Multi-ethnic	1.35E-01	9.47E-02	0.15283	
Pacific Islander	3.33E-01	2.63E-01	0.20535	
White	1.21E-01	5.54E-02	0.029053	*
Percent Part-time	-4.22E+00	1.06E-01	< 2e-16	***
Pell Eligibility	-2.47E-01	3.36E-02	1.82E-13	***
instU of U	3.06E-01	5.27E-02	6.64E-09	***
instUSU	6.10E-01	4.57E-02	< 2e-16	***
instUtah Tech	2.99E-02	9.92E-02	0.763284	
instUVU	1.21E-01	5.66E-02	0.032554	*
instWeber State	-7.89E-01	6.62E-02	< 2e-16	***
log(CEgr)	2.54E-02	2.06E-03	< 2e-16	***
log(CLEPgr)	6.60E-03	3.83E-03	0.084738	.
Low-Income	9.77E-02	4.66E-02	0.035856	*
Title I HS	-5.11E-02	4.87E-02	0.293993	
log(hs_gpa_gr)	8.73E-03	9.40E-03	0.353364	
log(ACT)	1.08E+00	8.26E-02	< 2e-16	***
Male	-1.36E-01	2.46E-02	3.75E-08	***
Section 504	-1.40E-01	1.66E-01	0.399085	
ELL	-2.65E-01	2.86E-01	0.353938	
CIPArchitecture	1.69E-01	1.78E-01	0.341882	
CIPArea/Ethnic Studies	6.39E-01	1.60E-01	6.59E-05	***
CIPBiology	-1.70E-01	1.09E-01	0.120003	
CIPBusiness	2.96E-01	1.02E-01	0.003756	**
CIPComms	2.96E-01	5.94E-01	0.617612	
CIPComp Sci	-3.44E-01	1.10E-01	0.001809	**
CIPConstructions	1.91E-01	5.87E-01	0.745305	
CIPEducation	2.52E-02	1.04E-01	0.808221	
CIPEngineering	-4.96E-01	1.06E-01	3.07E-06	***
CIPEngineering tech	-5.80E-01	2.05E-01	0.004633	**
CIPEnglish	2.84E-01	1.14E-01	0.013048	*
CIPFamily/Cons Sci	3.13E-01	1.12E-01	0.005026	**
CIPForeign Language	2.24E-01	1.43E-01	0.117929	
CIPHealth Prof	-2.13E-01	1.09E-01	0.051221	.
CIPHistory	-2.10E-01	1.46E-01	0.148928	
CIPHumanities	-4.59E-01	1.54E-01	0.002883	**
CIPInterdisc	1.56E-03	1.30E-01	0.990388	
CIPJournalism	4.48E-01	1.08E-01	3.46E-05	***
CIPLaw Enforcement	4.33E-01	1.53E-01	0.004574	**
CIPLegal	7.95E-01	2.40E-01	0.000925	***
CIPMath	-9.54E-03	1.33E-01	0.942851	
CIPMechanic	-1.15E+01	2.09E+02	0.955979	
CIPNatural Resources	1.36E-01	1.38E-01	0.322734	
CIPPhilosophy	-7.84E-02	1.98E-01	0.691916	
CIPPhysical Sci	-4.04E-01	1.24E-01	0.001146	**
CIPPsych	4.07E-01	1.08E-01	0.000163	***
CIPPublic Admin	5.00E-01	1.33E-01	0.000167	***
CIPRec Activities	-1.58E-01	4.58E-01	0.72987	
CIPRecreation	1.01E-02	1.17E-01	0.931057	
CIPSocial Sciences	2.49E-01	1.06E-01	0.019338	*
CIPTransportation	2.78E-01	2.28E-01	0.222271	
CIPVis/Perf Arts	-2.18E-02	1.06E-01	0.837609	
log(APgr):raceB	-6.42E-02	2.77E-02	0.020577	*
log(APgr):raceH	4.53E-03	1.18E-02	0.700366	
log(APgr):raceI	-6.01E-03	3.90E-02	0.877365	
log(APgr):raceM	1.80E-02	1.56E-02	0.248708	
log(APgr):raceP	4.52E-02	3.54E-02	0.201201	
log(APgr):raceW	-8.09E-04	9.22E-03	0.930072	
perc_pt:pell_er	3.26E+00	1.14E-01	< 2e-16	***

Table A-4: Predictors of Dropout/Stopout (Bachelor's)

	Coefficient	SE	p	
log(APgr)	-5.30E-02	1.86E-02	0.004409	**
Black	7.18E-01	3.60E-01	0.04598	*
Latine	3.92E-01	1.73E-01	0.023435	*
Native American	3.01E-01	4.87E-01	0.536987	
Multi-ethnic	4.37E-01	2.16E-01	0.043291	*
Pacific Islander	9.12E-01	3.69E-01	0.013486	*
White	5.12E-01	1.51E-01	0.000723	***
Percent Part-time	1.06E-01	4.41E-02	0.016679	*
Pell Eligibility	-5.77E-02	3.03E-02	0.056822	.
instU of U	-4.05E-01	4.82E-02	< 2e-16	***
instUSU	-2.89E-01	4.02E-02	6.45E-13	***
instUtah Tech	4.71E-01	5.00E-02	< 2e-16	***
instUVU	1.48E-01	4.30E-02	0.000552	***
instWeber State	2.30E-01	4.24E-02	5.96E-08	***
log(CEgr)	-2.51E-02	2.00E-03	< 2e-16	***
log(CLEPgr)	-2.36E-02	5.74E-03	3.89E-05	***
Low-Income	4.31E-01	3.18E-02	< 2e-16	***
Title I HS	5.65E-02	4.14E-02	0.172656	
log(hs_gpa_gr)	-1.65E-02	8.32E-03	0.046816	*
log(ACT)	-1.32E+00	6.56E-02	< 2e-16	***
Male	-3.08E-01	2.42E-02	< 2e-16	***
Section 504	2.54E-02	1.01E-01	0.800955	
ELL	-2.90E-01	1.50E-01	0.053542	.
CIPArchitecture	-3.29E-01	2.52E-01	0.191543	
CIPArea/Ethnic Studies	-6.66E-01	2.65E-01	0.012148	*
CIPBiology	-3.62E-01	1.03E-01	0.000412	***
CIPBusiness	-5.74E-01	9.51E-02	1.57E-09	***
CIPComms	-1.27E+01	2.24E+02	0.954787	
CIPComp Sci	-2.48E-01	1.01E-01	0.013829	*
CIPConstructions	-8.84E-02	2.14E-01	0.679268	
CIPEducation	-2.77E-01	9.48E-02	0.003439	**
CIPEngineering	-1.62E-01	1.05E-01	0.120696	
CIPEngineering tech	-3.74E-01	1.38E-01	0.006571	**
CIPEnglish	-3.03E-01	1.14E-01	0.007795	**
CIPFamily/Cons Sci	-9.57E-01	1.23E-01	8.17E-15	***
CIPForeign Language	-6.93E-01	1.57E-01	1.07E-05	***
CIPHealth Prof	-1.64E-01	9.74E-02	0.092707	.
CIPHistory	-3.71E-01	1.54E-01	0.015708	*
CIPHumanities	8.20E-01	9.21E-02	< 2e-16	***
CIPInterdisc	-1.44E+00	2.19E-01	4.57E-11	***

	Coefficient	SE	p	
CIPJournalism	-9.78E-01	1.13E-01	< 2e-16	***
CIPLaw Enforcement	-2.92E-01	1.07E-01	0.006257	**
CIPLegal	3.10E-01	2.15E-01	0.150092	
CIPMath	-5.22E-01	1.73E-01	0.002505	**
CIPMechanic	2.60E-01	5.08E-01	0.608956	
CIPNatural Resources	-7.22E-01	1.95E-01	0.00022	***
CIPPhilosophy	-9.12E-01	2.74E-01	0.000853	***
CIPPhysical Sci	-9.45E-02	1.24E-01	0.445931	
CIPPsych	-2.78E-01	9.88E-02	0.004863	**
CIPPublic Admin	-6.02E-01	1.38E-01	1.27E-05	***
CIPRec Activities	-1.25E+01	2.39E+02	0.958493	
CIPRecreation	-8.06E-01	1.17E-01	6.18E-12	***
CIPSocial Sciences	-8.14E-01	1.15E-01	1.36E-12	***
CIPTransportation	-4.20E-01	1.63E-01	0.009946	**
CIPVis/Perf Arts	-1.30E-01	9.64E-02	0.178998	
log(APgr):raceB	1.45E-02	4.08E-02	0.72193	
log(APgr):raceH	-6.32E-03	2.08E-02	0.761227	
log(APgr):raceI	-2.51E-02	5.48E-02	0.646317	
log(APgr):raceM	-1.69E-02	2.58E-02	0.513826	
log(APgr):raceP	3.69E-02	4.18E-02	0.378297	
log(APgr):raceW	9.52E-03	1.85E-02	0.607452	
perc_pt:pell_er	-5.50E-01	6.16E-02	< 2e-16	***

Table A-5: Predictors of First-Term Grade Point Average (GPA)

Effect	Estimate	SE	Lower Limit	Upper Limit	t	p	
(Intercept)	-0.196	0.097	-0.387	-0.006	-2.021	0.043278	*
log(APgr)	0.024	0.005	0.014	0.033	4.719	2.38E-06	***
low_income	-0.078	0.028	-0.133	-0.023	-2.792	0.005237	**
f_pell	-0.080	0.019	-0.117	-0.044	-4.272	1.94E-05	***
raceB	-0.336	0.141	-0.614	-0.059	-2.379	0.017344	*
raceH	-0.230	0.048	-0.324	-0.135	-4.769	1.86E-06	***
raceI	-0.199	0.159	-0.510	0.112	-1.252	0.210478	
raceM	-0.223	0.067	-0.356	-0.091	-3.311	0.000931	***
raceP	-0.639	0.140	-0.914	-0.364	-4.548	5.42E-06	***
raceW	-0.093	0.039	-0.170	-0.015	-2.352	0.0187	*
log(CEgr)	0.013	0.001	0.011	0.016	10.362	< 2e-16	***
part_time	-0.417	0.013	-0.443	-0.392	-32.672	< 2e-16	***
instSnow	0.023	0.020	-0.016	0.062	1.159	0.246424	
instSUU	0.010	0.024	-0.038	0.057	0.39	0.696593	
instU of U	0.042	0.022	-0.001	0.084	1.914	0.055566	.
instUSU	-0.073	0.020	-0.111	-0.034	-3.687	0.000227	***
instUtah Tech	-0.098	0.020	-0.137	-0.059	-4.895	9.86E-07	***
instUVU	-0.026	0.017	-0.059	0.007	-1.567	0.117049	
instWeber State	-0.233	0.017	-0.268	-0.199	-13.35	< 2e-16	***
title_one	0.060	0.017	0.028	0.093	3.633	0.00028	***
log(hs_gpa_gr)	0.063	0.004	0.055	0.070	16.22	< 2e-16	***
log(ACT)	1.071	0.024	1.024	1.119	44.124	< 2e-16	***
genderM	-0.241	0.009	-0.260	-0.223	-25.651	< 2e-16	***
usbe504	-0.167	0.042	-0.249	-0.084	-3.965	7.36E-05	***
b_intent	0.030	0.014	0.002	0.058	2.099	0.035816	*
termSpring	0.039	0.012	0.015	0.064	3.164	0.001559	**
termSummer	0.402	0.023	0.357	0.448	17.368	< 2e-16	***
ell	0.340	0.046	0.250	0.430	7.395	1.43E-13	***
hs_gap	0.341	0.010	0.321	0.361	33.341	< 2e-16	***
CIPArchitecture	0.090	0.094	-0.095	0.274	0.95	0.342245	
CIPArea/Ethnic Studies	-0.043	0.134	-0.306	0.219	-0.323	0.746442	
CIPBiology	0.100	0.049	0.004	0.197	2.037	0.041683	*
CIPBusiness	0.190	0.046	0.099	0.281	4.089	4.34E-05	***
CIPComms	0.182	0.085	0.016	0.348	2.146	0.031856	*
CIPComp Sci	-0.015	0.050	-0.113	0.082	-0.312	0.755328	
CIPConstructions	0.178	0.080	0.022	0.334	2.241	0.02506	*
CIPEducation	0.230	0.047	0.138	0.323	4.884	1.04E-06	***
CIPEngineering	0.059	0.048	-0.034	0.153	1.24	0.215156	
CIPEngineering tech	0.013	0.062	-0.109	0.136	0.214	0.830423	
CIPEnglish	0.088	0.057	-0.024	0.200	1.533	0.12519	
CIPFamily/Cons Sci	0.253	0.062	0.132	0.375	4.091	4.30E-05	***
CIPForeign Language	0.128	0.075	-0.020	0.275	1.697	0.089666	.
CIPHealth Prof	0.152	0.047	0.060	0.244	3.235	0.001217	**
CIPHistory	0.168	0.078	0.015	0.320	2.156	0.03108	*
CIPHumanities	0.165	0.045	0.078	0.253	3.688	0.000226	***

Table A-5: Predictors of First-Term Grade Point Average (GPA) - continued

Effect	Estimate	SE	Lower Limit	Upper Limit	t	p	
CIPInterdisc	0.152	0.102	-0.048	0.352	1.491	0.135996	
CIPJournalism	0.222	0.059	0.106	0.337	3.767	0.000166	***
CIPLaw Enforcement	-0.021	0.053	-0.125	0.084	-0.389	0.697419	
CIPLegal	0.012	0.089	-0.161	0.186	0.141	0.888071	
CIPMath	0.102	0.072	-0.040	0.244	1.409	0.158845	
CIPMechanic	0.280	0.067	0.148	0.412	4.15	3.33E-05	***
CIPNatural Resources	0.181	0.090	0.004	0.357	2.003	0.045192	*
CIPNone/Undec	-2.510	1.083	-4.633	-0.387	-2.317	0.020504	*
CIPPersonal and Culinary	0.070	0.090	-0.106	0.246	0.781	0.434714	
CIPPhilosophy	0.483	0.137	0.215	0.751	3.531	0.000415	***
CIPPhysical Sci	0.039	0.058	-0.075	0.152	0.669	0.503402	
CIPPrecision Prod	0.112	0.124	-0.132	0.356	0.897	0.369832	
CIPPsych	0.087	0.049	-0.010	0.184	1.767	0.077294	.
CIPPublic Admin	0.219	0.069	0.084	0.355	3.169	0.001531	**
CIPRecreation	0.317	0.058	0.203	0.431	5.456	4.89E-08	***
CIPSci Tech	-0.214	0.168	-0.542	0.115	-1.274	0.202525	
CIPSocial Sciences	0.164	0.057	0.053	0.276	2.883	0.003946	**
CIPTech Ed	-0.258	0.259	-0.766	0.250	-0.996	0.319241	
CIPTransportation	0.078	0.073	-0.065	0.221	1.066	0.286323	
CIPVis/Perf Arts	0.189	0.048	0.095	0.282	3.957	7.61E-05	***
log(APgr):low_income	0.007	0.003	0.001	0.013	2.168	0.030126	*
log(APgr):f_pell	0.006	0.002	0.002	0.010	2.733	0.006277	**
log(APgr):raceB	-0.005	0.016	-0.037	0.026	-0.339	0.734611	
log(APgr):raceH	0.005	0.006	-0.007	0.016	0.816	0.414757	
log(APgr):raceI	0.015	0.018	-0.020	0.050	0.858	0.390779	
log(APgr):raceM	0.011	0.008	-0.005	0.027	1.315	0.188669	
log(APgr):raceP	-0.016	0.016	-0.047	0.015	-1.008	0.313601	
log(APgr):raceW	0.003	0.005	-0.007	0.012	0.518	0.604117	
log(APgr):log(CEgr)	-0.002	0.000	-0.002	-0.001	-9.839	< 2e-16	***
f_pell:part_time	0.152	0.022	0.109	0.196	6.843	7.81E-12	***

Table A-6: Assumption Checking of Enrollments to Graduation Using Additive Regression (Associate)

	Slope	Coefficient	SE	z	p
Intercept	-0.087	-8.87E-05	4.50E-05	-1.97	4.86E-02
log(APgr)	0.007	7.87E-06	2.74E-06	2.87	4.14E-03
raceB	-0.113	-1.28E-04	2.65E-05	-4.84	1.30E-06
raceH	-0.059	-5.63E-05	2.62E-05	-2.15	3.19E-02
raceI	-0.001	1.96E-05	1.19E-04	0.165	8.69E-01
raceM	-0.033	-4.02E-05	3.42E-05	-1.18	2.40E-01
raceP	-0.087	-7.74E-05	5.06E-05	-1.53	1.27E-01
raceW	-0.031	-3.55E-05	2.54E-05	-1.4	1.63E-01
perc_pt	-0.074	-7.04E-05	3.85E-06	-18.3	1.08E-74
pell_er	-0.018	-1.11E-05	3.89E-06	-2.86	4.21E-03
instSnow	0.004	2.67E-05	3.69E-06	7.23	4.68E-13
instSUU	0.106	5.82E-05	1.82E-05	3.19	1.40E-03
instUSU	0.013	2.22E-05	4.92E-06	4.5	6.68E-06
instUtah Tech	0.085	6.26E-05	5.00E-06	12.5	5.01E-36
instUVU	0.013	7.34E-06	2.99E-06	2.46	1.40E-02
instWeber State	0.010	4.28E-06	3.29E-06	1.3	1.93E-01
log(CEgr)	0.005	4.52E-06	2.04E-07	22.1	2.38E-108
log(CLEPgr)	0.004	4.92E-06	3.26E-06	1.51	1.32E-01
low_income	0.001	-1.85E-06	2.86E-06	-0.647	5.17E-01
title_one	0.004	4.78E-06	4.73E-06	1.01	3.12E-01
log(hs_gpa_gr)	0.003	4.30E-06	9.11E-07	4.72	2.40E-06
log(ACT)	0.095	8.71E-05	5.36E-06	16.3	2.16E-59
genderM	-0.017	-1.81E-05	2.20E-06	-8.23	1.80E-16
usbe504	0.005	2.22E-06	8.07E-06	0.276	7.83E-01
ell	0.044	3.14E-05	5.30E-06	5.93	3.11E-09
CIPArchitecture	0.016	2.55E-05	1.56E-05	1.63	1.03E-01
CIPBiology	0.009	1.84E-05	1.79E-05	1.03	3.05E-01
CIPBusiness	0.018	3.34E-05	1.66E-05	2.02	4.34E-02
CIPComms	0.018	2.87E-05	1.62E-05	1.77	7.71E-02
CIPComp Sci	0.012	1.99E-05	1.65E-05	1.21	2.27E-01
CIPConstructions	0.031	4.81E-05	1.67E-05	2.87	4.04E-03
CIPEducation	0.019	3.63E-05	1.77E-05	2.05	4.03E-02
CIPEngineering	-0.006	5.25E-07	1.68E-05	0.0312	9.75E-01
CIPEngineering tech	0.002	1.15E-05	1.69E-05	0.68	4.97E-01
CIPEnglish	0.004	1.14E-05	2.18E-05	0.521	6.02E-01
CIPFamily/Cons Sci	0.035	4.59E-05	2.45E-05	1.87	6.11E-02
CIPForeign Language	0.032	3.37E-05	2.42E-05	1.39	1.64E-01
CIPHealth Prof	0.002	7.22E-06	1.64E-05	0.44	6.60E-01
CIPHistory	0.032	3.45E-05	2.72E-05	1.27	2.05E-01
CIPHumanities	0.037	4.99E-05	1.62E-05	3.09	2.01E-03

Table A-6: Assumption Checking of Enrollments to Graduation Using Additive Regression (Associate) - continued

	Slope	Coefficient	SE	z	p
CIPInterdisc	0.095	1.16E-04	3.44E-05	3.37	7.56E-04
CIPJournalism	0.023	3.88E-05	2.04E-05	1.9	5.72E-02
CIPLaw Enforcement	0.011	2.33E-05	1.67E-05	1.4	1.63E-01
CIPLegal	-0.006	7.15E-06	2.53E-05	0.283	7.77E-01
CIPMath	0.025	3.52E-05	3.31E-05	1.06	2.88E-01
CIPMechanic	0.013	3.21E-05	1.71E-05	1.88	6.06E-02
CIPNatural Resources	-0.021	-2.08E-05	2.19E-05	-0.95	3.42E-01
CIPPersonal and Culinary	-0.006	-9.49E-07	1.83E-05	-0.0518	9.59E-01
CIPPhilosophy	-0.522	-4.17E-05	2.01E-05	-2.08	3.78E-02
CIPPhysical Sci	0.004	1.16E-05	1.94E-05	0.601	5.48E-01
CIPPrecision Prod	0.031	3.91E-05	2.23E-05	1.75	8.00E-02
CIPPsych	0.014	3.29E-05	1.75E-05	1.88	6.03E-02
CIPPublic Admin	0.033	5.39E-05	2.24E-05	2.4	1.63E-02
CIPRecreation	0.017	3.24E-05	2.36E-05	1.38	1.69E-01
CIPSci Tech	-0.002	1.03E-05	2.51E-05	0.411	6.81E-01
CIPSocial Sciences	0.011	2.24E-05	1.87E-05	1.2	2.32E-01
CIPTech Ed	-0.464	-7.35E-05	1.49E-05	-4.93	8.26E-07
CIPTransportation	-0.002	3.01E-05	3.05E-05	0.989	3.23E-01
CIPVis/Perf Arts	-0.008	-7.48E-06	1.66E-05	-0.449	6.53E-01
log(APgr):raceB	-0.013	-1.38E-05	2.95E-06	-4.68	2.80E-06
log(APgr):raceH	-0.007	-6.98E-06	2.86E-06	-2.44	1.47E-02
log(APgr):raceI	0.001	3.41E-06	1.29E-05	0.264	7.92E-01
log(APgr):raceM	-0.003	-4.39E-06	3.75E-06	-1.17	2.42E-01
log(APgr):raceP	-0.009	-7.41E-06	5.50E-06	-1.35	1.78E-01
log(APgr):raceW	-0.004	-4.42E-06	2.77E-06	-1.6	1.10E-01
perc_pt:pell_er	0.015	1.57E-05	5.35E-06	2.94	3.29E-03

Table A-7: Assumption Checking of Dropout/Stopout Using Additive Regression (Associate)

	Slope	Coefficient	SE	z	p
Intercept	0.342	8.33E-05	1.20E-05	6.93	4.14E-12
log(APgr)	-0.00697	-1.97E-06	4.89E-07	-4.04	5.39E-05
raceB	0.0218	2.64E-05	3.07E-05	0.86	3.90E-01
raceH	0.0299	9.55E-06	4.54E-06	2.1	3.56E-02
raceI	0.151	3.61E-05	2.84E-05	1.27	2.03E-01
raceM	0.0239	1.32E-05	6.76E-06	1.95	5.10E-02
raceP	0.0468	1.75E-05	1.47E-05	1.19	2.33E-01
raceW	0.0428	1.24E-05	3.62E-06	3.44	5.88E-04
perc_pt	0.0106	-9.80E-08	1.75E-06	-0.0561	9.55E-01
pell_er	0.00942	2.66E-06	1.37E-06	1.94	5.18E-02
instSnow	-0.00084	2.08E-06	1.54E-06	1.35	1.76E-01
instSUU	-0.00074	-1.35E-06	5.85E-06	-0.23	8.18E-01
instUSU	0.0104	5.23E-06	2.16E-06	2.42	1.56E-02
instUtah Tech	0.0914	2.08E-05	1.93E-06	10.8	3.83E-27
instUVU	0.049	1.40E-05	1.46E-06	9.59	8.58E-22
instWeber State	0.0123	4.07E-06	1.46E-06	2.78	5.43E-03
log(CEgr)	-0.00425	-1.04E-06	8.23E-08	-12.6	1.91E-36
log(CLEPgr)	-0.00693	-2.12E-06	4.28E-07	-4.94	7.76E-07
low_income	0.0587	1.15E-05	1.44E-06	8.02	1.02E-15
title_one	0.0134	2.05E-06	2.00E-06	1.02	3.07E-01
log(hs_gpa_gr)	-0.00689	-1.95E-06	4.54E-07	-4.3	1.70E-05
log(ACT)	-0.153	-3.24E-05	2.61E-06	-12.4	2.53E-35
genderM	0.00797	3.06E-07	9.62E-07	0.318	7.50E-01
usbe504	-0.0208	-7.66E-06	3.99E-06	-1.92	5.47E-02
ell	0.0485	1.04E-05	6.15E-06	1.68	9.21E-02
CIPArchitecture	-0.0564	-5.54E-06	1.22E-05	-0.454	6.50E-01
CIPBiology	0.0311	9.22E-06	7.96E-06	1.16	2.47E-01
CIPBusiness	0.0252	9.37E-06	6.55E-06	1.43	1.53E-01
CIPComms	0.0622	1.61E-05	8.44E-06	1.9	5.69E-02
CIPComp Sci	0.0304	1.20E-05	7.00E-06	1.71	8.75E-02
CIPConstructions	-0.0718	-1.52E-05	6.98E-06	-2.17	3.00E-02
CIPEducation	0.018	7.68E-06	6.83E-06	1.12	2.61E-01
CIPEngineering	0.00853	5.67E-06	6.68E-06	0.849	3.96E-01
CIPEngineering tech	0.033	1.16E-05	7.74E-06	1.49	1.35E-01
CIPEnglish	0.0555	1.35E-05	8.90E-06	1.52	1.29E-01
CIPFamily/Cons Sci	0.0111	3.60E-06	8.66E-06	0.416	6.77E-01
CIPForeign Language	0.0386	1.10E-05	9.75E-06	1.13	2.58E-01
CIPHealth Prof	0.0123	3.09E-06	6.41E-06	0.483	6.29E-01
CIPHistory	-0.0137	3.25E-06	1.06E-05	0.306	7.59E-01
CIPHumanities	0.0535	1.70E-05	6.28E-06	2.71	6.75E-03

Table A-7: Assumption Checking of Dropout/Stopout Using Additive Regression (Associate) - continued

	Slope	Coefficient	SE	z	p
CIPInterdisc	-0.0339	-3.21E-06	9.78E-06	-0.328	7.43E-01
CIPJournalism	-0.018	-4.79E-06	7.48E-06	-0.641	5.21E-01
CIPLaw Enforcement	0.0491	1.65E-05	7.24E-06	2.27	2.30E-02
CIPLegal	0.0569	1.72E-05	1.44E-05	1.19	2.32E-01
CIPMath	0.00534	1.71E-05	1.31E-05	1.3	1.93E-01
CIPMechanic	0.00524	4.17E-06	7.11E-06	0.586	5.58E-01
CIPNatural Resources	-0.0248	-2.31E-06	9.30E-06	-0.249	8.04E-01
CIPPersonal and Culinary	0.0759	2.22E-05	8.87E-06	2.51	1.22E-02
CIPPhilosophy	3.28	1.53E-04	1.91E-04	0.802	4.22E-01
CIPPhysical Sci	0.0419	1.42E-05	9.56E-06	1.49	1.36E-01
CIPPrecision Prod	-0.00237	3.19E-06	9.76E-06	0.326	7.44E-01
CIPPsych	0.0056	4.42E-06	6.90E-06	0.641	5.21E-01
CIPPublic Admin	0.0103	6.06E-06	8.68E-06	0.698	4.85E-01
CIPRecreation	-0.0125	4.39E-06	1.18E-05	0.373	7.09E-01
CIPSci Tech	0.0443	1.25E-05	1.15E-05	1.09	2.78E-01
CIPSocial Sciences	-0.0262	-3.66E-06	7.71E-06	-0.474	6.35E-01
CIPTech Ed	1.39	1.27E-04	6.02E-05	2.11	3.47E-02
CIPTransportation	0.0592	1.58E-05	1.21E-05	1.31	1.91E-01
CIPVis/Perf Arts	0.054	1.82E-05	6.75E-06	2.7	6.96E-03
log(APgr):raceB	-0.00255	7.35E-07	3.34E-06	0.22	8.26E-01
log(APgr):raceH	0.000451	3.40E-07	5.86E-07	0.581	5.61E-01
log(APgr):raceI	0.00919	2.52E-06	3.11E-06	0.811	4.17E-01
log(APgr):raceM	0.00139	8.62E-07	8.49E-07	1.02	3.10E-01
log(APgr):raceP	-0.00627	-1.24E-06	1.69E-06	-0.732	4.64E-01
log(APgr):raceW	0.00257	7.76E-07	4.95E-07	1.57	1.17E-01
perc_pt:pell_er	-0.0761	-1.29E-05	2.42E-06	-5.34	9.08E-08

Table A-8: Assumption Checking of Enrollments to Graduation Using Additive Regression (Bachelor's)

	Slope	Coefficient	SE	z	p
Intercept	-0.13	-1.45E-04	3.24E-05	-4.48	7.35E-06
log(APgr)	0.000801	1.19E-06	1.06E-06	1.12	2.64E-01
raceB	-0.0101	-1.05E-05	2.56E-05	-0.409	6.82E-01
raceH	-0.00257	3.33E-06	9.67E-06	0.344	7.31E-01
raceI	0.000489	-1.61E-05	3.42E-05	-0.47	6.38E-01
raceM	0.00654	1.13E-05	1.32E-05	0.851	3.95E-01
raceP	0.00724	3.52E-05	5.02E-05	0.701	4.83E-01
raceW	0.00403	1.11E-05	7.31E-06	1.51	1.30E-01
perc_pt	-0.141	-2.45E-04	6.55E-06	-37.5	5.35E-307
pell_er	0.00314	-1.71E-06	4.59E-06	-0.373	7.09E-01
instU of U	0.00455	1.56E-05	5.34E-06	2.91	3.56E-03
instUSU	0.0399	5.95E-05	5.27E-06	11.3	1.25E-29
instUtah Tech	0.00632	8.64E-06	8.02E-06	1.08	2.81E-01
instUVU	0.00994	1.49E-05	5.72E-06	2.61	9.02E-03
instWeber State	-0.0165	-3.02E-05	5.05E-06	-5.97	2.34E-09
log(CEgr)	0.00186	2.44E-06	2.35E-07	10.4	3.93E-25
log(CLEPgr)	0.0008	1.49E-06	4.59E-07	3.24	1.18E-03
low_income	0.0082	9.37E-06	5.16E-06	1.82	6.95E-02
title_one	-0.00099	-2.11E-06	5.61E-06	-0.376	7.07E-01
log(hs_gpa_gr)	0.000519	8.02E-07	1.11E-06	0.722	4.70E-01
log(ACT)	0.0689	9.59E-05	8.62E-06	11.1	9.46E-29
genderM	-0.00707	-1.27E-05	2.87E-06	-4.42	9.84E-06
usbe504	-0.00579	3.13E-06	1.27E-05	0.246	8.05E-01
ell	-0.00741	-1.56E-05	2.02E-05	-0.775	4.38E-01
CIPArchitecture	0.0052	1.24E-05	2.61E-05	0.476	6.34E-01
CIPArea/Ethnic Studies	0.0701	7.94E-05	2.94E-05	2.7	6.96E-03
CIPBiology	-0.0143	-1.61E-05	1.48E-05	-1.09	2.77E-01
CIPBusiness	0.0214	2.87E-05	1.44E-05	2	4.57E-02
CIPComms	0.00313	1.94E-05	5.54E-05	0.35	7.27E-01
CIPComp Sci	-0.0132	-1.97E-05	1.47E-05	-1.34	1.79E-01
CIPConstructions	-0.0165	3.01E-06	3.93E-05	0.0766	9.39E-01
CIPEducation	0.00189	4.46E-06	1.46E-05	0.306	7.60E-01
CIPEngineering	-0.04	-5.02E-05	1.46E-05	-3.45	5.66E-04
CIPEngineering tech	-0.00888	-2.14E-05	1.69E-05	-1.27	2.06E-01
CIPEnglish	0.0276	3.76E-05	1.66E-05	2.27	2.34E-02
CIPFamily/Cons Sci	0.03	3.56E-05	1.61E-05	2.21	2.69E-02
CIPForeign Language	0.0132	1.61E-05	1.92E-05	0.839	4.01E-01
CIPHealth Prof	-0.0107	-1.52E-05	1.47E-05	-1.03	3.02E-01
CIPHistory	-0.00928	-1.73E-05	1.90E-05	-0.912	3.62E-01

Table A-8: Assumption Checking of Enrollments to Graduation Using Additive Regression (Bachelor's) - continued

	Slope	Coefficient	SE	z	p
CIPHumanities	-0.013	-2.44E-05	1.55E-05	-1.58	1.15E-01
CIPInterdisc	0.000182	-4.04E-06	1.74E-05	-0.232	8.16E-01
CIPJournalism	0.0317	4.33E-05	1.53E-05	2.84	4.56E-03
CIPLaw Enforcement	0.0277	3.58E-05	1.71E-05	2.1	3.60E-02
CIPLegal	0.0747	8.46E-05	4.82E-05	1.75	7.96E-02
CIPMath	0.0164	9.24E-06	1.89E-05	0.49	6.24E-01
CIPMechanic	-0.105	-1.27E-04	1.40E-05	-9.04	1.55E-19
CIPNatural Resources	0.0127	1.93E-05	1.96E-05	0.984	3.25E-01
CIPPhilosophy	-0.0119	-2.19E-05	2.38E-05	-0.922	3.56E-01
CIPPhysical Sci	-0.03	-3.98E-05	1.58E-05	-2.51	1.19E-02
CIPPsych	0.0325	4.09E-05	1.53E-05	2.68	7.41E-03
CIPPublic Admin	0.0404	5.45E-05	1.94E-05	2.81	4.97E-03
CIPRec Activities	-0.0233	-2.48E-05	6.19E-05	-0.401	6.89E-01
CIPRecreation	-0.0029	-2.20E-06	1.53E-05	-0.144	8.86E-01
CIPSocial Sciences	0.0197	2.56E-05	1.51E-05	1.7	8.90E-02
CIPTransportation	0.0207	2.04E-05	2.42E-05	0.84	4.01E-01
CIPVis/Perf Arts	-0.00503	-2.14E-06	1.46E-05	-0.146	8.84E-01
log(APgr):raceB	-0.00213	-3.38E-06	3.12E-06	-1.08	2.78E-01
log(APgr):raceH	-0.00012	5.79E-07	1.30E-06	0.445	6.56E-01
log(APgr):raceI	0.00108	-5.51E-07	4.16E-06	-0.133	8.95E-01
log(APgr):raceM	0.00136	1.93E-06	1.81E-06	1.07	2.85E-01
log(APgr):raceP	0.00176	4.86E-06	5.60E-06	0.868	3.85E-01
log(APgr):raceW	0.000624	8.85E-07	1.04E-06	0.853	3.94E-01
perc_pt:pell_er	0.0815	1.54E-04	8.70E-06	17.7	2.58E-70

Table A-9: Assumption Checking of Dropout/Stopout Using Additive Regression (Bachelor's)

	Slope	Coefficient	SE	z	p
Intercept	0.554	2.18E-04	1.12E-05	19.5	2.46E-84
log(APgr)	-0.001	-5.28E-07	3.14E-07	-1.68	9.27E-02
raceB	0.020	1.31E-05	7.28E-06	1.8	7.13E-02
raceH	0.012	4.84E-06	2.25E-06	2.15	3.16E-02
raceI	0.008	7.01E-06	6.89E-06	1.02	3.09E-01
raceM	0.021	9.82E-06	2.80E-06	3.51	4.55E-04
raceP	0.049	1.67E-05	9.93E-06	1.68	9.26E-02
raceW	0.019	9.49E-06	1.56E-06	6.07	1.26E-09
perc_pt	0.023	7.10E-06	2.82E-06	2.52	1.19E-02
pell_er	-0.003	-1.20E-06	1.23E-06	-0.978	3.28E-01
instU of U	-0.026	-1.65E-05	1.93E-06	-8.53	1.42E-17
instUSU	-0.012	-8.95E-06	1.60E-06	-5.6	2.19E-08
instUtah Tech	0.074	2.68E-05	3.07E-06	8.75	2.20E-18
instUVU	0.019	4.22E-06	1.86E-06	2.27	2.33E-02
instWeber State	0.024	8.76E-06	1.99E-06	4.4	1.09E-05
log(CEgr)	-0.003	-9.55E-07	7.69E-08	-12.4	2.08E-35
log(CLEPgr)	0.001	3.32E-07	1.33E-07	2.5	1.25E-02
low_income	0.058	2.00E-05	1.76E-06	11.3	8.14E-30
title_one	0.004	1.37E-06	1.76E-06	0.777	4.37E-01
log(hs_gpa_gr)	-0.002	-7.82E-07	3.33E-07	-2.35	1.89E-02
log(ACT)	-0.155	-5.66E-05	3.17E-06	-17.9	2.43E-71
genderM	-0.021	-1.11E-05	9.40E-07	-11.8	2.24E-32
usbe504	0.012	2.23E-06	5.56E-06	0.401	6.88E-01
ell	-0.031	-9.68E-06	1.03E-05	-0.938	3.48E-01
CIPArchitecture	-0.023	-1.11E-05	6.86E-06	-1.62	1.06E-01
CIPArea/Ethnic Studies	-0.030	-1.68E-05	5.93E-06	-2.84	4.52E-03
CIPBiology	-0.022	-1.03E-05	4.25E-06	-2.44	1.49E-02
CIPBusiness	-0.041	-1.77E-05	4.00E-06	-4.43	9.38E-06
CIPComms	-0.109	-5.29E-05	4.32E-06	-12.3	1.54E-34
CIPComp Sci	-0.013	-5.73E-06	4.20E-06	-1.36	1.72E-01
CIPConstructions	-0.005	2.65E-06	1.33E-05	0.2	8.41E-01
CIPEducation	-0.015	-7.51E-06	4.14E-06	-1.81	6.98E-02
CIPEngineering	-0.002	-2.30E-06	4.10E-06	-0.562	5.74E-01
CIPEngineering tech	-0.023	-1.24E-05	5.83E-06	-2.12	3.37E-02
CIPEnglish	-0.018	-9.50E-06	4.64E-06	-2.05	4.06E-02
CIPFamily/Cons Sci	-0.061	-2.74E-05	4.27E-06	-6.42	1.34E-10
CIPForeign Language	-0.046	-1.98E-05	5.21E-06	-3.81	1.41E-04
CIPHealth Prof	-0.003	-2.22E-06	4.33E-06	-0.512	6.09E-01
CIPHistory	-0.021	-1.03E-05	5.67E-06	-1.82	6.86E-02
CIPHumanities	0.136	5.54E-05	4.87E-06	11.4	4.65E-30

Table A-9: Assumption Checking of Dropout/Stopout Using Additive Regression (Bachelor's) - continued

	Slope	Coefficient	SE	z	p
CIPInterdisc	-0.068	-3.30E-05	4.46E-06	-7.39	1.48E-13
CIPJournalism	-0.068	-2.98E-05	4.21E-06	-7.08	1.40E-12
CIPLaw Enforcement	-0.012	-3.67E-06	5.58E-06	-0.658	5.11E-01
CIPLegal	0.048	1.52E-05	1.19E-05	1.27	2.03E-01
CIPMath	-0.020	-9.91E-06	4.76E-06	-2.08	3.72E-02
CIPMechanic	0.022	6.80E-06	2.83E-05	0.24	8.10E-01
CIPNatural Resources	-0.045	-2.04E-05	5.09E-06	-4	6.21E-05
CIPPhilosophy	-0.052	-2.42E-05	6.15E-06	-3.94	8.19E-05
CIPPhysical Sci	-0.005	-2.93E-06	4.74E-06	-0.618	5.37E-01
CIPPsych	-0.016	-7.46E-06	4.32E-06	-1.73	8.40E-02
CIPPublic Admin	-0.043	-1.94E-05	5.41E-06	-3.6	3.24E-04
CIPRec Activities	-0.079	-4.48E-05	4.11E-06	-10.9	1.26E-27
CIPRecreation	-0.056	-2.50E-05	4.35E-06	-5.74	9.49E-09
CIPSocial Sciences	-0.045	-2.04E-05	4.13E-06	-4.92	8.48E-07
CIPTransportation	-0.039	-1.45E-05	6.34E-06	-2.29	2.18E-02
CIPVis/Perf Arts	0.000	-1.00E-06	4.29E-06	-0.234	8.15E-01
log(APgr):raceB	-0.005	-1.94E-06	1.04E-06	-1.87	6.15E-02
log(APgr):raceH	-0.004	-1.67E-06	3.97E-07	-4.2	2.68E-05
log(APgr):raceI	-0.006	-2.42E-06	1.14E-06	-2.11	3.44E-02
log(APgr):raceM	-0.003	-1.66E-06	5.41E-07	-3.08	2.09E-03
log(APgr):raceP	-0.001	-1.31E-06	1.28E-06	-1.02	3.08E-01
log(APgr):raceW	-0.001	-6.44E-07	3.06E-07	-2.11	3.53E-02
perc_pt:pell_er	-0.073	-2.44E-05	3.26E-06	-7.47	7.74E-14