Institutional Effectiveness, Research & Planning

IMPACT OF COURSE LENGTH ON AND SUBSEQUENT USE AS A PREDICTOR OF COURSE SUCCESS

2008-2009 through 2012-2013

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Abstract

This study analyzes course success[1] rates of students earning a grade on record in 8-week condensed courses at Crafton Hills College, a small suburban community college in Southern California, over five academic years compared to students earning a grade on record in the same course taught by the same instructors in a full semester traditional course of 18 weeks. Controlling for instructor, course, and academic term in this study mitigates the impact of other influences on student success not fully considered in previous research. The study then applies classification tree algorithms and binary logistic regression to determine whether course length predicts students' course success rates. The findings follow previous studies that students enrolled in condensed courses are more likely to be successful than students in traditional length courses. Findings include positive statistical and practical relationships for course success in six subjects and for students with a lower than average prior cumulative GPA. Additionally, prior cumulative GPA and course length are the best predictors of a student successfully completing a course.

Introduction & Literature Review

In Summer 2013 an instructor at Crafton Hills College observed abnormally high course completion and success rates in a 5-week lower division general education course, which prompted an inquiry to the Office of Institutional Effectiveness, Research & Planning (OIERP) on whether there was a statistical difference in student success when comparing coterminous (i.e. full-term or traditional) and non-coterminous (i.e. short-term or compressed) courses. Research clearly shows that compressed and accelerated courses lead to higher course success rates across many disciplines. Sheldon and Durdella (2009) found that success rates increased from 56.7% in traditional length English courses to 87% in condensed courses. Math and reading success rates were compared in the same study. Although the increases weren't as dramatic as English, math and reading success rates were 14% and 11% higher, respectively. Austin and Gustafson (2006) found that the higher success rates in condensed courses were meaningful measurements of learning outcomes by controlling for student characteristics, previous and future performance. Logan and Geltner (2000) analyzed nearly 450,000 student records and found that students in condensed courses across all disciplines had higher success rates. In addition to increased success rates, Edgecombe noted that students in condensed courses had higher course completion (formally, retention) rates and persisted through their developmental sequence more completely than other students.

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[1] Success is defined as a student earning a grade on record of A, B, C or P/CR. The success rate is measured as the number of students earning a grade on record of A, B, C or P/CR divided by the total number of students earning a grade on record/GOR (grades of A, B, C, D, F, P/CR, NP/NC, I or W).

Common wisdom has led many faculty to believe that community college students, especially those in need of developmental coursework, require additional time to properly assimilate curricula; however, these perceptions are negated quantitatively by the aforementioned studies as well as qualitatively by students and faculty alike. As Edgecombe (2011) and Kretovics, Crowe, and Hyun (2005) noted, compressed courses allow the student to maintain the same contact hours with the instructor as a traditional length course. The same number of hours allows for the same academic rigor but requires instructors to restructure how lessons are delivered and assessed (Edgecombe, 2011; Kretovics et al., 2005). Edgecombe (2011) and Johnson (2009) both recommended that course lessons, assignments, and assessments be restructured to align more closely with course learning outcomes to ensure time is spent efficiently on the required concepts. A summary of instructor surveys found that faculty preferred condensed courses due to increased student motivation and classroom interactions (Daniel, 2000). Negative perceptions from faculty included fatigue, lack of preparation time, and perceived negative impact on student learning outcomes (Daniel, 2000). In the case of students, Daniel (2000) summarized numerous student survey findings that students took condensed courses for myriad reasons: including, convenience, perceived higher quality instruction, increased interaction, and innovative instructional modalities (pg. 302). In other words, students felt the condensed courses were as rigorous, if not more so, than traditional length courses. Ross-Gordon (2011) noted that mature, non-traditional students thrive in the intensive learning environment provided by condensed courses.

Concerns over long-term learning outcomes are also well-documented; however, studies in non-sequenced or stand-alone compressed courses show that while there is a short-term increase in success, the long-term impact on knowledge retention is the same for students in compressed and traditional courses (Austin & Gustafson, 2006; Daniel, 2000). Austin and Gustafson (2006) found that although students were significantly more successful in condensed courses in comparison to students in traditional length courses, students were equally successful in a subsequent course of the same discipline as the condensed course meaning that the impact on long-term student learning was the same regardless of course length.

Multiple studies noted pedagogical adjustments were required in order to accommodate the changes created by a condensed timeframe. By definition, a condensed course would require the same number of contact hours as a traditional length course; however, faculty consistently noted that they were required to offer innovative learning experiences, adjust syllabi, change assignments and assessments, require strict student attendance, and enforce student preparation for class. (Johnson, 2009; Kretovics et al., 2005). In a condensed timeframe, the time being shortened is time outside of the classroom leaving both students and faculty with less time to prepare for course meetings, which led to feelings of fatigue and increased stress (Kretovics et al., 2005). Additionally, because class meeting times are typically longer, a single absence could be more impactful on learning outcomes (Johnson, 2009).

With a traditional term of 18 weeks, two series of 8-week non-coterminous course offerings could be scheduled consecutively with a first set of courses beginning on the same week as traditional courses and a second set beginning on the eleventh week of the traditional term. As Emslie (2012) noted, a configured compressed calendar allows for the institution to sequence requisite courses consecutively in the same term, so students can more quickly complete developmental courses. The pairing and sequencing of similar and linked compressed courses into the same term promotes student progression through faster and successful course pathways (Edgecombe, 2011). Scheduling sequenced compressed developmental courses in this manner,

as Sheldon and Durdella (2009) suggest, should be applied by community colleges in order to increase student progress.

Bremer et al. (2013) found that students who successfully complete English, reading, and writing developmental courses in their first term were more likely to persist into their second term and second academic year. Conversely, the same study found that these same students were more likely to take longer to complete their program with only 12.6% of students requiring developmental courses finishing within two years. Bremer et al. (2013) noted that this finding was expected, because students requiring developmental courses would naturally take longer to complete transfer-level and/or program courses. Edgecombe (2011) noted that developmental courses offered in various accelerated formats tend to promote student progression through clear and innovative program pathways.

Previous studies have also attempted to predict student performance in courses. Budden, Hsing, Budden, and Hall (2010) conducted a study on term-to-term retention and found that the best predictor for student retention was cumulative GPA. Specifically, a higher cumulative GPA would predict a higher probability of a student returning in the subsequent term. Goldstein and Perin (2008) found that student success was best predicted by level of English course completion where students who had completed transfer-level English were more likely to successfully complete their course. Finally, Bremer et al. (2013) found that mathematics placement scores were the best predictor for student success when controlling for developmental courses where students who scored higher on their math assessment test were at better odds of successfully completing their courses.

Research Questions

This study addressed two questions: Are community college students more successful in their courses when enrolled in compressed courses as compared to students enrolled in traditional full-term length courses? If the success rate is different between compressed and traditional-length courses, can course length then be used to predict course success? If there is no difference in success rates, the following hypotheses would hold true:

> H1: There is no statistical or practical difference between course success rates for community college students enrolled in compressed courses and students enrolled in traditional-length courses.

> H2: Course length does not predict course success rates.

Methodology

All historical student records were compiled from the comprehensive higher education student information management system at San Bernardino Community College District (SBCCD). SBCCD includes Crafton Hills College and San Bernardino Valley College. Course records were limited to fall and spring terms at Crafton Hills College over the previous five years were selected in order to control for location and the apparent difference in student performance between primary and intersession terms. For instance, the average student success rate in summer terms (84%) are substantially ($d = 0.28$) and statistically significantly ($p < 0.001$) higher than the average success rate in primary terms (72%). Previous studies have included compressed courses offered during a summer session in their analyses; however, by controlling for the term in which the

courses are offered allows for this study to control for other variables which could influence student success, such as access to co-curricular and extra-curricular student support services, involvement in extra-curricular activities and events, higher student and faculty course load, and perceptions about intersession courses.

Compressed courses were identified by calculating the length of time between the first meeting date and last meeting date of the course. Selected compressed courses were further limited to courses of approximate 8 weeks in length, because sequenced courses within the same primary term would likewise be limited to approximately 8 weeks each. Compressed courses of other lengths, such as 5 weeks or 13 weeks, were excluded due to pedagogical differences that could exist of other compressed course lengths. Courses with a SAM priority code of B (advanced occupational) as defined by the California Community College Chancellor's Office were removed from the selection due to the specialized course and cohort designs of occupational programs at Crafton Hills College, such as Fire Technology and Respiratory Care. A total of 4,592 records were identified for the treatment group. A control group of records was identified by selecting records from identical courses that were full-term length in the same primary terms as the compressed courses. The courses were further limited to the same instructors who taught compressed courses in order to control for pedagogical approaches. A total of 11,002 records were identified for the control group.

Multiple variables were created and calculated using various data in the student records. A student course grade was marked as successful if the student earned a grade of A, B, C, or P/CR. Conversely, students were considered not successful if the student earned a grade on record (GOR) other than A, B, C, or P/CR, inclusive of a grade of W; unsuccessful grades included D, F, I, W, and NP/NC. As Goldstein and Perin (2008) found, including grades of W in analyses of student performance did not impact any results. Including all grades on record provides the largest representation on possible student performance in the courses studied. The success variable was used as the dependent variable in the analyses.

Cumulative prior GPA, cumulative prior course credits attempted, and cumulative prior grade points earned were calculated using all SBCCD student records. Grade points were assigned uniformly according to Crafton Hills College's grading system as follows: A=4 grade points, B=3, C=2, D=1, F or I=0, and the remaining grades are assigned no value. Lastly, the mean (2.72) and standard deviation (1.01) were calculated to categorize the cumulative prior GPA as a normalized distribution of grades by standard deviation.

Student's term age was calculated as a continuous variable in which the student's birth date was subtracted from the term start date. Ethnicities were categorized as follows: Asian/Pacific Islander, African-American/Black, Hispanic/Latino, Native American/Alaskan, Caucasian/White, and other. A dichotomous variable was created in which a student was flagged as a first-time Crafton Hills College student if the record was a grade earned in the first term a student was enrolled at Crafton Hills College. Additionally, student placement results were merged from Accuplacer to a student record if the placement test was completed prior to the beginning of the course; placement tests are administered by Crafton Hills College in three developmental subjects: English, math and reading. The results of the tests were coded into a categorical variable labeled with the course into which the student was placed.

Success rates were compared between the treatment group (students earning a GOR in selected compressed courses) and the control group (students earning a GOR in traditional-length courses) using meta-analyses methods. The effect size statistic (*d*) is commonly used in

meta-analyses. A meta-analysis uses quantitative techniques to determine the average effect of a given treatment over multiple studies. Noticing that even small differences can be statistically significant when large pools of data are analyzed, Jacob Cohen developed one method of interpreting effect size. Cohen defined "small," "medium," and "large" effect sizes and explained that an effect size of 0.20 can be considered small, an effect size of 0.50 can be considered medium, and an effect size of 0.80 can be considered large. Effect size is calculated by dividing the difference of the two means by the pooled standard deviation. It is important to mention that the number of students in each group does not influence effect size; whereas, when statistical significance is calculated, the number of students in each group does influence the significance level (i.e., "p" value being less than 0.05). Accordingly, using Cohen as a guide, a substantial practical effect would be 0.20 or higher.

A series of multivariate statistical techniques as described by Wurtz (2008) were used to measure the degree of relationships between several independent variables in order to predict student success, the dependent variable. Categorical independent variables (i.e. ethnicity, age, and placement test results) were dummy coded, so each value could be independently analyzed against the dependent variable. Multiple regression using the enter method identified whether multicollinearity existed between any of the candidate predictor variables; multiple regression detected multicollinearity ($\beta \geq 1.0$ and/or tolerance ≤ 0.01) between gender, Caucasian students, and select student assessment placements, meaning that these variables had a moderate to high intercorrelation and should not be used as candidate predictors in further analysis. Conversely, multicollinearity was not detected in the remaining variables: ethnicities other than Caucasian, first-time student, age at the beginning of the respective term, cumulative prior GPA, credits attempted, grade points earned, and course length; these variables were suitable independent variables for use in logistic regression analysis.

Binary logistic regression using the forward stepwise Wald method predicted the probability of student success through the application of various combinations of the candidate predictors identified in the multiple regression above. Finally, a classification tree was built using the classification and regression tree (CRT) algorithm in SPSS to accurately predict students who successfully completed their course by partitioning the previously identified candidate variables into segments where similar outcomes are grouped together.

Student Success Rates by Course Length

Table 1 compares demographic attributes for students completing compressed courses to the demographics of students completing traditional-length courses. African-American students, males, students over 25 years of age, and students with a prior cumulative GPA less than 2.72 are slightly more represented in compressed courses than in traditional-length courses. Conversely, Caucasian students, females, students under 25 years of age, and students with a prior cumulative GPA greater than 2.72 are slightly more represented in traditional-length courses than in compressed courses. None of the differences are practically significant, however.

Table 1. Count and percentage of student demographics by course length

Attribute	Traditional courses		Compressed courses	
	N	%	N	%
Ethnicity				
Asian	581	5.3	255	5.6
African American	766	7.0	411	9.0
Hispanic	3,976	36.1	1,627	35.4
Native American	203	1.8	85	1.9
Caucasian	5,320	48.4	2,143	46.7
Other/Unknown	156	1.4	71	1.5
Gender				
Female	6,016	54.7	2,378	51.8
Male	4,968	45.2	2,206	48.0
Missing	18	0.2	8	0.2
Age				
19 or younger	4,453	40.5	1,563	34.0
20-24	3,573	32.5	1,411	30.7
25-29	1,190	10.8	582	12.7
30-34	634	5.8	295	6.4
35-39	422	3.8	226	4.9
40-49	513	4.7	331	7.2
50 and above	215	2.0	184	4.0
Prior Cumulative GPA				
3.74-4.00	1,375	15.4	531	14.8
2.73-3.73	4,048	45.5	1,589	44.3
2.72	28	0.3	9	0.3
1.71-2.71	2,524	28.4	1,044	29.1
0.70-1.70	526	5.9	235	6.5
0.00-0.69	400	4.5	181	5.0

Note: "N" is the number of students within an attribute subcategory (i.e. Female). "%" is the percentage of students within an attribute subcategory divided by the total number of students within an attribute category (i.e. Gender).

Table 2 presents the average age of students and prior cumulative grade point average at the beginning of the academic term in which they completed compressed courses in comparison to those students who completed traditional-length courses. Students completing compressed courses average 25 years of age which is slightly higher than students completing traditional courses (24 years old). Students completing compressed courses have an average GPA of 2.77 which is slightly lower in comparison to students completing traditional-length courses (2.81). This result counters previous studies which found that students in compressed courses typically have

a higher GPA than students in traditional-length courses (Kretovics et al., 2005; Sheldon & Durdella, 2009). Neither of the differences are practically significant.

Table 2. Average value of student attributes by course length

Attribute	Traditional courses	Compressed courses
	mean	mean
Age at start of the term	24	25
Cumulative prior GPA	2.81	2.77

Table 3 illustrates the overall success rate for students in compressed courses in comparison to traditional-length courses. The overall success rate for students completing compressed courses is 75%, which is statistically significantly ($p < 0.001$) higher than the success rate for students completing a traditional-length course taught by the same professors in the same primary terms. Practically, the difference is slight ($d = 0.13$), which means that the success of an average student in a compressed course is 5 percentage points higher than the success of an average student in a traditional-length course. If compressed courses offered during summer courses were included in the sample of compressed courses, the success rate for compressed courses would have increased to 81%, which is statistically significantly ($p < 0.001$) and substantially ($d = 0.28$) greater than the success rate of traditional-length courses in primary terms.

Table 3. Success rates by course length

Measurement	Traditional courses		Compressed courses		d	p
	N	%	N	%		
Students Successful	7,599	69.1	3,437	74.8	0.13	<0.001

Table 4 illustrates the success rate for students distributed across a normalized distribution of prior cumulative GPA. As previously stated, the average prior cumulative GPA was 2.72, and the standard deviation was 1.01. The distribution of prior cumulative GPA in the study population is negatively skewed ($g_1 = -1.092$), which is similar to the skew ($G_1 = -1.110$) in all student records in the same time period as the study illustrating student records included in the sample are an unbiased sample of all student records. The success rates for all prior cumulative GPA segments were higher for students in compressed courses than for students in traditional-length courses. Students in compressed courses with a prior cumulative GPA one standard deviation below the mean (1.71 to 2.71) had a statistically significant ($p < 0.001$) and substantially ($d = 0.26$) higher success rate (70%) than students in traditional-length courses with the same prior cumulative GPA (57%). The success of an average student in a compressed course with a prior cumulative GPA on standard deviation below the mean (1.71 to 2.71) is 11 percentage points higher than the success of an average student in a traditional-length course with the same prior cumulative GPA. Students in compressed courses with a prior cumulative GPA one standard deviation above the mean (2.73 to 3.73) had a statistically significant ($p < 0.001$) and nearly substantially ($d = 0.18$) success rate (85%) than students in traditional-length courses with the same prior cumulative GPA (77%). The success of an average student in a compressed course with a prior cumulative GPA on standard deviation above the mean (2.73 to 3.73) is 7 percentage points

higher than the success of an average student in a traditional-length course with the same prior cumulative GPA. Lastly, students in compressed courses with a prior cumulative GPA at the mean (2.72) had a substantially (*d* = 0.33) higher success rate (89%) than students in traditional-length courses with the same prior cumulative GPA (75%). The success of an average student in a compressed course with a prior cumulative GPA at the mean (2.72) is 13 percentage points higher than the success of an average student in a traditional-length course with the same prior cumulative GPA.

Table 4. Success rates by course length and normalized distribution of prior cumulative GPA

Prior cumulative GPA	Traditional courses		Compressed courses		*d*	p
	N	%	N	%		
3.74-4.00 (SD = 2)	1,180	85.8	464	87.4	0.05	0.364
2.73-3.73 (SD = 1)	3,127	77.2	1,342	84.5	0.18	<0.001
2.72 (Mean)	21	75.0	8	88.9	0.33	0.324
1.71-2.71 (SD = -1)	1,438	57.0	729	69.8	0.26	<0.001
0.70-1.70 (SD = -2)	200	38.0	106	45.1	0.14	0.068
0.00-0.69 (SD = -3)	165	41.3	83	45.9	0.09	0.302

At Crafton Hills College, the instructional programs for the college are divided by subject matter into one of three divisions, each lead by a dean. The Division of Arts and Sciences contains most general subject program areas (e.g. the humanities, social sciences, and natural sciences). The Division for Career and Human Development contains programs that are considered career and technical education programs typically focused on preparing students to be employed in specific industries within the college's geographic service area; program areas include radiological technology, fire protection, emergency medical technology, and child development. Finally, the Division of Math, Reading, English, and Instructional Support includes English, math, reading, tutoring, and learning communities. Table 5 illustrates the success rate for students in compressed courses in comparison to students in traditional-length courses by instructional division. Students in a compressed course offered in the Division of Arts and Sciences had a statistically significantly (p < 0.001) and substantially (*d* = 0.24) higher success rate (78%) than students in traditional-length courses in the same instructional division (67%). The success of an average student in a compressed course offered in the Division of Arts and Sciences is 9.5 percentage points higher than the success of an average student in a traditional-length course offered in the same instructional division. The success rates for students in compressed courses offered in the other two instructional divisions were neither significantly nor practically different when compared to the success rates for students in traditional-length courses offered in the same instructional divisions.

Table 5. Success rates by course length and instructional division

Division	Traditional courses		Compressed courses		*d*	p
	N	%	N	%		
Division of Arts and Sciences	1,646	66.7	1,032	77.8	0.24	<0.001
Division of Career and Human Development	611	83.1	1,091	84.5	0.04	0.420
Division of Math, English, Reading, and Instructional Support	5,342	68.5	1,314	66.6	-0.04	0.095

Table 6 illustrates the success rates for students in compressed courses offered in various subjects within the Division of Arts and Sciences compared to students in traditional-length courses in the same subjects. There is a statistically significant and substantial difference in four subjects: computer information systems (p = 0.002, d = 0.20), history (p = 0.020, d = 0.55), communication studies (p < 0.001, d = 0.45), and theatre arts (p < 0.001, d = 0.50). The success of an average student in a compressed course offered in computer information systems was 8 percentage points higher, in history was 21 percentage points higher, in communication studies was 17 percentage points higher, and in theatre arts was 19 percentage points higher than the success of an average student in a traditional-length course offered in the same subject, respectively. The difference in success rates for students in music or religion courses were neither statistically significant nor substantial, although compressed courses in religion appeared to have a slight negative practical effect on the success rate (d = -0.13). Notably, only one compressed course was offered in history and religion, and compressed courses in theatre arts, history and religion included a minimal number of students.

Table 6. Success rates by course length and Division of Arts and Sciences course subject

Division of Arts and Sciences Course Subject	Traditional courses		Compressed courses		d	p
	N	%	N	%		
Computer Information Systems	287	69.3	476	77.9	0.20	0.002
History	64	57.7	11	84.6	0.55	0.020
Music	578	77.3	33	78.6	0.03	0.844
Religion	81	71.1	13	65.0	-0.13	0.607
Communication Studies	540	56.3	493	77.6	0.45	<0.001
Theatre Arts	96	80.7	6	100.0	0.50	<0.001

Table 7 illustrates the success rates for students in compressed courses offered in various subjects within the Division of Career and Human Development compared to students in traditional-length courses in the same subjects. The success rates for students in compressed courses within allied health (84%) and respiratory care (85%) were slightly higher than the success rates for students in traditional-length courses in the same subjects (83%); however, the difference was neither significant (p > 0.05) nor substantial (d < 0.20). Courses identified as clearly occupational were excluded from this study, so only introductory courses in allied health and respiratory care were included in the analysis.

Table 7. Success rates by course length and Division of Career and Human Development course subject

Division of Career and Human Development Course Subject	Traditional courses		Compressed courses		d	p
	N	%	N	%		
Allied Health	441	83.4	649	84.1	0.02	0.737
Respiratory Care	170	82.5	442	85.2	0.07	0.391

Table 8 illustrates the success rates for students in compressed courses offered in various subjects within the Division of Math, English, Reading, and Instructional Support compared to students in traditional-length courses in the same subjects. The success rate for students in compressed

English courses (88%) was statistically significantly (p = 0.025) and substantially (*d* = 0.37) higher than the success rate for students in traditional-length English courses (71%). The success of an average student in a compressed English course is 14 percentage points higher than the success of an average student in the same traditional-length course. The success rates for students in compressed courses within college life (75%) and mathematics (67%) were slightly higher than the success rates for students in traditional-length courses in the same subjects (72% and 66%, respectively); however, the difference was neither significant (p > 0.05) nor substantial (*d* < 0.20). The success rate for students in compressed learning resources courses were statistically significantly (p < 0.001) and substantially (*d* = -0.34) ***lower*** than the success rate for students in traditional-length courses in the same subject. The success of an average student in a learning resource compressed course is 13 percentage points lower than the success of an average student in the same traditional-length course. Learning resources courses are learning communities which are linked to one or two other courses from other disciplines and used as an alternative learning strategy.

Table 8. Success rates by course length and Division of Math, English, Reading, and Instructional Support subject

Division of Math, English, Reading, and Instructional Support Course Subject	Traditional courses		Compressed courses		*d*	p
	N	%	N	%		
College Life	119	72.1	18	75.0	0.06	0.767
English	256	71.1	21	87.5	0.37	0.025
Learning Resources	298	68.5	106	52.0	-0.34	<0.001
Mathematics	4,062	66.3	1,122	67.1	0.02	0.530
Reading	607	84.7	47	92.2	0.21	0.063

Predicting Student Success Rates using Course Length

Having found evidence of a positive relationship between student success and compressed course offerings overall and in eleven of thirteen subjects, six of which were substantially significant, a regression analysis was used to examine whether variables predicted course success.

Table 9 provides the classification table results of a regression utilizing various continuous and dummy-coded candidate predictor variables (i.e. course length, ethnicity, term age, first-time student, prior cumulative GPA, and placement test results) previously discussed in the Methodology section. With an average success rate of 72%, the cut-off value for percentage correct in an acceptable model would be greater than 72%; none of the models reached this threshold, although Model 2 had an overall percentage correct of 66%, a successful percentage correct of 67%, and a non-successful percentage correct of 64.1%. Model 2 provided the best predictors of student success of the eleven models, because it had the highest overall percentage correct of the 11 models produced in the logistic regression.

Table 9. Binary logistic regression classification table results for success rates

Observed			Predicted		
			Success Rate		Percentage Correct
			Not Successful	Successful	
Model 1	Success Rate	Not Successful	2,261	1,366	62.3
		Successful	2,925	5,938	67.0
	Overall Percentage				*65.6*
Model 2	Success Rate	Not Successful	2,324	1,303	64.1
		Successful	2,923	5,940	67.0
	Overall Percentage				*66.2*
Model 3	Success Rate	Not Successful	2,330	1,297	64.2
		Successful	2,936	5,927	66.9
	Overall Percentage				*66.1*
Model 4	Success Rate	Not Successful	2,408	1,219	66.4
		Successful	3,133	5,730	64.7
	Overall Percentage				*65.2*
Model 5	Success Rate	Not Successful	2,402	1,225	66.2
		Successful	3,126	5,737	64.7
	Overall Percentage				*65.2*
Model 6	Success Rate	Not Successful	2,417	1,210	66.6
		Successful	3,102	5,761	65.0
	Overall Percentage				*65.5*
Model 7	Success Rate	Not Successful	2,422	1,205	66.8
		Successful	3,094	5,769	65.1
	Overall Percentage				*65.6*
Model 8	Success Rate	Not Successful	2,425	1,202	66.9
		Successful	3,100	5,763	65.0
	Overall Percentage				*65.6*
Model 9	Success Rate	Not Successful	2,430	1,197	67.0
		Successful	3,100	5,763	65.0
	Overall Percentage				*65.6*
Model 10	Success Rate	Not Successful	2,409	1,218	66.4
		Successful	3,107	5,756	64.9
	Overall Percentage				*65.4*
Model 11	Success Rate	Not Successful	2,413	1,214	66.5
		Successful	3,100	5,763	65.0
	Overall Percentage				*65.5*

Table 10 provides an analysis of Model 2 provided in the logistic regression. While the Wald statistics show the model is statistically significant (X^2 (2) = 1228.968, p < 0.001), the Hosmer & Lemeshow goodness-of-fit statistic is also statistically significant (X^2 (8) = 69.443, p < 0.001) suggesting that the model is *not* reliable.

Table 10. Analysis of binary logistic regression Model 2

Test	X^2	df	p
Wald Overall Model Test	1228.968	2	<0.001
Hosmer & Lemeshow Goodness-of-Fit Test	69.443	8	<0.001

Table 11 provides an analysis of the predictor variables utilized in Model 2. Although the model is not determined to be reliable according to the Hosmer & Lemeshow goodness-of-fit test statistic, examining the predictor variables included—*and the predictor variables not included*—in Model 2 provides insight into what possible relationships may or may not exist. The two best predictors in this model are prior cumulative GPA and course length. Prior cumulative GPA has an odds ratio of 2.083 and a positive β coefficient, which means that a student is two times more likely to succeed for every 1 point increase in that student's prior cumulative GPA. Similarly, course length has an odds ratio of 1.553 and a positive β coefficient meaning a student enrolled in a compressed course is one and a half times more likely to succeed than a student enrolled in a traditional-length course.

Table 11. **Analysis of binary logistic regression Model 2 predictor variables**

Predictor	β	Wald X^2	p	Exp(β)	95% CI for Exp(β)	
					Lower	Upper
Course Length	0.440	84.594	<0.001	1.553	1.414	1.706
Prior Cumulative GPA	0.734	1030.557	<0.001	2.083	1.991	2.178
Constant	-1.208	335.723	<0.001	0.299		

Although the model is not reliable, these same two variables appear in every model produced in the binary logistic regression with exception of the first model which only entered the prior cumulative GPA variable. Notably, Model 2 omitted every student demographic attribute included in the analysis such as age during the academic term and ethnicities. Similarly, other academic attributes such as whether the student was in their first primary term and placement test results were also omitted from Model 2. Although some of these student attributes were included in other models, the models were not as successful as predicting student success as Model 2.

Figure 1 illustrates the resulting classification tree using the CRT algorithm in SPSS, and the predictor and risk analyses are provided in Table 12. With an overall percentage correct of 72.5% and subsequent risk estimate of 0.275, the classification tree performs better than the cut-off value of 72%, meaning the classification tree is an acceptable predictor of student success. Notably, 93.5% of successful student records were predicted correctly.

Table 12. Analyses of classification tree prediction and risk

Observed	Predicted		
	Not Successful	Successful	Percent Correct
Not Successful	989	3,569	21.7%
Successful	713	10,323	93.5%
Overall Percentage	10.9%	89.1%	72.5%
Risk Statistics			
Estimate	0.275		
Standard Error	0.004		

The first six nodes of the classification tree utilize prior cumulative GPA to segment the student records to produce the most likely outcomes within a single segment, which is consistent with the binary logistic regression finding that prior cumulative GPA is the best predictor of student
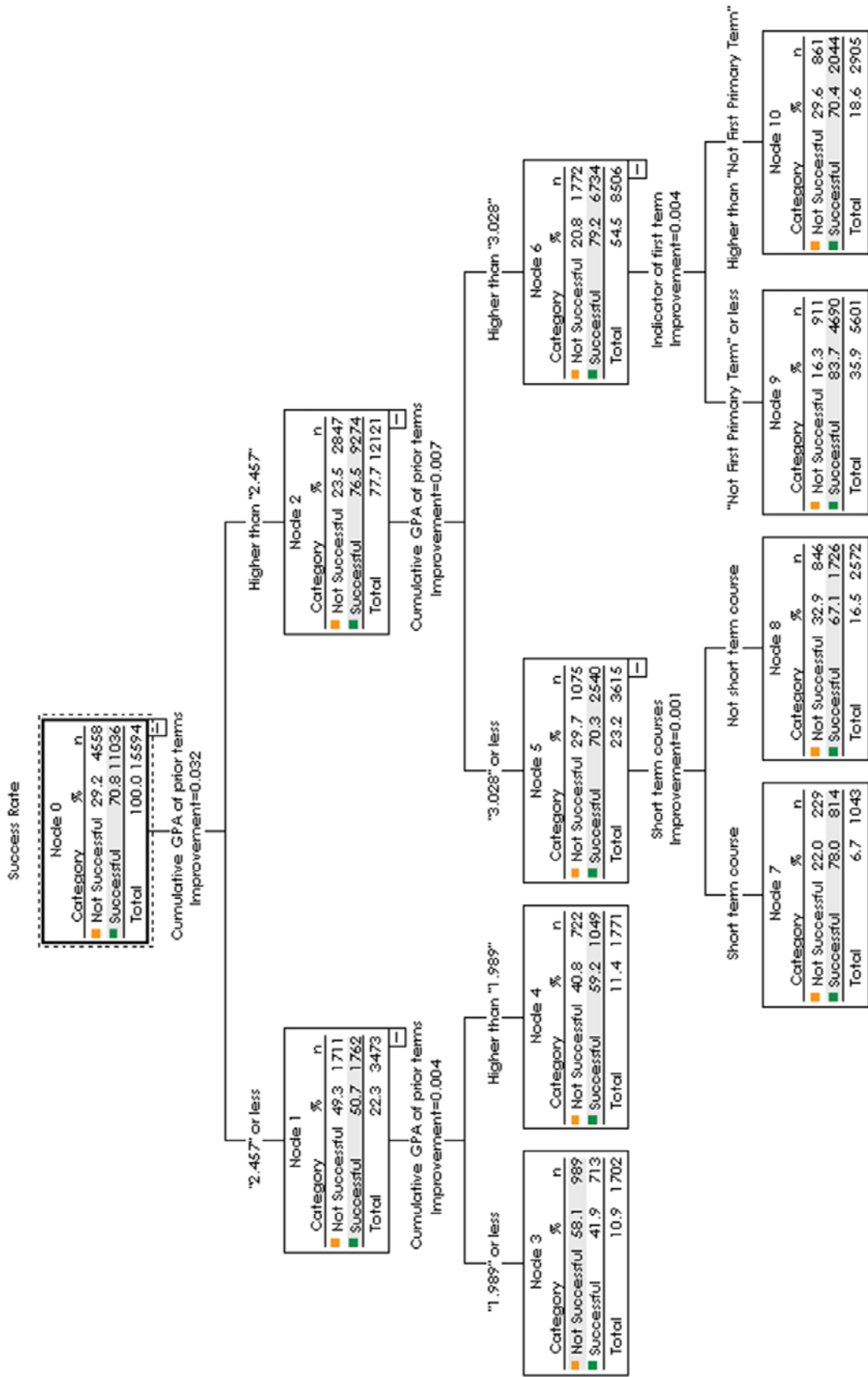
Figure 1. Classification tree for success rates

success. The first segmentation occurs at a prior cumulative GPA of 2.457. Students with a prior cumulative GPA greater than 2.457 had a success rate of 77%. Notably, the success rate of students with a prior cumulative GPA between 2.457 and 3.028 was 70%, which is less than the overall success rate of 71%; however, the success rate increased to 78% when students within the same range of prior cumulative GPA were enrolled in a compressed course in comparison to 67% for students enrolled in a traditional-length course.

Table 13 illustrates the gain and index ratios for each of the nodes within the classification tree. Node 9 has the highest index ratio (118%) and gain ratio (43%), which means that 43% of successful student records are identified as students with prior coursework at CHC and prior cumulative GPAs greater than 3.028. Node 7 has the second highest index ratio (110%) and a gain ratio of 7%, which means that 7% of the successful student records are identified as students with a prior cumulative GPA between 2.457 and 3.028 and were in a condensed course. The range of prior cumulative GPA identified in this group is within one standard deviation of the average prior cumulative GPA, 2.72.

Table 13. **Analysis of classification tree node gains**

Node	Node		Gain		Successful Responses	Index Ratio
	N	%	N	%		
9	5,601	35.9	4,690	42.5	83.7	118.3
7	1,043	6.7	814	7.4	78.0	110.3
10	2,905	18.6	2,044	18.5	70.4	99.4
8	2,572	16.5	1,726	15.6	67.1	94.8
4	1,771	11.4	1,049	9.5	59.2	83.7
3	1,702	10.9	713	6.5	41.9	59.2

Discussion & Conclusion

Limitations
Recognizing limitations within this study are important for identifying controls and improvements for the continued study of student success by course length. Some of the independent variables utilized in this study had their own limitations. Results from placement tests were missing for a large majority of student records in this study. Eighty nine percent of records did not have an English placement test result. For math, 84% of records were missing results, and 69% of records were missing results from the reading placement test. Additionally, students who enrolled in multiple courses over the five-year study, whether traditional-length or compressed, could be duplicated in this study possibly causing bias in prior cumulative GPA. A student's success or non-success in an included course would subsequently compound in the same student's cumulative GPA which, depending on the student's enrollment in a compressed course or traditional-length course within the control group, could be included in a future term's record as the student's prior cumulative GPA.

This study was limited to an exploratory quantitative logistic regression and segmentation modeling analysis, although a body of the literature points to qualitative data as an important consideration when analyzing student performance in compressed courses in comparison to traditional-length courses. Qualitative considerations not measured in this study include

pedagogical differences or changes, student and faculty perceptions when entering the course, and long-term knowledge retention by students.

Lastly, this study is limited to studying differences between condensed and traditional-length courses. A new body of research is emerging in the area of accelerated courses, which is different than condensed courses in that the student contact hours in condensed courses are the same as traditional-length courses and accelerated courses have fewer student contact hours than both condensed and traditional-length courses.

Implications
This study was conducted due to explicit interest from various instructional programs at Crafton Hills College. Although the overall results find there is a statistical relationship of student success between compressed and traditional-length courses, the practical relationship isn't substantial according the effect size statistic. When examining the effect size and statistical relationship of student success by course length within instructional divisions and subjects, there appear to be much stronger positive practical implications. For example, a significant and practical relationship appears in six subjects: English, reading, history, computer information systems, communications studies, and theatre arts. Positive, yet insignificant relationships were found in an additional five subjects: mathematics, college life, allied health, respiratory care, and music.

Importantly, English, reading, and mathematics are developmental subjects, which provides opportunities for CHC to consider alternative scheduling to assist students in successfully completing developmental sequences. The results of this study are in agreement with other studies, including Sheldon and Durdella (2009), which found significant improvements in student success in developmental courses offered in compressed formats. Only one subject, learning resources, had a statistically and negative practical relationship, which would require additional analysis to determine a correlation for the lower success rate in compressed courses. Finally, condensed courses might cause a strain on facilities (e.g. classroom space) and support services due to condensed courses having the same number of contact hours in a shorter period of time and being required to meet more days a week for more hours in comparison to traditional-length courses.

Future Research
Future research is recommended to identify what pedagogical adjustments, if any, faculty make when moving curriculum to a condensed term. Previous research suggests that syllabi, course outlines, assessments, and assignments are adjusted to ensure material covered closely adheres to student learning outcomes (Kretovics et al., 2005). Any adjustments made by faculty need to be evaluated to further control a future study and measure impacts on student success. Additionally, student and faculty perceptions also need to be measured in a future study prior to and immediately following condensed courses as previous studies have shown that perceptions can impact student performance (Daniel, 2000).

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