Institutional Effectiveness, Research & Planning

2014 POST-IMPLEMENTATION PREREQUISITE VALIDATION STUDIES

Part II: Examination of the Effectiveness of Current Prerequisites in Chemistry and Physics

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Part II: Examination of the Effectiveness of Current Prerequisites

Introduction

Title 5 Education Code requires that interdisciplinary course prerequisites are reviewed every six years [§ 55003(b)(4)]. In addition to examining the impact of the prerequisite, the college is also required to examine disproportionate impact [§ 55003 (g)(2)]. Title 5 [§ 55502 (e)] defines disproportionate impact as occurring "…when the percentage of persons from a particular racial, ethnic, gender, age or disability group who are directed to a particular service or placement based on an assessment instrument, method, or procedure is significantly different from the representation of that group in the population of persons being assessed, and that discrepancy is not justified by empirical evidence demonstrating that the assessment instrument, method or procedure is a valid and reliable predictor of performance in the relevant educational setting."

The Crafton Hills College (CHC) Office of Institutional Effectiveness, Research, and Planning (OIERP) is in the process of examining the effectiveness of prerequisites that have been implemented from fall 2000 to fall 2012. Part II examines the effectiveness of course prerequisites for the following target courses:

Table 1: Part II Target Courses, Course Title, Current Prerequisites, and Term Prerequisites were implemented.

Target Course	Target Course Title	Current Prerequisite	Term Implemented
CHEM-101	Introduction to Chemistry	MATH-090/C	2000FA
CHEM-150	General Chemistry I	MATH-095/C	2000FA
PHYSIC-110	General Physics I	MATH-103 or Eligibility for 160	2011FA

Part I examined the effectiveness of course prerequisites for the following target courses, and the research for Part I was illustrated in a separate report:

Table 2: Part I Target Courses, Course Title, Current Prerequisites, and Term Prerequisites were implemented.

Target Course	Target Course Title	Current Prerequisite
BIOL-130	Cell and Molecular Biology	CHEM-101 or 150 & MATH-095
BIOL-131	Populations and Organisms	MATH-095/C
JOUR-120	Fundamentals of News Writing	ENGL-010/015
MICRO-150	Medical Microbiology	CHEM-101or 150
PSYCH-108	Statistics	MATH-095/C
THART-226	Play and Screenplay Analysis	ENGL-010/015

Summary of Results

1. Did the target course success rates increase after the prerequisites were implemented?

   The success rates increased after the prerequisite was implemented for all three target courses examined.

Target Course	Increase	Substantial	Significant
CHEM-101	Yes	Yes	Yes
CHEM-150	Yes	Yes	Yes
PHYSIC-110	Yes	No	No

   Note: **Increase** refers to whether or not there was an increase in the target course success rate, **substantial** refers to whether or not the change in the target course success rate had an effect size that was .20 or higher, and **significant** refers to a statistically significant ($p < .05$) change in the target course success rate from pre- to post-implementation of the prerequisite(s).

2. What is the racial/age/gender/disability makeup of the course post implementation compared to pre implementation?

   One common finding across the target courses was an increase in the proportion of Hispanic student's post-implementation than pre-implementation, which mirrors the increase in the proportion of Hispanic student's campus wide at Crafton. The increase was statistically significant in CHEM-101 and CHEM-150.

3. Does the increased success of students in each protected category support the implementation if indeed the percentages of students in each group have changed?

   Yes, in general, female students, Asian Students, and Hispanic Students were substantially ($ES >= .20$) and statistically significantly ($p < .05$) more likely to successfully complete the target course if they had met the prerequisite than students who had not met the prerequisite.

4. Was there disproportionate impact?

   No, disproportionate impact was not indicated for any of the target courses.

5. What effect did the implementation have on overall course enrollment?

   The overall course enrollment in all three courses increased after the implementation of the prerequisites for each course.

The results presented here support keeping the prerequisites in place for each of the three target courses. The target course success rates increased after the prerequisite was implemented for each of the target courses.

Findings

Question 1: Did the target course success rates increase after the prerequisite was implemented?

One of the main concerns after implementing a prerequisite for a target course is whether the students who were required to meet the prerequisite had an increased likelihood of successfully completing the target course. The target course prerequisites have been in place for different periods of time, and, as a result, the time frame for examining the success rate prior to the prerequisite varied for each target course. If the time frame post-implementation occurred five years or less from the current complete year (i.e. 2013-2014), then the same amount of time post-implementation was matched with the pre-implementation time frame. As an illustration, the prerequisite for PHYSIC-110 was implemented in Fall 2011. The time from Fall 2011 to the current complete year was three years; therefore, the pre-implementation time frame in which the post-implementation success rate was compared to, was also three years. If the pre-requisite was implemented six or more years from the most recent complete year (i.e. 2013-2014) then the time frame pre-implementation was only the three most recent years to help control for recency of the curriculum. In addition, only students enrolled in the target courses in primary terms (i.e. fall and spring) were included in the study to control for higher success rates in summer semesters, which are most likely a result of the type of student who chooses to enroll in summer courses.

Table 3: Target Courses, Term Prerequisite Established, and Time Frame Examined Pre- and Post-Implementation.

Target Course	Prerequisite Course	Term Prerequisite Established	Time Frame Pre-Implementation	Time Frame Post-Implementation
CHEM-101	MATH-090/C	2000FA	1997-98 to 1999-00	2000-01 to 2013-14
CHEM-150	MATH-095/C	2000FA	1997-98 to 1999-00	2000-01 to 2013-14
PHYSIC-110	MATH-103 or Eligibility for 160	2011FA	2008-09 to 2010-11	2011-12 to 2013-14

The performance of the students who earned a GOR in the target courses specified in Table 3 post-implementation was compared to students who earned a GOR in the target course pre-implementation in primary terms only. The effect size statistic was used to indicate the size of the difference on course success for students who were required to meet the prerequisite post-implementation and students who earned a grade on record (GOR, A, B, C, D, F, I, NP, P, or W) in each target course prior to the implementation of the prerequisite. One method of interpreting effect size was developed by Jacob Cohen. Jacob Cohen defined "small," "medium," and "large" effect sizes. He explained that an effect size of .20 can be considered small, an effect size of .50 can be considered medium, and an effect size of .80 can be considered large. An effect size is considered to be meaningful if it is .20 or higher. 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 lower than .05).

Referring to Table 3A, students who were required to complete the prerequisites for CHEM-101 and 150 were statistically significantly ($p < .01$) and substantially (ES >= .20) more likely to successfully complete CHEM-101 (76%) and CHEM-150 (78%) than students who were not required to complete

the prerequisite for CHEM-101 (53%) and CHEM-150 (69%). Students who were required to complete the prerequisite for PHYSIC-110 were more likely to successfully complete the course (67%) than students who were not required to complete the prerequisite (61%) although the increase was neither substantial nor significant. Notably, only one section of PHYSIC-110 is offered each academic year, which limited the total number of students who could take the course.

Table 3A: Target Course Success Rates Pre- and Post-Implementation of the Prerequisite Courses.

Target Course	Success Rate							
	Pre-Implementation			Post-Implementation				
	#	N	%	#	N	%	ES	P Value
CHEM-101	390	737	52.9	3,336	4,414	75.6	.51	< .001
CHEM-150	129	188	68.6	1,071	1,374	78.0	.22	.009
PHYSIC-110	25	41	61.0	30	45	66.7	.12	.589

Question 2: What is the racial/age/gender/disability makeup of the course post implementation compared to pre implementation?

Proportionally, gender and disability were not statistically significantly ($p < .05$) higher or lower from pre-implementation to post-implementation of the prerequisite for CHEM-101, CHEM-150, and PHYSIC-110 (see Tables 4 – 4B). There was a statistically significantly ($p < .05$) higher proportion of students for the following target course demographics:

- A higher proportion of Hispanic students (30%) enrolled in CHEM-101 after the prerequisite was implemented than prior to when the prerequisite was implemented (18%, see Table 4)
- A higher proportion of Hispanic students (27%) enrolled in CHEM-150 after the prerequisite was implemented than prior to when the prerequisite was implemented (16%, see Table 4A)

The increase in the proportion of Hispanic students mirrors the increase in the proportion of Hispanic student's campus wide, which has increased every year for the last ten years.

There were also statistically significant ($p < .05$) lower proportions of students for the following target course demographics:

- A lower proportion of Caucasian students (53%) enrolled in CHEM-101 after the prerequisite was implemented than prior to when the prerequisite was implemented (66%, see Table 4)
- A lower proportion of students 30 – 34 years old (6%) enrolled in CHEM-101 after the prerequisite was implemented than prior to when the prerequisite was implemented (9%, see Table 4)
- A lower proportion of Caucasian students (51%) enrolled in CHEM-150 after the prerequisite was implemented than prior to when the prerequisite was implemented (63%, see Table 4A)
- A lower proportion of students 30 – 34 years old (15%) enrolled in PHYSIC-110 after the prerequisite was implemented than prior to when the prerequisite was implemented (2%, see Table 4B)

Table 4: Gender, Ethnicity, and Age Pre- and Post-Implementation of MATH-090/C as the Prerequisite to CHEM-101.

Demographic Characteristics	Pre-Implementation		Post-Implementation		Total	
	#	N	%	#	N	%
Gender						
Female	466	63.2	2,878	65.2	3,344	64.9
Male	271	36.8	1,527	34.6	1,798	34.9
Unknown	0	0.0	9	0.2	9	0.2
Total	**737**	**100.0**	**4,414**	**100.0**	**5,151**	**100.0**
Ethnicity						
Asian	34	4.6	263	6.0	297	5.8
African American	41	5.6	314	7.1	355	6.9
Hispanic	131	17.8a	1,303	29.5a	1,434	27.8
Native American	12	1.6	74	1.7	86	1.7
Caucasian	489	66.4b	2,353	53.3b	2,842	55.2
Unknown	30	4.1	107	2.4	137	2.7
Total	**737**	**100.0**	**4,414**	**100.0**	**5,151**	**100.0**
Age						
19 or younger	229	31.1	1,423	32.2	1,652	32.1
20-24	256	34.8	1,668	37.8	1,924	37.4
25-29	97	13.2	587	13.3	684	13.3
30-34	65	8.8c	280	6.3	345	6.7
35-39	39	5.3	187	4.2	226	4.4
40-49	47	6.4	228	5.2	375	5.3
50 or older	3	0.4	40	0.9	43	0.8
Total	**737**	**100.0**	**4,414**	**100.0**	**5,151**	**100.0**

a – The proportion of Hispanic students was statistically significantly ($p < .05$) higher post-implementation (29.5%) than pre-implementation (17.8%) of the prerequisite.

b – The proportion of Caucasian students was statistically significantly ($p < .05$) lower post-implementation (53.3%) than pre-implementation (66.4%) of the prerequisite.

c – The proportion of students 30 to 34 years old was statistically significantly ($p < .05$) lower post-implementation (6.3%) than pre-implementation (8.8%) of the prerequisite.

Table 4A: Gender, Ethnicity, and Age Pre- and Post-Implementation of MATH-095/C as the Prerequisite to CHEM-150.

Demographic Characteristics	Pre-Implementation		Post-Implementation		Total	
	#	N	%	#	N	%
Gender						
Female	88	46.8	629	45.8	717	45.9
Male	100	53.2	742	54.0	842	53.9
Unknown	0	0.0	3	0.2	3	0.2
Total	**188**	**100.0**	**1,374**	**100.0**	**1,562**	**100.0**
Ethnicity						
Asian	11	5.9	131	9.5	142	9.1
African American	13	6.9	106	7.7	119	7.6
Hispanic	30	16.0a	369	26.9a	399	25.5
Native American	3	1.6	25	1.8	28	1.8
Caucasian	119	63.3b	696	50.7b	815	52.2
Unknown	12	6.4	47	3.4	59	3.8
Total	**188**	**100.0**	**1,374**	**100.0**	**1,562**	**100.0**
Age						
19 or younger	60	31.9	459	33.4	519	33.2
20-24	80	42.6	588	42.8	668	42.8
25-29	24	12.8	186	13.5	210	13.4
30-34	9	4.8	63	4.6	72	4.6
35-39	8	4.3	34	2.5	42	2.7
40-49	5	2.7	42	3.1	47	3.0
50 or older	2	1.1	2	0.1	4	0.3
Total	**188**	**100.0**	**1,374**	**100.0**	**1,562**	**100.0**

a – The proportion of Hispanic students was statistically significantly ($p < .05$) higher post-implementation (26.9%) than pre-implementation (16.0%) of the prerequisite.

b – The proportion of Caucasian students was statistically significantly ($p < .05$) lower post-implementation (50.7%) than pre-implementation (63.3%) of the prerequisite.

Table 4B: Gender, Ethnicity, Age, and Disability Status Pre- and Post-Implementation of MATH-103 or Eligibility for 160 as the Prerequisite to PHYSIC-110.

Demographic Characteristics	Pre-Implementation		Post-Implementation		Total	
	#	N	%	#	N	%
Gender						
Female	22	53.7	17	37.8	39	45.3
Male	19	46.3	28	62.2	47	54.7
Unknown	0	0.0	0	0.0	0	0.0
Total	**41**	**100.0**	**45**	**100.0**	**86**	**100.0**
Ethnicity						
Asian	7	17.1	7	15.6	14	16.3
African American	0	0.0	4	8.9	4	4.7
Hispanic	9	22.0	12	26.7	21	24.4
Native American	3	7.3	2	4.4	5	5.8
Caucasian	21	51.2	20	44.4	41	47.7
Unknown	1	2.4	0	0.0	1	1.2
Total	**41**	**100.0**	**45**	**100.0**	**86**	**100.0**
Age						
19 or younger	12	29.3	10	22.2	22	25.6
20-24	15	36.6	24	53.3	39	45.3
25-29	7	17.1	8	17.8	15	17.4
30-34	6	14.6a	1	2.2	7	8.1
35-39	0	0.0	0	0.0	0	0.0
40-49	1	2.4	0	0.0	1	1.2
50 or older	0	0.0	0	0.0	0	0.0
Total	**41**	**100.0**	**45**	**100.0**	**86**	**100.0**
Disability Status						
Not a DSPS Student	40	97.6	43	95.6	83	96.5
DSPS Student	1	2.4	2	4.4	3	3.5
Total	**41**	**100.0**	**45**	**100.0**	**86**	**100.0**

a – The proportion of students 30 to 34 years old was statistically significantly ($p < .05$) lower post-implementation (14.6%) than pre-implementation (2.2%) of the prerequisite.

Question 3: Does the increased success of students in each protected category support the implementation, if indeed the percentages of students in each group have changed?

The increased success of students in protected categories supports the implementation of the prerequisite for all three target courses.

- CHEM-101 (see Table 5)
    - Female students who successfully completed the prerequisite were statistically significantly (p < .001) and substantially (ES = .51) more likely to successfully complete CHEM-101 (76%) than female students who had not successfully completed the prerequisite (54%)
    - African American students who successfully completed the prerequisite were statistically significantly (p = .002) and substantially (ES = .55) more likely to successfully complete CHEM-101 (72%) than African American students who had not successfully completed the prerequisite (46%)
    - Hispanic students who successfully completed the prerequisite were statistically significantly (p < .001) and substantially (ES = .60) more likely to successfully complete CHEM-101 (72%) than Hispanic students who had not successfully completed the prerequisite (44%)
    - Native American students who successfully completed the prerequisite were statistically significantly (p = .050) and substantially (ES = .67) more likely to successfully complete CHEM-101 (73%) than Hispanic students who had not successfully completed the prerequisite (42%)
    - 19 or younger students who successfully completed the prerequisite were statistically significantly (p < .001) and significantly (ES = .45) more likely to successfully complete CHEM-101 (74%) than 19 or younger students who had not successfully completed the prerequisite (54%)
    - 20 – 24 year old students who successfully completed the prerequisite were statistically significantly (p < .001) and substantially (ES = .58) more likely to successfully complete CHEM-101 (74%) than 20 – 24 year old students who had not successfully completed the prerequisite (47%)
- CHEM-150 (see Table 5A)
    - Female students who successfully completed the prerequisite were statistically significantly (p = .006) and substantially (ES = .35) more likely to successfully complete CHEM-150 (79%) than female students who had not successfully completed the prerequisite (64%)
    - 19 or younger students who successfully completed the prerequisite were statistically significantly (p = .014) and substantially (ES = .38) more likely to successfully complete CHEM-150 (78%) than 19 or younger students who had not successfully completed the prerequisite (62%)
    - 20 – 24 year old students who successfully completed the prerequisite were statistically significantly (p < .001) and substantially (ES = .76) more likely to successfully complete CHEM-150 (95%) than 20 – 24 year old students who had not successfully completed the prerequisite (75%)
- PHYSIC-110 (see Table 5C)
    - Female students who successfully completed the prerequisite substantially (ES = .50) more likely to successfully complete PHYSIC-110 (82%) than female students who had not successfully completed the prerequisite (59%)

o   Hispanic students who successfully completed the prerequisite were substantially
    (ES = .81) more likely to successfully complete PHYSIC-110 (83%) than Native
    American students who had not successfully completed the prerequisite (44%)

Table 5: CHEM-101 Success Rates Pre- and Post-Implementation of MATH-090/C as the Prerequisite to CHEM-101 by Gender, Ethnicity, and Age.

Demographic Characteristic	Success Rate							
	Pre-Implementation			Post-Implementation				
	#	N	%	#	N	%	ES	P Value
Gender								
Female	250	466	53.6	2,190	2,878	76.1	.51	< .001
Male	140	271	51.7	1,139	1,527	74.6	.51	< .001
Unknown	0	0	■	7	9	77.8	■	
Total	**390**	**737**	**52.9**	**3,336**	**4,414**	**75.6**	**.51**	**< .001**
Ethnicity								
Asian	20	34	58.8	215	263	81.7	.56	.010
African American	19	41	46.3	226	314	72.0	.55	.002
Hispanic	58	131	44.3	936	1,303	71.8	.60	< .001
Native American	5	12	41.7	54	74	73.0	.67	.050
Caucasian	269	489	55.0	1,821	2,353	77.4	.51	< .001
Unknown	19	30	63.3	84	107	78.5	.35	.124
Total	**390**	**737**	**52.9**	**3,336**	**4,414**	**75.6**	**.51**	**< .001**
Age								
19 or younger	123	229	53.7	1,056	1,423	74.2	.45	< .001
20-24	121	256	47.3	1,232	1,668	73.9	.58	< .001
25-29	57	97	58.8	453	587	77.2	.42	.001
30-34	33	65	50.8	225	280	80.4	.68	< .001
35-39	22	39	56.4	160	187	75.6	.73	.001
40-49	30	47	63.8	180	228	78.9	.36	.047
50 or older	3	3	100.0	30	40	75.0	-.58	.001
Total	**390**	**737**	**52.9**	**3,336**	**4,414**	**75.6**	**.51**	**< .001**

Table 5A: CHEM-150 Success Rates Pre- and Post-Implementation of MATH-095/C as the Prerequisite to CHEM-150 by Gender, Ethnicity, and Age.

Demographic Characteristic	Success Rate							
	Pre-Implementation			Post-Implementation				
	#	N	%	#	N	%	ES	P Value
Gender								
Female	56	88	63.6	494	629	78.5	.35	.006
Male	73	100	73.0	574	742	77.4	.10	.356
Unknown	0	0	■■■	3	3	100.0	■■■	
Total	**129**	**188**	**68.6**	**1,071**	**1,374**	**78.0**	**.22**	**.009**
Ethnicity								
Asian	6	11	54.5	104	131	79.4	.59	.126
African American	9	13	69.2	74	106	69.8	.01	.967
Hispanic	22	30	73.3	273	369	74.0	.01	.939
Native American	3	3	100.0	20	25	80.0	-.51	.021
Caucasian	79	119	66.4	563	696	80.9	.35	.006
Unknown	10	12	83.3	37	47	78.7	-.11	.719
Total	**129**	**188**	**68.6**	**1,071**	**1,374**	**78.0**	**.22**	**.009**
Age								
19 or younger	37	60	61.7	358	459	78.0	.38	.014
20-24	60	80	75.0	454	477	95.2	.76	< .001
25-29	13	24	54.2	150	186	80.6	.63	.015
30-34	7	9	77.8	48	63	76.2	-.04	.920
35-39	7	8	87.5	28	34	82.4	-.14	.718
40-49	4	5	80.0	32	42	76.2	-.09	.857
50 or older	1	2	50.0	1	2	50.0	.00	1.000
Total	**129**	**188**	**68.6**	**1,071**	**1,374**	**78.0**	**.22**	**.009**

Table 5B: PHYSIC-110 Success Rates Pre- and Post-Implementation of MATH-103 or Eligibility for 160 as the Prerequisite to PHYSIC-110 by Gender, Ethnicity, Age, and Disability Status.

Demographic Characteristic	Success Rate							
	Pre-Implementation			Post-Implementation				
	#	N	%	#	N	%	ES	P Value
Gender								
Female	13	22	59.1	14	17	82.4	.50	.114
Male	12	19	63.2	16	28	57.1	-.12	.687
Total	**25**	**41**	**61.0**	**30**	**45**	**66.7**	**.12**	**.589**
Ethnicity								
Asian	4	7	57.1	6	7	85.7	.61	.271
African American	0	0	■	2	4	50	■	
Hispanic	4	9	44.4	10	12	83.3	.81	.078
Native American	2	3	66.7	1	2	50.0	-.30	.800
Caucasian	15	21	71.4	11	20	55.0	-.34	.288
Unknown	0	1	0.0	0	0	■	■	
Total	**25**	**41**	**61.0**	**30**	**45**	**66.7**	**.12**	**.589**
Age								
19 or younger	96	118	81.4	67	89	75.3	-.15	.299
20-24	112	146	76.7	123	151	81.5	.12	.317
25-29	39	47	83.0	40	45	88.9	.17	.420
30-34	13	17	76.5	15	15	100.0	.7	.034
35-39	6	9	66.7	5	5	100.0	.78	.069
40-49	5	7	71.4	5	5	100.0	.73	.152
50 or older	0	0	■	1	2	50.0	■	
Total	**25**	**41**	**61.0**	**30**	**45**	**66.7**	**.12**	**.589**
Disability Status								
Not a DSPS Student	24	40	60.0	29	43	67.4	.15	.487
DSPS Student	1	1	100.0	1	2	50.0	■	
Total	**25**	**41**	**61.0**	**30**	**45**	**66.7**	**.12**	**.589**

Question 4: Was there disproportionate impact?

In addition to providing evidence that the proposed prerequisite is "such that a student who has not met the prerequisite is highly unlikely to receive a satisfactory grade in the course" [Title 5, §5503(d)(2)], Title 5 regulations also state that the district should conduct, "…an evaluation to determine whether the prerequisite or corequisite has a disproportionate impact on particular groups of students described in terms of race, ethnicity, gender, age or disability, as defined by the Chancellor. When there is a disproportionate impact on any such group of students, the district shall, in consultation with the Chancellor, develop and implement a plan setting forth the steps the district will take to correct the disproportionate impact." [Title 5, §55003(g)(2)]. To clarify, the Chancellor's Office has operationally defined disproportionate impact, stating that it occurs when, "…the percentage of persons from a particular racial, ethnic, gender, age or disability group who are directed to a particular service or placement based on an assessment instrument, method or procedure is significantly different than the representation of that group in the population of persons being assessed and that discrepancy is not justified by empirical evidence demonstrating that the assessment instrument, method or procedure is a valid and reliable predictor of performance in the relevant educational setting [Title 5, §55502(d)]."

A useful statistical model in analyzing disproportionate impact is classification and regression tree (CART) modeling, a statistical application that is useful in situations in which the overall goal is to divide a population into segments that differ with respect to a designated criterion. In short, CART modeling affords researchers the opportunity to examine the interaction and impact of a number of distinct categorical predictor variables (e.g., gender, ethnicity, and age) on a categorical dependent variable (e.g., met prerequisite/did not meet prerequisite). CART modeling initially identifies the best predictor variable, conducting a splitting algorithm that further identifies additional statistically significant predictor variables and splits these variables into smaller subgroups. CART modeling merges categories of a predictor variable that are not significantly different. This merging, combined with the splitting algorithm, ensures that cases in the same segment are homogeneous with respect to the segmentation criterion, while cases in different segments tend to be heterogeneous with respect to the segmentation criterion. As it applies to disproportionate impact, CART modeling has a number of distinct advantages over traditional statistical applications used to examine categorical data (e.g., chi-square, cluster analysis, etc.). Utilizing CART modeling, researchers can easily determine whether specific aspects of numerous categorical predictor variables merge to provide a more accurate identification of populations experiencing disproportionate impact (e.g., male Latino students under twenty-one years of age, female Asian students 30 to 34 years of age, etc.).

As it pertains to this study, CART modeling was conducted to determine whether specific student populations disproportionately earned a GOR in the target courses pre- and/or post-implementation. The following predictor variables were entered into each CART model:

Gender:

Group 1) Male
Group 2) Female
Group 3) Unknown/No Response

Ethnicity:

        Group 1) Asian
        Group 2) African American
        Group 3) Caucasian
        Group 4) Hispanic
        Group 5) Native American
        Group 6) Caucasian
        Group 7) Unknown/No Response

Age:

        Group 1) 19 or Younger
        Group 2) 20 to 24 Years of Age
        Group 3) 25 to 29 Years of Age
        Group 4) 30 to 34 Years of Age
        Group 5) 35 to 39 Years of Age
        Group 6) 40 to 49 Years of Age
        Group 7) 50 Years of Age or Older

Disability:

        Group 1) Students Who Do Not Have Disabilities
        Group 2) Students With Disabilities

To examine whether disproportionate impact existed, one CART model was generated for each target course to compare the demographic characters pre- and post-implementation of the prerequisite.

Disproportionate impact was not indicated for any of the target courses examined: CHEM-101, CHEM-150, and PHYSIC-110.

Figure 1 uses segmentation modeling to identify disproportionate impact when MATH-090/C was and was not the prerequisite for CHEM-101. ***The segmentation model indicates that disproportionate impact does not exist by gender, ethnicity, age, and/or disability status.***

Figure 1: CART Segmentation Model Examining Disproportionate Impact When Prerequisite for CHEM 101 is MATH-090/C (Age, Gender, Ethnicity, and Disability Status examined).

Prerequisite Comparison pre and post implementation

Node 0		
Category	%	n
■ Earned a GOR Pre-Implementation in CHEM-101 or CHEM-150	14.3	737
■ Earned a GOR Post-Implementation in CHEM-101 or CHEM-150	85.7	4414
Total	100.0	5151

Legend:
- ■ Earned a GOR Pre-Implementation in CHEM-101 or CHEM-150
- ■ Earned a GOR Post-Implementation in CHEM-101 or CHEM-150

Note: Disproportionate Impact was not identified. Risk Estimate = .143, SE of Risk Estimate = .005, Improvement set to .01, Child Node set to 5% of Total N unless less than 50, Parent Node is twice the Child Node.

Figure 2 uses segmentation modeling to identify disproportionate impact when MATH-095/C was and was not the prerequisite for CHEM-150. ***The segmentation model indicates that disproportionate impact does not exist by gender, ethnicity, age, and/or disability status.***

Figure 2: CART Segmentation Model Examining Disproportionate Impact When Prerequisite for CHEM-150 is MATH-095/C (Age, Gender, Ethnicity, and Disability Status examined).

Prerequisite Comparison pre and post implementation

Node 0		
Category	%	n
■ Earned a GOR Pre-Implementation in CHEM-101 or CHEM-150	12.0	188
■ Earned a GOR Post-Implementation in CHEM-101 or CHEM-150	88.0	1374
Total	100.0	1562

Legend:
- ■ Earned a GOR Pre-Implementation in CHEM-101 or CHEM-150
- ■ Earned a GOR Post-Implementation in CHEM-101 or CHEM-150

Note: Disproportionate Impact was not identified. Risk Estimate = .120, SE of Risk Estimate = .008, Improvement set to .01, Child Node set to 5% of Total N unless less than 50, Parent Node is twice the Child Node.

Figure 3 uses segmentation modeling to identify disproportionate impact when MATH-103 or Eligibility for 160 was and was not the prerequisite for PHYSIC-110. ***The segmentation model indicates that disproportionate impact does not exist by gender, ethnicity, age, and/or disability status.***

Figure 3: CART Segmentation Model Examining Disproportionate Impact When Prerequisite for JOUR-120 is MATH-103 or Eligibility for 160 (Age, Gender, Ethnicity, and Disability Status examined).

Prerequisite Comparison pre and post implementation

Node 0		
Category	%	n
■ Earned a GOR Pre-Implementation in PHYSIC-110	47.7	41
■ Earned a GOR Post-Implementation in PHYSIC-110	52.3	45
Total	100.0	86

■ Earned a GOR Pre-Implementation in PHYSIC-110
■ Earned a GOR Post-Implementation in PHYSIC-110

Note: Disproportionate Impact was not identified. Risk Estimate = .477, SE of Risk Estimate = .054, Improvement set to .01, Child Node set to 5% of Total N unless less than 50, Parent Node is twice the Child Node.

Question 5: What effect did the implementation have on overall course enrollment?

To examine the effect on the implementation of the prerequisite on enrollment, the six primary terms (i.e. three years) pre-implementation were compared to the six primary terms post-implementation. Overall, the results indicated that course enrollment in the target courses increased from pre- to post-implementation of the prerequisite (see Table 6). Specifically, enrollments increased 6% for CHEM-101, 12% for CHEM-150, and 10% for PHYSIC-110.

Table 6: GOR Earned Three Years Pre- and Post-Implementation of the Prerequisite by Term.

Implementation		Course		
		CHEM-101	CHEM-150	PHYSIC-110
Pre	Fall 1	104	59	14
	Spring 1	105	0	0
	Fall 2	101	69	10
	Spring 2	146	0	0
	Fall 3	127	60	17
	Spring 3	154	0	0
	Total	**737**	**188**	**41**
Post	Fall 1	128	69	14
	Spring 1	115	0	0
	Fall 2	123	70	17
	Spring 2	112	22	0
	Fall 3	154	50	14
	Spring 3	151	0	0
	Total	**783**	**211**	**45**
Difference		**+46**	**+23**	**+4**
% Difference		**+6.2%**	**+12.2%**	**+9.8%**