CRAFTON HILLS COLLEGE
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Research Brief

The Relationship between Successfully Completing CHEM-101 prior to Earning a Grade on Record in CHEM-150 from 2012-2013 to 2016-2017

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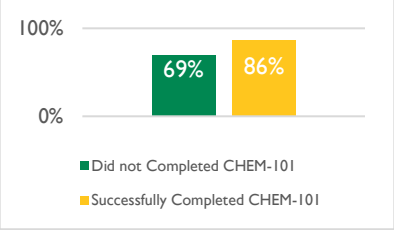
Purpose of Brief

The Crafton Hills College Chemistry Department was interested in learning whether students who completed CHEM-101 prior to earning a grade on record (GOR) in CHEM-150, would increase the likelihood of students successfully completing CHEM-150.

Summary of Findings

- Overall, students who successfully completed CHEM-101 prior to earning a GOR in CHEM-150 were statistically significantly and substantially more likely to earn a successful grade in CHEM-150 (86%) then students who did not complete CHEM-101 (69%)



- Females, males, 20-34 year olds, Asian Students, and Hispanic Students were statistically significantly and substantially more likely to successfully complete CHEM-150 if they had successfully completed CHEM-101 when compared to students who had not successfully completed CHEM-101
- Prior to implementing CHEM-101 as a prerequisite to CHEM-150, consider the impact on CHEM-150 enrollments

Overview

The Crafton Hills College Chemistry Department was interested in learning whether students who completed CHEM-101 (Introduction to Chemistry) prior to earning a grade on record (GOR) in CHEM-150 (General Chemistry I), would increase the likelihood of students successfully completing CHEM-150. Currently, CHEM-150 has a prerequisite of MATH-095. A post-implementation study of the effectiveness of MATH-095 as a perquisite to CHEM-150 conducted in July 2014 illustrated that students who successfully completed MATH-095 prior to earning a GOR in CHEM-150 were statistically significantly and substantially more likely to successfully complete CHEM-150. Even with the MATH-095 prerequisite there has been a decline in the CHEM-150 course success rate from 87% in 2012-2013 to 64% in 2016-2017. Accordingly, the Chemistry Department is exploring methods of increasing the likelihood that students will complete CHEM-150 successfully.

Possible Implications

The results strongly indicate that adding successful completion of CHEM-101 as a prerequisite to CHEM-150 will statistically significantly and substantially increase the likelihood that students will successfully complete CHEM-150. Specifically, students who successfully completed CHEM-101 prior to earning a GOR in CHEM-150 were statistically significantly and substantially more likely to earn a successful grade in CHEM-150 (86%) then students who did not complete CHEM-101 (69%). With some minor differences due to the number of students in each comparison group, this result was consistent across gender, age, and ethnicity.

However, the Chemistry Department also needs to be aware that implementing CHEM-101 as a prerequisite to CHEM-150 might decrease enrollments. Namely, students will have to have successfully completed both CHEM-101 and MATH-095 prior to enrolling in CHEM-150. In 2016-2017 only 21 (11%) of the 192 students who earned a GOR in CHEM-150 had successfully completed both courses. Of the 8,427 students who earned a GOR in 2016-2017, 441 (5%) had successfully completed both CHEM-101 and MATH-095. This suggests that there are enough students to fill CHEM-150; however, it is not possible to identify how many of these students need to take CHEM-150 at this time.

Methodology

General Chemistry I (CHEM-150) students who earned a grade on record (GOR) from 2012-2013 to 2016-2017 were identified to explore the relationship between successfully completing Introduction to Chemistry (CHEM-101) and successfully completing CHEM-150. A GOR is a grade of A, B, C, D, F, I, P, NP, or W, and represents students who were enrolled at census. Course success refers to earning a grade of A, B, C, or P. If students had taken CHEM-150 or CHEM-101 more than once, the grade from the first term they took the course was used. In addition, CHEM-150 honors students were excluded from the research. Students were only identified as successfully completing CHEM-101 if they had earned a grade of A, B, C, or P prior to the start of the CHEM-150 section in which they earned their first GOR.

The effect size statistic indicates the size of the difference on CHEM-150 course success, between students who successfully completed CHEM-101 prior to earning a GOR in CHEM-150, and students who did not earn a GOR in CHEM-101 or successfully complete CHEM-101 prior to earning a GOR in CHEM-150. Jacob Cohen developed one method of interpreting effect size. Jacob Cohen defined "small," "medium," and "large" effect sizes. He explained that an effect size of .20 is small, an effect size of .50 is medium, and an effect size of .80 is large. Research in the social sciences has indicated that a substantial effect is considered meaningful if the effect size is .10 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 less than .05).

Sample

From 2012-2013 to 2016-2017, 844 students earned a GOR in CHEM-150 at Crafton Hills College. Of these, 141 (17%) successfully completed CHEM-101 prior to earning a GOR in CHEM-150.

Findings

Table 1 on the following page illustrates the CHEM-150 course success rate for students who did and did not successfully completed CHEM-101 from 2012-2013 to 2016-2017. Overall, students who successfully completed CHEM-101 prior to earning a GOR in CHEM-150 were statistically significantly and substantially more likely to earn a successful grade in CHEM-150 (86%) then students who did not complete CHEM-101 (69%).

Equally important, when disaggregating the results by gender, ethnicity, and age the following sub groups of students who successfully completed CHEM-101 prior to earning a GOR in CHEM-150 were also statistically significantly and substantially more likely to earn a successful grade in CHEM-150: females, males, students who were 20 – 34 years old, Asian students, and Hispanic students. The other sub groups had a substantially higher CHEM-150 success rate if they had successfully completed CHEM-101 prior to earning a GOR in CHEM-150: students 19 years old or younger or 50 years old or older, Native American students, and Caucasian students. These relationships were not statistically significantly different because there were too few students who successfully completed CHEM-101. Finally, African American students statistically had the same CHEM-150 course success rate in both groups. The most likely reason for this is that only four African American students had successfully completed CHEM-101 prior to earning a GOR in CHEM-150.

Table 1: CHEM-150 Course Success Rate Comparison between Students who did not and who did Successfully Complete CHEM-101 by Gender, Age, and Ethnicity from 2012-2013 to 2016-2017.

Demographics	Did Not Successfully Complete CHEM-101 Prior to Earning First GOR in CHEM-150			Successfully Completed CHEM-101 Prior to Earning First GOR in CHEM-150			Substantially Different*	Statistical Significant**
	#	N	%	#	N	%		
Gender								
Female	189	295	64.1%	59	72	81.9%	Yes	Yes
Male	277	386	71.8%	60	67	89.6%	Yes	Yes
Unknown	1	1	100.0%					
Total	467	682	68.5%	119	139	85.6%	Yes	Yes
Age								
19 or Younger	184	273	67.4%	13	18	72.2%	Yes	No
20-24 Years Old	192	284	67.6%	70	84	83.3%	Yes	Yes
25-29 Years Old	56	77	72.7%	24	25	96.0%	Yes	Yes
30-34 Years Old	21	28	75.0%	8	8	100.0%	Yes	Yes
35-39 Years Old	6	7	85.7%	1	1	100.0%	Yes	No
40-49 Years Old	7	9	77.8%	2	2	100.0%	Yes	No
50 or Older	1	4	25.0%	1	1	100.0%	Yes	No
Total	467	682	68.5%	119	139	85.6%	Yes	Yes
Ethnicity								
Asian	38	62	61.3%	7	7	100.0%	Yes	Yes
African American	22	42	52.4%	2	4	50.0%	No	No
Hispanic	175	271	64.6%	47	54	87.0%	Yes	Yes
Native American	9	10	90.0%	1	1	100.0%	Yes	No
Caucasian	218	288	75.7%	61	72	84.7%	Yes	No
Decline to State	4	8	50.0%	1	1	100.0%	Yes	No
Unknown	1	1	100.0%					
Total	467	682	68.5%	119	139	85.6%	Yes	Yes

Note: "#" refers to the number of students who successfully completed CHEM-150, "N" refers to the number of GOR earned in CHEM-150, and "%" is the CHEM-150 course success rate or the number of students who successfully completed CHEM-150 divided by the number of GOR earned and multiplied by 100.
*"Yes" refers to a meaningful or substantial effect size difference if the effect size is .10 or higher. "No" refers to an effect size difference that is below .10.
**"Yes" refers to a p-value that is less than .01 and indicates that the difference in course success is a result of chance only 1 out of 100 times. "No" refers to a p-value that is .01 or higher.

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