

Understanding Graduation Rates at Higher Education Institutions: A Forecasting Model

Serina Al-Haddad, Rachael Boone and Emma Campbell
School of Business Administration
Stetson University

Corresponding Author: Serina Al-Haddad, Shaddad1@stetson.edu

ABSTRACT

Graduation rates and degree completion have always been a concern for students, students' families and universities. Moreover, many consider college degree completion rates to be among one of the most important indicators of institutional quality according to a report from the Higher Education Research Institute published in the United States of America. This research studied factors that can explain graduation rates which include student-faculty ratio, financial factors, and enrollment status. Data was collected and analyzed for state and private universities, and a Multiple Regression Model (MLR) was built to forecast graduation rates. The model was able to highlight variables that significantly relate to graduation rates. Researchers can use this article to understand the different factors that correlate with degree completion and to forecast graduations rates at Higher Education Institutions. The international researcher can explore replicating the forecasting model at universities outside the United States of America.

Introduction

Graduation rates are usually defined as the time to complete a degree program within four to six years of starting the degree (Paterson & Gordon, 2010), and graduation rate has become one of the commonly regarded statistics as a primary indicator of institutional performance for higher education (DeAngelo, Franke, Hurtado, Pryor, & Tran, 2011). In the DeAngelo, et al. (2011) report published by the Higher Education Research Institute, the authors stated that high graduation rates are important to society because greater degree attainment is associated with higher salaries and lower unemployment rates; therefore, impacting the economic health of the United States. Recent research has shed the light on the importance of increasing graduation rates at higher education institutions (Haynes, 2016; Joy, 2017). Before 1985, institutional statistics on universities' graduation rates did not exist (Cook & Pullaro, 2010), and now graduation rates have come to reflect overall quality of student learning, intellectual involvement, how well students are integrated into campus life, and how effectively a campus delivers what students expect and need. For instance, in a study performed on Texas high schools, concluded that the accountability pressure on schools affected college graduation rates. In 1993, a test-based accountability system was introduced in Texas resulting in sanctions

put in place for underperforming schools (Deming, Cohodes, Jennings, & Jencks, 2016). This caused school officials to pressure students to achieve high test scores to avoid government punishments. The study found that this pressure affected students' college enrollment and completion rates as well as their job earnings as adults. Subsequently, students enrolled in underperforming schools had more pressure to do well on state tests which resulted in an increase in students' college enrollment and completion rates. Thus, the study found that high school accountability influences graduation rates. However, this paper proposes that the relative size of the college's student population, financial factors, and enrollment statuses has a statistically significant relationship with the institutional dedication to the student and ultimately the graduation rate. This paper chose to focus on these factors to determine whether our hypothesis holds true for over 1000 higher education institutions universities in the United States of America as shown in the conceptual model section.

This paper is divided into six sections. The first section introduces the topic and the need for a model to forecast graduation rates. The second section reviews and integrates the available literature history and the main authors that addressed graduation rates. The third section proposes a conceptual model that addresses the variables that predict graduation rates. The fourth section explains the data collection and analysis processes, the fifth section discusses the results and its implications, and the sixth section summarizes the paper with an overall conclusion and areas for future research.

Literature Review

Graduation rates have continued to be a popular indicator of institutional performance. Other studies have been performed about college graduation rates using different variables than this study. For instance, eight cohorts of undergraduate college students in the 1990s were studied resulting in the conclusion that there is a positive correlation between state funding and college graduation rates (Zhang, 2009). It was found that for every 10% increase in state funding, there was a 0.64% increase in graduation rates per full-time student. The author concluded that "it is the interaction between student characteristics (including commitments to their educational goals and institutions and the academic and social contexts of the institutions that ultimately determines students' college persistence and graduation" (Zhang, 2009, p. 716).

Additionally, Montgomery and Beronda (2012) used this same study as a resource for their study on graduation rates. In their study, they compared graduation rates of ten historically black colleges and ten predominately white institutions. While their main independent variable was race, they also used other variables such as geographical location, socioeconomic factors, and population size. Their results suggested that historically black colleges have lower graduation rates; thus, affecting state funding. Both Zhang's, and Montgomery's and Beronda's studies used graduation rates as a performance measure for determining funding levels. Furthermore, both studies used the Integrated Postsecondary Education Data System which

this paper also utilized with the difference being that this study used data from more recent years.

Similar to Montgomery's and Beronda's study, Mooring and Mooring (2016) hypothesized that the graduation rates for minority community college transfer students vary and that the factors that best predict timely graduation also vary by ethnicity. They found that their hypotheses were valid. The results concluded that the most predictive factor for African American transfer students was enrollment in a four-year transfer program at the community college while the predictive factor for Hispanic Americans was obtaining a credential before transferring. Furthermore, a high GPA was the best predictive factor for Asian American transfer students.

Another study utilized prediction models using graduation rates as a performance indicator of community colleges (Moosai, Walker, & Floyd, 2011). Therefore, this study was not focused on what specific variables impact graduation rates, but was more concerned with how graduation rates could predict a higher education institution's performance. From this study using data from California, Florida, and Michigan community colleges, the results concluded that graduation rates could predict whether a college was exceeding, meeting, or below expectations. Yet, the researchers warned that the performance of an institution consists of numerous factors, not just graduation rates. Thus, this study will determine which major variables are significantly related to graduation rates which can predict institutional performance.

Another community college study used a regression model to compare the differences in graduation rates between students who transferred from community colleges to students who stayed at the college for all four years (Friedl, Pittenger & Sherman, 2012). They examined 417 University of Tennessee students and compared the performance of students who had previously taken an intermediate math course at a community college with those who had taken the same course at a four-year institution. It was found that the students who transferred performed poorer in college-level math courses at the university suggesting that community college transfer students may result in decreasing a university's four-year graduation rate.

Additionally, Melguizo (2008) found that the selectivity of institutions impacted graduation rates. In her study, Melguizo sampled 3,000 students across the nation. While this study used three specific independent variables, Melguizo used three sets of variables: student characteristics, pre-college achievement, and postsecondary institutional characteristics. Her regression analysis concluded that students who attended the most selective universities were more likely to graduate with a bachelor's degree.

Instead of just focusing on student characteristics, Crawford's (2015) study solely focused on the impact on institutional expenses. From his study using ANOVA, Crawford discovered that library and instruction expenses had a strong, positive correlation with college retention and graduation rates. Thus, he concluded that since private schools typically have larger funds for

library and instruction expenses, more students graduate from private than public colleges, on average. Additionally, Crawford's results can support Melguizo's study about the impact of the selectivity of schools. From both studies, it can be hypothesized that since private schools tend to be more selective and have more funding that they have higher graduation rates than public colleges and universities.

Conceptual Model

Previous studies have successfully determined factors that impact graduation rates and how graduation rates impact institutional performance. However, none of the studies specifically focused on areas related to the number of applications received and accepted, student enrollment size, financial factors, enrollment statuses and student/faculty ratio. Furthermore, none of the studies had a similar scope as this research since this paper is using data from 1,155 higher education institutions across the United States.

This research proposed a framework that will predict graduation rates based on multiple independent variables including applications received, applications accepted, new students enrolled, part-time undergrads, out-of-state tuition and student/faculty ratio.

Figure 1 shows the multiple variables addressed in this paper. As shown in the conceptual model, this research focused on understanding the potential relationships between graduation rates (dependent variable) and the six independent variables in order to forecast the graduation rates.

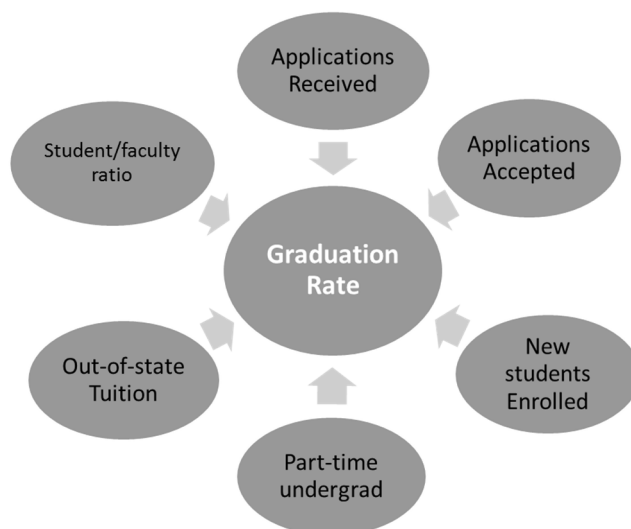


Figure 1: The Conceptual Model Dependent and Independent Variables

Variables Definitions

The six independent variables are defined as follows:

- Number of applications received: Total number of applications that were submitted to the school in the school year documented.
- Number of applications accepted: Number of applications that were submitted and accepted for spring or fall entry by the university or college.
- Number of new students enrolled: Number of new students entering the university at the start of the August or fall semester.
- Number of part time undergraduate: Total number of undergraduates in the program that are part-time students as defined by the university or college (typically less than 12 credits).
- Out of state tuition: Amount of tuition paid by students that are commuting out of state.
- Student/faculty ratio: Ratio of students to faculty members in the university.

The dependent variable in this paper is Graduation Rate. This variable is the percentage of a higher education institution's first-time, first-year undergraduate students who complete their program within 150% of the published time. In this proposed conceptual model, graduation rate is considered exclusively for four-year programs.

The following section describes the data collection and the analysis processes this study implemented.

Data Collection and Analysis

Research Main Question.

The main question in this research paper was what can forecast graduation rates? To answer this question, the following hypothesis was proposed and tested:

- Research Hypothesis
 - H_0 (null hypothesis): There is no correlation between “Applications Received, Applications Accepted, New students Enrolled, Part-time undergrads, Out-of-state Tuition and Student/faculty Ratio” and “Graduation Rates.”
 - H_1 (alternative hypothesis): There is a correlation between “Applications Received, Applications Accepted, New students Enrolled, Part-time undergrads, Out-of-state Tuition and Student/faculty Ratio” and “Graduation Rates.”

Data Collection Approach.

Data from 1,155 colleges across the nation was collected from the U.S News and World Report (National Universities Ranking, 2016), universities' websites, and phone calls to the universities made to verify any old/missing data. The number of higher education institutions collected grouped per state is shown in Table 1.

Data Collection Approach.

Data from 1,155 colleges across the nation was collected from the U.S News and World Report (National Universities Ranking, 2016), universities' websites, and phone calls to the universities made to verify any old/missing data. The number of higher education institutions collected grouped per state is shown in Table 1.

Table 1
Number of Higher Education Institutions per State

State	# of HE Institutions	State	# of HE Institutions
Alaska	2	Montana	7
Alabama	24	North Carolina	44
Arkansas	12	North Dakota	7
Arizona	4	Nebraska	14
California	61	New Hampshire	11
Colorado	13	New Jersey	26
Connecticut	16	New Mexico	8
District of Columbia	6	Nevada	2
Delaware	4	New York	89
Florida	25	Ohio	44
Georgia	35	Oklahoma	13
Hawaii	2	Oregon	13
Iowa	28	Pennsylvania	78
Idaho	6	Rhode Island	7
Illinois	47	South Carolina	24
Indiana	36	South Dakota	9
Kansas	20	Tennessee	30
Kentucky	21	Texas	51
Louisiana	20	Utah	5
Massachusetts	48	Virginia	37
Maryland	21	Vermont	13
Maine	12	Washington	15
Michigan	33	Wisconsin	27
Minnesota	24	West Virginia	15
Missouri	31	Wyoming	1
Mississippi	14		

The detailed statistics of the six interdependent variables: applications received, applications accepted, new students' enrolled, part-time undergrads, out-of-state tuition and student/faculty ratio, are shown in Table 2.

Table 2
Statistics of the Six Interdependent Variables per State

State	Sum of app. Received	Sum of app. Accepted	Sum of new Students Enrolled	Sum of Part-time Undergrads	AVG of out-of-state Tuition	AVG of Student/faculty Ratio
Alaska	339	263	144	2,718	\$ 6,393	10.7
Alabama	48,797	36,839	17,795	23,264	\$ 5,368	16.6
Arkansas	19,603	17,078	10,808	11,181	\$ 5,161	16.3
Arizona	33,276	27,870	10,432	15,615	\$ 7,121	18.6
California	266,518	172,911	54,577	82,157	\$ 11,461	14.4
Colorado	51,705	36,058	14,420	18,811	\$ 8,821	19.7
Connecticut	60,265	35,503	11,497	18,359	\$ 12,936	12.7
District of Columbia	35,380	16,348	6,201	4,473	\$ 13,989	8.9
Delaware	17,334	13,066	4,521	6,980	\$ 7,893	18.2
Florida	77,542	53,498	21,190	56,376	\$ 8,843	16.3
Georgia	95,097	59,786	28,922	36,455	\$ 6,756	15.2
Hawaii	5,079	3,382	2,127	3,282	\$ 3,690	13.8
Iowa	44,683	37,977	15,875	15,137	\$ 10,783	13.8
Idaho	10,945	9,050	5,333	10,292	\$ 6,836	13.9
Illinois	122,948	86,174	34,133	39,473	\$ 10,202	13.6
Indiana	101,685	81,821	37,576	49,032	\$ 9,651	14.4
Kansas	28,339	21,788	12,443	16,025	\$ 7,349	14.8
Kentucky	41,229	32,340	16,667	24,066	\$ 6,863	14.5
Louisiana	52,691	45,484	25,335	27,746	\$ 5,744	18.0
Massachusetts	159,329	100,911	34,191	46,978	\$ 12,830	13.3
Maryland	63,458	39,904	13,379	19,927	\$ 10,117	13.9
Maine	17,376	11,453	4,731	6,674	\$ 9,865	15.9
Michigan	110,967	86,944	37,324	62,464	\$ 9,085	17.7
Minnesota	52,159	37,924	19,580	34,144	\$ 10,212	14.5
Missouri	60,632	48,425	22,156	38,318	\$ 8,183	14.9
Mississippi	29,305	18,985	9,172	8,120	\$ 5,582	16.0
Montana	9,782	8,241	5,045	5,175	\$ 6,692	16.6
North Carolina	127,170	76,746	31,553	27,820	\$ 8,395	13.8
North Dakota	7,911	6,546	4,550	3,400	\$ 5,548	16.4
Nebraska	21,724	20,423	10,792	13,563	\$ 6,808	15.0
New Hampshire	33,547	22,531	6,498	8,689	\$ 12,276	16.2
New Jersey	129,267	66,899	18,576	39,184	\$ 9,094	15.5
New Mexico	12,487	10,581	5,469	11,478	\$ 6,071	16.1
Nevada	3,068	2,569	1,624	2,989	\$ 6,995	11.5
New York	336,847	210,346	67,668	94,222	\$ 11,037	14.0

Ohio	131,720	103,317	48,317	53,355	\$ 1,117	14.4
Oklahoma	21,597	18,859	10,540	14,509	\$ 5,803	17.0
Oregon	25,936	20,742	7,369	5,034	\$ 12,046	14.2
Pennsylvania	226,449	145,665	50,958	56,339	\$ 11,784	13.7
Rhode Island	36,655	21,950	7,106	9,640	\$ 12,896	14.8
South Carolina	45,498	33,852	14,203	12,738	\$ 7,947	15.7
South Dakota	8,605	7,719	5,474	4,972	\$ 6,146	16.1
Tennessee	59,939	42,992	20,739	25,894	\$ 7,497	14.3
Texas	134,473	99,820	53,111	83,262	\$ 6,431	17.0
Utah	17,694	14,762	9,834	16,728	\$ 5,505	17.6
Virginia	118,319	72,610	27,200	21,749	\$ 10,084	13.6
Vermont	19,847	13,944	4,769	4,038	\$ 13,164	11.9
Washington	45,755	31,896	12,982	11,046	\$ 10,718	14.9
Wisconsin	71,058	55,233	23,701	28,221	\$ 9,722	15.6
West Virginia	28,214	23,631	10,762	10,803	\$ 7,881	14.6
Wyoming	2,029	1,516	1,073	1,488	\$ 5,988	15.1

Data Analysis.

Standard multiple regression analysis was performed to test the research hypothesis. A multiple linear regression (MLR) model was constructed with the six interdependent variables discussed in section 0 all 1,155 higher education institutions and the dependent variable “Graduation Rate”. The results of the hypotheses testing using standard multiple regression are shown in Table 3 and the detailed MLR output is shown in Table 4 and Table 5.

Table 3
Results of Hypothesis Testing

Relationship Strength	Significant Relationship	Significance Level	Significant Contribution
R ² = 0.426	Yes	0.00 < 0.05	<ul style="list-style-type: none"> • Number of applications received • Number of Part-time undergrad • Out-of-state tuition

Table 4
The Results of the Multiple Linear Regression Model for Graduation Rates

Regression Statistics	
Coefficient of Determination (R ²)	0.425752

Table 5
Multiple Linear Regression Output

	Coefficients	Standard Error	t Stat	P-value
Intercept	39.77871	2.27782	17.4635	0.00000
Number of applications received	0.001411	0.000361	3.908984	0.00010

Number of application accepted	-0.00055	0.000659	-0.83221	0.40547
Number of new student enrolled	-0.00039	0.001087	-0.35874	0.71986
Number of Part-time undergrad	-0.00242	0.000296	-8.1865	0.00000
Out-of-state tuition	0.002337	0.000122	19.09706	0.00000
Student/faculty ratio	-0.10323	0.101047	-1.0216	0.30718

The results in Table and Table 4 show that this research conceptual model that includes applications received, applications accepted, new students enrolled, part-time undergrads, and out-of-state tuition and student/faculty ratio explains almost 43% of the variation in the graduation rate.

The Refined Conceptual Model.

In order to find the significant unique contribution of individual variables on the dependent variable, the observed levels of significance (p-value) were examined. The three variables that significantly relate to the dependent variable (graduation rate) are number of applications received, number of part-time undergrads and out-of-state tuition.

To improve the forecast of the developed MLR model, only the significant variables with p-value of 0.0 (in bold italic in Table 5) were included and a refined MLR model was built as shown in Table 6 and Table 7.

Table 6

The Results of the Refined Multiple Linear Regression Model for Graduation Rates

Regression Statistics	
Coefficient of Determination (R ²)	0.424297

Table 7

Refined Multiple Linear Regression Output

	Coefficients	Standard Error	t Stat	P-value
Intercept	37.37284	1.175189	31.80155	0.00000
Number of applications received	0.000997	0.000125	7.978915	0.00000
Number of PT undergrad	-0.00254	0.000279	-9.10238	0.00000
Out-of-state tuition	0.002421	0.000107	22.71887	0.00000

The results in Table 6 and Table 7 show that the conceptual model that includes number of applications received, number of part-time undergrads and out-of-state tuition explains almost 42.4 % of the variation in the graduation rate and the three independent variables significantly relate to graduation rate.

The regression model shown in Equation 1 intended to forecast graduation rate. Equation 1 demonstrates the interrelationship between the research variables of graduation rate, number of applications received, number of part-time undergrads and out-of-state tuition.

$$\text{Graduation Rate} \cong 37.373 + 0.000997 (\text{number of applications received}) - 0.00254 (\text{number of parttime undergrads.}) + 0.00242 (\text{out - of - state tuition}) \quad (1)$$

The positive contributions of number of applications received and out-of-state tuition demonstrate that the increase in these two variables positively correlates with an increase in graduation rate. The negative contribution of number of part-time undergraduates, however, demonstrates that the increase in the number of part-time undergraduates negatively correlates with graduation rate.

Discussion

Standard multiple regression analyses were performed to test the research hypothesis and found that the six variables discussed in this paper (applications received, applications accepted, new students enrolled, part-time undergrads, out-of-state tuition and student/faculty ratio) were able to explain almost 43% of the variation in the graduation rate.

The conceptual model was refined to include the three significant variables only (with p-value of 0.0) and the refined multiple regression model that includes number of applications received, number of part-time undergrads and out-of-state tuition was able to explain almost 42.4 % of the variation in the graduation rate.

The coefficient of determination (R^2) which explains how much variation in the dependent variable (graduation rate) was explained by the independent variables is almost the same when including all six variables; the significant and insignificant ones. Therefore, the significant variables were considered only when building the refined conceptual model.

The refined conceptual model showed that the number of applications received and out-of-state tuition positively relates to graduation rate while part-time undergraduates negatively relates to graduation rate.

To test the applicability and practical use of our model in forecasting graduation rates, the developed conceptual model in this research paper was used to forecast the graduation rates for two universities in Florida, USA as shown in Table.

Table 8
A Forecasting Example

	No. of Applications rec'd	No. of PT undergrad	Out-of-state tuition	Actual Graduation rate	Forecasted Graduation Rate
Stetson University	1557	81	12315	73%	69%
University of Central Florida	6986	7152	6618	46%	42%

The results in Table show that the multiple regression model developed in this research was able to forecast with close proximity the graduation rates at Stetson University and the University of Central Florida.

The ability to forecast graduation rates with such proximity could predict whether the educational institution was exceeding, meeting, or below expectations. This helps in institutional planning and reflects overall quality of student learning, intellectual involvement and how effectively a campus delivers what students expect and need.

Conclusion and Future Research

This section summarizes the results of this paper and how the research conceptual model, data collection and data analysis were able to predict graduation rates. The data collection and analysis performed in section 4 led to three significant variables that relate to graduation rate: number of applications received, number of part-time undergrads and out-of-state tuition. These three variables were able to explain 42.4 % of the variation in the graduation rate.

This research was able to reject the null hypothesis and support at 5% level of significance the alternative hypothesis that states: there is a correlation between “Applications Received, Applications Accepted, New students Enrolled, Part-time undergrads, Out-of-state Tuition and Student/faculty Ratio” and “Graduation Rates.” The analysis showed that the increase in number of applications received and out-of-state tuition significantly increases graduation rate, while the increase in the number of part-time undergraduates significantly decreases graduation rates. Since the increase in the number of part-time undergraduates negatively relates to graduation rates, future research can look into institutional policies for hiring their part-time students to work on-campus as an incentive for them to become full-time students. In addition to the positive relationship this might have on graduation rates, students who work on-campus do not have to worry about commuting to work and have the opportunity to build strong connections with the institutions’ faculty and staff. Further research can look into the commitment students work on-campus feel toward their degree completion and graduation when they have a secured job on-campus.

Future research can consider developing a “Linear Optimization” model. Optimization is the process of selecting values of decision variables that minimize or maximize a quantity of interest. The objective function can be to maximize graduation rate where the decision variables are: applications received, applications accepted, new students’ enrolled, part-time undergrads, out-of-state tuition and student/faculty ratio. Each higher education institution can identify the appropriate constraints and limitations for each of the decision variables. For example the lowest acceptable value for out-of-state or the highest ratio of student/faculty. Higher education institutions can find the right combination of decision variables that maximize their graduation rates.

Since graduation rates have come to reflect overall quality of higher education institutions and how effectively a campus delivers what students expect and need, future research can also focus on gathering more data from universities as well as validating the data obtained to make sure it is up to date and correct. Additionally, a different study could be done specifically focusing on the graduation rates of four-year institutions since multiple studies have already been conducted only on two-year colleges as noted in this paper’s references. Then, research could be executed to compare the variables that impact four-year graduation rates to two-year rates. Furthermore, a comparison could be made between graduation rates in public versus private universities or certain schools, colleges. Future research can replicate the forecasting model at universities outside the United States of America. And finally, future research can investigate further the interaction between the independent variables and how the interaction might relate to graduation rates.

References

- Crawford, G.A. (2015). The Academic Library and Student Retention and Graduation: An Exploratory Study. *Portal: Libraries and the Academy*, 15(1), pp. 41-57.
- Cook, B., & Pullaro, N. (2010). *College graduation rates: Behind the numbers*. Washington, DC: American Council on Education.
- DeAngelo, L., Franke, R., Hurtado, S., Pryor, J.H. & Tran, S. (2011). *Completing College: Assessing Graduation Rates at Four-Year Institutions*. Los Angeles: Higher Education Research Institute.
- Deming, D.J., Cohodes, S., Jennings, J. & Jencks, C., (2016). When Does Accountability Work? Texas System Had Mixed Effects on College Graduation Rates and Future Earnings. *Education Next*, 16(1), pp. 71-76.
- Friedl, J., Pittenger, D.J. & Sherman, M. (2012). Grading Standards and Student Performance in Community College and University Courses. *College Student Journal*, 46(3), pp. 526-532.
- Haynes, K. S. (2016). *College access as vital as improving graduation rates*. San Diego Union-Tribune, The Web Edition Articles (CA).

- Integrated Postsecondary Education Data System (2016). *National Center for Educational Statistics*.
- Joy, S. P. (2017). *College graduation rates depend mainly on the students--but colleges matter too. Here's how much*. Online Submission. ERIC. Institute of Education Science.
- Melguizo, T. (2008). Quality Matters: Assessing the Impact of Attending More Selective Institutions on College Completion Rates of Minorities. *Research in Higher Education*, 49(3), pp. 214-236.
- Montgomery, R. & Montgomery, B.L. (2012). Graduation Rates at Historically Black Colleges and Universities: An Underperforming Performance Measure for Determining Institutional Funding Policies. *Journal of Continuing Higher Education*, 60(2), pp. 93-109.
- Mooring, R.D. & Mooring, S.R. (2016). Predictors of Timely Baccalaureate Attainment for Underrepresented Minority Community College Transfer Students. *Community College Journal of Research and Practice*, 40(8), pp. 681-694.
- Moosai, S., Walker, D.A. & Floyd, D.L. (2011). Using Student and Institutional Characteristics to Predict Graduation Rates at Community Colleges: New Developments in Performance Measures and Institutional Effectiveness. *Community College Journal of Research and Practice*, 35(10), pp. 802-816.
- National Universities Ranking (2016). *U.S News and World Report*. Retrieved February 22, 2016, from <http://colleges.usnews.rankingsandreviews.com/best-colleges>.
- Paterson, N. & Gordon, G. (2010). *How one university examined graduation rates of its undergraduate student population*. Association for Institutional Research.
- Zhang, L. (2009). Does State Funding Affect Graduation Rates at Public Four-Year Colleges and Universities? *Educational Policy*, 23(5), pp. 714-731.