Student Behaviors in Relation to Majors and the Impact on Graduation

Office of Institutional Research

March-April, 2013

This study was conducted at the request of the Student Retention and Graduation Subcommittee of the Academic Policy Committee. This committee is currently working on several policy issues related to majors, such as placing limitations on how many times a student can change their major, setting deadlines in relation to the timing of declaring majors, and the implementation of restrictions with regard to having a second major and/or minor. To facilitate discussion regarding these policies, this study intends to review student behaviors in relation to the changing of majors, the timing of declaring majors, and having a single major vs. double majors. Furthermore, this study will analyze the impact of such behaviors on graduation.

Sample and Methodology:

The 2004-2006 native freshmen cohorts (N=7,516) and 2006-2008 transfer cohorts (N=9,973) were selected since those were the most recent samples which allowed for the calculation of 6-year and 4-year graduation rates (by 2012), respectively. Within these cohorts, 3,080 native freshmen graduated within 6 years for a graduation rate of 42%, while 5,891 transfers graduated within 4 years for a graduation rate of 59%.

This study consists of two major analyses: the first focuses on the academic performance of those who successfully graduated within 4 or 6 years. Those students were divided into several sub-groups in terms of different behaviors, such as changing majors vs. no change of major; declaring majors early vs. declaring late, and having a single major vs. having double majors and/or minors. Three measurements were used for comparison, including degree GPA, degree units and actual units. For native freshmen, actual units refers to all units that were taken at Sacramento State. For transfers, actual units refer to Sacramento State units plus up to 70 transfer units. The difference between degree units and actual units is that the actual unit count includes all units that were completed at Sacramento State, regardless of whether or not they counted toward the final degree.

The second analysis compares the graduation rate of students within the different behavior categories, in terms of changing majors, declaring majors and maintaining single or double majors. For the purpose of this comparison, all native freshmen and transfers, regardless of whether they graduated or not, were selected for analysis and were divided into sub-groups in terms of behavior.

Tracking student behaviors related to changing majors, declaring majors, or maintaining single or double majors for extended periods of time is a very complicated task. Adding to this difficulty is the fact that some students drop out or transfer out before they have a chance to declare or change a major. This is especially troublesome when facing drop-out rates as high as about 20% after the first college year. In terms of tracking data through student records, drop-outs and transfer-outs most likely did not have a chance to do anything in relation to their majors. In these cases, it would be incorrect to define those students as having “never changed majors”, having a “single major” or maintaining a status of “undecided” when comparing the graduation rates between sub-groups.

In order to avoid the flaw in the methodology, the tracking groups were set up based on semester enrollment. Enrolled students were then divided into the different groups to compare the graduation rates between the paired subgroups in each category. Due to data availability, the subcategories of

single and multiple majors were based upon the "last known" major, second major and/or minor of each student by the end of 6th year for native freshmen and by the end of 4th year for transfers. Please note that graduation rates are calculated based upon those enrolled in each semester and thus are much higher than the graduation rates of whole cohorts.

Independent Sample T-Tests and Chi-Square Tests were adopted in order to compare degree GPAs, degree and actual units, graduation rates and students' background factors. By utilizing the statistic tests, this study insures that any differences found among the comparison groups did not occur by chance. In addition, two regression models were developed to examine the prediction power of each factor on graduation for both native freshmen and transfers.

Changing Majors - Findings

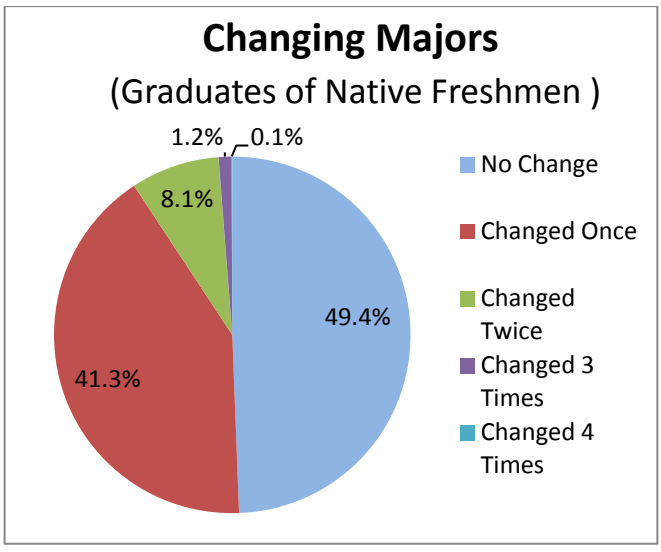
1. Changing Majors and the Academic Performance of Bachelor's Degree Recipients

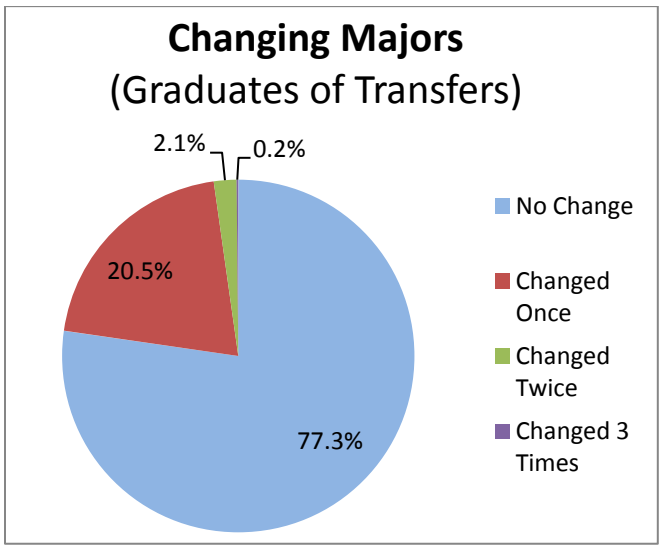
This study revealed that 49% of native freshmen who graduated within 6 years never changed their majors, while 41% only changed their majors once during their college careers. In relation to transfers, 77% never changed their majors; while 21% changed their major once during their college careers (See Table 1 and graphs below).

Table 1. Changing Majors among Students who Graduated within 6 or 4 Years

	Native Freshmen		Transfers		Total	
	Count	%	Count	%	Count	%
No Change	1,521	49.4%	4,553	77.3%	6,074	67.7%
Changed Once	1,273	41.3%	1,207	20.5%	2,480	27.6%
Changed Twice	248	8.1%	122	2.1%	370	4.1%
Changed 3 Times	36	1.2%	9	0.2%	45	0.5%
Changed 4 Times	2	0.1%	0	0.0%	2	0.0%
Total	3,080	100.0%	5,891	100.0%	8,971	100.0%

Notes: The counts started after students initially declared their majors. Excluded the changes from pre-majors to majors.





When comparing degree GPAs and units, this study revealed that both native freshmen and transfer graduates who did not change majors achieved significantly higher degree GPAs than those who changed their majors. Furthermore, in relation to transfers, the number of degree units and actual units accumulated by those who never changed majors were also significantly lower than those who changed their majors. The results were similar when comparing those who never changed their major to those who only changed their major once during the 4-year or 6-year tracking period (See Table 2 and Table 3 below and the graph on following page).

Table 2. Comparison of Degree GPAs and Units among Graduates (I)

	Changed Major		Did Not Change Major			
	Count	Mean	Count	Mean	Gap	Statistical Significance
Native Freshmen (Graduated within 6 Years)						
Degree GPA	1,559	3.02	1,521	3.12	-0.10	*Yes*
Degree Units	1,559	134.2	1,521	133.6	0.6	*No*
Actual Units	1,559	128.2	1,521	127.2	1.0	*No*
Transfers (Graduated within 4 Years)						
Degree GPA	1,338	3.07	4,553	3.13	-0.06	*Yes*
Degree Units	1,338	140.6	4,553	137.2	3.4	*Yes*
Actual Units	1,338	133.0	4,553	129.3	3.7	*Yes*

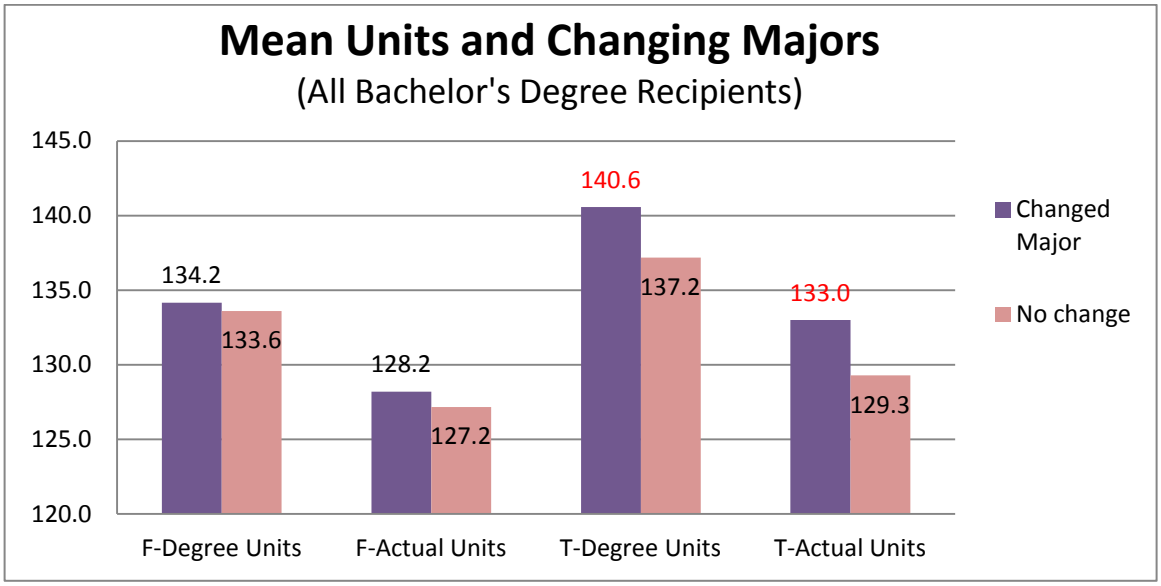
**T-Test, p<.001, Higher value is highlighted in yellow.*

Notes: For native freshmen, "Actual Units" refer to the number of units that were completed at Sacramento State, regardless of whether or not they count towards the degree. For transfers, "Actual Units" refer to the number of units taken at Sacramento State plus up to 70 transfer units.

Table 3. Comparison of Degree GPAs and Units among Graduates (II)

	Changed Major Once		Did Not Change Major			
	Count	% /Mean	Count	% /Mean	Gap	Statistical Significance
Native Freshmen (Graduated within 6 Years)						
Degree GPA	1,273	3.02	1,521	3.12	-0.10	*Yes*
Degree Units	1,273	133.6	1,521	133.6	0.0	*No*
Actual Units	1,273	127.6	1,521	127.2	0.4	*No*
Transfers (Graduated within 4 Years)						
Degree GPA	1,207	3.07	4,553	3.13	-0.06	*Yes*
Degree Units	1,207	139.9	4,553	137.2	2.7	*Yes*
Actual Units	1,207	132.3	4,553	129.3	3.0	*Yes*

**T-Test, p<.001, Higher value is highlighted in yellow.*



Notes: "F" refers to native freshmen; "T" refers to transfers. Numbers in red show significant differences.

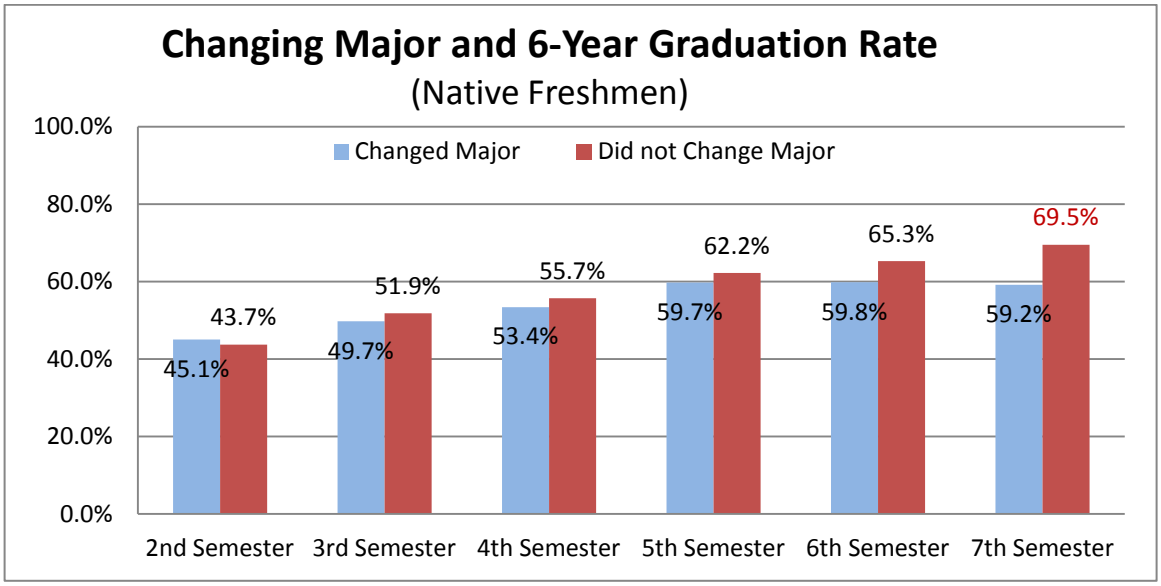
2. Changing Majors and Graduation

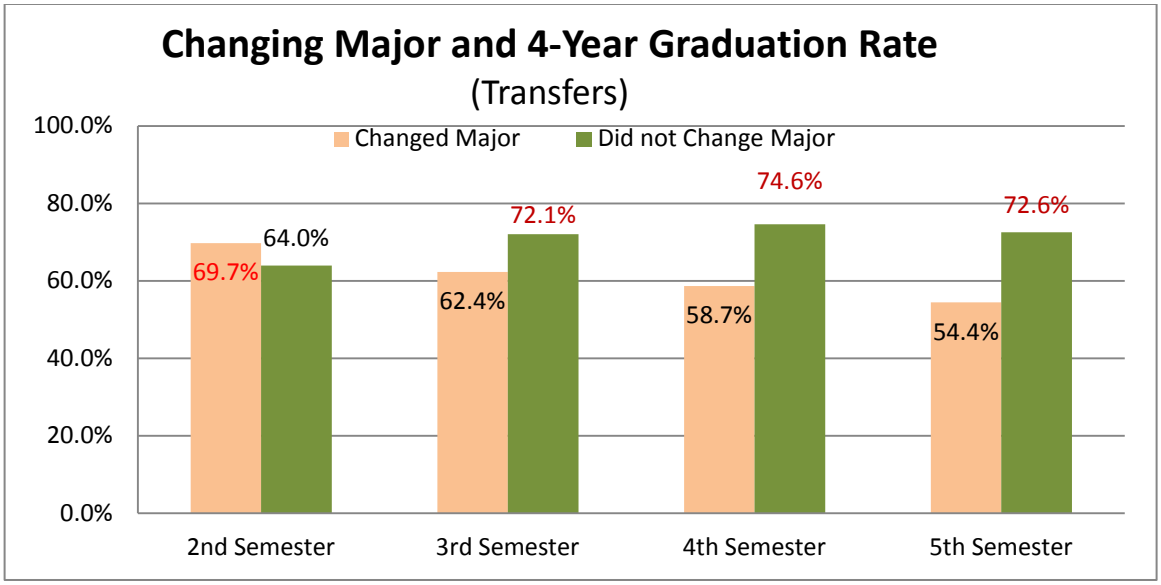
As mentioned previously, the most accurate method of tracking whether students changed or did not change majors is based on enrollment in each semester. Thus, this study defined students as "changed major" or "did not change major" by comparing their most current majors with their majors in the previous semester. Students who were "undecided" were defined as "did not change major" until they declared majors for the first time. Furthermore, all pre-majors were treated as majors (See Table 4 below and graphs on following page)

Table 4. The Timing of Changing Major and 6-Year/4-Year Graduation Rate

	Changed Major		Did not Change Major			
	Count	Rate	Count	Rate	*Gap*	Statistic Significance
Native Freshmen						
2nd Semester	257	45.1%	2,804	43.7%	1.4%	*No*
3rd Semester	277	49.7%	2,729	51.9%	-2.1%	*No*
4th Semester	244	53.4%	2,729	55.7%	-2.3%	*No*
5th Semester	377	59.7%	2,593	62.2%	-2.5%	*No*
6th Semester	295	59.8%	2,674	65.3%	-5.5%	*No*
7th Semester	360	59.2%	2,627	69.5%	-10.3%	*Yes*
Transfers						
2nd Semester	426	69.7%	5,344	64.0%	5.8%	*Yes*
3rd Semester	573	62.4%	5,136	72.1%	-9.7%	*Yes*
4th Semester	307	58.7%	5,181	74.6%	-15.9%	*Yes*
5th Semester	301	54.4%	3,442	72.6%	-18.1%	*Yes*

**Chi-square Test, p<.001, Higher value is highlighted in yellow; p<.01, Higher value is highlighted in green.*





According to the results, changing major at the 7th semester was the turning point for 6-year graduation within native freshmen: The "no change" group achieved significantly higher 6-year graduation rates at the 7th semester than the "changed" group. For transfers, the third semester was the turning point in terms of the 4-year graduation rate. In other words, in terms of affecting graduation rates, changing majors did not make much of a difference in relation to native freshmen during their first three years at the university or for transfers during their first year at this university.

Declaring a Major - Findings

1. The Timing of Declaring Majors and the Academic Performance of the Bachelor's Degree Recipients

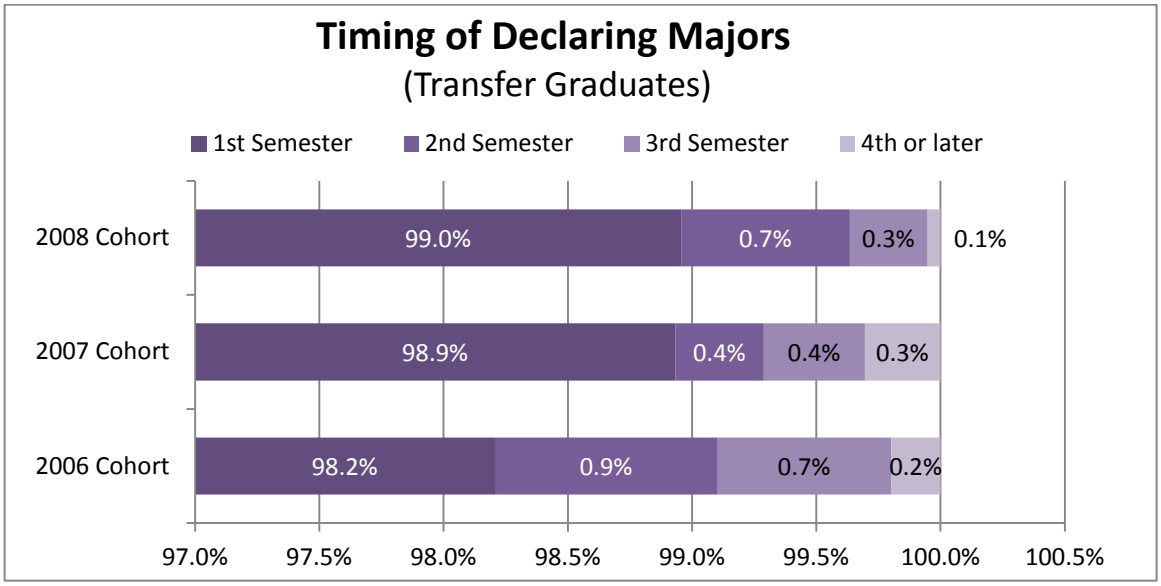
By using the same methodology as used for changing majors, this study also tracked students who declared a major ("Declared") and those who did not ("Undecided") from the first to fifth term within

native freshmen and from the first to third term within transfers. In general, students rarely changed from "Declared" to "Undecided" with few exceptions. Thus, the counts for "Declared" and "Undecided" are cumulative for each term provided. This study showed that 81% of native freshmen graduates had declared majors at the first semester, while 99% of transfer graduates had declared their majors at the first semester. The graphs below illustrate the trends and proportions of majors declared each semester for the graduates of both native freshmen and transfers (See Table 5 and graphs below).

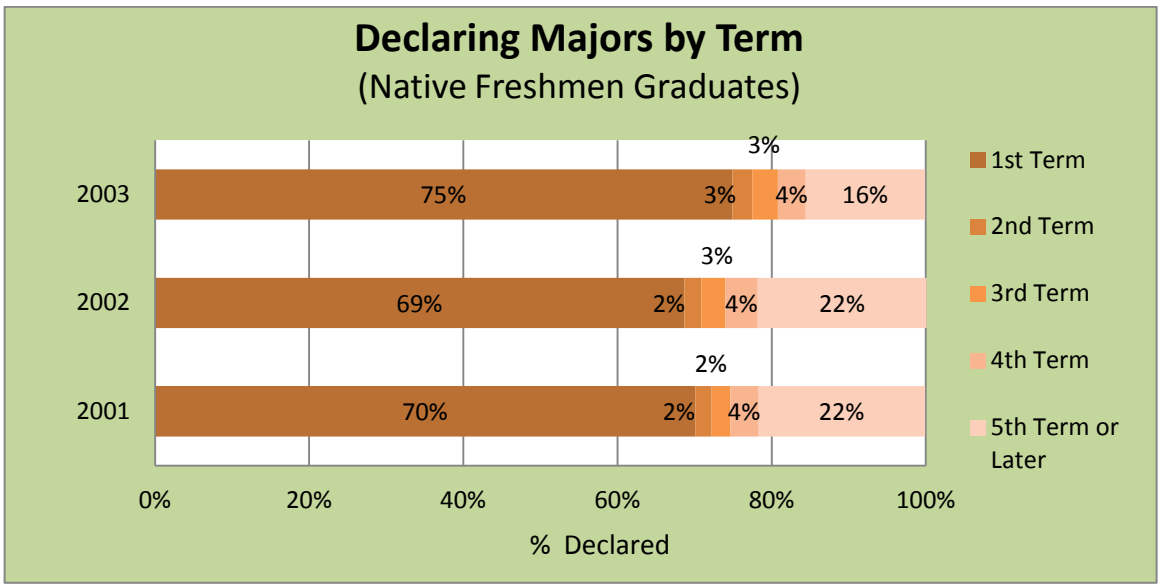
Table 5. Declaring Majors among Students who Graduated within 6 or 4 Years

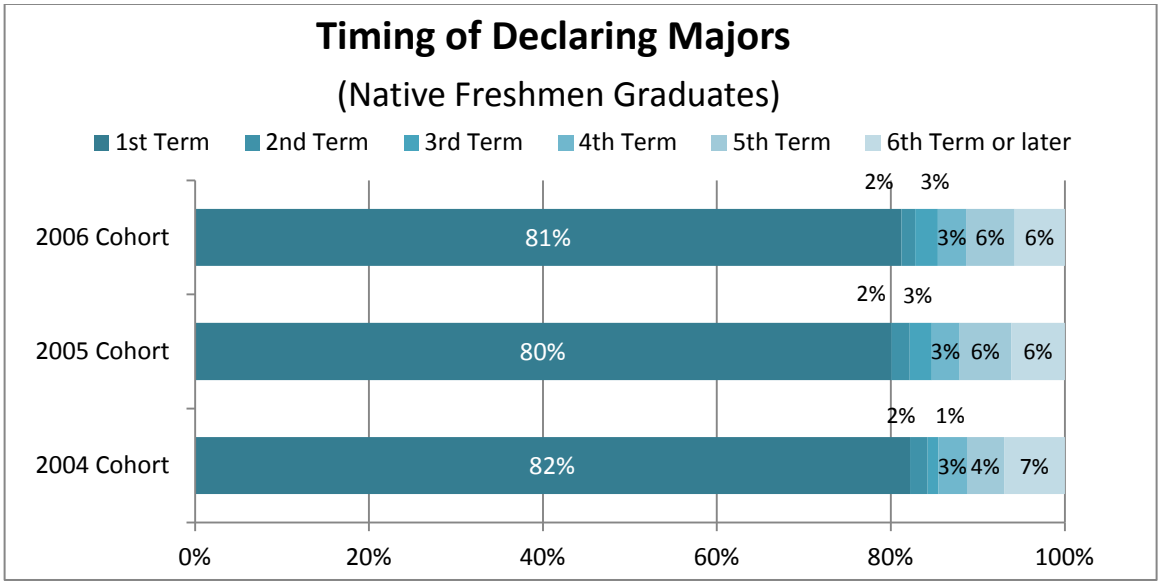
	Native Freshmen		Transfers		Total	
	Count	%	Count	%	Count	%
1st Semester	2,499	81.1%	5,814	98.7%	8,313	92.7%
2nd Semester	59	1.9%	38	0.6%	97	1.1%
3rd Semester	66	2.1%	28	0.5%	94	1.0%
4th Semester	100	3.2%	11	0.2%	111	1.2%
5th Semester	163	5.3%			163	1.8%
6th Semester or later	193	6.3%			193	2.2%
Total	3,080	100.0%	5,891	100.0%	8,971	100.0%

Notes: All pre-majors are defined as "Declared".



According to the longitudinal data presented, it's clear that an increasing number of students who graduated within 6 years had declared their major at the first term. Within the 2001-2003 native freshmen cohorts, approximately 71% of those who graduated declared their major at the first term, that percentage increased to 80% within the 2004-2006 cohorts. The graphs on the following page display the timing of declaring major in relation to graduates from within the 2001-2003 native freshmen and 2004-2006 native freshmen cohorts.





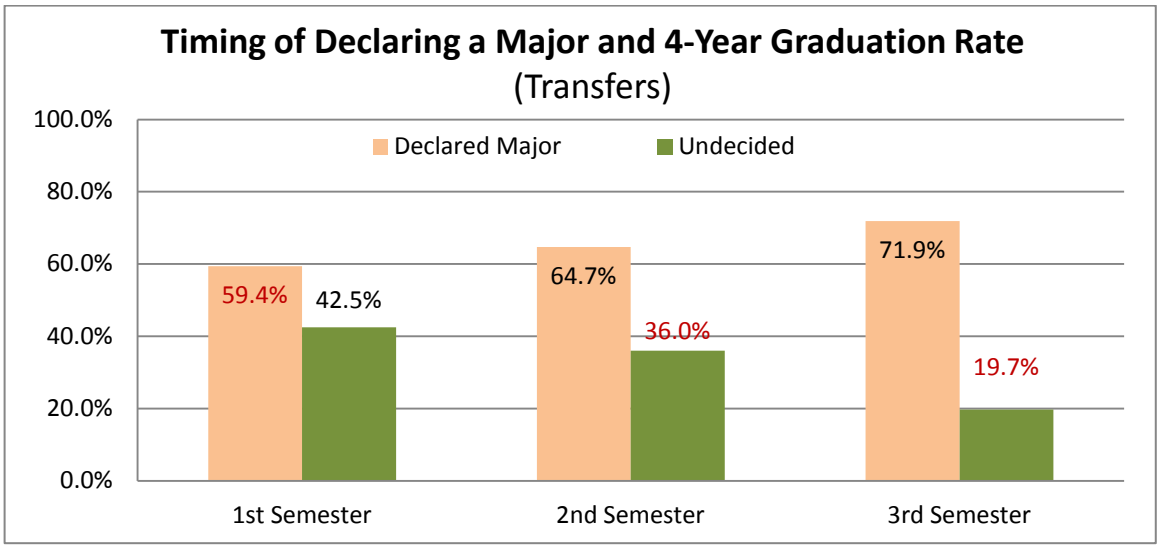
2. The Timing of Declaring a Major and Graduation

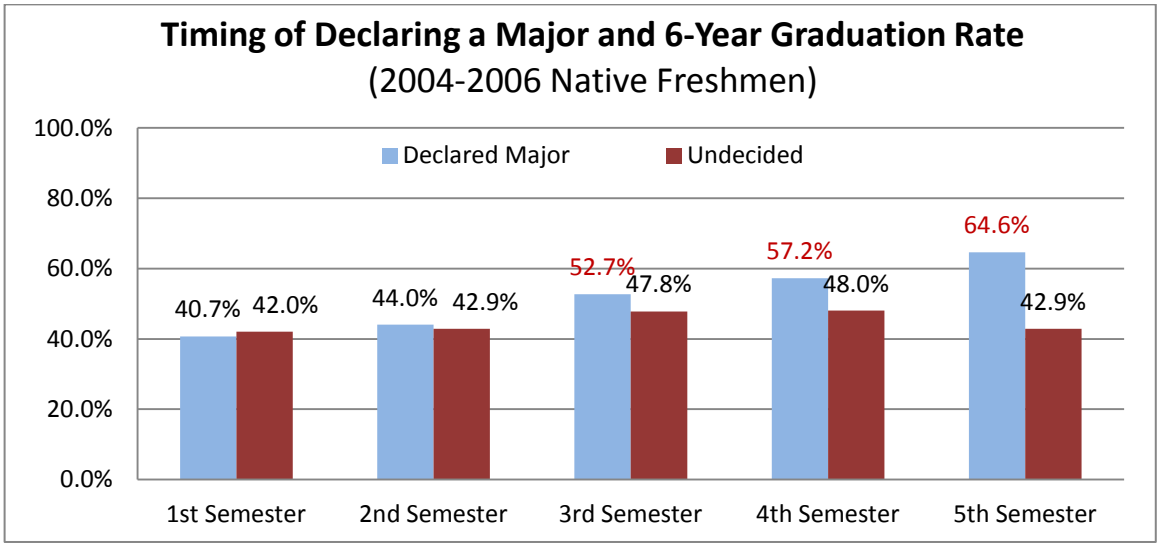
By tracking students who declared majors versus those who remained undecided on a term by term basis, this study identified the turning point by which declaring a major has the most impact on facilitating graduation. According to the results, the turning point for native freshmen is the third semester: Students who declared a major by third semester achieved a significantly higher 6-year graduation rate than those who remained "Undecided" (53% vs. 48%, respectively). The turning point was much sooner for transfers: Students who declared a major during their first semester at this university achieved a significantly higher 4-year graduation rate than those who remained "Undecided". It is important to note, however, that 99% of transfers had already chosen their majors when they entered this university (See Table 6 and graphs on following page).

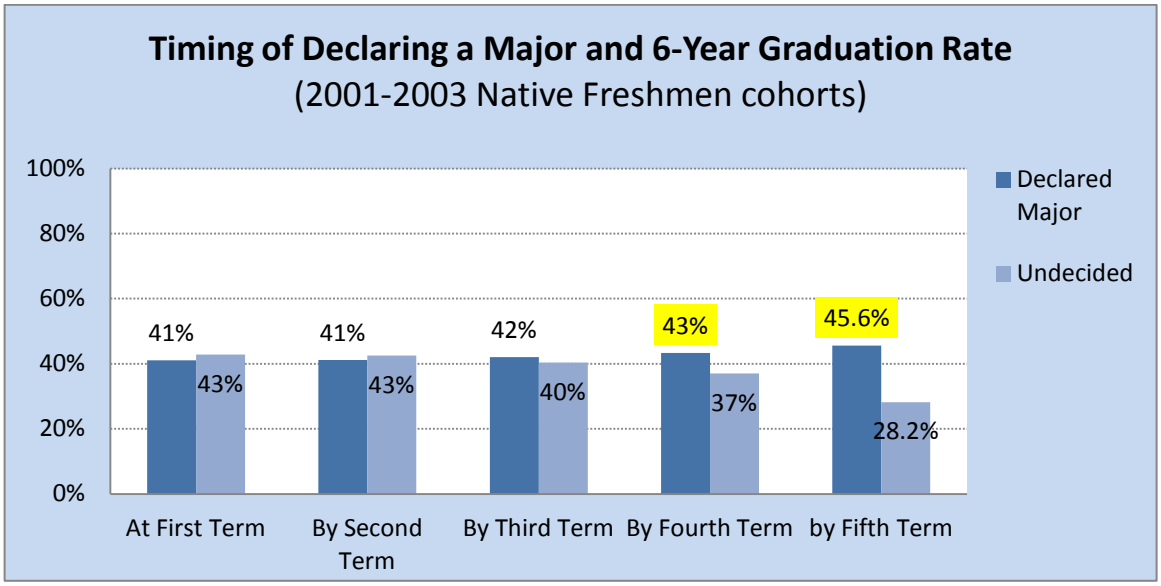
Table 6. The Timing of Declaring a Major and 6-Year/4-Year Graduation Rate

	Declared Major		Undecided		Gap	Statistical Significance
	Count	Rate	Count	Rate		
Native Freshmen						
1st Semester	2,499	40.7%	581	42.0%	-1.3%	*No*
2nd Semester	2,465	44.0%	596	42.9%	1.2%	*No*
3rd Semester	2,425	52.7%	581	47.8%	4.9%	*Yes*
4th Semester	2,499	57.2%	474	48.0%	9.2%	*Yes*
5th Semester	2,712	64.6%	258	42.9%	21.8%	*Yes*
Transfers						
1st Semester	5,814	59.4%	77	42.5%	16.8%	*Yes*
2nd Semester	5,730	64.7%	40	36.0%	28.7%	*Yes*
3rd Semester	5,681	71.9%	28	19.7%	52.1%	*Yes*

Chi-square Test, p<.001, Higher value is highlighted in yellow; p<.01, Higher value is highlighted in green.







When reviewing graphs from a previous study in relation to the 2001-2003 native freshmen cohorts, the results from that study were consistent with this one. The 4th semester was the turning point, which provides a 6-year trend in terms of the timing of declaring a major in relation to 6-year graduation rates (at 99.9% confidence level, $p<.001$).

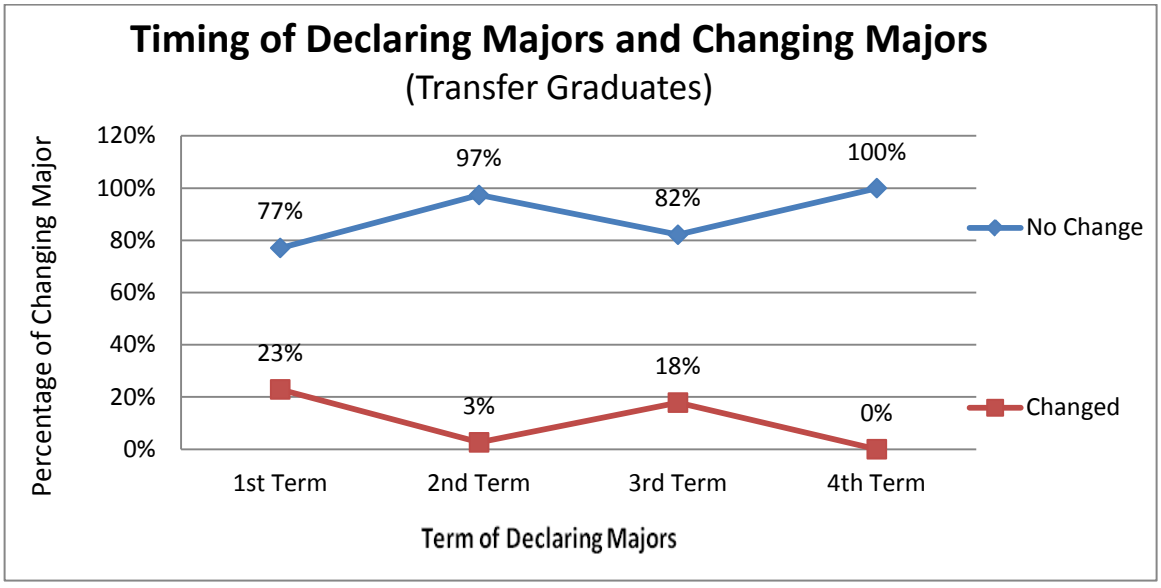
3. The Timing of Declaring Majors and Changing Majors

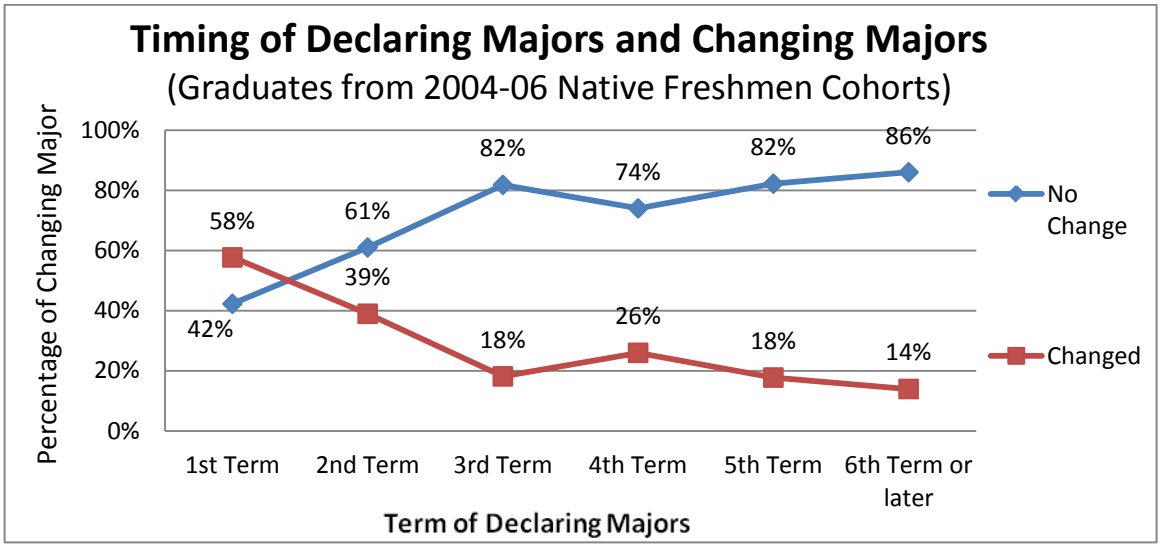
In order to address the question of whether or not the early declaration of majors results in an increase in the frequency of changing majors, this study examined the relationship between the term in which majors were declared and the number of major changes in relation to Bachelor degree recipients from within the 2004-2006 native freshmen cohorts and of 2006-2008 transfer cohorts. The results indicate that 58% of the Bachelor's degree recipients who declared their majors at the first term changed their majors at least once. However, a majority of the students who declared their majors after the first term never changed majors. This result is also consistent with a previous study based on 2001-2003 native freshmen cohorts, which provides a 6-year trend in terms of the timing of declaring majors and changing majors.

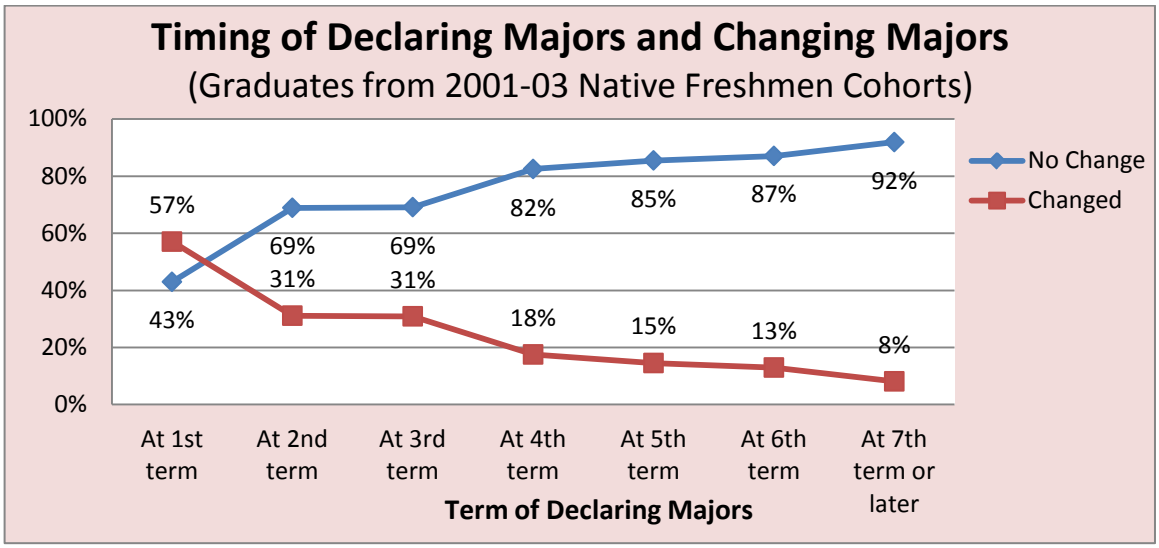
The story is very different for transfers: the vast majority of transfers never changed their majors, regardless of which semester they declared their major in, although the proportion has fluctuated (See the Table 7 and graphs on following page).

Table 7. Declaring and Changing Majors (Bachelor's Degree Recipients)

Declaring Majors	Never Changed	Changed Once	Changed Twice	Changed 3 times	Changed 4 times	Total
Native Freshmen						
Declared at 1st term	1,057	1,171	239	30	2	2499
Declared at 2nd term	36	18	3	2		59
Declared at 3rd term	54	11	1			66
Declared at 4th term	74	20	3	3		100
Declared at 5th term	134	28	1			163
Declared at 6th term or later	166	25	1	1		193
Total	1,521	1,273	248	36	2	3,080
Transfers						
Declared at 1st term	4,482	1,201	122	9		5,814
Declared at 2nd term	37	1	0	0		38
Declared at 3rd term	23	5	0	0		28
Declared at 4th term	11	0	0	0		11
Total	4,553	1,207	122	9		5,891







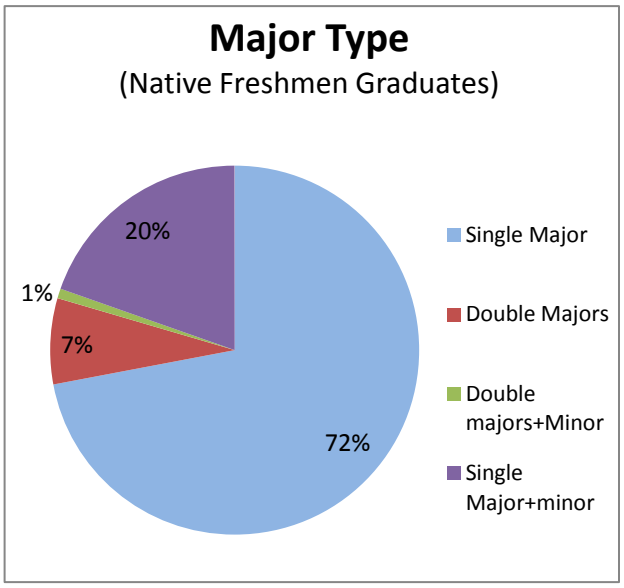
Single Major vs. Double Majors/Minors - Findings

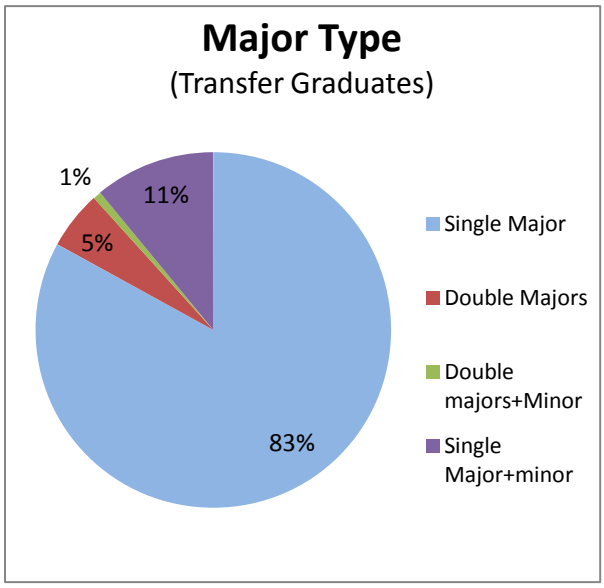
1. Major Type and the Academic Performance of Bachelor's Degree Recipients

Students can generally be grouped into four categories in terms of their major type: Single major, single major plus minor, double majors, and double majors plus minor. Data regarding major types were based on the "last known" major type for both native freshmen and transfers. This study revealed that 72% of native freshmen graduates and 83% of transfer graduates had single majors (See Table 8 and graphs on following page).

Table 8. Major Type among Students who Graduated within 6 or 4 Years

	Native Freshmen		Transfers		Total	
	Count	%	Count	%	Count	%
Single Major	2,218	72.0%	4,889	83.0%	7,107	79.2%
Single Major + Minor	604	19.6%	646	11.0%	1,250	13.9%
Double Majors	232	7.5%	312	5.3%	544	6.1%
Double Majors + Minor	26	0.8%	44	0.7%	70	0.8%
Total	3,080	100.0%	5,891	100.0%	8,971	100.0%



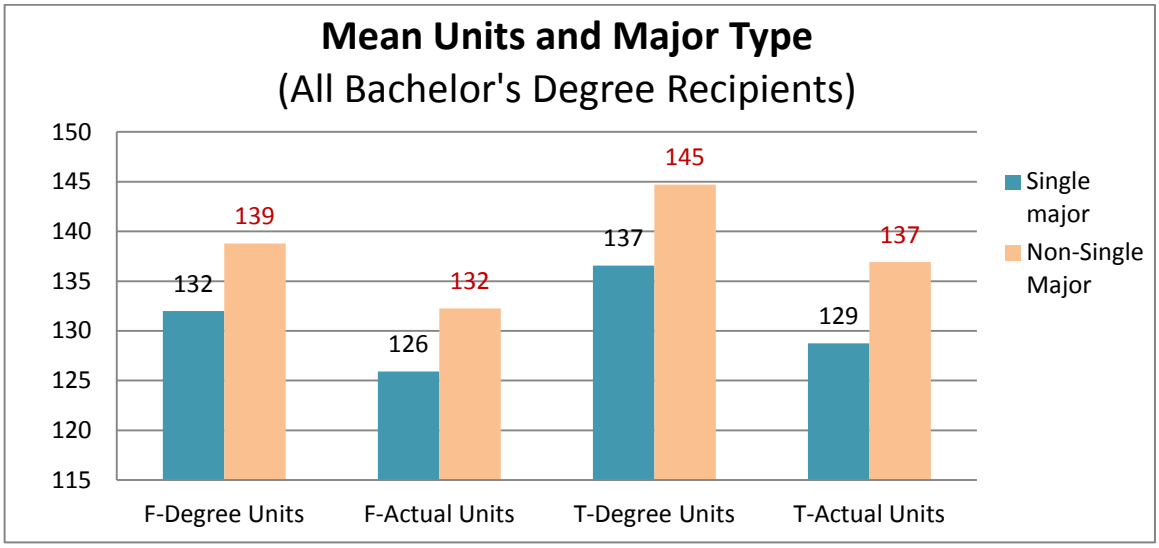


When comparing their academic performance, this study found that graduates who had double majors and/or minors achieved significantly higher degree GPAs than those who had single majors. This finding was applicable to both native freshmen and transfers. However, both native freshmen and transfers with more than a single major had a significantly higher number of degree units and actual units than those with a single major (See Table 9 below and the graph on following page).

Table 9. Degree GPA and Units between Single Major vs. Non-Single Major

	Single Major		Non-single Major		Gap	Statistical Significance
	Count	Mean	Count	Mean		
Native Freshmen (Graduated within 6 Years)						
Degree GPA	2,218	3.05	862	3.12	-0.07	*Yes*
Degree Units	2,218	132.0	862	138.8	-6.8	*Yes*
Actual Units	2,218	125.9	862	132.3	-6.3	*Yes*
Transfers (Graduated within 4 Years)						
Degree GPA	4,889	3.11	1,002	3.16	-0.06	*Yes*
Degree Units	4,889	136.6	1,002	144.7	-8.1	*Yes*
Actual Units	4,889	128.7	1,002	136.9	-8.2	*Yes*

**T-Test, p<.001, Higher value is highlighted in yellow; p<.01, Higher value is highlighted in green.*



Note: "F" refers to native freshmen; "T" refers to transfers.

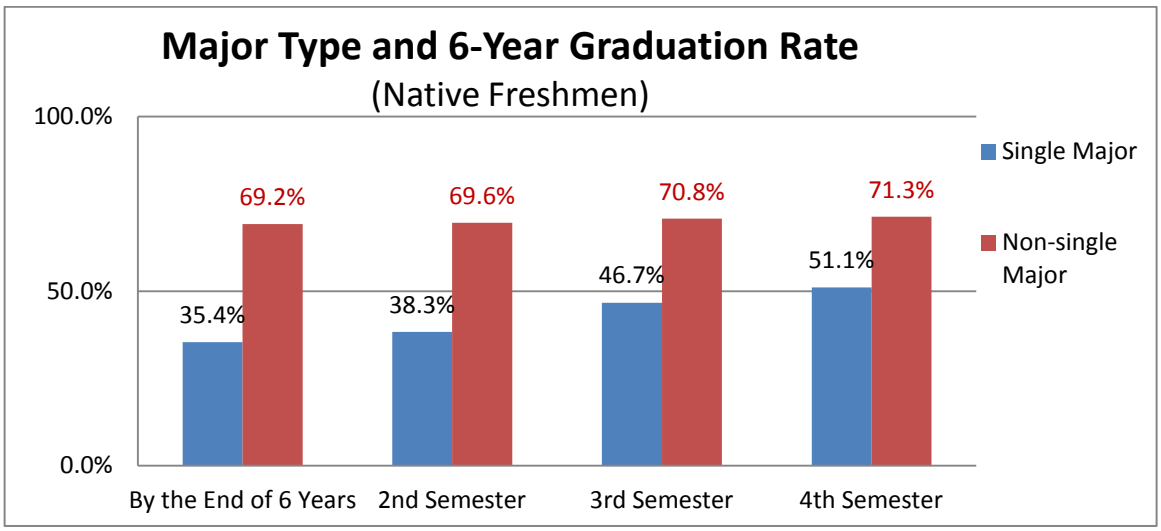
2. Major Type and Graduation

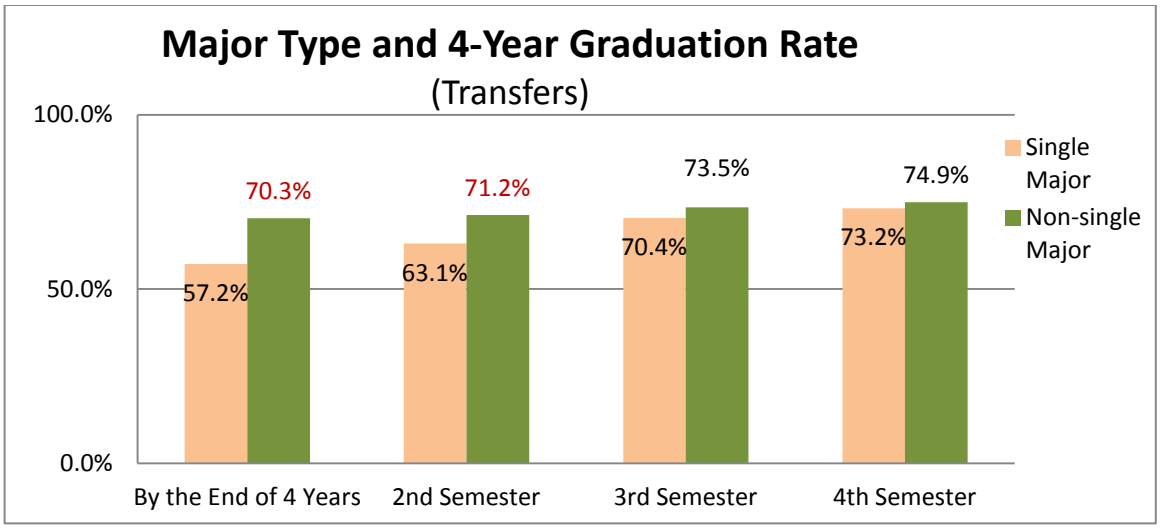
Due to the data availability, instead of tracking the major type by semester, this study only obtained the "last known" major, second major or minor by the end of 6 or 4 years period. By using the "last known" major type, it defined all students into two sub-groups: single major and double majors/minors and then compared the 6-year graduation rate of native freshmen and 4-year graduation rate of transfers between the two sub-groups (See Table 10 and graphs on following page).

Table 10. Comparison of Graduation Rate between Single Major and Non-Single Major

	Single Major		Non-single Major			
	Count	Rate	Count	Rate	*Gap*	Statistic Significance
Native Freshmen (Graduated within 6 Years)						
By the End of 6 Years	2,218	35.4%	862	69.2%	-33.9%	*Yes*
2nd Semester Enrollees	2,205	38.3%	856	69.6%	-31.3%	*Yes*
3rd Semester Enrollees	2,159	46.7%	847	70.8%	-24.0%	*Yes*
4th Semester Enrollees	2,133	51.1%	840	71.3%	-20.2%	*Yes*
Transfers (Graduated within 4 Years)						
By the End of 4 Years	4,889	57.2%	1,002	70.3%	-13.1%	*Yes*
2nd Semester Enrollees	4,788	63.1%	982	71.2%	-8.1%	*Yes*
3rd Semester Enrollees	4,734	70.4%	975	73.5%	-3.0%	*No*
4th Semester Enrollees	4,528	73.2%	960	74.9%	-1.7%	*No*

**Chi-square Test, p<.001, Higher value is highlighted in yellow.*





The results show that both native freshmen and transfer with non-single majors actually achieved significantly higher 6-year or 4-year graduation rates than their peers with single majors. When taking the first year attrition into consideration (23% for native freshmen and 19% for transfer), the difference of 6-year graduation rate remained as statistically significant based on the native freshmen who still enrolled at third or fourth semester. However, the graduation rate became not significantly different based on the third and fourth semester enrollees of transfers

It seems counterintuitive that students with double majors and/or minors achieved higher graduation rate than their peers with single majors. However, after analyzing the background factors of the two sub-groups, this study discovered that students with non-single majors actually had significantly higher high school GPAs, SAT scores or transfer GPAs than their single major peers. Students with double majors and/or minors were also more likely to be full-time students. In contrast to these characteristics, students in need of remediation were more likely to maintain a single major. However, there were no significant differences, within both native freshmen or transfers, in terms of other characteristics, such as being an under-represented minority, commuter, or community college origin, between single major

and non-single majors. The sole exception to this was gender: Male native freshmen and female transfers were more likely to have a single major (See Appendix I).

Regression Models for Graduation:

After examining student behaviors related to majors, it was necessary to develop regression models to analyze the prediction power of those factors on the graduation of native freshmen and transfers. Besides the factor of changing majors, the timing of declaring majors, major types, background factors, and first year intervention factors (native freshmen only) were also incorporated into the two models.

The first model incorporates 19 factors in relation to predicting 6-year graduation of native freshmen. After a selection process (stepwise variable selection), only 12 factors were identified as being strong predictors on 6-year graduation. Factors which showed little prediction power were excluded from the models, although some of these factors have been identified as being contributors to graduation when examined individually (See Table 11 below).

Table 11 Regression Model 1: 6-Year Graduation for Native Freshmen (2004-2006 Cohorts)

Predict Variables	B	S.E.	Wald	df	Sig.	Exp(B)	Odds Ratio	Rank
Gender(1)	-.248	.070	12.645	1	.000	.781	1.3	9
Commuter(1)	.161	.072	4.940	1	.026	1.174	1.2	10
Full-time at first term(1)	.730	.244	8.915	1	.003	2.074	2.1	2
High School GPA	.772	.080	92.028	1	.000	2.163	2.2	1
SAT Math Score	.001	.000	6.130	1	.013	1.001	1.0	
Athlete(1)	-.750	.173	18.704	1	.000	.472	2.1	2
Equity Programs(1)	.377	.090	17.485	1	.000	1.459	1.5	6
Learning Community(1)	-.205	.084	5.971	1	.015	.814	1.2	10
Major Type(1)	-.711	.082	75.395	1	.000	.491	2.0	4
Changed major(1)	-.343	.066	26.919	1	.000	.710	1.4	7
Declared majors by 3rd term(1)	.352	.156	5.115	1	.024	1.422	1.4	7
Declared majors by 4th term(1)	-.494	.161	9.470	1	.002	.610	1.6	5
Constant	-2.073	.442	21.963	1	.000	.126		
Model Indicators								
Baseline P*	41.0%		Chi-Square (df)		394.708(12)			
Model N	4,308		Pseudo R^2		.088-.117			
-2log L	5505.489		% Correctly predicted (Graduated)		91.2%			

* Refers to 6-year graduation rate.

According to this regression model, high school GPA, full-time status at the first term, and being an athlete were the top three predictors for 6-year graduation. Major type (single majors vs. non-single majors), timing of declaring a major, and changing majors were ranked at #4, #5 and #7, respectively, in term of prediction power on 6-year graduation. In other words, students with double majors were 2

times more likely to graduate within 6-years than those with a single major when keeping other factors constant. In the same token, students who declared majors by the 3rd term or 4th term were 1.4 or 1.6 times, respectively, more likely to graduate than those who did not do so. Students who never changed majors were 1.4 times more likely to graduate than those who changed their majors. One indicator of the quality of this model is the percent correctly predicted, which was as high as 91% in relation to predicting those who will graduate within 6 years.

The second regression model developed for this study was used to predict the 4-year graduation rate of transfers by using 12 factors, including factors relating to student behaviors as they pertain to majors. After utilizing the same selection process as was used for native freshmen, 10 factors were deemed as having significant prediction power (See Table 12 below).

Table 12 Regression Model 2: 4-Year Graduation for Transfers (2006-2008 Cohorts)

Predict Variables	B	S.E.	Wald	df	Sig.	Exp(B)	Odds Ratio	Rank
Age	-.030	.005	41.892	1	.000	.971	1.0	
Gender	-.225	.053	18.110	1	.000	.798	1.3	5
Underrepresented Minority	.299	.062	23.110	1	.000	1.349	1.3	5
Full-time at first term	-.723	.061	141.107	1	.000	.485	2.1	2
Community College	-.164	.063	6.795	1	.009	.849	1.2	6
Admission type	-.626	.140	20.094	1	.000	.535	1.9	3
Transfer GPA	1.063	.061	307.323	1	.000	2.894	2.9	1
Transfer Units	.013	.001	101.473	1	.000	1.013	1.0	
Changed Major at 3rd Term	.363	.070	26.996	1	.000	1.437	1.4	4
Constant	-2.668	.220	146.823	1	.000	.069		

Model Indicators			
Baseline P*	59.1%	Chi-Square (df)	817.618(9)
Model N	8,011	Pseudo R^2	.097-.139
-2log L	8824.338	% Correctly predicted (Graduated)	87.5%

* Refers to 4-year graduation rate.

According to this model, transfer GPA, full-time status at the first term, and admission type (regular admit vs. exceptional admit) were the top three factors in terms of prediction power for 4-year graduation. Changing major was ranked as the #4 indicator in this model. In other words, students who did not change their major at the third term were 1.4 times more likely to graduate than those who had changed their majors at that term. It was not surprising that timing of declaring a major and type of major were ultimately excluded from this model because only 21% of transfers had a double major and/or minor, and 98% of them had already declared their major at the first semester. This model had a prediction power of 88% in terms of correctly predicting those who will graduate within 4 years.

Discussion and Recommendations:

With regard to changing majors, this study demonstrated that 49% of native freshmen who graduated within 6 years had never changed their majors, while 77% of transfers who graduated within 4 years had never changed majors. Graduates who never changed majors also achieved higher degree GPAs than those who changed major within both the native freshmen and transfers cohorts. In relation to transfers, graduates who never changes majors also accumulated fewer units than those who changed majors. The differences between these two groups were statistically significant. When comparing the graduation rate between students who never changed majors and those who had changed majors at least once, this study revealed that changing majors had no impact on graduation if that change took place prior to the 7th semester for native freshmen. However, changing majors at or after the 3rd semester made a significant difference in terms of the 4 year graduation rate of transfers.

In relation to the timing of declaring majors, the results of this study indicated that declaring a major at the first term may be optimal with regard to graduation: over 80% of the students who succeeded in graduating within 6 years and over 98% of the students who succeeded in graduating within 4 years declared their majors at the first term. However, the possibility of graduation is not significantly impacted by the declaring of a major as long as the major is declared by the third term for native freshmen. However, it appears crucial that transfers declare their major upon entry to this university, as there was a significant difference between the graduation rates of those who were "Declared" and those who remained "Undecided" beginning in the first semester.

Upon review of the effect of the early declaration of majors on the number of major changes, this study found that the majority (58%) of Bachelor's degree recipients within the native freshmen cohort had changed majors when they declared a major *in* the first semester. However, this trend was reversed by the second semester: A majority (61%-86%) of native freshmen never changed their major when they declared a major *after* the first semester. The results regarding the timing of declaring majors and changing majors substantiates a previous study performed by the OIR based on 2001-2003 native freshmen cohorts, which makes a convincing case for a six year trend. As for transfers, 77% of Bachelor's degree recipients had never changed their majors after declaring their major at the first semester. This gap became even wider after the first semester: 97% to 100% of those who graduated had never changed their majors when declaring majors from the 2nd to 4th semester.

In terms of major type (single major vs. non-single major), this study demonstrated that 72% of the graduates within the native freshmen cohort, and 83% of the graduates within transfer cohort had single majors when they successfully graduated within 6 or 4 years, respectively. Among Bachelor's degree recipients, those who had double majors and/or minors achieved higher GPAs and accumulated a greater number of units than their peers who had a single major. These differences were statistically significant. When comparing the graduation rate between these two sub-groups, students with non-single majors achieved significantly higher graduation rates than those who had a single major. However, further analysis revealed that students with non-single majors generally came from better academic backgrounds: They had higher high school GPAs, SAT scores and transfer GPAs. They

were also more likely to maintain full-time status for at least at the first semester, and were unlikely to need remediation in comparison with their peers.

Through the use of two regression models, this study demonstrated the interaction between student behaviors relating to majors, as well as other factors, in relation to predicting graduation rates. The first model showed that all of the behaviors tested in relation to majors were strong predictors for the 6-year graduation of native freshmen, even when taking other selected background and intervention factors into consideration. The second model identified only the behavior of changing majors at the 3rd semester as a strong predictor of 4-year graduation for transfers when taking background factors into consideration.

The following recommendations are based upon the findings of this study:

1. It may be necessary to set up restrictions with regard to changing majors in order to facilitate graduation within 4 or 6 years. This study revealed that students who changed majors even once achieved lower graduation rates than those who never changed majors. To support such a policy, enhanced advising would be necessary to help student choose majors that were not only of interest to them, but also feasible in terms of their ability to succeed within the program and eventually earn a degree.
2. In terms of timing, based upon this study, the latest semester for changing majors could be set at the 6th semester for native freshmen and the 2nd for transfers. Any changes of majors after those cutoff periods could negatively impact the likelihood of graduation within 4 or 6 years.
3. It appears as though it is optimal for students to declare their major at the first semester, especially in relation to transfers. In terms of native freshmen, it may prove beneficial to require that they declare a major no later than the 3rd semester, even if they have not yet accumulate 61 units by that time. According to this study, the timing of declaring a major had strong impact on graduation. Thus, a 3rd semester deadline for declaring majors, rather than the current policy of declaration at 61 units may be in order. The findings of this study seem to support the idea that the timing could prove to be too late for students with regard to declaring a major at 61 units. The mean number of units for native freshmen by the end of the 3rd term was 38, and was still only 51 by the end of the 4th term. Among those students, only 13% had actually reached the 61 unit threshold, while 59% had only completed 51 units by the end of the 4th semester.
4. According to this study, students with double majors and/or minors generally came from advanced academic background. As such, they were able to successfully graduate within 6 or 4 year in a higher rate than their peers with a single major. Therefore, even though all students should have the option of having double majors and/or minors, specific academic standards may need to set in place, such as taking high school GPA, SAT score or transfer GPA into consideration and identifying the cutoff points. Furthermore, part-time students, as well as those in need of remediation might be best served by maintaining a single major.

Appendix

Comparison of Background Factors between Single Majors and Non-Single Majors

	Single Major		Non-single Major		Gap	Statistical Significance
	Count	% /Mean	Count	% /Mean		
Native Freshmen						
Gender						
Female	3,712	59.2%	813	65.3%		
Male	2,559	40.8%	432	34.7%	-18.4%	*Yes*
Ethnicity						
URM	1,917	30.6%	370	29.7%	0.9%	*No*
Non-URM	4,354	69.4%	875	70.3%		
Remediation						
Need	4,400	70.2%	813	65.3%	4.9%	*Yes*
Did not need	1,871	29.8%	432	34.7%		
Enrollment Status						
Full-time	6,060	96.6%	1,231	98.9%	-2.2%	*Yes*
Part-time	211	3.4%	14	1.1%		
Commuter						
Living on Campus	1,921	30.6%	405	32.5%		
Commuting	4,350	69.4%	840	67.5%	1.9%	*No*
High School GPA	6,265	3.2	1,242	3.3	-0.1	*Yes*
SAT Math	5,103	489	1,027	506	-16	*Yes*
SAT Verb	5,103	470	1,027	485	-14	*Yes*
Transfers						
Gender						
Female	3,659	42.8%	423	29.7%		
Male	4,889	57.2%	1,002	70.3%	14.4%	*Yes*
Ethnicity						
URM	1,814	21.2%	307	21.5%	-0.3%	*No*
Non-URM	6,734	78.8%	1,118	78.5%		
From Community College						
Yes	6,549	76.6%	1,133	79.5%	-2.9%	*No*
No	1,999	23.4%	292	20.5%		
Enrollment Status						
Full-time	6,360	74.4%	1,162	81.5%	-7.1%	*Yes*
Part-time	2,188	25.6%	263	18.5%		
Transfer GPA	8,436	3.0	1,418	3.1	-0.1	*Yes*
Transfer Units	8,436	72.2	1,419	71.6	0.6	*No*
Age	8,548	24.1	1,425	23.7	0.4	*No*

**Chi-square Test or T-Test, p<.001, Higher value is highlighted in yellow; p<.01, Higher value is highlighted in green.*