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Killing Them with Kindness: Policies Not Based on Data Might Do More Harm than Good

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ABSTRACT

Educational administrators sometimes have to make decisions based on what they believe is in the best interest of their students because they do not have the data they need at the time. Some administrators do not even know that the data exist to help them make their decisions. However, well-intentioned policies that are not based on facts can sometimes do more harm than good for the students and the institution. This presentation discusses the results of the policy analyses conducted by the Office of Institutional Research at Western Kentucky University using Base SAS®, SAS/STAT®, SAS® Enterprise Miner™, and SAS® Visual Analytics. The researchers analyzed Western Kentucky University's math course placement procedure for incoming students and assessed the criteria used for admissions decisions, including those for first-time first-year students, transfer students, and students readmitted to the University after leaving in poor academic standing—procedures and criteria previously designed with the students' best interests at heart. The presenters discuss the statistical analyses used to evaluate the policies and the use of SAS Visual Analytics to present their results to administrators in a visual manner. In addition, the presenters discuss subsequent changes in the policies, and where possible, the results of the policy changes.

INTRODUCTION

Those of us in education administration are not in our current positions to get rich. Often we have taken positions in education because we believe in the value of the product we are selling—education. As such, we tend to want the best for our students and try to do what is best for them when we make decisions about how they go about earning their degrees. However, in trying to do what we think is best, we sometimes forget the value of studying and evaluating our own decisions. At all levels of education we are taught to challenge our instincts with fact-finding research. Yet, as educators we sometimes go with our instincts when we make policy decisions for our students based on what we believe is happening rather than on what is actually happening.

At Western Kentucky University (WKU), we have built a culture among our faculty, staff, and administrators that relies on evaluating data before making decisions that affect our students. One embodiment of that culture was the development of the Provost's Retention Task Force (RTF), whose goal was to identify and implement strategies to substantially increase student retention and graduation rates. The RTF was challenged to study all processes and procedures that could have an impact on student persistence. Throughout its almost four-year tenure, the task force has assessed a number of policies, some of which have been shown to be a hindrance to students, while others, thought to negatively impact student persistence, have been shown to actually have little effect.

The WKU Office of Institutional Research (IR) played an integral part in the evaluation of policies by the RTF by providing the majority of the data and analyses used to assess each strategy. The remainder of the paper will explore some of the analyses and data visualizations IR used to present the policy analyses to the RTF and other university administrators for their consideration.

MATH COURSE PLACEMENT

WKU enrolls 21,000 students and is a comprehensive public, four-year postsecondary institution located in Bowling Green, Kentucky. Entering students are placed in their first math course based on their scores on the math portion of the ACT exam and WKU's own Math Placement Exam (MPE). Other exams, such as the Accuplacer, COMPASS, and KYOTE are also used when students have not taken the ACT exam.

WKU has degree programs that require only general math (MATH 109 at WKU) and other majors, typically business and science majors that are more math-intensive and require at least college algebra

(MATH 116 at WKU). As shown in Table 1 for 43% of the baccalaureate degree programs offered at WKU, general math meets the entry-level math requirement for the program. College algebra and more advanced math courses will also satisfy the requirement, but general math is the minimum requirement for these majors. However, for 48% of the programs, only college algebra (or above) will meet the entry-level math requirements. The remaining nine percent of degree programs are undeclared majors or have various requirements based on the major or concentration.

Math Track	Courses based on Placement	Course Level	% of Degree Programs Whose Math Requirements Are Met by Track*
General Math	MATH 109	College	43%
Algebra	DMA 055 (Beginning)	Developmental	48% (as well as the 43% above)
	DMA 096 (Intermediate)	Developmental	
	MATH 116 (College)	College	

**Remaining 9% of degree programs are for undeclared majors or have various requirements based on concentrations.*

Table 1. Math Tracks, Placement Scores, and Degree Program Requirements

Students with any placement score may take general math, but those scoring less than 19 on the math portion of the ACT are put into sections, which require supplemental class time, while students who score 19 or higher on the math portion of the ACT are placed into regular course sections. For students enrolled in majors that require college algebra or higher, the path to completion is much longer, particularly for those who start at the lowest course level. Students who are initially placed into beginning algebra must successfully complete it, then successfully complete intermediate algebra, then successfully complete college algebra, a total of three courses, to meet the minimum math requirements. At the least it takes them an additional two semesters to complete their entry-level math requirements compared to students with the same placement scores who only need general math to meet their major math requirements.

In their review of institutional processes, the RTF discovered that all incoming students were being "placed" into the algebra track, even if their major did not require algebra. Administrators, out of the kindness of their hearts, had instructed IT to produce placement sheets for all students as if they all required the algebra track. The reasoning was that even if students were in majors for which general math met the math requirement, students might change their major later and need the courses in the algebra track. At that point, they would have to start all over and take the courses in the algebra track.

IR took a look to see how often this backtracking occurred. When we looked at students who initially enrolled in majors that required general math, only 14% of them eventually switched to a major that required college algebra or higher and had to complete the algebra sequence. So, we were placing 86% of these students into an algebra track that they would never need, which cost them unnecessary time and money. What was worse was the abysmal college algebra completion rates of those who were placed into beginning and intermediate algebra. As shown in Table 2, only six percent of the students who were initially placed into beginning algebra passed it, took and passed intermediate algebra, and took and passed college algebra in two years. Only 21% of those students initially placed into intermediate algebra passed it, and took and passed college algebra. Of those placed into college algebra, 77% passed it.

Fall 2010 Cohort Placed in:	N	Passed 055	Took 096	Passed 096	Took 116	Passed 116
DMA055 (Beginning Algebra)	463	49%	32%	21%	11%	6%
DMA096 (Intermediate Algebra)	490			59%	32%	21%
MATH116 (College Algebra)	594					77%

Table 2. Two-Year College Algebra Completion Rates by Course Placement for Entering Fall 2010 Students

In late July 2011, when the RTF discovered we were placing students according to what they might need in the future and not what they needed at the moment, the RTF immediately recommended changing the schedules of all students enrolled for fall 2011, whose major required general math, but who were currently placed in the algebra course sequence. The recommendation was approved and with each student's approval, 160 students were moved to general math courses during the first two weeks of August. Since then, all students have been placed according to their major requirements.

To assess the effects of the change in the policy IR looked at students enrolled in spring 2012 who would have been placed into the various courses in the algebra track, but were now placed in general math. Their general math pass rates are shown in Table 3.

Students Who Would Have Been Placed in:	Took MATH 109 (General Math) Spring 2012	Passed MATH 109 (General Math) Spring 2012
DMA055 (Beginning Algebra)	312	65%
DMA096 (Intermediate Algebra)	192	66%
MATH116 (College Algebra)	115	86%

Table 3. Spring 2012 Success in General Math by Previous Algebra Track Placement

Compared to the six percent of students in fall 2010 who were placed in beginning algebra and successfully completed college algebra over the next two years, the 65% general math pass rate of those who would have been placed in beginning algebra is a significant improvement. Additionally, the 66% general math pass rate of those who would have been placed in intermediate algebra is also a significant improvement over the 21% of fall 2010 students placed in intermediate algebra who eventually passed college algebra. Even the 86% pass rate of those who would have been placed in college algebra is higher than the college algebra pass rate of 77%.

By not being afraid to evaluate our own policies and processes, we have removed a large roadblock for our underprepared students. We have saved our students thousands of dollars in tuition. We have also removed an unnecessary requirement of taking courses, which few students successfully completed. We have also reinforced the idea that we should advise students according to their current major requirements, not according to what we think they might do in the future (i.e., change their major and need different math courses.)

ADMISSIONS CRITERIA: FIRST-TIME-IN-COLLEGE STUDENTS

Another policy initially developed based on what we thought was best for our students was our admissions criteria for first-time-in-college (FTIC) students. WKU has a unique history--until 2013 our university housed a community college within it. Underprepared students were enrolled at the university, but were placed in smaller class sections and provided additional support systems through the community college. As such, our admissions criteria were originally developed under the premise that everyone deserves a chance to succeed and those who were underprepared in some area could succeed with extra support. However, with our one-year retention rate of underprepared students around 50%, we

knew that providing the chance to succeed was not enough. In fact, an earlier Academic Quality Task Force had already put into place a policy to slowly raise the admissions criteria each year because we knew we were admitting students with little chance of success. In 2010, the minimum admissions criteria shown in Table 4 were put in place with the idea they would be raised each year through 2014.

Year	Minimum High School Grade Point Average (GPA)	Minimum ACT Composite Score
2010	2.00	16
2011	2.00	17
2012	2.00	18
2013	2.00	19
2014	2.00	20

Table 4. Admissions Criteria Developed by WKU Academic Quality Task Force in 2010

In fall 2012, IR again took on the task of evaluating the success of our students based on their entry characteristics to see if we could further refine the admissions criteria. To do this, we first looked at our one-year attrition risk models we developed using SAS® Enterprise Miner™. (For a detailed description of our model development, see Bogard, 2013; Bogard, James, Helbig & Huff, 2012.) For ease of explanation to administrators, we used the decision tree model. We learned a long time ago, that even with highly intelligent, well-educated administrators, presenting data and research should be very simple and relay only the most important facts. As researchers, we have to know what we are doing down to choosing the appropriate variables for our models, gathering all the data, cleansing and modifying the data, choosing the best methods for the analysis, and truly understanding the complexities of how policies and practices influence how the results must be interpreted. However, administrators and members of a task force do not have the time, nor the desire to sift through all the details. They just want the bottom line. As such, a simplified depiction of our pre-enrollment tree, similar to what we presented to our Council of Academic Deans, is shown in Figure 1.

The simplified tree was color-coded to visually show relative retention rates for students in each node; nodes with retention rates above the average of 69% were shaded green; nodes with averages close to model average were shaded yellow; nodes with averages between 45% and 65% were shaded orange; and, nodes with retention rates below 45% were shaded red. For this model, we used variables available to us prior to the student's enrollment at WKU, the same time frame in which we would be making admissions decisions.

Figure 1 illustrates the strong influence of high school grade point average (GPA) on one-year persistence along with the absence of any significant effect of the ACT composite score. Even though we put a lot of variables in the model that we know influence persistence, such as gender and citizenship, we cannot make admissions decisions on many of those variables. The variables we can use are achievement indicators such as high school GPA and ACT scores.

After studying models using just those variables we could systematically use for admissions decisions, we developed the following minimum admissions criteria which we partially implemented for fall 2013 and fully implemented fall 2014: a 20 ACT Composite Score or 940 SAT Score or a High School GPA 2.50 or a Composite Admissions Index (CAI) of 55+, where CAI = (20 * HS GPA) + ACT.

The previous WKU admission guidelines placed undue emphasis on the ACT composite score and did not align with the probabilities of retention and success. The revised criteria produced an easy-to-understand, linear range of scores, appropriately weighted high school GPA, and aligned with the

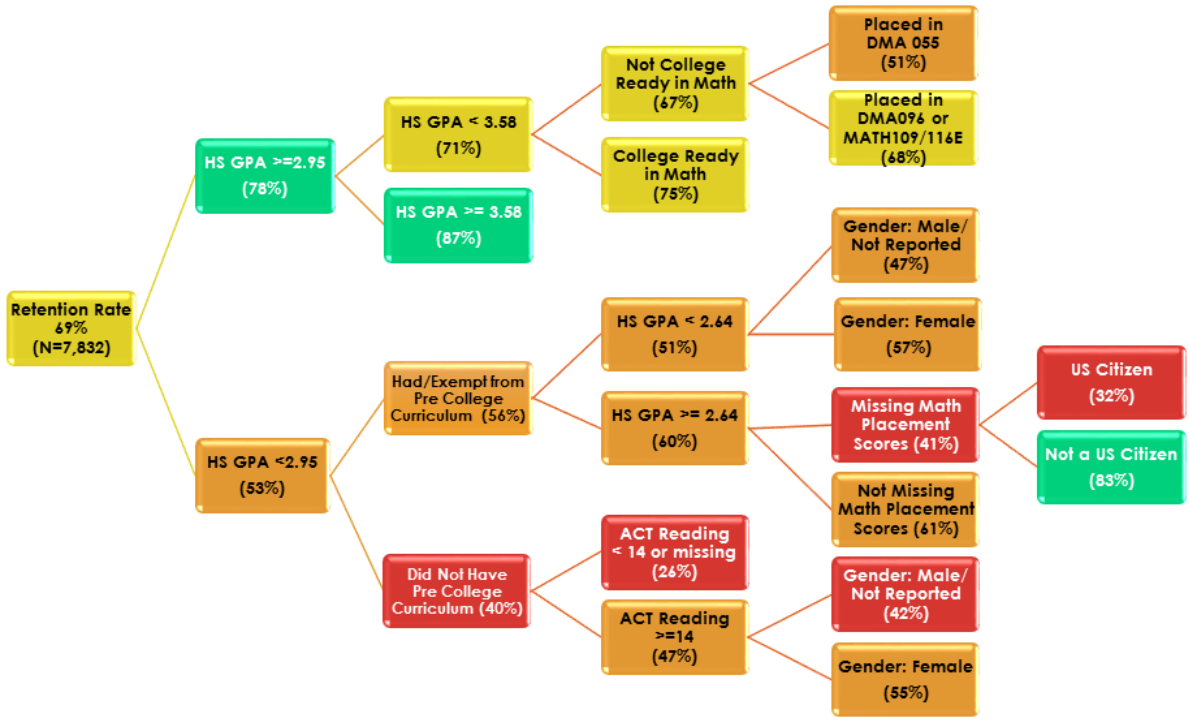


Figure 1. Pre-Enrollment Decision Tree Predicting FTIC Student One-Year Persistence

likelihood of first-year persistence. The new method also allows for us to slowly increase the CAI requirement from 55 to 65 as enrollment and demographics change, to continue to further refine our entering cohort. The new method does not admit any of the students previously not admitted and adds students with a high school GPA less than 2.5 and either an ACT less than 10 or a CAI less than 55 to the "Not Admitted" category. It also adds a competitive admissions category for those with an ACT between 10 and 20 and a CAI between 55 and 65. Figure 2 shows the previous admissions criteria compared to the new criteria.

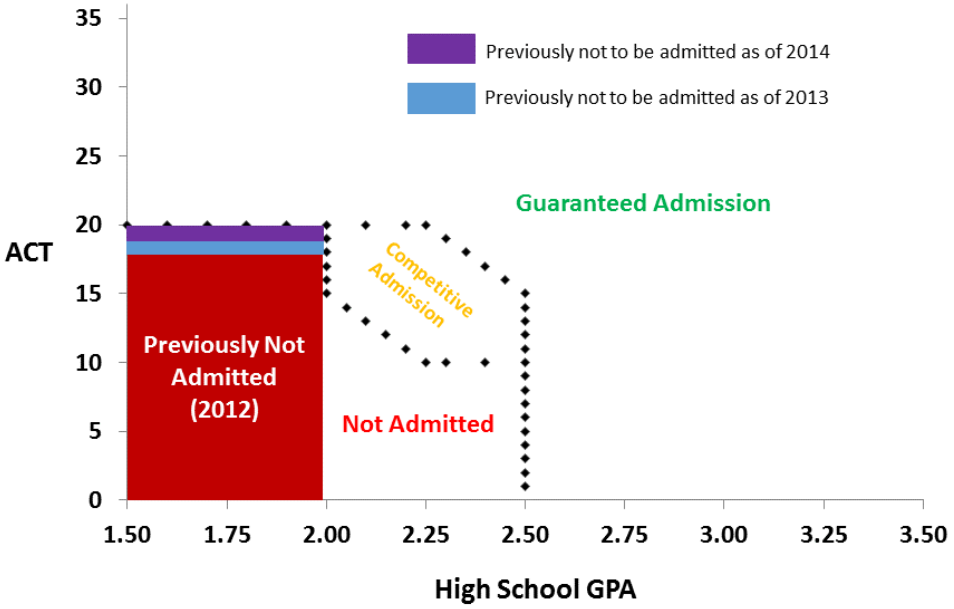


Figure 2. Comparison of Previous and New Admissions Criteria

Actual persistence of our students using the new admissions criteria is not available due to the lack of time since implementation. However, we can look at one-year persistence with the new admissions criteria applied to previous cohorts and look at the changing demographics of the entering cohorts as possible indications of what we might expect in the future. Table 5 shows the one-year persistence of students using the new admissions criteria applied to the fall 2011, 2012, and 2013 cohorts.

New Admissions Category	**One-Year Retention Rates**		
	Fall 2011 Cohort	Fall 2012 Cohort	Fall 2013 Cohort
Not Admitted	35%	28%	27%
Competitive	46%	38%	46%
Guaranteed	68%	68%	71%
Total	**66%**	**65%**	**69%**

Table 5. One-Year Persistence by New Admissions Categories

The one-year persistence rates of those guaranteed to be admitted are consistently much higher than those admitted in the competitive category, which are consistently higher than those who will no longer be admitted. If we look at the average high school GPA and ACT scores of the entering cohorts over the past 10 years, as shown in Figure 3, there has been a significant increase for both the fall 2013 and fall 2014 cohorts, which could lead to increased persistence rates in the future.

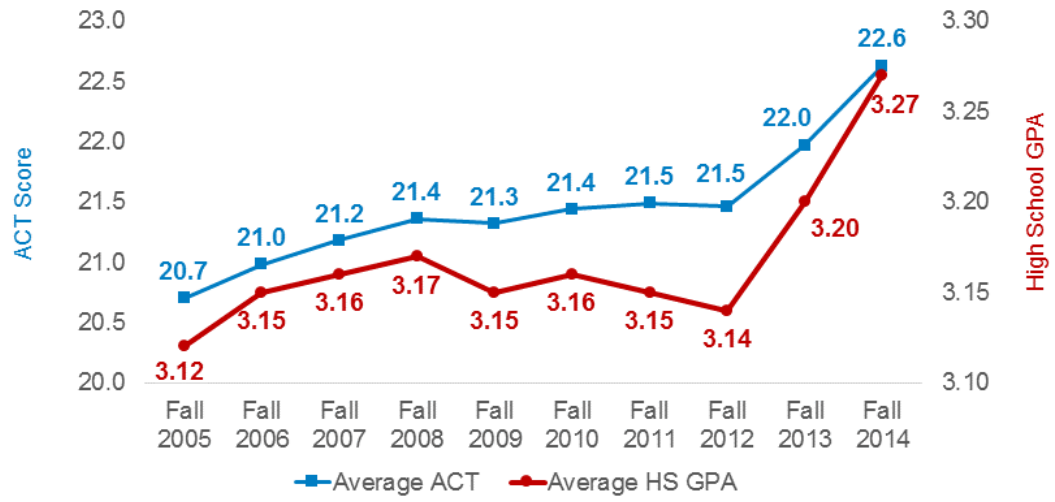


Figure 3. Average ACT and High School GPA of Entering Cohorts: Fall 2005-Fall 2014

By continually reevaluating our admissions criteria and adjusting them to align more closely with student success, we can use our data in the best interest of our students. During our analysis, we realized our admissions criteria relied heavily on ACT score. Yet, a much better predictor of student success was high school GPA. We also discovered that the odds of certain students succeeding at WKU were very small. By not providing false hope to students, who have very little chance of success at our institution, we prevent them from spending time and money on an endeavor that is not a promising option for them. It also opens them up to other opportunities that are a better fit.

ADMISSIONS CRITERIA: TRANSFER STUDENTS

Per the request of the RTF, IR analyzed the admissions criteria of first-time transfer students. Members of the RTF believed the transfer admissions policy admitted students who had little chance of success. However, they wanted to use data to inform their decision about whether or not to change the criteria, and if they did recommend changes to it, which criteria they should use. The minimum transfer admissions criteria that were being evaluated, along with the distribution of students, fall GPAs, and one-year retention rates of transfer students from fall 2007 through fall 2013, are shown in Table 6 below.

Transfer GPA	Transfer Hours	HS GPA	ACT	CAI	N	Average Fall GPA	One-Year Retention Rate	Current Admission Category
2.00+	24+				3,770	2.89	76%	Good Standing (GS)
<2.00	24+				219	2.19	52%	Competitive (CO)
2.00+	<24				525	2.43	56%	Good Standing (GS)
<2.00	<24	2.50+			177	1.91	40%	Good Standing (GS)
<2.00	<24		20+		31	2.07	35%	Good Standing (GS)
<2.00	<24			55+	26	1.45	23%	Competitive (CO)
<2.00	<24	<2.50	<20	<55	49	1.79	33%	Not Admitted (NA)

Table 6. Current Transfer Admissions Criteria including Fall 2007-2013 Transfer Students, Fall GPAs and One-Year Retention Rates

To put the fall GPA in perspective, one must understand the criteria WKU uses to determine good academic standing. Table 7 shows the WKU GPA and Overall GPA, which includes WKU and transfer work that are required of all undergraduate students to maintain good academic standing. With these GPA cutoffs in mind, transfer GPAs and fall term GPAs less than 2.00 are of concern depending on the number of hours attempted. Students with WKU and Overall GPAs less than 1.70 are automatically on academic probation, regardless of the number of hours they have attempted.

WKU GPA and Overall GPA (including transfer work) Required for Good Academic Standing	# of Attempted Hours
1.70	0.1 to 17.0
1.80	17.1 to 33.9
1.90	34.0 to 50.9
2.00	51.0 or more

Table 7. WKU and Overall GPA Required to Maintain Good Academic Standing

To analyze the transfer admissions data, IR used SAS® Enterprise Miner™ to develop decision tree models based on two different measures of success: one tree predicted fall GPA and one predicted fall-to-fall retention of first-time transfer students. First-time transfer students, who first transferred to WKU in the fall semesters from 2007 through 2013 and did not transfer with a degree, were included in the models. Transfer GPA, number of credit hours transferred, ACT scores (composite, math, English, reading and science), high school GPA, type of transfer institution (Kentucky community college, public

Kentucky university, private Kentucky institution, and out-of state institutions), and gender were entered as independent variables in both models.

Figure 4 is a simplified illustration of the decision tree built to predict fall GPA for first-time transfer students. The nodes of the tree are shaded to show the fall GPAs for the students in each node relative to the average fall GPA of all students in the model (*M*=2.74, *n*=4,793). To help the reader put the fall GPAs into perspective, fall GPAs higher than the average of 2.74 were shaded green, GPAs close to the average were shaded yellow, GPAs lower than average, but still in good standing (2.00 or greater) were shaded orange, and those below 2.00 were shaded red. Since we were interested only in culling out those students who had little chance of success, the factors influencing students in good standing are displayed in the purple boxes in Figure 4 and labeled "Irrelevant Factors."

The entire decision tree showed that transfer GPA was the most important factor (1.00 importance) in predicting fall GPA, followed by high school GPA (0.3929), transfer hours (0.2746), ACT English score (0.1847), ACT composite score (0.1419), and gender (0.1189). While gender was important for the model as a whole, it did not influence the fall GPAs of students who earned less than the average fall GPA of 2.74.

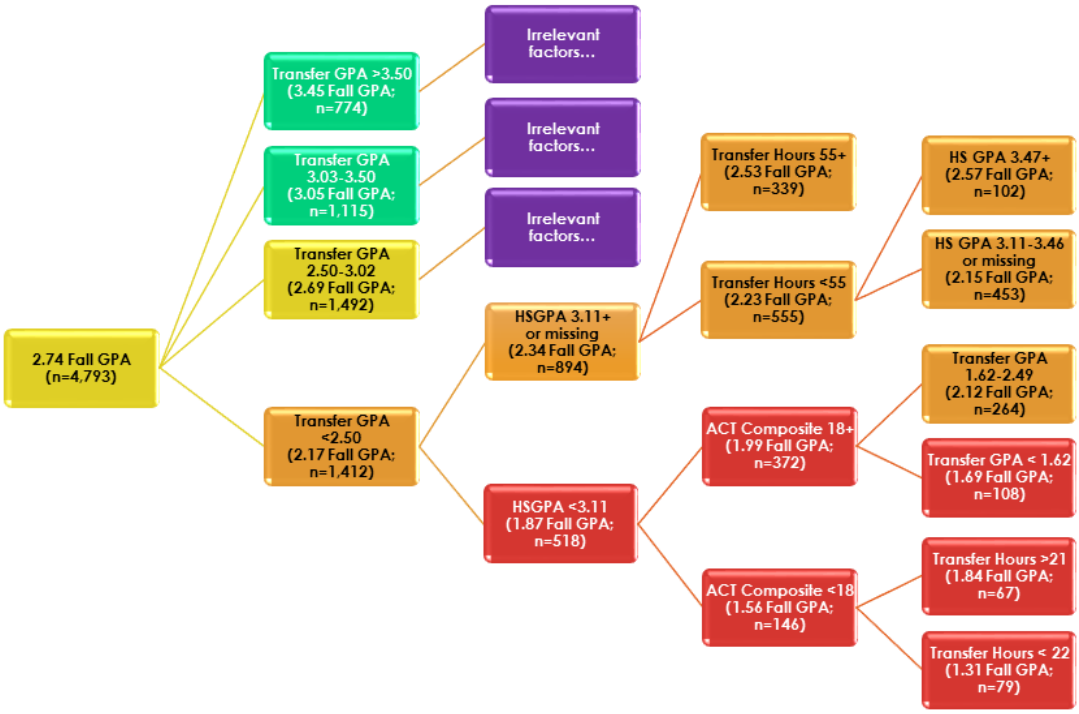


Figure 4. Decision Tree Predicting Fall GPA of Transfer Students

The average fall GPAs of students with a transfer GPA of 2.50 or higher were in the good standing range (above a 2.00). For students who transferred in with a GPA less than 2.50 (*n*=1,412), their average fall GPA was 2.17. However, a number of factors further differentiated their fall GPAs. For students who transferred with a GPA below 2.50, if their high school GPA was greater than 3.10 or missing then they had average fall GPAs that put them in good standing (*M*=2.34, *n*=894). One thing to note about the data is that missing high school GPAs or ACT scores is often indicative of a student transferring in 24 or more hours. With our current admissions criteria, we do not require students who transfer in 24 or more hours to report their high school GPAs or ACT scores, even though some of them do report their scores. As shown in Table 8, of the 894 students in the "HS GPA 3.11+ or missing" node, 729 (82%) transferred in 24 or more hours and only 305 (34%) had high school GPAs of 3.11 or higher. So, while this node references high school GPA, it is also measuring students with and without 24 or more transfer hours. This emphasizes just how important it is to understand your data before you start interpreting your results.

Transfer Hours	High School GPA		
	3.11 or Higher	Missing	All
24 or More	179 (20%)	550 (62%)	729 (82%)
Less than 24	126 (14%)	39 (4%)	165 (18%)
All	305 (34%)	589 (66%)	894 (100%)

Table 8. Transfer Hours and High School GPA Distribution of Students in "HSGPA 3.11+ or Missing" Node

For students who transferred in with a GPA less than 2.50 and a high school GPA lower than 3.11, the outlook for their fall GPA was not very good (*M*=1.87, *n*=518). If they had an ACT composite of 18 or higher, their average fall GPA was right at good standing (1.99, *n*=372). Additionally, if these students transferred with a GPA between 1.62 and 2.49, their average fall GPA was in good standing (*M*=2.12, *n*=264). But, if they transferred with a GPA less than 1.62, their average fall GPA was low (*M*=1.69, *n*=108). However, if these students had an ACT composite lower than 18, their average fall GPA was 1.56 (*n*=146), with transfer hours further differentiating between not being successful, for those with 22 or more hours (*M*=1.84, *n*=67) and failure for those with less than 22 transfer hours (*M*=1.31, *n*=79).

To look at another indicator of student success, IR developed a decision tree predicting fall-to-fall retention of first-time transfer students. The same population of students and independent variables used to develop the tree predicting fall GPA were used to develop the one-year retention decision tree. Figure 5 shows a simple depiction of the decision tree. To show the relative retention rates of each node, the nodes were color coded. Nodes for students with retention rates above the average of 70% were shaded green; Nodes with retention rates at or right below average were shaded yellow; Nodes with retention rates lower than average, but higher than 50% were shaded orange; and nodes with retention rates 50% or lower were shaded red. Again, we were not concerned with the factors that predicted retention rates higher than average—we just wanted to pinpoint those factors that were most influential in predicting low retention rates. Therefore, those factors differentiating between average and higher retention rates are shown in a purple “Irrelevant Factors” box.

For the full model, transfer GPA was the most important factor in predicting one-year retention (1.000 importance), followed by transfer hours (0.4583), high school GPA (0.3856), ACT math score (0.1672) and ACT composite score (0.1626). For the portion of the tree in which we were interested, the ACT composite score was not a significant predictor of one-year retention.

Students who transferred in a GPA greater than 3.00 had excellent retention rates (80%, *n*=1,969), while those who transferred in GPAs lower than 0.95 did not fare well (22% retention, *n*=81). Students who transferred in with a GPA between 2.17 and 3.00 did well if they transferred in 25 or more hours (72% retention, *n*=1,704). If they transferred in fewer than 25 hours and had a transfer GPA between 2.58 and 3.00, their retention rate was acceptable (65% retention, *n*=187), but if their transfer GPA was between 2.17 and 2.57, they did not do well (46% retention, *n*=156) unless their math ACT was over 18 (63% retention, *n*=51). Students transferring in with GPAs between 0.95 and 2.16 did not do well (49% retention, *n*=819) unless they had a high school GPA of 3.40 or higher (68% retention, *n*=72) or transferred in 33 or more hours (59% retention, *n*=188).

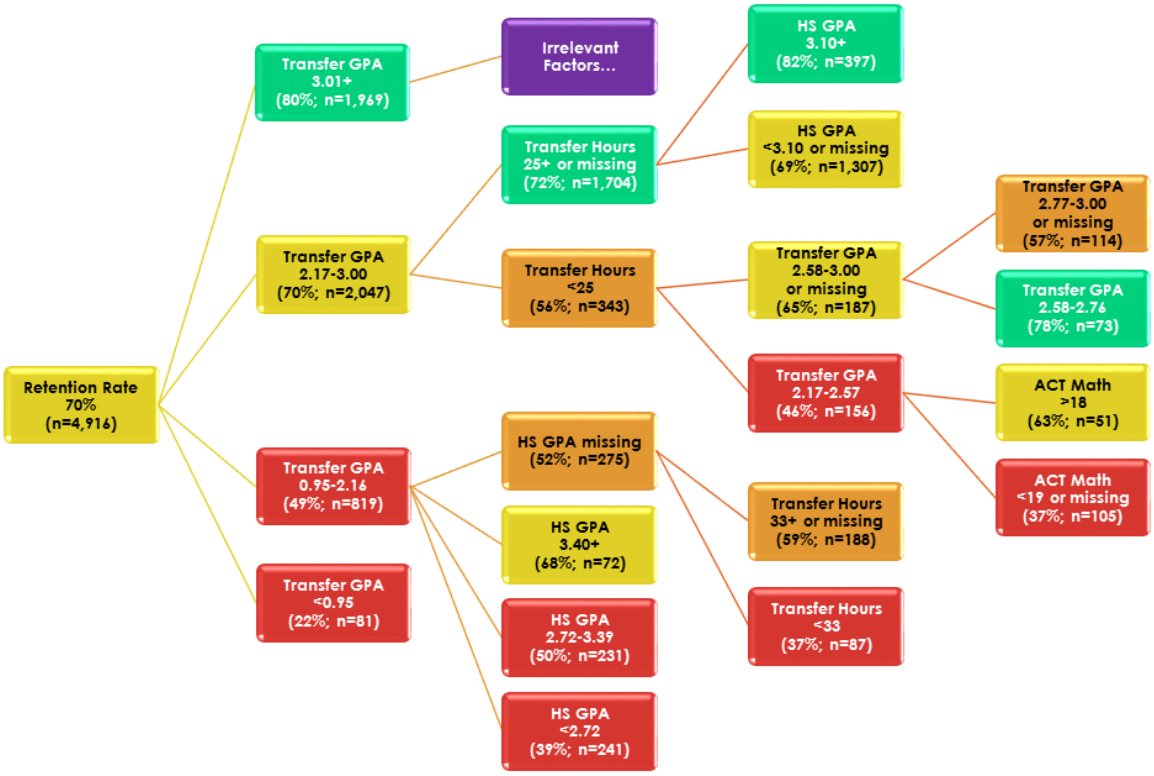
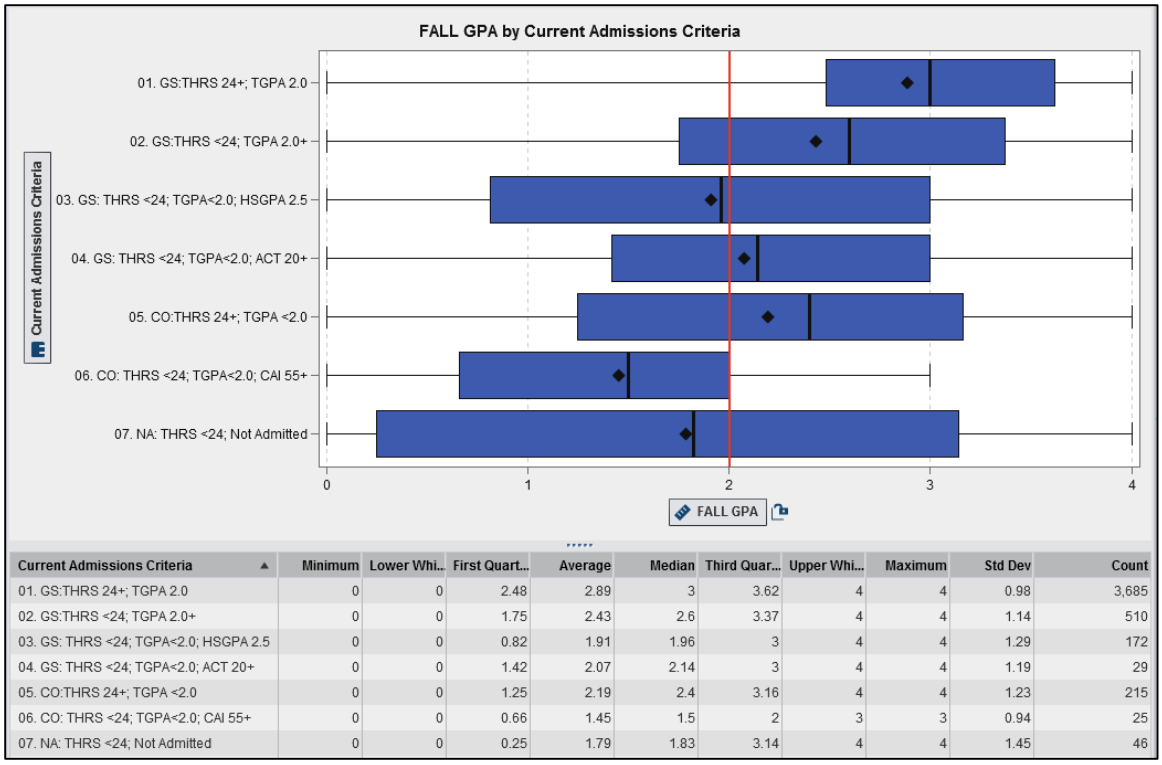


Figure 5. Decision Tree Predicting Fall-to-Fall Retention of First-Time Transfer Students

Using the results from the two decision tree models, IR developed the proposed transfer admissions criteria outlined in Table 9. To compare the average fall GPAs of students admitted using the current and proposed admissions categories, two box plots were produced using SAS® Visual Analytics. Figure 6 displays the fall GPAs using the current admissions categories. What is immediately noticeable is the mean and median fall GPAs for some of the students admitted in good standing and as competitive admissions fall below 2.00. In fact, for students admitted using the CAI of 55 or more, 75% had fall GPAs below 2.00 and not one student had a fall GPA above 3.00. The mean and median fall GPA of those not admitted was even higher than those for students admitted using the CAI. One caveat is that the small number of students admitted using the CAI (*n*=25) might influence this finding over time.

Transfer GPA	Transfer Hours	HS GPA	ACT	N	Average Fall GPA	Retention Rate	Suggested Admission
2.50+	Any			3,412	2.98	76%	Good Standing (GS)
	Any	3.10+		299	2.41	62%	Good Standing (GS)
1.00 - 2.49	24+			597	2.23	61%	Competitive (CO)
1.60 - 2.49	<24		19+	230	2.16	53%	Competitive (CO)
All Others				259	1.71	32%	Not Admitted (NA)

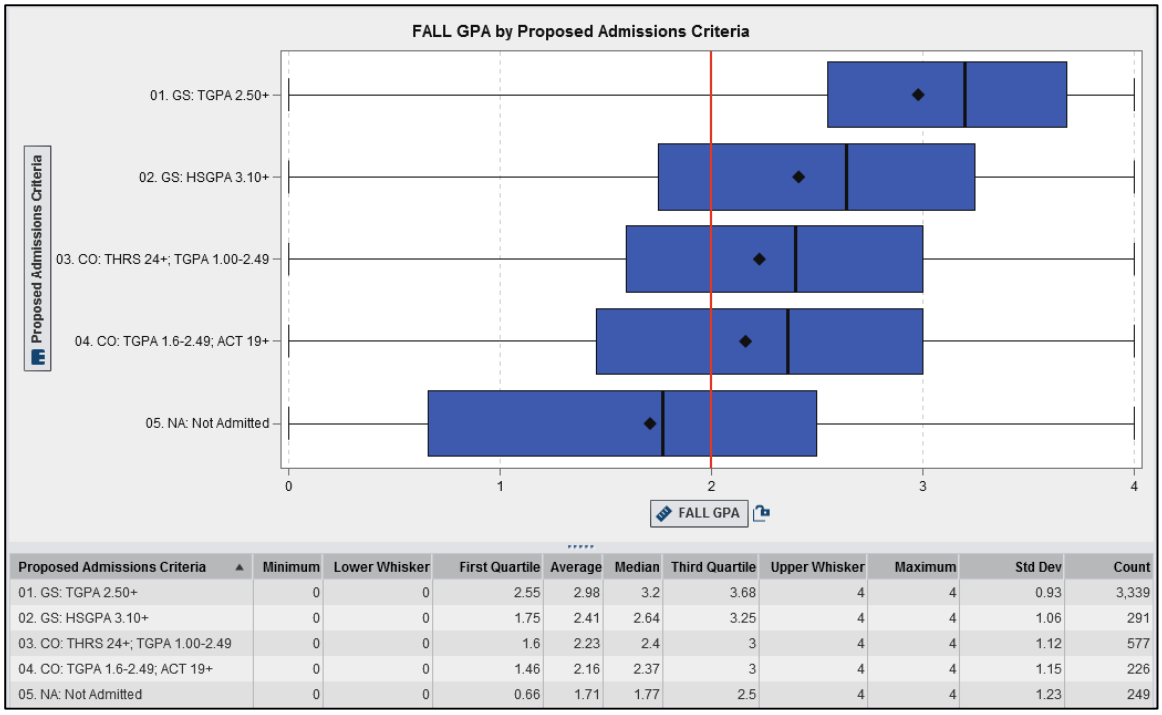
Table 9. Proposed Minimum Transfer Admissions Criteria



Current Admissions Criteria	Minimum	Lower Whi...	First Quart...	Average	Median	Third Quar...	Upper Whi...	Maximum	Std Dev	Count
01. GS:THRS 24+; TGPA 2.0	0	0	2.48	2.89	3	3.62	4	4	0.98	3,685
02. GS:THRS <24; TGPA 2.0+	0	0	1.75	2.43	2.6	3.37	4	4	1.14	510
03. GS: THRS <24; TGPA<2.0; HSGPA 2.5	0	0	0.82	1.91	1.96	3	4	4	1.29	172
04. GS: THRS <24; TGPA<2.0; ACT 20+	0	0	1.42	2.07	2.14	3	4	4	1.19	29
05. CO:THRS 24+; TGPA <2.0	0	0	1.25	2.19	2.4	3.16	4	4	1.23	215
06. CO: THRS <24; TGPA<2.0; CAI 55+	0	0	0.66	1.45	1.5	2	3	3	0.94	25
07. NA: THRS <24; Not Admitted	0	0	0.25	1.79	1.83	3.14	4	4	1.45	46

Figure 6. Fall GPA Box Plot by Current Admissions Categories: Fall 2007-2013 Transfer Students

The box plot using the proposed admissions categories shows a very different picture. Figure 7 shows the mean and median for all admitted students was over 2.00, while the mean and median were less than 2.00 for those who would not be admitted. Additionally, those admitted in good standing had higher mean and median GPAs than those admitted competitively.



Proposed Admissions Criteria	Minimum	Lower Whisker	First Quartile	Average	Median	Third Quartile	Upper Whisker	Maximum	Std Dev	Count
01. GS: TGPA 2.50+	0	0	2.55	2.98	3.2	3.68	4	4	0.93	3,339
02. GS: HSGPA 3.10+	0	0	1.75	2.41	2.64	3.25	4	4	1.06	291
03. CO: THRS 24+; TGPA 1.00-2.49	0	0	1.6	2.23	2.4	3	4	4	1.12	577
04. CO: TGPA 1.6-2.49; ACT 19+	0	0	1.46	2.16	2.37	3	4	4	1.15	226
05. NA: Not Admitted	0	0	0.66	1.71	1.77	2.5	4	4	1.23	249

Figure 7. Fall GPA Box Plot by Proposed Admissions Categories: Fall 2007-2013 Transfer Students

Because looks can be deceiving, IR ran one-way ANOVAs with a Tukey-Kramer HSD (honest significant difference) test to see if the mean fall GPAs were significantly different for students admitted in each of the admissions categories using the current and proposed admissions categories. The one-way ANOVA using the current admissions criteria found there was a significant difference between at least two of the means, $F(6,4675) = 63.94$, $p < .0001$. The Tukey-Kramer test confirmed the patterns shown in the box plot. As displayed in Table 10, the same letter of "A" in the Tukey-Kramer letter comparison showed that the mean for students admitted in good standing with 24 or more hours and at least a 2.00 transfer GPA (M=2.89, n=3,685) was not statistically different from the mean of the students admitted in good standing with fewer than 24 transfer hours and a transfer GPA of at least a 2.00 (M=2.43, n=510). Not having a letter in common with the rest of the categories showed that the mean of 2.89 for those admitted with 24 or more transfer hours and a transfer GPA of at least 2.00 was significantly different from the means for the rest of the admissions categories. The Tukey-Kramer test also showed that some of the means for students currently admitted in good standing, competitively admitted, and not admitted were not significantly different using the current criteria.

Means with the same letter are not significantly different.						
Tukey Grouping				**Mean**	**N**	**Current Admissions Category**
A				2.89	3685	01. GS:THRS 24+; TGPA 2.0+
A	B			2.43	510	02. GS:THRS <24; TGPA 2.0+
	B	C		2.19	215	05. CO:THRS 24+; TGPA <2.0
	B	C		2.07	29	04. GS: THRS <24; TGPA<2.0; ACT 20+
	B	C	D	1.91	172	03. GS: THRS <24; TGPA<2.0; HSGPA 2.5
		C	D	1.79	46	07. NA: THRS <24; Not Admitted
			D	1.45	25	06. CO: THRS <24; TGPA<2.0; CAI 55+

Table 10. Tukey-Kramer Letter Comparison of Average Fall GPAs using Current Admissions Criteria

The ANOVA using the proposed admissions criteria also showed a significant difference between at least two of the categories' means, $F(4,4677) = 179.49$, $p < .0001$. The Tukey-Kramer letter comparison of average fall GPAs using the proposed admissions criteria is shown in Table 11. While the average fall GPA of some of the students admitted in good standing was not statistically different from some of those admitted competitively, the average GPA for those not admitted was different from the average GPA for all other groups.

Means with the same letter are not significantly different.						
Tukey Grouping				**Mean**	**N**	**Proposed Admissions Category**
A				2.98	3339	01. GS: TGPA 2.50+
	B			2.42	291	02. GS: HSGPA 3.10+
	B	C		2.23	577	03. CO: THRS 24+; TGPA 1.00-2.49
		C		2.16	226	04. CO: TGPA 1.6-2.49; ACT 19+
			D	1.71	249	05. NA: Not Admitted

Table 11. Tukey-Kramer Letter Comparison of Average Fall GPAs using Proposed Admissions Criteria

To visually show the various retention rates by the current and proposed admissions criteria, two bar charts were created using SAS® Visual Analytics. Figure 8 shows the retention rates using the current criteria, while Figure 9 shows the retention rates by the proposed categories.

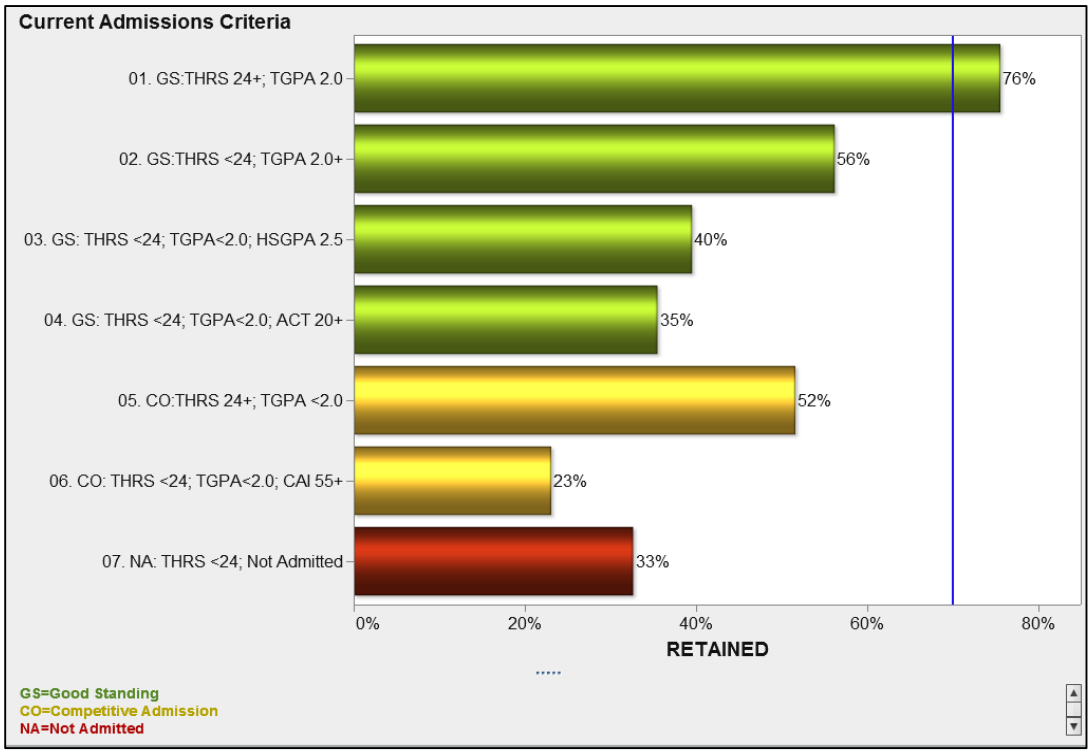


Figure 8. One-Year Retention Rates of Transfer Students by Original Admissions Categories: Fall 2007-2013

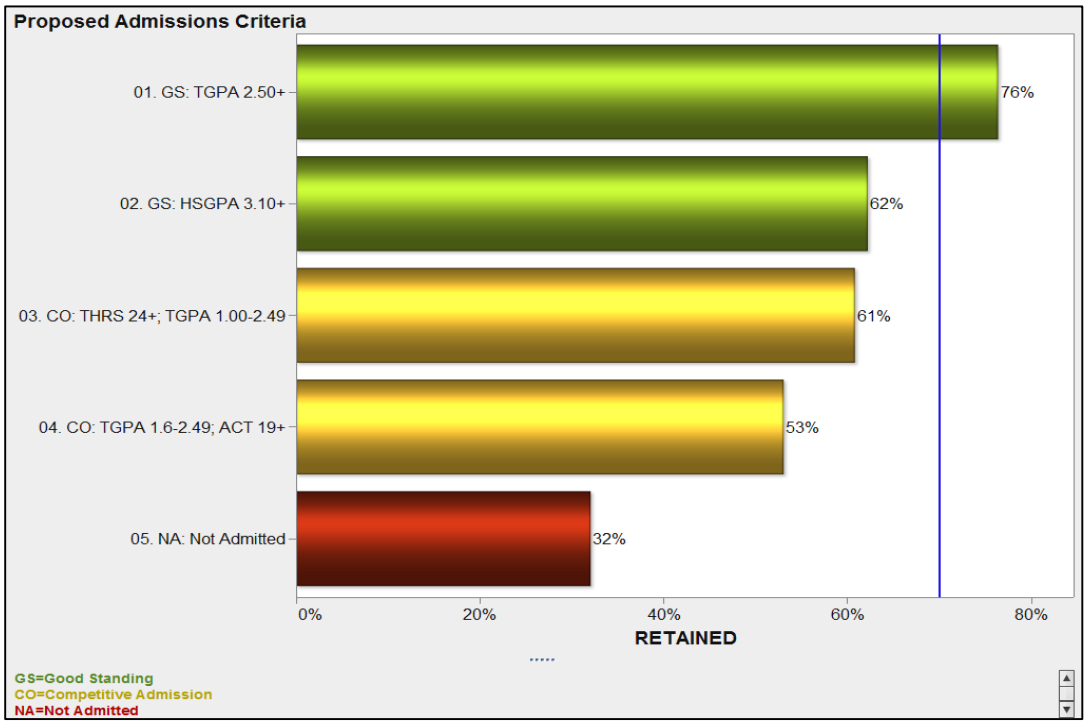


Figure 9. One-Year Retention Rates of Transfer Students by Proposed Admissions Categories: Fall 2007-2013

The graphs for the current admissions categories again show that some competitively admitted students have higher retention rates than some admitted in good standing, and those who should not have been admitted had higher retention rates than some students admitted competitively. On the other hand, the proposed admissions categories showed that while some students admitted competitively had rates similar to those of students admitted in good standing, students who would not be admitted had significantly lower retention rates than all categories of admitted students.

Again, just to be certain that the graphs were providing an accurate picture, a one-way ANOVA with a Tukey-Kramer HSD test was produced to determine which retention rates were significantly different from the others. The ANOVA found there was a significant difference between at least two of the means, $F(6,4790) = 52.21$, $p < .0001$. The results of Tukey-Kramer test for the current categories is shown in Table 12. Just as the bar charts showed, the retention rates of students admitted in good academic standing and competitively were similar to students who would not have been admitted using the current criteria.

Means with the same letter are not significantly different.						
Tukey Grouping				**Mean**	**N**	**Current Admissions Category**
A				.7577	3770	01. GS:THRS 24+; TGPA 2.0
A	B			.5619	525	02. GS:THRS <24; TGPA 2.0+
	B	C		.5160	219	05. CO:THRS 24+; TGPA <2.0
	B	C	D	.3955	177	03. GS: THRS <24; TGPA<2.0; HSGPA 2.5
	B	C	D	.3548	31	04. GS: THRS <24; TGPA<2.0; ACT 20+
		C	D	.3265	49	07. NA: THRS <24; Not Admitted
			D	.2308	26	06. CO: THRS <24; TGPA<2.0; CAI 55+

Table 12. Tukey-Kramer Letter Comparison of Retention Rates using Current Admissions Criteria

The ANOVA comparing the mean retention rates of students in the proposed admissions categories found there was a significant difference in the average retention of at least two of the groups, $F(4,4792) = 82.25$, $p < .0001$. The results of the Tukey-Kramer test are shown in Table 13. Again, like the bar chart showed, while the retention rate of some of the students admitted in good academic standing was not significantly different from the rate of some of the students admitted competitively, the retention rate of those not admitted was significantly different from the rates of all students who would be admitted using the proposed categories.

Means with the same letter are not significantly different.						
Tukey Grouping				**Mean**	**N**	**Proposed Admissions Category**
A				.7637	3412	01. GS: TGPA 2.50+
	B			.6221	299	02. GS: HSGPA 3.10+
	B	C		.6080	597	03. CO: THRS 24+; TGPA 1.00-2.49
		C		.5304	230	04. CO: TGPA 1.6-2.49; ACT 19+
			D	.3205	259	05. NA: Not Admitted

Table 13. Tukey-Kramer Letter Comparison of Retention Rates using Proposed Admissions Criteria

When the proposed admissions criteria was presented to the Retention Task Force and to other administrators involved in the process, a number of issues were discussed. First, the RTF agreed that the criteria needed to be revised. However, they were concerned that the proposed criteria would admit students, who would automatically be on academic probation due to their low transfer GPAs. Even though we currently allow many more students, who are on academic probation to be admitted than the proposed criteria would allow, the RTF was concerned the proposed criteria were not stringent enough. Second, the proposed criteria would not admit students, who would have been admitted under our first-time in college admissions criteria, if they had enrolled at WKU first instead of transferring to WKU after attending another institution.

At this time, IR still needs to meet with the Enrollment Management Division to discuss our findings and how they want to proceed. It will be up to Enrollment Management to weigh the data against their instincts. The data showed that a segment of transfer students admitted in poor academic standing did succeed. On the other hand, our instincts, as voiced by the RTF, would tell us that transfer students, who are admitted in poor academic standing, will not succeed. Additionally, Enrollment Management will have to decide if we should admit transfer students, who would have been admitted as FTIC students, but the data indicate will not be successful.

ADMISSION CRITERIA: READMITTED STUDENTS

One last area the RTF asked IR to evaluate was the readmission of students who returned to WKU, after leaving in poor academic standing. The RTF was concerned that we were simply readmitting these students without providing any support or guidance and expecting them to do better than they did when they were enrolled previously.

To assess the probable success of these students, IR developed a decision tree to predict the grade point average of students the first term they were enrolled as readmitted students. The model included students who were readmitted in the fall terms from 2002 through 2008. The following variables were selected as input variables: Hours earned at WKU, quality points earned at WKU, WKU GPA, total hours earned at the postsecondary level, total quality points earned at the postsecondary level, postsecondary education GPA, WKU GPA the last term enrolled before being readmitted, WKU GPA the next to last term enrolled before being readmitted, and academic standing the last term enrolled before being readmitted. These variables are all considered when determining a student's academic standing at WKU. A simplified depiction of the tree is shown in Figure 10. Once again, variables that further differentiated students with higher than average first readmit term GPAs were indicated in purple boxes as "Irrelevant factors." Nodes with first readmit term GPAs higher than the average of 2.34 were shaded green; those with averages close to the overall average were shaded yellow; those with GPAs lower than average, but higher than 2.00 were shaded orange, and those with GPAs lower than 2.00 were shaded red.

The tree identified two groups of students who were not successful as readmitted students: Students with a postsecondary grade point average below 0.91 (1.50 average first readmit term GPA; *n*=171) and students with a postsecondary GPA between 0.91 and 1.48 with a WKU GPA less than 0.81 for the last term they were enrolled at WKU prior to being readmitted (1.48 average first readmit term GPA; *n*=71). One group of students was right at the good standing mark of 2.00—those students with a postsecondary GPA between 1.49 and 1.72 and a WKU GPA less than 0.81 for the last term they were enrolled prior to being readmitted (*n*=56).

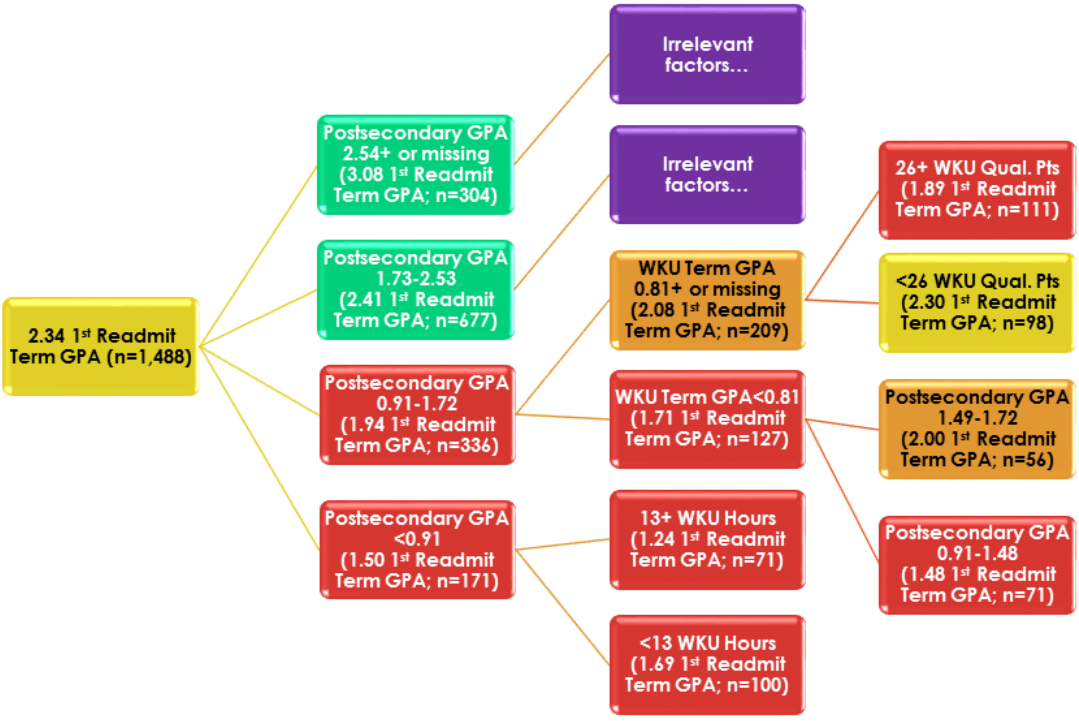


Figure 10. Decision Tree Predicting First Readmit Term GPA for Readmitted Students: Fall 2002-2008

IR used SAS® Enterprise Miner™ to develop a decision tree to predict the one-year retention of students readmitted after leaving in poor academic standing. Just like the tree developed to predict first readmitted term GPA, the model used students readmitted during the fall semesters of 2002 through 2008. The model also used the same independent variables that were used in the GPA model. A simplified version of the tree is shown in Figure 11. Once again the nodes were shaded to show retention rates relative to the average of 50% (*n*=1,594); The node with higher than average retention rate was shaded green, the node with a retention rate close to the average was shaded yellow, those nodes with retention rates below average but above 35% were shaded orange, and those nodes with retention rates below 35% were shaded red. Again, the factors that further differentiated retention rates for students with above average retention rates were included in an "Irrelevant factors" purple box.

Similar to the tree predicting first readmit term GPA, the most important factor predicting one-year retention was postsecondary grade point average. The next most important factor was the grade point average earned the last term the student was enrolled at WKU (.3631 importance), followed by WKU hours earned (.1568 importance).

What may seem odd about the tree is the retention rates of students with a postsecondary GPA between a 1.09 and 1.65. One would expect those students with higher WKU term GPAs to have higher retention rates, but those whose term GPA was between 0.29 and 1.02 or missing was higher (49%; *n*=83) than either those with a term GPA of 1.03 or higher (39%, *n*=99) or those with a term GPA below 0.29 (22%, *n*=60). Some of the fluctuation in the retention rate comes from the fact that the number of students in each node is small. What is also influencing this rate is that there are a few students in the node who are missing their term GPA, which means they received academic renewal for the coursework for that term. These students tend to have high first readmit term GPAs and high retention rates.

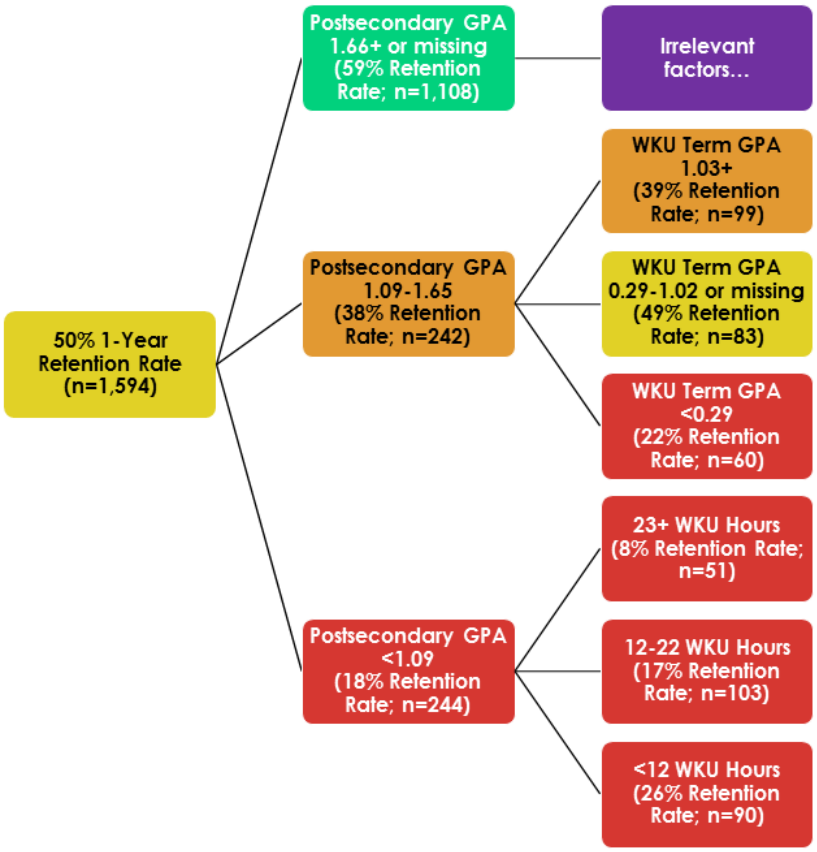


Figure 11. Decision Tree Predicting One-Year Retention for Readmitted Students: Fall 2002-2008

IR also used SAS® Enterprise Miner™ to develop a decision tree predicting six-year graduation of these students (*M*=27%, *n*=1,594). However, the best predictor for students with low graduation rates was having fewer than 81.5 or missing quality points (14% graduation rate, *n*=856), with WKU GPA further differentiating graduation rate; Only 4% of those with a WKU GPA less than 1.12 (*n*=263) graduated in six years, while 18% of those with a higher or missing WKU GPA (*n*=593) graduated during the same time frame. The students with missing quality points and WKU GPAs complicated the analysis because they had received academic renewal, meaning all of their previous postsecondary coursework was zeroed out so they could not count the grades, nor the courses toward their degree. These students were included with the students with low quality points, but higher WKU GPAs.

Due to the fact that quality points, which are a function of the number of hours a student has completed, cannot be used in admissions decisions, IR used only the first readmitted term GPA and one-year retention decision tree models to develop proposed readmissions criteria, which are shown in Table 14.

To develop the criteria, some of the actual cutoffs in the decision tree were rounded to the nearest grade point to make the proposed admissions categories simpler. Students who had received academic renewal had a very high average first readmitted term GPA (3.13; *n*=120) and one-year retention rates (69%; *n*=120), but they had a very low six-year graduation rate (18%). The low graduation rate is to be expected because these students are basically starting over on their postsecondary work. However, when looking at the 90 students in the sample, who would have had eight years to graduate, only 3 more students graduated in eight years instead of six. While the group of students receiving academic renewal deserves more study, it is beyond the scope of this paper.

While the overall WKU GPA was not a significant factor predicting first readmitted term GPA for those students with at least a 2.00 postsecondary GPA, students with a WKU GPA less than 2.00 would

automatically be placed on probation, so IR proposed placing them in a competitive admissions category instead of admitting them in good standing. What is interesting about this group of students is that their first readmitted term GPA (*M*=2.45, *n*=95) was lower than the GPA for those with a WKU GPA over 2.00 (*M*=2.68, *n*=525), but their one-year retention rate was higher (63% compared to 61%) and their six-year graduation rate was the highest of any proposed admissions group (46%).

Post-secondary GPA	Overall WKU GPA	Last WKU Term GPA	N	Average 1st Readmit Term GPA	1-Year Retention Rate	6-Year Graduation Rate	Suggested Admission
2.00+	2.00+		525	2.68	61%	38%	Good Standing (GS)
2.00+	<2.00		95	2.45	63%	46%	Competitive (CO)
1.00-1.99		1.00+	392	2.24	48%	26%	Competitive (CO)
1.50-1.99		<1.00	182	2.16	47%	24%	Competitive (CO)
1.00-1.49		<1.00	85	1.71	27%	7%	Not Admitted (NA)
<1.00			195	1.52	16%	3%	Not Admitted (NA)
Missing (Academic Renewal)			120	3.13	69%	18%	Competitive (CO)

Table 14. Proposed Readmissions Criteria

To see if the mean first readmitted term GPAs were statistically different for the proposed admissions categories, IR ran a one-way ANOVA using the proposed readmissions categories to predict first readmitted term GPA. The ANOVA found there were significant differences in the mean GPAs, $F(6,1483) = 34.79$, $p < .0001$. The results from a Tukey-Kramer post-hoc test of the means is shown in Table 15. As expected, the students who received academic renewal had an average GPA that was higher and statistically different from all the other mean GPAs. Students with postsecondary GPAs of 2.0 or higher had similar first readmitted term GPAs, regardless of their overall WKU GPA. Students who would be competitively admitted, excluding those with academic renewal all had similar mean GPAs. Also, students who would not be admitted showed statistically different mean GPAs compared to all other groups.

Means with the same letter are not significantly different.					
Tukey Grouping			Mean	N	Proposed Admissions Category
A			3.13	100	7. CO: Postsecondary GPA missing; Academic renewal
	B		2.68	497	1. GS: Postsecondary GPA 2.0 +; WKU GPA 2.0 +
	B	C	2.45	91	2. CO: Postsecondary GPA 2.0 +; WKU GPA < 2.00
		C	2.24	374	3. CO: Postsecondary GPA 1.00-1.99; WKU TGPA 1.00+
		C	2.16	169	4. CO: WKU TGPA < 1.0 ; Postsecondary GPA 1.50-1.99
			D	1.71	78	5. NA: WKU TGPA < 1.0 ; Postsecondary GPA 1.00-1.49

Table 15. Tukey-Kramer Letter Comparison of 1st Readmitted Term GPA by Proposed Readmissions Criteria

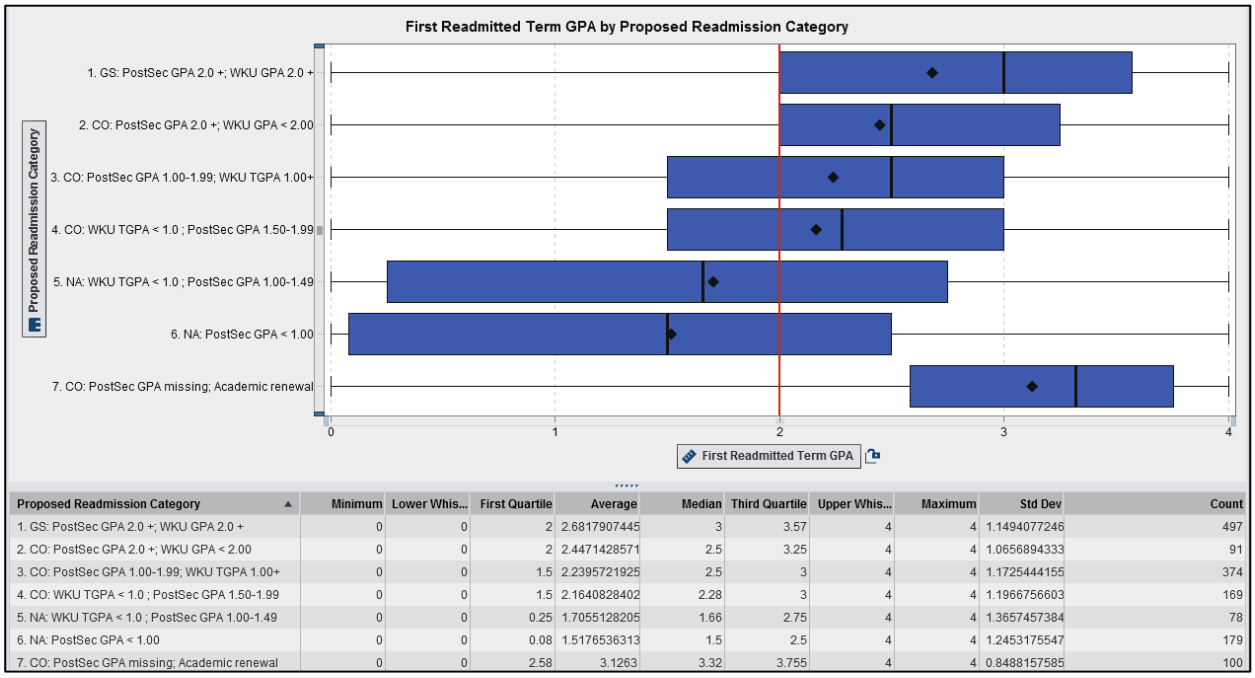
To see if the retention rates were statistically different for students in each of the proposed admissions categories, IR ran a one-way ANOVA using the proposed admissions categories to predict retention. The ANOVA found there were significant differences in the retention rates, $F(6, 1587) = 28.78$, $p < .0001$. The Tukey-Kramer post-hoc test of the means is shown in Table 16. The average retention rates did not split as neatly as the first readmitted term GPAs. The average retention rate for the students admitted in good standing was not statistically different from the retention rates of any of the competitive admissions categories. However, the retention rate of students who would not be admitted was significantly different from the retention rates of any of the student groups who would be admitted.

Means with the same letter are not significantly different.

Tukey Grouping				Mean	N	Proposed Admissions Category
A				0.6917	120	7. CO: Postsecondary GPA missing; Academic renewal
A	B			0.6316	95	2. CO: Postsecondary GPA 2.0 +; WKU GPA < 2.00
A	B	C		0.6095	525	1. GS: Postsecondary GPA 2.0 +; WKU GPA 2.0 +
	B	C		0.4847	392	3. CO: Postsecondary GPA 1.00-1.99; WKU TGPA 1.00+
		C		0.4670	182	4. CO: WKU TGPA < 1.0 ; Postsecondary GPA 1.50-1.99
			D	0.2706	85	5. NA: WKU TGPA < 1.0 ; Postsecondary GPA 1.00-1.49

Table 16. Tukey-Kramer Letter Comparison of One-Year Retention Rate by Proposed Readmissions Criteria

To visually examine the first readmit term GPA, one-year retention, and six-year graduation rates of students by the proposed readmission criteria, IR used SAS® Visual Analytics to produce graphs. A box plot of the average first term GPAs is shown in Figure 12. The plot very quickly shows the distribution of GPAs by readmissions categories and the extremely high GPA of the students who received academic



Proposed Readmission Category	Minimum	Lower Whis...	First Quartile	Average	Median	Third Quartile	Upper Whis...	Maximum	Std Dev	Count
1. GS: PostSec GPA 2.0 +; WKU GPA 2.0 +	0	0	2	2.6817907445	3	3.57	4	4	1.1494077246	497
2. CO: PostSec GPA 2.0 +; WKU GPA < 2.00	0	0	2	2.4471428571	2.5	3.25	4	4	1.0656894333	91
3. CO: PostSec GPA 1.00-1.99; WKU TGPA 1.00+	0	0	1.5	2.2395721925	2.5	3	4	4	1.1725444155	374
4. CO: WKU TGPA < 1.0 ; PostSec GPA 1.50-1.99	0	0	1.5	2.1640828402	2.28	3	4	4	1.1966756603	169
5. NA: WKU TGPA < 1.0 ; PostSec GPA 1.00-1.49	0	0	0.25	1.7055128205	1.66	2.75	4	4	1.3657457384	78
6. NA: PostSec GPA < 1.00	0	0	0.08	1.5176536313	1.5	2.5	4	4	1.2453175547	179
7. CO: PostSec GPA missing; Academic renewal	0	0	2.58	3.1263	3.32	3.755	4	4	0.8488157585	100

Figure 12. First Readmitted Term GPA Box Plot by Proposed Readmissions Categories: Fall 2002-2008 Readmitted Students

renewal. Notice the mean and median GPAs for all admitted categories were above 2.00, while the majority of students who would not be admitted had GPAs that fell below a 2.00.

The bar chart of one-year retention rates of students by proposed admissions category is shown in Figure 13. Again, the graph quickly highlights the very high retention rate of those who received academic renewal and the higher than expected retention rate of students with postsecondary GPAs of 2.00 or higher and WKU GPAs less than 2.00.

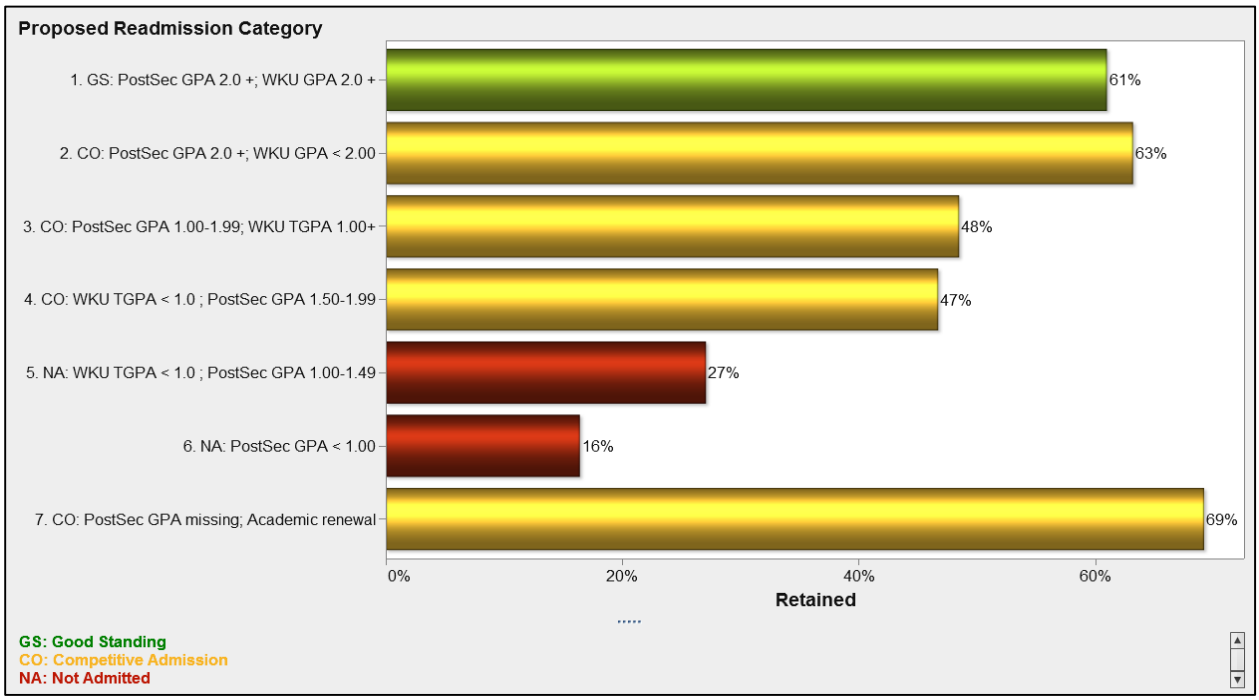


Figure 13. One-Year Retention Rates of Readmitted Students by Proposed Readmissions Categories: Fall 2002-2008

While a model predicting six-year graduation was not used to determine the readmission categories, the ultimate goal is for these students to graduate with a degree. Looking at the graduation rates in SAS® Visual Analytics, as shown in Figure 14, helps show the relation between the readmissions categories and graduation rates.

Again, the students with a postsecondary GPA of 2.00 or better, but a WKU GPA less than 2.00, stand out because of their high graduation rate. The graph also visually points out the unusually low graduation rate of students who received academic renewal.

At the time of this paper, IR had not yet presented the results of the readmission criteria analyses to the Retention Task Force and Enrollment Management Administrators. When we do, we plan to present the graphs produced using SAS® Visual Analytics as they convey the results of our analyses well. With the analyses, we now have a much better understanding of what happens to our students who are readmitted after leaving in poor academic standing. First, there are some students who have very little chance of success that we should consider not readmitting. Second, there are some students who have a decent chance of success, but who might benefit from support services to help them stay on track. Third, further research needs to be done on our students who receive academic renewal to understand their success or lack thereof. The analyses and visualizations provide a place for us to start our discussions.

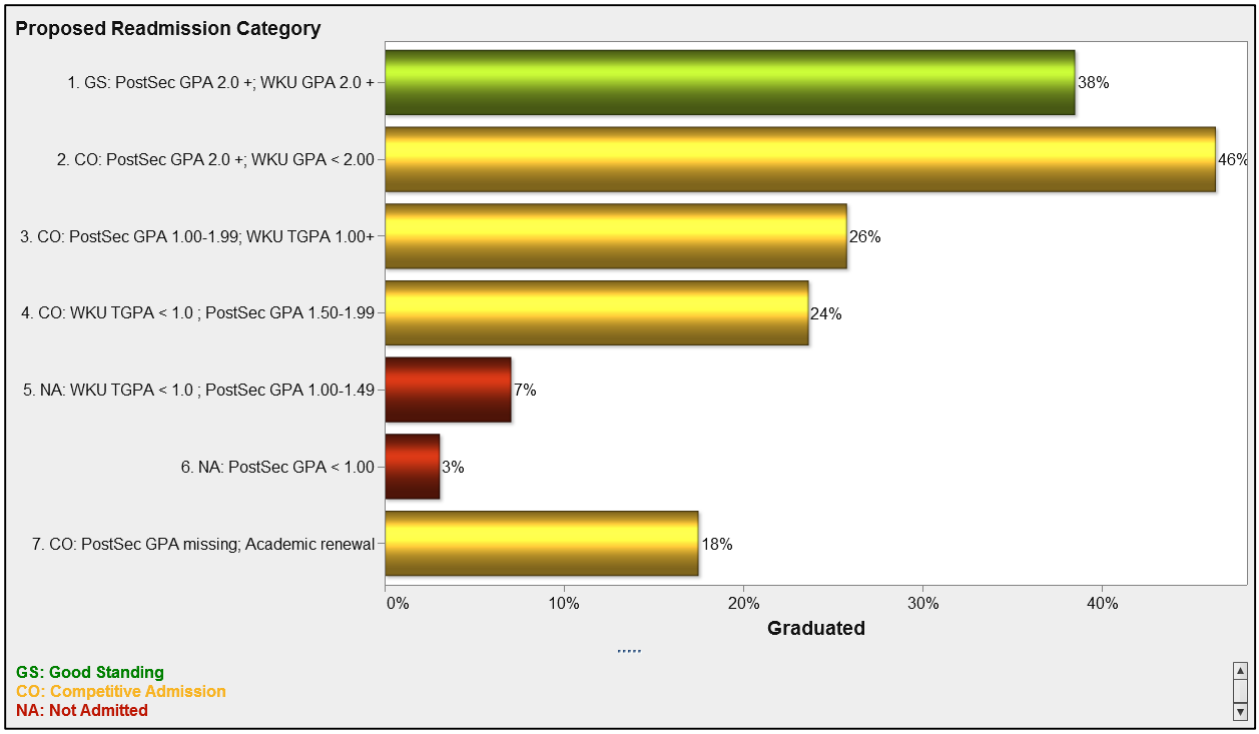


Figure 14. Six-Year Graduation Rates of Readmitted Students by Proposed Readmissions Categories: Fall 2002-2008

CONCLUSION

Often times, those of us in education administration believe we know what is best for our students. However, if we look at the data, we can often find examples where what we believed was beneficial to our students simply was not in their best interest. If we adopt a culture of evaluating and re-evaluating our policies with an eye toward continual improvement, we may find that what worked well in the past or what we thought was working well, has actually been detrimental to our students or needs to be refined to better serve our current population of students. Having said that, we must also operate within the parameters of reality knowing that change is often slow and even though we find statistically significant results, those results can only inform policy if we are able to provide them in an easy-to-understand, visual format that change agents can understand. At WKU we continue to evaluate our policies using research and visualizations that help us all understand what is happening with our students. As we get more sophisticated in our endeavors, we hope to continue to provide even more meaningful and useful analyses for our decision makers.

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