Observed vs. Predicted Graduation and Retention, by Department

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Executive Summary

First-time freshman graduation and retention rates at CSU vary substantially across Colleges and Departments. Part of this variation is attributable to differing levels of freshman academic preparedness and different distributions of demographic characteristics that are known to predict successful retention and graduation. This report identifies departments whose freshmen students appear to be underperforming or overperforming on graduation and retention measures, compared to similar freshmen in other departments within the same College.

One-third of studied departments underperform on observed freshmen retention, compared to the predictive model. Underperforming departments that serve large quantities of Minority, Pell, and First Generation students may be ripest for policy intervention. Departments that serve above-average proportions of 2+ of the above student groups, and also underperform on retention, include Biochemistry & Molecular Biology; Health & Exercise Science; and Psychology.

Just over one-third of departments (37.5%) underperform on six-year graduation rate, compared to the model predictions. As with retention, underperforming departments that serve above-average proportions of Minority, Pell, and First Generation students may be of particular note. Departments serving above-average proportions of those populations, but underperforming on six-year graduation, include Biology; Design & Merchandising; Health & Exercise Science; History; Political Science; and Provost/Academic VP (undeclared students).

Minority, Pell and First Generation students are over-represented within certain colleges and departments in relation to the CSU freshman population overall. For the most recent studied first-time full-time Freshman cohorts, ranging from Fall 2010 to Fall 2014, the following colleges/college groupings serve above-average proportions of the above student groups: Agricultural Sciences, Health & Human Sciences, Intra-University, Liberal Arts (Social Science department grouping), Natural Sciences, Veterinary Medicine & Biomedical Sciences. See the Appendix for full data on student demographic distributions by-department and by-College.

Purpose

This report explores the difference between an undergraduate department's **observed** cohort retention and graduation rates, compared with the department's **predicted** cohort retention and graduation rates based on the characteristics of their students. Each department's predicted retention and graduation rate is determined according to the demographic composition and academic preparedness of its First-Time, Full-Time Freshman (FTFT) cohort, indexed to the observed graduation and retention rates for the department's overseeing College. The report updates a prior study completed by Institutional Research in the summer of 2014. Demographic data by college and department are available in the Appendix of this report, along with details on the regression models created to predict graduation and retention.

Data

The data set for the retention portion of this report includes all first-time, full-time (FTFT) freshman students in the FA10 – FA14 cohorts. The data for the graduation portion of the report includes all first-time, full-time freshman students in the FA05 – FA09 cohorts. Five years of cohorts are examined in this study, for the purpose of achieving adequate sample sizes at the department level for quantitative inquiry while focusing only on the timeliest FTFT freshman cohorts. Departments with fewer than 25 FTFT freshmen majors over the selected cohort frames are excluded from this report (data from low-N departments are included in the college-level predictive models).

Each student's department is defined as their major department at census of their first fall semester. For the retention portion of the study, successful retention is defined as a student returning to CSU during the second fall semester. For the graduation portion of the study, successful graduation is defined as a student graduating within six years with a Bachelor's degree from any CSU department.

Methodology

Separate logistic regression models are created to obtain the predicted probability that each FTFT freshman will retain to CSU, and the predicted probability that each FTFT freshman will graduate with six years. These models are run separately within college, with the colleges of Liberal Arts and Health & Human Sciences (HHS) further broken down into subgroups due to the heterogeneity of the departments in those colleges. The exception is that colleges in which FTFT freshmen declare in only one major department in substantial numbers (Business and Intra-University) are compared to a full-population regression model that includes all FTFT freshmen, rather than only same-college students, since there are not multiple departments to make comparisons between for those colleges. The Construction Management department has also been identified as significantly different from the remainder of the HHS departments, and thus was also compared to the full-population predictor model rather than the HHS college model.

The regression models predict retention and six year graduation using Index Score, which is the CCHE's composite measuring high school students' academic preparation, and several demographic variables that are known to impact CSU retention and graduation including Gender, First Generation College status, Pell Recipient status, Colorado state residency, and Minority status. Creating different regression models for each college grouping allows us to account for the fact that predictor variables show varying impacts on student outcomes across the different colleges.

Once the predicted retention and graduation rates are calculated for each student, these by-student predicted rates are used to calculate an average predicted retention and graduation rate by department. The difference between each department's average predicted rate and observed rate is described in this report as the percentage point (PP) difference between the model and actual rates. 95% confidence intervals are constructed around the department's average predicted rates, and these predicted ranges are then used to determine whether the department's observed retention and graduation rates are within the range predicted by the model.

Study Limitations

While this methodology has some capacity for identifying departments whose students appear to be over- or underperforming relative to other students with similar demographic and academic preparation characteristics, there are several limitations to this study that suggest cautious interpretation of its findings.

First, this analysis is descriptive in nature and cannot warrant causal attributions. Any significant difference that is observed indicates that the department has a higher or lower rate based on the cohort characteristics and the performance of comparison departments. A significant difference does not necessarily indicate that the department has caused the higher or lower rate, or that these divergent rates are necessarily inappropriate, problematic, or laudable.

Second, the predictive models used to create the predicted retention and graduation formulas capture only a portion of the variance associated with successful retention and graduation. Several other critical variables that may explain retention and graduation are omitted from the model, including (but not limited to) measures of by-department and by-college academic rigor, student interpersonal characteristics, and high school characteristics. Adding additional predictive variables to the model, such as department rigor, may well alter the findings of the study.

Third, each department's performance is assessed only in comparison to the other departments in its college or college sub-group. Thus, results indicating over- or under- performance compared to the model prediction should only be viewed in terms of predicted performance for similarly prepared students within the same college, not CSU as a whole. The exceptions to this rule are Business, Intra-University (undeclared), and Construction Management, which are each compared to a predictive model derived from the full studied population. Any significant findings among these departments should be interpreted in reference to the graduation and retention rates observed for similarly-prepared CSU FTFT freshmen across the entire studied population. It is also important to note that this comparison method lacks the capacity to detect differences between Colleges; existing across-college differences in six year graduation rates are neither accounted for nor explored by this methodology.

Finally, this study employs a cross-sectional analysis to answer questions posed over a long-term time frame. One limitation of using this methodology for longitudinal analysis is that the model does not account for any changes in retention or graduation patterns that occur across the studied time frame. A related limitation is that each student is classified within their first-term major department, which is not necessarily the same department that they continue with throughout their CSU career. Finally, the time lag between the studied cohorts and the reporting date means that it is possible that some observed department-level effects are historical effects that have already been accounted for by administrative or department-level policy changes.

Results: Observed versus Predicted Retention

Table 1 below displays observed and predicted retention rates by department. Each department's predicted retention rate is the average predicted rate for that department's students, according to their college's regression model; except Business, Construction Management, and Intra-University, whose predictions are based on the full-college regression model. Non-highlighted departments have observed retention rates that fall within the 95% confidence range of the predicted retention rate, and thus do not differ statistically from the prediction. Departments highlighted in green display an observed retention rate that is significantly greater than that predicted by the model, while those in red display an observed retention rate that is significantly lower than that predicted by the model.

Table 1: Observed vs. Predicted Retention by Department, FA10-FA14 FTFT Freshman Cohorts

College	Department	Number of Students	Observed Retention	Predicted Retention	PP Difference	Lower Bound Predicted	Upper Bound Predicted
CSU FTFT Freshmen Cohorts, FA10-FA14		21798	85.5%	85.3%	0.22		
Agricultural Sciences	Agricultural & Resource Economics	145	83.4%	83.7%	-0.22	82.7%	84.6%
	Animal Sciences	838	85.7%	85.3%	0.40	84.9%	85.7%
	Horticulture & Landscape Arch.	112	83.0%	85.1%	-2.03	84.0%	86.1%
	Soil and Crop Sciences	33	84.8%	85.7%	-0.87	83.7%	87.8%
Business	Business Intra-College	1643	89.7%	88.0%	1.63	87.9%	88.2%
Engineering	Chemical Engineering	251	90.4%	91.5%	-1.06	91.0%	92.0%
	Civil and Environmental Engineering	471	91.1%	89.6%	1.44	89.3%	90.0%
	Electrical Engineering	276	88.8%	89.9%	-1.15	89.3%	90.5%
	Engineering Intra-College	820	92.0%	90.5%	1.44	90.2%	90.8%
	Mechanical Engineering	785	88.5%	89.9%	-1.41	89.6%	90.2%
Health & Human Sci	Construction Management	233	87.6%	84.0%	3.60	83.3%	84.7%
	Design and Merchandising	409	85.6%	85.4%	0.22	84.8%	85.9%
	Food Science & Human Nutrition	354	86.2%	85.4%	0.76	84.8%	86.0%
	Health and Exercise Science	1182	84.1%	84.7%	-0.63	84.3%	85.1%
	Human Development & Family Studies	303	85.5%	85.1%	0.35	84.4%	85.9%
	School of Social Work	139	89.2%	85.1%	4.07	84.2%	86.1%
Intra-University	Provost/Academic VP	5891	83.6%	83.5%	0.13	83.3%	83.6%
Liberal Arts	Anthropology	86	81.4%	83.6%	-2.21	82.8%	84.4%
	Art	415	79.8%	82.4%	-2.65	81.8%	83.0%
	Communication Studies	208	84.1%	81.3%	2.79	80.3%	82.4%
	Economics	87	87.4%	83.6%	3.73	82.7%	84.5%
	English	315	81.9%	83.3%	-1.35	82.5%	84.0%
	Foreign Languages & Literatures	59	83.1%	82.4%	0.65	80.4%	84.4%
	History	157	84.7%	83.9%	0.82	83.3%	84.5%
	Journalism & Media Communication	310	85.2%	85.0%	0.18	84.6%	85.4%
	Liberal Arts Intra-College	264	82.2%	82.8%	-0.59	81.9%	83.6%
	Music, Theatre, & Dance	367	85.8%	82.7%	3.09	82.1%	83.4%
	Political Science	249	84.3%	83.3%	1.00	82.8%	83.9%
	Sociology	251	83.7%	82.5%	1.19	82.0%	83.0%
Natural Sciences	Biochemistry & Molecular Bio	255	85.1%	86.3%	-1.25	85.6%	87.1%
	Biology	1806	85.8%	84.3%	1.50	84.0%	84.6%
	Chemistry	199	82.9%	86.1%	-3.19	85.2%	87.0%
	Computer Science	341	88.3%	87.5%	0.78	87.0%	88.0%
	Mathematics	130	84.6%	87.7%	-3.08	86.7%	88.7%
	Natural Sciences Intra-College	29	58.6%	82.6%	-24.03	78.5%	86.8%
	Physics	82	80.5%	86.6%	-6.09	85.2%	87.9%
	Psychology	918	82.9%	83.4%	-0.48	82.9%	83.8%
VMBS	Biomedical Sciences	404	92.6%	92.2%	0.33	91.7%	92.8%
	Environmntl & Radiologic Health	49	83.7%	84.7%	-1.03	81.2%	88.2%
	Microbiology, Immunology & Pathology	162	85.8%	85.8%	-0.01	83.9%	87.7%
Warner Natural Resources	Ecosystem Science & Sustainability	70	92.9%	86.2%	6.62	85.0%	87.5%
	Fish/Wildlife/Conservation Biology	282	83.7%	84.5%	-0.78	83.7%	85.3%
	Forest & Rangeland Stewardship	269	82.9%	84.2%	-1.30	83.5%	84.9%
	Geosciences	63	82.5%	83.7%	-1.11	82.3%	85.0%
	Human Dimensions of Natural Res.	86	84.9%	83.7%	1.15	82.7%	84.8%

Observed vs Predicted Retention: Summary of Results

- Among the 45 departments included in this analysis, 13 departments (28.9%) display an observed retention within the predicted range; 15 departments (33.3%) have an observed retention that is lower than predicted by the regression model; and 17 departments (37.8%) have an observed retention that is higher than predicted.
    - For instance, Biology's observed retention rate for its 1806 cohort students is 85.8%. The department's predicted retention rate is 84.3%, which represents a percentage point (PP) difference of +1.5%.
    - Biology's predicted 95% confidence interval for retention ranges from 84.0% to 84.6%. Since the observed retention is higher than the upper bound of the confidence interval, we conclude that the department of Biology retains students at a significantly greater-than-expected rate.

- Department size is an important consideration for interpreting these results.
    - Policy interventions will be most effective if targeted toward underperforming departments that advise the largest numbers of FTFT freshman students.
    - Larger departments with more students have a smaller 95% confidence interval for observed retention than smaller departments, so even a small absolute PP difference may be statistically significant.

- Departments with <u>higher</u> than expected retention rates, and at least 200 students, include:
    - Animal Sciences; Biology; Business Intra-College; Communication Studies; Civil and Environmental Engineering; Computer Science; Construction Management; Engineering Intra-College; Food Science & Human Nutrition; Music, Theatre & Dance; Political Science; Sociology
    - Overperforming departments that serve above-average proportions of Pell or First Generation students are Animal Sciences; Biology; Music, Theatre, & Dance; Political Science; and Sociology.

- Departments with <u>lower</u> than expected retention rates, and at least 200 students, may be ripest for policy intervention:
    - Art; Biochemistry & Molecular Biology; Chemical and Biological Engineering; Electrical and Computer Engineering; English; Forest & Rangeland Stewardship; Health & Exercise Science; Mechanical Engineering; Psychology
    - Underperforming departments that serve above-average proportions of Pell or First Generation students may be of particular note. These departments are Biochemistry & Molecular Biology; Health & Exercise Science; and Psychology.
    - Underperforming departments that serve above-average proportions of Minority students may also be of interest. Qualifying departments include Biochemistry & Molecular Biology; Health & Exercise Science; and Psychology.

- Veterinary Medicine & Biomedical Sciences is the only college with multiple Freshman departments whose departments' observed retention all fall within the model's predicted range.
    - For each college other than VMBS, some departments show a relatively low observed retention compared to the model while others display relatively high retention compared to the model.

- For Intra-University students, observed retention is within the range predicted by the full cohort model.
    - Despite a lower absolute retention rate than the full CSU FTFT population, Intra-University students retain at rates that are within the expected range given their level of academic preparation and their distribution of demographic characteristics.

- Compared to the July 2014 report studying FA08-FA12 cohorts, the following departments have flipped from underperforming previously to overperforming in the current report:
    - Animal Sciences; History; Human Dimensions of Natural Resources; Sociology
        - For example, in the July 2014 report Animal Sciences' observed retention of 84.7% was significantly less than the predicted value of 85.3%.
        - In the current report, Animal Sciences' observed retention increases to 85.7%, which is significantly greater than the predicted value of 85.3%.

- Compared to the July 2014 report studying FA08-FA12 cohorts, the following departments have flipped from overperforming previously to underperforming in the current report:
    - Anthropology; Forest & Rangeland Stewardship; Horticulture & Landscape Architecture
        - For example, in the July 2014 report Anthropology observed a retention rate of 87.3%, which is significantly higher than the predicted rate of 85.2%.
        - In the current report, Anthropology's retention rate is now 81.4%, which is significantly lower than the predicted rate of 83.6%.

Results: Observed vs Predicted Graduation

Table 2 below displays observed and predicted six year graduation rates by department. Each department's graduation rate corresponds to the observed six year graduation rate for all students who declare a major in the department by Census of first semester. The in-department graduation rate, displayed in the rightmost column, shows the proportion of students who both started and graduated in the department within six years. Highlighted departments have observed retention rates that do not differ statistically from the prediction. Departments highlighted in green display an observed retention rate that is significantly greater than that predicted by the model, while those in red display an observed retention rate that is significantly lower than that predicted by the model.

Table 2: Observed vs. Predicted Graduation by Department, FA05-FA09 FTFT Freshman Cohorts

College	Department	Number of Students	Observed Six Year Grad	Predicted Six Year	PP Difference	Lower Bound	Upper Bound Predicted	In-Dep't 6 Yr Grad
CSU FTFT Freshmen Cohorts, FA05-FA09		20495	65.6%	65.1%	0.49			24.3%
Agricultural Sciences	Agricultural & Resource Economics	102	76.5%	66.9%	9.54	63.9%	69.9%	53.9%
	Agricultural Sciences Intra-College	25	72.0%	73.4%	-1.43	68.2%	78.7%	8.0%
	Animal Sciences	708	66.9%	67.8%	-0.84	66.6%	69.0%	49.4%
	Horticulture & Landscape Arch.	178	65.2%	66.0%	-0.82	63.8%	68.1%	48.9%
	Soil and Crop Sciences	34	67.6%	71.7%	-4.04	65.7%	77.6%	67.6%
Business	Business Intra-College	1557	77.5%	71.2%	6.31	70.8%	71.6%	N/A
Engineering	Chemical and Biological Engineering	223	74.4%	71.7%	2.76	70.5%	72.9%	43.0%
	Civil and Environmental Engineering	382	72.8%	69.4%	3.35	68.5%	70.4%	42.1%
	Electrical and Computer Engineering	252	60.7%	69.7%	-8.99	68.5%	70.9%	26.2%
	Engineering Intra-College	239	67.4%	69.0%	-1.66	67.8%	70.2%	5.4%
	Mechanical Engineering	602	69.3%	68.7%	0.53	68.0%	69.5%	43.0%
Health & Human Sci	Construction Management	416	71.4%	58.9%	12.51	57.9%	59.9%	61.3%
	Design and Merchandising	760	64.7%	66.1%	-1.36	65.4%	66.8%	36.4%
	Food Science & Human Nutrition	349	72.8%	65.7%	7.03	64.7%	66.8%	45.3%
	Health and Exercise Science	803	60.9%	65.6%	-4.70	64.9%	66.3%	39.6%
	Health and Human Sciences Intra-College	85	70.6%	65.3%	5.24	63.2%	67.5%	8.2%
	Human Development & Family Studies	239	76.2%	67.8%	8.37	66.5%	69.1%	59.8%
	School of Social Work	101	63.4%	65.8%	-2.46	63.5%	68.1%	48.5%
Intra-University	Provost/Academic VP	5788	60.5%	61.0%	-0.54	60.7%	61.3%	N/A
Liberal Arts	Anthropology	65	72.3%	70.0%	2.27	67.3%	72.7%	35.4%
	Art	427	62.8%	62.6%	0.16	61.5%	63.7%	47.5%
	Communication Studies	109	72.5%	62.0%	10.53	59.8%	64.1%	46.8%
	Economics	43	72.1%	65.8%	6.32	61.6%	69.9%	41.9%
	English	369	66.4%	68.9%	-2.55	67.8%	70.0%	44.7%
	Foreign Languages & Literatures	90	61.1%	68.6%	-7.53	66.4%	70.8%	42.2%
	History	247	63.2%	67.0%	-3.81	65.6%	68.4%	47.0%
	Journalism & Media Communication	416	74.3%	72.8%	1.46	72.1%	73.6%	51.9%
	Liberal Arts Intra-College	403	65.8%	65.1%	0.68	64.0%	66.2%	13.2%
	Music, Theatre, Dance	397	62.2%	63.0%	-0.81	61.8%	64.2%	44.6%
	Political Science	304	65.8%	67.3%	-1.52	66.0%	68.6%	43.4%
	Sociology	204	63.2%	64.7%	-1.49	63.2%	66.3%	37.3%
Natural Sciences	Biochemistry & Molecular Bio	183	62.8%	66.4%	-3.58	64.3%	68.5%	25.1%
	Biology	1208	62.8%	63.9%	-1.04	63.1%	64.6%	31.7%
	Chemistry	172	60.5%	64.9%	-4.45	62.7%	67.1%	23.8%
	Computer Science	209	65.6%	64.9%	0.65	63.5%	66.3%	43.1%
	Mathematics	135	63.0%	67.4%	-4.43	65.2%	69.5%	36.3%
	Natural Sciences Intra-College	312	59.3%	60.4%	-1.06	58.9%	61.8%	1.9%
	Physics	71	56.3%	62.3%	-5.96	58.6%	66.0%	16.9%
	Psychology	868	63.2%	58.8%	4.48	57.8%	59.7%	34.6%
VMBS	Biomedical Sciences	378	82.5%	82.0%	0.59	81.3%	82.6%	52.1%
	Environmental & Radiologic Health	42	64.3%	72.9%	-8.60	68.6%	77.2%	28.6%
	Microbiology, Immunology & Pathology	157	74.5%	73.1%	1.38	71.1%	75.1%	45.2%
	Vet Med & Biomed Sci Intra-College	284	68.0%	68.7%	-0.76	67.2%	70.3%	N/A
Warner Natural Resources	Fish & Wildlife Conservation Biology	213	62.0%	65.4%	-3.41	63.5%	67.3%	34.3%
	Forest & Rangeland Stewardship	128	69.5%	63.7%	5.82	61.0%	66.4%	41.4%
	Geosciences	44	47.7%	62.5%	-14.81	58.0%	67.0%	29.5%
	Human Dimensions of Natural Res.	92	58.7%	60.3%	-1.63	57.1%	63.5%	43.5%
	Natural Resources Intra-College	82	75.6%	66.4%	9.20	63.3%	69.5%	N/A

Observed versus Predicted Graduation: Summary of Results

- Among the 48 departments included in this analysis, 16 departments (33.3%) display an observed retention within the predicted range; 18 departments (37.5%) have an observed retention that is lower than predicted by the regression model; and 14 departments (29.2%) have an observed retention that is higher than predicted.

- Understanding each department's comparison group is critical for accurate interpretation of results.
    - Observed graduation for Business Intra-College, Intra-University, and Construction Management is compared to predictions based on graduation performance for students throughout all colleges.
    - Observed graduation for all other departments is in reference to predicted values based on graduation performance for students in the overseeing College as a whole.
        - This study does not account for existing differences in six-year graduation rate across Colleges; for instance the College of Natural Sciences' observed six-year graduation rate is 62.5%, while the College of Business's six-year graduation rate is 77.5%.

- Departments with <u>higher</u> than expected graduation rates versus comparison departments, and at least 200 students, include:
    - Business Intra-College; Chemical & Biological Engineering; Civil & Environmental Engineering; Construction Management; Food Science & Human Nutrition; Human Development & Family Studies; Journalism & Media Communication; Psychology
    - Departments with higher-than-expected six year graduation rates, and above average proportions of Pell or First Generation students, include Human Development & Family Studies; Journalism & Media Communications; and Psychology.

- Departments with <u>lower</u> than expected graduation rates versus comparison departments, and at least 200 students include:
    - Biology; Design & Merchandising; Electrical & Computer Engineering; Engineering Intra-College; Fish & Wildlife Conservation Biology; English; Health & Exercise Science; History; Political Science; Provost/Academic VP (undeclared students).
    - Departments with lower-than-expected six year graduation rates, and above average proportions of Pell or First Generation students, include Biology; Design & Merchandising; Health & Exercise Science; History; Political Science; Provost/Academic VP (undeclared students).

- For Intra-University students, observed graduation is below the range predicted by the full cohort model.
    - Intra-University students graduate at significantly lower six-year rates than predicted by the model.
    - However, the absolute difference between observed and predicted graduation is very small at 0.5%; this small decrement may well be explained by demand characteristics (unmeasured variables that may account for differences between otherwise similar students entering with/without a declared major).

Appendix: Demographics by Department and College

Table 3. Demographics by Department, College – FA10-FA14 Retention Study Cohorts

Departments in GREEN serve above-average proportions of two or more of: First Gen, Minority, and Pell students.

College	Department	Number of Students	% Male	% Pell	% First Gen	% Colorado Resident	% Minority	Avg App Index
CSU Full-Time/First-Time Freshmen Cohorts, FA10-FA14		**21798**	**44.6%**	**22.2%**	**24.5%**	**75.6%**	**19.1%**	**114.9**
Agricultural Sciences	Agricultural & Resource Economics	145	48%	21%	30%	70%	10%	111
	Animal Sciences	838	11%	24%	32%	44%	18%	116
	Horticulture & Landscape Arch.	112	66%	17%	25%	79%	7%	113
	Soil and Crop Sciences	33	45%	24%	21%	64%	6%	116
Business	Business Intra-College	1643	55%	17%	17%	80%	15%	120
Engineering	Chemical Engineering	251	61%	14%	19%	76%	14%	126
	Civil and Environmental Engineering	471	67%	20%	18%	67%	13%	123
	Electrical Engineering	276	87%	20%	22%	79%	16%	124
	Engineering Intra-College	820	71%	15%	17%	75%	13%	124
	Mechanical Engineering	785	87%	14%	17%	72%	11%	123
Health and Human Sciences	Construction Management	233	95%	18%	22%	73%	15%	109
	Design and Merchandising	409	5%	24%	22%	86%	21%	110
	Food Science & Human Nutrition	354	18%	16%	16%	72%	14%	112
	Health and Exercise Science	1182	36%	24%	28%	80%	20%	113
	Human Development & Family Studies	303	3%	22%	25%	82%	18%	112
	School of Social Work	139	7%	29%	34%	86%	24%	113
Intra-University	Provost/Academic VP	5891	51%	24%	27%	80%	21%	109
Liberal Arts	Anthropology	86	23%	26%	30%	67%	20%	116
	Art	415	22%	25%	22%	83%	18%	115
	Communication Studies	208	25%	22%	23%	77%	18%	109
	Economics	87	78%	9%	18%	74%	14%	114
	English	315	25%	23%	22%	84%	15%	117
	Foreign Languages & Literatures	59	34%	22%	25%	75%	25%	117
	History	157	57%	23%	25%	82%	13%	114
	Journalism & Media Communication	310	28%	23%	25%	79%	19%	118
	Liberal Arts Intra-College	264	29%	28%	22%	77%	21%	114
	Music, Theatre, & Dance	367	35%	26%	27%	83%	18%	117
	Political Science	249	50%	27%	29%	80%	30%	113
	Sociology	251	44%	35%	35%	84%	31%	109
Natural Sciences	Biochemistry & Molecular Bio	255	38%	25%	29%	83%	24%	120
	Biology	1806	26%	24%	28%	65%	25%	118
	Chemistry	199	49%	26%	25%	74%	29%	120
	Computer Science	341	87%	21%	18%	84%	18%	120
	Mathematics	130	52%	25%	22%	85%	18%	122
	Natural Sciences Intra-College	29	28%	14%	28%	69%	7%	116
	Physics	82	73%	17%	20%	72%	16%	121
	Psychology	918	22%	28%	32%	82%	25%	113
Veterinary Medicine & Biomedical Sci	Biomedical Sciences	404	23%	14%	15%	66%	15%	128
	Environmntl & Radiologic Health	49	45%	22%	20%	69%	24%	118
	Microbiology, Immunology & Pathology	162	25%	25%	27%	81%	24%	119
Warner College of Natural Resources	Ecosystem Science & Sustainability	70	46%	9%	11%	54%	17%	117
	Fish/Wildlife/Conservation Biology	282	47%	23%	23%	57%	13%	117
	Forest & Rangeland Stewardship	269	63%	17%	15%	54%	11%	114
	Geosciences	63	78%	19%	24%	65%	13%	111
	Human Dimensions of Natural Res.	86	50%	13%	14%	57%	9%	111

College (College Grouping)	N	2nd Fall Retention	% Male	% Pell	% First Gen	% Colorado Resident	% Minority	Avg App Index
Agricultural Sciences	1128	85.1%	22.6%	22.7%	30.5%	51.4%	15.6%	115
Business	1677	89.7%	54.8%	17.0%	17.4%	79.7%	15.0%	120
Engineering	2603	90.3%	76.0%	15.9%	17.9%	73.5%	12.8%	124
Health & Human Sciences	2405	85.0%	22.2%	23.0%	25.1%	80.3%	19.4%	112
HHS (Construction Mgt)	233	87.6%	95.3%	18.0%	22.3%	73.4%	15.0%	109
Intra-University	5891	83.6%	51.3%	24.1%	27.3%	80.4%	21.3%	109
Liberal Arts (Arts)	782	82.6%	27.9%	25.2%	24.6%	83.0%	17.6%	116
Liberal Arts (Languages)	846	82.6%	26.8%	24.1%	22.5%	79.6%	18.3%	114
Liberal Arts (Soc Sci)	1171	83.7%	44.1%	26.4%	28.5%	79.0%	23.2%	114
Natural Sciences	3768	84.8%	34.3%	24.7%	27.7%	73.5%	23.9%	117
Vet Med & Bio Sciences	615	90.1%	25.4%	17.4%	18.7%	70.4%	17.9%	125
Warner Natural Resources	770	84.3%	55.3%	18.3%	18.2%	56.6%	12.3%	115

Table 4. Demographics by Department, College – FA05-FA09 Graduation Study Cohorts

Departments in GREEN serve above-average proportions of two or more of: First Gen, Minority, and Pell students.

College	Department	Number of Students	% Male	% Pell	% First Gen	% Colorado Resident	% Minority	Avg App Index
CSU Full-Time/First-Time Freshmen Cohorts, FA05-FA09		**20495**	**43.8%**	**15.0%**	**26.1%**	**79.5%**	**14.5%**	**113.3**
Agricultural Sciences	Agricultural & Resource Economics	102	55.9%	18.6%	31.4%	76.5%	6.9%	111
	Agricultural Sciences Intra-College	25	56.0%	28.0%	48.0%	84.0%	0.0%	117
	Animal Sciences	708	11.2%	16.5%	30.9%	45.9%	11.6%	115
	Horticulture & Landscape Arch.	178	73.6%	14.6%	27.5%	72.5%	12.4%	110
	Soil and Crop Sciences	34	61.8%	29.4%	38.2%	88.2%	5.9%	116
Business	Business Intra-College	1557	49.9%	12.3%	24.0%	82.1%	11.6%	119
Engineering	Chemical and Biological Engineering	223	65.0%	10.8%	18.4%	75.8%	9.9%	125
	Civil and Environmental Engineering	382	73.6%	11.8%	20.7%	78.8%	9.7%	122
	Electrical and Computer Engineering	252	88.5%	12.3%	15.9%	78.2%	13.9%	123
	Engineering Intra-College	239	78.2%	9.6%	14.6%	80.3%	12.6%	121
	Mechanical Engineering	602	90.2%	10.6%	17.8%	77.1%	11.8%	121
Health and Human Sciences	Construction Management	416	93.3%	10.1%	22.6%	78.6%	9.6%	107
	Design and Merchandising	760	2.9%	15.9%	25.4%	80.8%	13.2%	110
	Food Science & Human Nutrition	349	21.2%	11.7%	24.1%	75.1%	14.0%	111
	Health and Exercise Science	803	33.9%	15.6%	28.9%	82.6%	15.8%	112
	Health and Human Sciences Intra-College	85	16.5%	16.5%	28.2%	82.4%	11.8%	110
	Human Development & Family Studies	239	0.8%	13.8%	27.6%	91.6%	13.0%	111
	School of Social Work	101	3.0%	19.8%	36.6%	85.1%	13.9%	111
Intra-University	Provost Acad Vice President	5788	51.9%	15.5%	27.9%	84.4%	15.4%	108
Liberal Arts	Anthropology	65	23.1%	21.5%	21.5%	61.5%	18.5%	116
	Art	427	26.9%	14.8%	19.7%	85.7%	12.4%	114
	Communication Studies	109	29.4%	13.8%	28.4%	78.9%	16.5%	108
	Economics	43	67.4%	18.6%	14.0%	67.4%	16.3%	112
	English	369	24.7%	13.8%	24.9%	86.4%	14.4%	115
	Foreign Languages & Literatures	90	25.6%	21.1%	27.8%	86.7%	15.6%	115
	History	247	53.4%	14.2%	28.7%	82.6%	10.5%	112
	Journalism & Media Communication	416	30.8%	16.8%	29.3%	87.5%	13.5%	117
	Liberal Arts Intra-College	403	33.0%	12.9%	18.9%	81.1%	14.4%	111
	Music, Theatre, Dance	397	36.0%	17.6%	22.9%	88.4%	14.9%	115
	Political Science	304	48.7%	18.1%	30.9%	79.9%	21.1%	113
	Sociology	204	40.7%	21.1%	34.3%	82.8%	20.6%	109
Natural Sciences	Biochemistry & Molecular Bio	183	44.3%	15.3%	26.2%	83.1%	23.5%	120
	Biology	1208	28.6%	16.2%	25.3%	69.5%	16.9%	117
	Chemistry	172	50.0%	23.8%	27.3%	83.7%	13.4%	118
	Computer Science	209	91.4%	12.4%	20.1%	81.3%	14.8%	118
	Mathematics	135	40.7%	13.3%	22.2%	77.8%	7.4%	120
	Natural Sciences Intra-College	312	29.8%	17.9%	28.2%	86.5%	23.1%	113
	Physics	71	81.7%	14.1%	33.8%	78.9%	15.5%	118
	Psychology	868	23.7%	19.0%	31.3%	81.7%	19.0%	112
Veterinary Medicine & Biomedical Sci	Biomedical Sciences	378	22.8%	11.9%	22.5%	72.0%	14.6%	127
	Environmental & Radiologic Health	42	26.2%	21.4%	23.8%	78.6%	14.3%	118
	Microbiology, Immunology & Pathology	157	28.0%	16.6%	29.3%	77.1%	15.3%	119
	Vet Med/Biomed Sci Intra-College	284	26.4%	15.1%	36.3%	72.5%	18.0%	115
Warner College of Natural Resources	Fish/Wildlife/Conservation Biology	213	63.4%	15.0%	28.2%	59.2%	13.1%	115
	Forest & Rangeland Stewardship	128	71.9%	4.7%	17.2%	62.5%	7.0%	112
	Geosciences	44	70.5%	11.4%	25.0%	65.9%	9.1%	111
	Human Dimensions of Natural Res.	92	53.3%	10.9%	16.3%	51.1%	8.7%	111
	Natural Res Intra-College	82	50.0%	6.1%	22.0%	57.3%	7.3%	115

College (College Grouping)	N	Six Year Grad Rate	% Male	% Pell	% First Gen	% Colorado Resident	% Minority	Avg App Index
Agricultural Sciences	1047	67.7%	28.8%	17.1%	31.0%	55.7%	10.8%	114
Business	1573	77.4%	50.0%	12.3%	23.9%	82.3%	11.6%	119
Engineering	1698	69.2%	81.2%	11.0%	17.8%	77.9%	11.5%	122
Health & Human Sciences	2337	65.9%	16.6%	15.1%	27.2%	81.9%	14.2%	111
HHS (Construction Mgt)	416	71.4%	93.3%	10.1%	22.6%	78.6%	9.6%	107
Intra-University	5788	60.5%	51.9%	15.5%	27.9%	84.4%	15.4%	108
Liberal Arts (Arts)	824	62.5%	31.3%	16.1%	21.2%	87.0%	13.6%	115
Liberal Arts (Languages)	971	66.3%	28.7%	14.1%	23.1%	83.4%	14.7%	113
Liberal Arts (Soc Sci)	1301	68.5%	42.2%	17.6%	29.4%	82.2%	16.0%	114
Natural Sciences	3240	62.8%	35.7%	16.8%	27.0%	76.9%	17.4%	116
Vet Med & Bio Sciences	861	75.4%	25.1%	14.3%	28.3%	73.4%	15.8%	121
Warner Natural Resources	477	62.1%	64.4%	11.1%	22.6%	59.1%	10.3%	113

Appendix: Retention Study Logistic Regression Model

Retention Study - Logistic Regression Results for Demographic/Academic Control Variables, by College													
	AS	BU	EG	HHS- no CM	HHS- CM only	IU	LA- Arts	LA- Humanities	LA- Social Sciences	NS	VMBS	WCNR	Full Model
Odds Ratios[1] Associated with Demographic/Academic Control Variables													
Minority (Non-Minority)				1.35									
Male (Female)													1.07
Resident (Non-Resident)		1.92	1.83	1.79		1.45	1.95	1.57	1.50	1.69	2.61	1.50	1.59
Pell (Non-Pell)			.60			.82	.67					.55	.85
First Generation (Non-First Gen)	.63	.62		.47		.75		.37		.54	.57		.63
Index	1.03	1.03	1.04	1.02	1.04	1.03	1.03		1.02		1.07	1.03	1.03
Model Fit													
Number of Students	1125	1673	2575	2399	231	5737	780	838	1160	3735	609	762	21624
Nagelkerke R^2 (model fit estimate)	.040	.034	.041	.050	.054	.025	.039	.054	.020	.057	.135	.045	.042
% Cases Predicted By Model	85.1%	89.7%	90.2%	85.0%	87.4%	83.5%	82.6%	82.6%	83.6%	84.8%	90.5%	84.4%	85.4%

[1]Odds ratios are only displayed when their significance level is less than .1; Blank value indicates the control variable is not significant in the model

[2]The number of student included in the regression models is reduced from the overall sample size due to some students missing an index score

- Index score is a significant predictor of retention for 9 of 11 college groupings (omitting Construction Management from consideration, due to low sample size for that grouping)
    - Index score is only non-significant for Natural Sciences and Liberal Arts/Social Sciences.

- Colorado residency is a significant positive predictor of retention for all 11 college groupings.

- Either Pell or First Generation Status is a significant predictor for 10 of 11 groupings; these two variables covary substantially (Pearson's r = .31). Pell and First Generation are significant in conjunction for only the Full Model and the Intra-University model.

- Gender is not a significant predictor of retention for any college, but is significant for the full population model.

- Minority status is only a significant predictor of retention for the college of Health & Human Sciences; minority students that begin with an HHS major (other than Construction Management) retain at higher than expected rates based on their other demographics and academic preparation characteristics.

- Minority status is not a significant predictor of second fall retention for any other College, nor for the full population model. This finding may provide some evidence that minority students are returning to CSU for their second fall at rates similar to non-minority students, after controlling for index and demographic characteristics.

Appendix: Graduation Study Logistic Regression Model

Graduation Study - Logistic Regression Results for Demographic/Academic Control Variables, by College													
	AS	BU	EG	HHS- no CM	HHS- CM only	IU	LA- Arts	LA- Humanities	LA- Social Sciences	NS	VMBS	WCNR	Full Model
Odds Ratios[1] Associated with Demographic/Academic Control Variables													
Minority (Non-Minority)						.85				.82			.85
Male (Female)		1.29		1.28		1.38			1.26	1.20			1.21
Resident (Non-Resident)	1.65	1.41	1.51	1.65		1.39	1.59	1.50	1.58	1.54	1.92	1.92	1.51
Pell (Non-Pell)	.47	.63	.50	.72						.78			.78
First Generation (Non-First Gen)				.66		.66	.73		.63	.71		.66	.72
Index	1.06	1.02	1.04	1.03		1.03	1.04	1.04	1.04	1.05	1.06	1.05	1.04
Model Fit													
Number of Students	1039	1565	1656	2324	415	5741	820	965	1287	3125	859	557	20353
Nagelkerke R^2 (model fit estimate)	.156	.025	.054	.064	NS	.056	.079	.078	.073	.109	.114	.128	.076
% Cases Predicted By Model	71.5%	77.6%	69.4%	67.1%		61.9%	64.0%	66.9%	69.0%	65.3%	75.7%	65.4%	66.5%

[1]Odds ratios are only displayed when their significance level is less than .1; Blank value indicates the control variable is not significant in the model

[2]The number of student included in the regression models is reduced from the overall sample size due to some students missing an index score

- The model for the department of Construction Management is non-significant, likely due to small sample size.
- Index score is a significant predictor of graduation for all 11 of 11 college groupings, plus the Full Model. Colorado residency is also a significant positive predictor of graduation for all 11 of 11 college groupings.
- Either Pell or First Generation Status is a significant predictor for 9 of the 11 groupings; these two variables covary substantially (Pearson's r = .31). Pell and First Generation are both significant in the models for the Colleges of Natural Sciences and Health & Human Sciences, and in the Full Model. In all cases, these demographic variables correlate with lesser likelihood of six year graduation.
- Gender is a significant predictor of graduation for the college of Business, Health & Human Sciences, Liberal Arts (Social Science), Natural Sciences, Intra-University, and the Full Model. It may be of interest that Gender is a significant predictor of graduation despite the lack of Gender significance for predicting retention for any of the 11 college groupings.
- Minority status is a significant predictor of graduation for students beginning in the college of Natural Sciences, Intra-University, and the Full Model. For each of these populations, minority status corresponds with a significantly lower graduation rate, with all other predictor variables held constant.
- For all other colleges, Minority status does not predict a significant portion of the variance associated with graduation. According to the model, minority students in these colleges appear to graduate at comparable rates to similarly-prepared non-minority students.