

Early Indicators of Student Progress and Success

Purpose

The purpose of this study is to predict student retention and graduation based on freshman academic progress (credit hours passed) and success (GPA) while controlling for prior academic preparation (CDHE index). The goal is to identify students as early as possible who may be in need of, and could benefit from, extra support services.

Methodology

Six regression models are used to predict three outcomes (freshman retention, 4-year graduation, and 6-year graduation). Three of the models use progress and success metrics at the end of a student’s first fall semester and the remaining three models use the same, but cumulative, metrics at the end of a student’s first academic year. The models are based on new freshman fall cohorts (FA02-FA11) and deliberately do not control for any demographic variables except academic preparation as measured by CDHE index. In all cases, when a predicted probability of retention or graduation is presented, an average index score (113) is assumed.

Results

Figure 1 displays the predicted graduation and retention probabilities for four differing levels of first fall academic progress and success. Figure 2 displays the same examples for the end of the first academic year. The trends at both points in time are similar. Students that earn a 3.0 GPA (as opposed to a 2.0) have higher probabilities of retention and eventual graduation. Assuming equivalent GPAs, students who pass 15 credits a semester have higher probabilities of retention and eventual graduation than students who pass only 12 credits a semester. In terms of the models’ predicted probabilities it is better for students to complete 12 credits a semester with a 3.0 GPA rather than 15 credits a semester with a 2.0 GPA.

Figure 1.

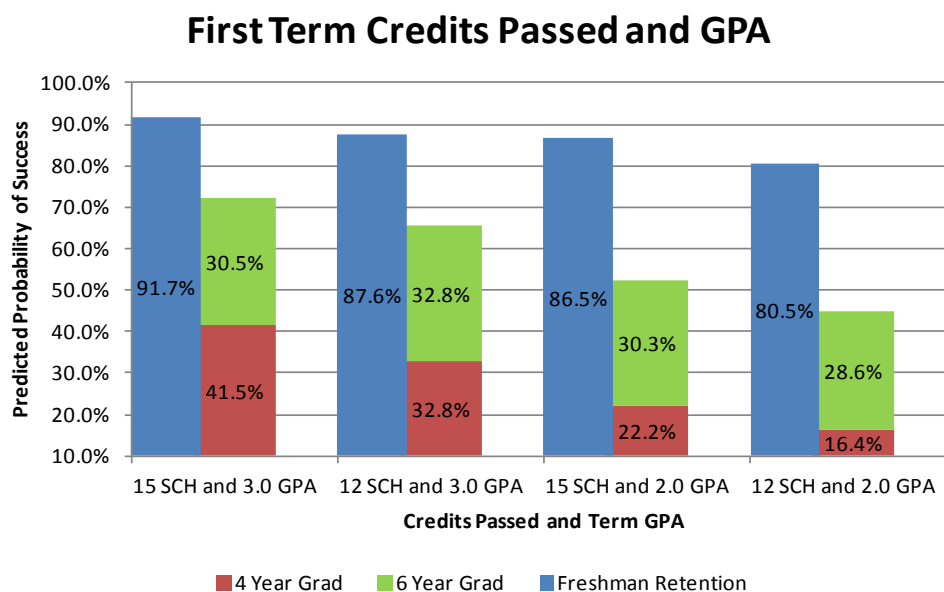
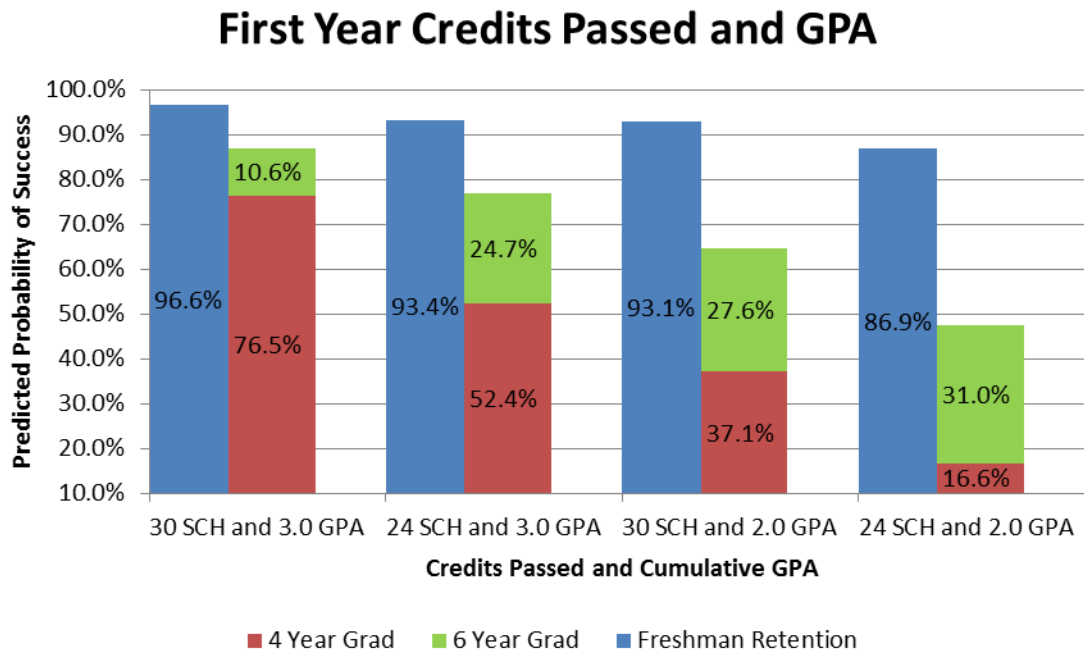


Figure 2.



Tables 1 and 2 show the regression coefficients converted to odds ratios (OR) and goodness of fit statistics for the first term and first year models respectively. Interpretation of the odds ratios follows for each of the three outcomes (freshman retention, 4-year graduation, 6-year graduation).

Table 1.

First Fall Student Success and Progress						
	Freshman Retention		4 Year Graduation		6 Year Graduation	
	Odds Ratio	P-Value	Odds Ratio	P-Value	Odds Ratio	P-Value
Index	1.005	0.000	1.010	0.000	1.003	0.106
Fall Passed Credits*	1.638	0.000	1.457	0.000	1.349	0.000
Fall GPA	1.804	0.000	2.492	0.000	2.334	0.000
GPA by Credit Interaction	0.950	0.000				
Percent Correctly Predicted	85		69		72	
Nagelkerke R Square	0.144		0.224		0.223	

*The number of credits passed is divided by three. The interpretation of the odds ratio is in terms of every additional 3 credit class.

**The interaction terms between GPA and credits passed is only included in models when the interaction is statistically significant.

Table 2.

First Academic Year Student Success and Progress						
	Freshman Retention		4 Year Graduation		6 Year Graduation	
	Odds Ratio	P-Value	Odds Ratio	P-Value	Odds Ratio	P-Value
Index	1.000	0.991	1.002	0.204	0.995	0.009
Cumulative Passed Credits*	2.273	0.000	3.573	0.000	2.213	0.000
Cumulative GPA	2.417	0.000	6.646	0.000	4.040	0.000
GPA by Credit Interaction	0.887	0.000	0.830	0.000	0.912	0.003
Percent Correctly Predicted		89		70		75
Nagelkerke R Square		0.155		0.269		0.273

*The number of credits passed is divided by six The interpretation of the odds ratio is in terms of every two additional 3 credit classes.

Freshman Retention (first term model)

As shown in table 1, this model includes an interaction term between credits passed and GPA. This means that the association between credits passed and freshman retention is dependent on a student’s GPA. Likewise, the association between GPA and freshman retention is dependent on the number of credits passed. The odds ratios for passed credits and GPA cannot be interpreted without the interaction odds ratio.

- Assuming a student earns a 3.0 GPA, passing an additional 3 credit course (e.g. moving from 12 passed credits to 15) in their first fall semester results in 41% higher odds (OR=1.406) of that student being retained. As shown in figure 1, this same student has a predicted probability of being retained to their second fall semester of 91.7%.
- Assuming a student earns a 2.0 GPA, passing an additional 3 credit course (e.g. moving from 12 passed credits to 15) in their first fall semester results in 48% higher odds (OR=1.480) of that student being retained. As shown in figure 1, this student has a predicted probability of being retained to their second fall semester of 86.5%.

Regardless of the interaction, there is a positive association between GPA and freshman retention, as well as, a positive association between passed credits and freshman retention. However, the magnitude of these positive associations is dependent on the level of the other independent variable.

The first term freshman retention model predicted 85% of the cases correctly.

Freshman Retention (first academic year model)

As shown in table 2, there is a positive association between GPA and freshman retention, as well as, a positive association between passed credits and freshman retention. The interaction term between GPA and credits passed is statistically significant and is included in the model. Therefore, the odds ratios for passed credits and GPA cannot be interpreted without the interaction odds ratio.

- Assuming a student earns a 3.0 GPA, passing two additional 3 credit courses (e.g. moving from 24 passed credits to 30) in their first year results in 59% higher odds (OR=1.586) of that student being retained. As shown in figure 2, this student has a predicted probability of being retained to their second fall semester of 96.6%.
- Assuming a student earns a 2.0 GPA, passing two additional 3 credit courses (e.g. moving from 24 passed credits to 30) in their first year results in 79% higher odds (OR=1.788) of that student being retained. As shown in figure 2, this student has a predicted probability of being retained to their second fall semester of 93.1%.

The first year freshman retention model predicted 89% of the cases correctly.

4-Year Graduation (first term model)

As shown in table 1, with every additional three credit course a student passes in their first fall semester the odds of graduating in four years increases 46% (OR=1.457) and with every one point increase in first fall GPA the odds of a graduating in four years increases 149% (OR=2.492). There is a statistically significant positive association between first fall GPA and 4-year graduation, as well as, a statistically significant positive association between the number of credits passed in the first fall and 4-year graduation. The magnitude of the association between GPA and 4-year graduation is larger than the magnitude of the association between credit completion and 4-year graduation.

The first term 4-year graduation model predicted 69% of the cases correctly.

4-Year Graduation (first academic year model)

As shown in table 2, there is a positive association between GPA and 4-year graduation, as well as, a positive association between passed credits and 4-year graduation. The interaction term between GPA and credits passed is statistically significant and is included in the model. Therefore, the odds ratios for passed credits and GPA cannot be interpreted without the interaction odds ratio.

- Assuming a student earns a 3.0 cumulative GPA, passing two additional 3 credit courses (e.g. moving from 24 passed credits to 30) in their first year results in 104% higher odds (OR=2.038) of that student graduating in four years. As shown in figure 2, this student has a predicted probability of graduating in four years of 76.5%.
- Assuming a student earns a 2.0 cumulative GPA, passing two additional 3 credit courses (e.g. moving from 24 passed credits to 30) in their first year results in 146% higher odds (OR=2.457) of that student graduating in four years. As shown in figure 2, this student has a predicted probability of graduating in four years of 37.1%.

The first year 4-year graduation model predicted 70% of the cases correctly.

6-Year Graduation (first term model)

As shown in table 1, with every additional three credit course a student passes in their first fall semester the odds of graduating in six years increases 35% (OR=1.349) and with every one grade point increase in first fall GPA the odds of a graduating in six years increases 133% (OR=2.334). There is a statistically significant positive association between first fall GPA and 6-year graduation, as well as, a statistically significant positive association between the number of credits passed in the first fall and 6- year graduation. The magnitude of the association between GPA and 6-year graduation is larger than the magnitude of the association between credit completion and 6-year graduation.

The first term 6-year graduation model predicted 72% of the cases correctly.

6-Year Graduation (first academic year model)

As shown in table 2, there is a positive association between GPA and six year graduation, as well as, a positive association between passed credits and six year graduation.

- Assuming a student earns a 3.0 cumulative GPA, passing two additional 3 credit courses (e.g. moving from 24 passed credits to 30) in their first year results in 68% higher odds (OR=1.681) of that student graduating in six years. As shown in figure 2, this student has a predicted probability of graduating in six years of 87.1%.
- Assuming a student earns a 2.0 cumulative GPA, passing two additional 3 credit courses (e.g. moving from 24 passed credits to 30) in their first year results in 84% higher odds (OR=1.843) of that student graduating in six years. As shown in figure 2, this student has a predicted probability of graduating in six years of 64.7%.

The first year 6-year graduation model predicted 75% of the cases correctly.

Index (first term model)

As shown in table 1, a student's index score is positively associated with both retention and 4-year graduation. There is not a statistically significant association between index and 6-year graduation. A bivariate analysis of index and 6-year graduation shows the positive correlation that would be expected based on reports from IR-Interactive. The results from this analysis indicate that academic preparation, measured by index, is not a strong predictor of 6-year graduation after controlling for a first term academic progress and success.

Index (first academic year model)

As shown in table 2, a student's index score is not statistically significant for the models that predict retention and four year graduation. Index has a statistically significant negative association with six year graduation. These regression results indicate that once first year success and progress are controlled for academic preparation (measured by index) is not a strong predictor of retention and graduation.

Summary

All six models presented illustrate the importance of academic preparation, progress, and success in predicting freshman retention and eventual graduation. To a large extent, prediction of these critical outcomes can be done with just these three variables.

The models suggest that GPA is more important than credits passed in terms of predicting both retention and graduation. Relative to advising, if a student is not academically prepared to earn a 'B' average, it is better to encourage them to attempt fewer credits in order to allow extra time for learning the material. The higher grade will benefit him/her more than completing more hours less successfully.

While the academic year models and the term models produce similar accuracy in prediction, the first term models have the added benefit of providing the opportunity for earlier intervention and therefore may have more utility on campus.

Additionally, the findings from this study correspond with findings from two previous studies conducted by Institutional Research. First, a prior research study concluded that after controlling for student's demographics and academic preparation, the number of credit hours a student completes in their first year has a strong positive correlation with students' predicted probability of graduation and retention. This study also found that there is a strong positive association between student success and completing the foundational math and composition courses in the first year. A second prior research study found that failing a course in a student's first year has a strong negative association with students' predicted probability of graduation. The current study and findings from these two previous studies show that early measures of student progress and success are strong predictors of graduation and could be used to increase the intentionality of our support services for students.