California State University Chico

CHICO STATE BY THE NUMBERS – October 2021

A publication of the Chico State Office of Institutional Research

Major Switching Across Colleges and Effects on Six-Year Graduation Rates

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While some students may enter college with a clear sense of what type of degree they want to pursue, and are able to maintain that same goal throughout their college career, for others their choice of degree may change as their educational goals are shaped by the various challenges, opportunities, and experiences they encounter during their college careers. In this month's By the Numbers report, we ask: what have been the most frequent changes of major across Chico State colleges? And what are the effects of switching majors between colleges on students' academic success? To investigate, we use institutional data on major switching activity across Chico State colleges within first-time freshmen cohorts between 2012 and 2018, and examine changes in six-year graduation rates for those who switched majors across colleges, compared to students who remained in the same college of major.

Notes on Presentation of Data

In Figures 1 through 4, student data are arranged in a matrix that cross-tabulates the college of the major that first-time freshmen students declare upon matriculation (rows on the left side) with the college of the major that students ended up in within either two or four years after matriculation (columns at the top). Students in cells that fall along the top-left-to-bottom-right diagonal therefore represent students whose declared major remained in the same college within the respective time frame.

While Undergraduate Education is shown in the figures alongside the seven colleges, this designation most often refers to first-time freshmen who have not yet declared a major: switching out of Undergraduate Education in these cases means that students went from undeclared to having declared a major. Less frequently, students may switch *into* Undergraduate Education from a college if they leave one major but fail to declare a new one.

Historical Trends in Major Switching

Figures 1 and 2 show the frequency of switching majors between colleges within two and four years of matriculation between Fall 2012 and 2018 and Fall 2012 and Fall 2016, respectively. The percentages in each cell represent the proportion of all students who matriculated into majors in a particular college and later changed to a major in another college. Cells are shaded by the size of this proportion, with darker green indicating larger proportions, and all proportions total to 100% across each row. Cells along the diagonal are labeled 0% since these students' majors remained in the same college.

Looking at Figures 1 and 2, we can first observe that most students tend to remain in the same college of major as the one they matriculated into (i.e., in cells along the diagonal) – moving into a major in a different college is not especially common, and most major switching occurs within colleges. However, some colleges have tended to retain more of their declared majors than others, as can be observed by comparing the number of students who remain in the same college with the total cohort size in the row totals in Figures 1 and 2. The numbers of students who switched from each college within four years of matriculation, and the resulting rate calculated by dividing these counts by total cohort size, are shown in Table 1 below. As can be seen, the college of Natural Sciences had the largest aggregate cohort size at matriculation (i.e., first-time freshmen with declared majors in the college), but also the highest rate of majors switching to other colleges within four years (45.9%), followed by Humanities and Fine Arts (37%). The lowest rate of major switching was for students with declared majors in Engineering, Computer Science, and Construction Management (20.9%).

What types of major switches from one college to another are students most commonly choosing? As can be seen in Figures 1 and 2, initial Agriculture majors

Table 1. Rates of Major Switching Across Colleges Within Four Years of Matriculation, Fall 2012 – Fall 2016 First-Time Freshmen Cohorts

College	Frequency	Cohort	Rate
Agriculture	214	767	27.9%
Behavioral and Social Sciences	557	2,387	23.3%
Business	414	1,767	23.4%
Communication and Education	423	1,751	24.2%
Engineering, Computer Science, and Construction Management	397	1,904	20.9%
Humanities and Fine Arts	316	853	37.0%
Natural Sciences	1,170	2,551	45.9%
Total	**3,491**	**11,980**	**29.1%**

most commonly switched into majors in either Behavioral and Social Sciences or Natural Sciences. Students with initial majors in either Behavioral and Social Sciences, Business, or Communication and Education tended to most commonly make switches between these three colleges. Engineering, Computer Science, and Construction Management majors most often switched into majors in Business, while Humanities and Fine Arts majors most often switched into majors in either Behavioral and Social Sciences or Communication and Education; these latter two colleges were also the most frequent destinations for students who entered Chico State without a declared major. Natural Sciences majors most frequently transferred into majors in Behavioral and Social Sciences.

Owing in part to Natural Science's large cohort sizes, the most common switching pathway by far was for those switching from majors in Natural Sciences into majors in Behavioral and Social Sciences, with 375 students having made this switch within 2 years between Fall 2012 and Fall 2018 (43% of total), and 578 students having made it within 4 years between Fall 2012 and Fall 2016 (49% of total).[1] In general, there also seems to have been a relatively high amount of major-switching between the colleges of Behavioral and Social Sciences, Business, and Communication and Education. In total, 936 students variously switched majors between these three colleges within four years of matriculation, representing 19% of all cross-college major switching activity between Fall 2012 and Fall 2016.

Analysis of more recent cross-college movement for the Fall 2017 and 2018 first-time freshmen cohorts shows trends largely consistent with those in Figures 1 and 2. Minor points of differentiation include: a larger proportion of students switching from Communication and Education into Behavioral and Social Sciences (48%) and a somewhat smaller proportion switching from Communication and Education into Business (19.5%); and a larger proportion of students switching from Natural Sciences into Behavioral and Social Sciences (48.3%) and fewer switching from Natural Sciences to Communication and Education (22.5%).

Historical Effects on Graduation Rates

If some types of cross-college major switches are more common than others, what types of switches are the most beneficial for the students who make them? More specifically, do some students who switched majors across colleges graduate within six years at higher rates than those who remained in the same college? In Figures 3 and 4, which look at the effect of switching majors between colleges on six-year graduation rates for Fall 2012 – Fall 2014 first-time freshmen cohorts, cells falling along the diagonal can be compared with those to their left or right, which represent students who switched to a major within a different college. In each cell in Figures 3 and 4, the six-year graduation rate is labeled at the top, followed by the variation in graduation rates when compared to those of students who remained in the same college, and the number of

[1] It is worth noting that, of the 1,170 students who switched from majors in Natural Sciences into majors in other colleges within four years of matriculation between Fall 2012 and Fall 2016 (Figure 2), 590 (or 50.4%) had declared a Pre-Nursing major within Natural Sciences at matriculation. Within Behavioral and Social Sciences, most of these students switched into majors in Health Science (113), Healthcare Management / Administration (61), Child Development (46), and Psychology (38), while in Communication and Education, most ended up in either Exercise Physiology (51) or Liberal Studies (38).

Term Type	Cohort Type	College of Major at Entry	College of Major by Year								
			Agriculture	Behavioral and Social Sciences	Business	Communication and Education	Engineering, Computer Science, and Construction Management	Humanities and Fine Arts	Natural Sciences	Undergraduate Education	Grand Total
Fall	First-Time Freshman	Agriculture	910 0.0%	64 29.0%	19 8.6%	34 15.4%	16 7.2%	11 5.0%	58 26.2%	19 8.6%	1,131 100.0%
		Behavioral and Social Sciences	21 4.1%	2,840 0.0%	141 27.6%	180 35.3%	44 8.6%	45 8.8%	66 12.9%	13 2.5%	3,350 100.0%
		Business	16 4.4%	85 23.2%	2,089 0.0%	123 33.5%	68 18.5%	32 8.7%	29 7.9%	14 3.8%	2,456 100.0%
		Communication and Education	9 2.6%	131 37.3%	98 27.9%	2,050 0.0%	25 7.1%	30 8.5%	37 10.5%	21 6.0%	2,401 100.0%
		Engineering, Computer Science, and Construction Management	13 3.3%	58 14.7%	137 34.7%	51 12.9%	2,402 0.0%	33 8.4%	49 12.4%	54 13.7%	2,797 100.0%
		Humanities and Fine Arts	3 1.1%	62 23.0%	35 13.0%	83 30.9%	27 10.0%	943 0.0%	20 7.4%	39 14.5%	1,212 100.0%
		Natural Sciences	21 2.4%	375 42.9%	120 13.7%	240 27.4%	63 7.2%	28 3.2%	2,816 0.0%	28 3.2%	3,691 100.0%
		Undergraduate Education	17 1.7%	278 27.8%	204 20.4%	222 22.2%	100 10.0%	68 6.8%	112 11.2%	951 0.0%	1,952 100.0%

Figure 1. Frequency of Major Switching Across Colleges within Two Years of Matriculation, Fall 2012 – Fall 2018 First-Time Freshmen Cohorts

Term Type	Cohort Type	College of Major at Entry	College of Major by Year								
			Agriculture	Behavioral and Social Sciences	Business	Communication and Education	Engineering, Computer Science, and Construction Management	Humanities and Fine Arts	Natural Sciences	Undergraduate Education	Grand Total
Fall	First-Time Freshman	Agriculture	553 0.0%	64 29.9%	26 12.1%	41 19.2%	12 5.6%	10 4.7%	48 22.4%	13 6.1%	767 100.0%
		Behavioral and Social Sciences	15 2.7%	1,830 0.0%	156 28.0%	226 40.6%	43 7.7%	51 9.2%	60 10.8%	6 1.1%	2,387 100.0%
		Business	17 4.1%	112 27.1%	1,353 0.0%	163 39.4%	59 14.3%	32 7.7%	29 7.0%	2 0.5%	1,767 100.0%
		Communication and Education	8 1.9%	158 37.4%	121 28.6%	1,328 0.0%	26 6.1%	34 8.0%	33 7.8%	43 10.2%	1,751 100.0%
		Engineering, Computer Science, and Construction Management	12 3.0%	71 17.9%	160 40.3%	58 14.6%	1,507 0.0%	37 9.3%	47 11.8%	12 3.0%	1,904 100.0%
		Humanities and Fine Arts	3 0.9%	92 29.1%	43 13.6%	112 35.4%	23 7.3%	537 0.0%	21 6.6%	22 7.0%	853 100.0%
		Natural Sciences	22 1.9%	578 49.4%	125 10.7%	320 27.4%	64 5.5%	53 4.5%	1,381 0.0%	8 0.7%	2,551 100.0%
		Undergraduate Education	18 1.5%	359 29.9%	239 19.9%	296 24.7%	108 9.0%	69 5.8%	111 9.3%	280 0.0%	1,480 100.0%

Figure 2. Frequency of Major Switching Across Colleges within Four Years of Matriculation, Fall 2012 – Fall 2016 First-Time Freshmen Cohorts

students that each cell represents. Cells are also visually shaded by the degree of variation in graduation rates from those who remained in majors in the same college, with green shading indicating an increase in graduation rates for those who switched, and blue indicating a decrease in graduation rates for those who switched. Darker shades indicate larger The diagonal line of students whose majors remained in the same college are shaded grey, since they have zero variance. Cells representing less than 20 students have been omitted in Figures 3 and 4 to ensure that the graduation rates shown reflect a substantial number of students and are therefore less volatile. All data in Figures 3 and 4 are filtered by one- and two-year retention[2], respectively, in order to control for the potential non-retention of students whose majors remained in the same colleges[3].

As can be seen in Figure 3, most switches were beneficial to six-year graduation rates for those retained at least one year. Unsurprisingly, switching was most beneficial for those who moved from undeclared to having a declared major within that period (i.e., moved from Undergraduate Education into a college of major), but was also highly beneficial for those switching from Natural Sciences or Engineering, Computer Science, and Construction Management into Behavioral and Social Sciences or Communication and Education; from Behavioral and Social Sciences into Communication and Education or Business.

Although the student counts are somewhat smaller, we can also note that switches made from other colleges into majors in Engineering, Computer Science, and Construction Management or Natural Sciences were somewhat detrimental to chances of graduation within six years. This is likely due to several interrelated factors: switching from a non-STEM (Science, Technology, Engineering, and Mathematics) major into a STEM major is more likely to 1) require a larger amount of re-orientation to the new knowledge base needed for proficiency; 2) offer less transferability of prerequisite and GE course units across degree pathways; and/or 3) require students to earn a much larger number of units within the major to graduate. All of these factors would undoubtedly contribute to longer time to degree requirements for students making a later entry into a STEM-based degree program. These factors are also likely to affect students who switch between STEM majors in different colleges.

The timing of a cross-college major switch also appears to be impactful: on average, those who switched majors across colleges within four years (shown in Figure 4) tended to experience either more pronounced detriments or smaller benefits to graduation rates, while those who switched within two years (Figure 3) tended to experience either greater benefits or smaller detriments. Switches with more pronounced negative effects on graduation rates included those switching from Business into Behavioral and Social Sciences, Communication and Education, or Engineering, Computer Science, and Construction Management, as well as those switching from Behavioral and Social Sciences into Engineering, Computer Science, and Construction Management, Humanities and Fine Arts, or Natural Sciences. Students switching within four years out of Natural Sciences and into Behavioral and Social Sciences or Communication and Education continued to see strong gains in graduation rates, as well as the improvement in rates for those who moved from undeclared to declaring a major within four years.

It is important to note that this report does not focus on the reasons *why* students changed particular majors across colleges. In ancillary survey data gathered from the "Plan Change" forms that students submit when changing their major, which cover all terms between Spring 2008 and Spring 2019, 38% of students switching majors across colleges said they were doing so because they believed they would have "better career options," followed by 32% who felt that "the major does not match my personality." Pursuing an educational path where jobs are relatively plentiful, and where the

[2] One-year retention for first-time freshmen refers to enrollment in a subsequent Fall term after enrollment in an initial Fall term; Two-year retention refers to enrollment in two subsequent Fall terms after enrollment in an initial Fall term.

[3] Students who switched majors would have needed to still be retained (i.e., enrolled) *to be able* to switch majors, while students who did not switch may or may not have been retained. This creates a potential negative bias in graduation rates for the latter group, since retention is necessary for eventual graduation.

Term Type	Cohort Type	College of Major at Entry	College of Major by Year: Agriculture	Behavioral and Social Sciences	Business	Communication and Education	Engineering, Computer Science, and Construction Management	Humanities and Fine Arts	Natural Sciences	Undergraduate Education	Grand Total
Fall	First-Time Freshman	Agriculture	81.4% 0.0% 301	72.7% -8.7% 22					64.0% -17.4% 25		79.6% -1.8% 348
		Behavioral and Social Sciences		77.6% 0.0% 961	91.5% 13.9% 47	86.1% 8.4% 79			60.6% -17.0% 33		78.3% 0.7% 1,120
		Business		80.5% -0.8% 41	81.3% 0.0% 747	84.5% 3.2% 58	70.4% -10.9% 27				81.1% -0.2% 873
		Communication and Education		93.3% 14.6% 60	84.4% 5.7% 45	78.7% 0.0% 781					80.0% 1.3% 886
		Engineering, Computer Science, and Construction Management			74.6% 5.4% 59		69.1% 0.0% 742			58.3% -10.8% 24	69.2% 0.1% 825
		Humanities and Fine Arts		85.7% 14.8% 28		85.0% 14.1% 40		70.9% 0.0% 316			73.4% 2.6% 384
		Natural Sciences		85.3% 18.6% 129	77.6% 10.9% 49	82.6% 15.9% 92	60.0% -6.7% 25		66.7% 0.0% 930		70.1% 3.5% 1,225
		Undergraduate Education		86.0% 17.9% 114	86.7% 18.7% 98	92.9% 24.8% 113	82.6% 14.5% 46	75.9% 7.8% 29	82.7% 14.6% 52	68.1% 0.0% 379	78.1% 10.0% 831

Figure 3. Effects of Major Switching Across Colleges within Two Years of Matriculation on Six-Year Graduation Rates, Fall 2012 – Fall 2014 First-Time Freshmen Cohorts

Term Type	Cohort Type	College of Major at Entry	College of Major by Year: Agriculture	Behavioral and Social Sciences	Business	Communication and Education	Engineering, Computer Science, and Construction Management	Humanities and Fine Arts	Natural Sciences	Undergraduate Education	Grand Total
Fall	First-Time Freshman	Agriculture	87.3% 0.0% 245	88.2% 0.9% 34		91.3% 4.0% 23			85.7% -1.6% 21		87.6% 0.3% 323
		Behavioral and Social Sciences		84.3% 0.0% 733	88.2% 3.9% 85	87.6% 3.3% 121	61.5% -22.8% 26	73.1% -11.2% 26	64.1% -20.2% 39		83.4% -0.9% 1,030
		Business		79.1% -11.2% 67	90.3% 0.0% 547	79.2% -11.1% 101	63.0% -27.3% 27				86.8% -3.5% 742
		Communication and Education		90.1% 4.7% 81	84.8% -0.6% 66	85.4% 0.0% 591		90.5% 5.0% 21		95.7% 10.2% 23	86.3% 0.9% 782
		Engineering, Computer Science, and Construction Management		73.5% -3.9% 34	79.3% 1.9% 82	80.0% 2.6% 30	77.4% 0.0% 602				77.5% 0.1% 748
		Humanities and Fine Arts		78.6% 1.8% 56	82.6% 5.8% 23	86.6% 9.8% 67		76.8% 0.0% 207			79.3% 2.5% 353
		Natural Sciences		88.1% 18.0% 311	75.0% 4.9% 76	88.4% 18.3% 172	65.6% -4.4% 32	72.0% 1.9% 25	70.1% 0.0% 461		78.5% 8.4% 1,077
		Undergraduate Education		85.5% 59.6% 207	90.5% 64.6% 147	92.2% 66.3% 179	78.0% 52.0% 59	75.0% 49.1% 40	82.8% 56.8% 58	25.9% 0.0% 27	84.5% 58.6% 717

Figure 4. Effects of Major Switching Across Colleges within Four Years of Matriculation on Six-Year Graduation Rates, Fall 2012 – Fall 2014 First-Time Freshmen Cohorts

knowledge and tasks involved are a good match with one's personal values and sense of self, are both essential elements of satisfaction with post-college life. However, we should be wary of the potential for a "personality" mismatch in one's initial field of study to sometimes be another way of expressing difficulty in seeing someone "like me" pursuing a particular kind of career, and how this aligns with historical group inequities in various professional domains.

These data also suggest the importance of recognizing the non-linear major pathways that many students have taken to graduation. For instance, the relatively high degree of historical movement from Natural Sciences into Behavioral and Social Science and Communication and Education suggests the potential utility of developing a more formal sense of "STEM-adjacent" educational pathways, such as the large amount of movement from the Pre-Nursing major into various health science-adjacent majors in other colleges (see Footnote 1). Recognizing and planning around such alternate pathways could aid both the sending and receiving departments, in the respective colleges, in developing a more formal sense of the scientific and technical interests that students are bringing into their new majors. In doing so, it would also aid in cultivating a broader, perhaps more useful understanding of just what we mean when we refer to a "STEM" field, since the term has often focused strongly on original research and development fields, and therefore has sometimes excluded supporting or adjacent fields that are nonetheless critical to scientific and technological innovation[4].

[4] Carnevale, Anthony P., Nicole Smith, and Michelle Melton. 2013. *STEM: Science, Technology, Engineering, Mathematics*. Washington, D.C.: Georgetown Center on Education and the Workforce. Link