Paper 1448-2014

From Providing Support to Driving Decisions: Improving the Value of Institutional Research

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ABSTRACT

For almost two decades, Western Kentucky University's Office of Institutional Research (WKU-IR) has used SAS® to help shape the future of the institution by providing faculty and administrators with information they can use to make a difference in the lives of their students. This presentation provides specific examples of how WKU-IR has shaped the policies and practices of our institution and discusses how WKU-IR moved from a support unit to a key strategic partner. In addition, the presentation covers the following topics: How the WKU Office of Institutional Research developed over time; Why WKU abandoned reactive reporting for a more accurate, convenient system using SAS® Enterprise Intelligence Suite for Education; How WKU shifted from investigating what happened to predicting outcomes using SAS® Enterprise Miner™ and SAS® Text Miner; How the office keeps the system relevant and utilized by key decision makers; What the office has accomplished and key plans for the future.

INTRODUCTION

In the children's book, *Stuck*, Oliver Jeffers (2011) tells the story of a little boy named Floyd, who got himself into an awful mess when his kite got stuck up in a tree. To get his kite down, he threw his shoe into the tree and it also got stuck. He then threw his other shoe up in the tree and it too got stuck. Next he threw a ladder, a bucket of paint, a duck, a chair, a bicycle, the family car, an orangutan, the milkman, a fire truck, a boat, and a whale, and they all got stuck in the tree. While Floyd's actions might seem silly to adults, how many times do we sit in committee meetings and instead of trying to understand what it would take to solve a problem, we throw money, marketing, or staff time into masking the problem or giving excuses as to why the numbers look like they do? Instead of even admitting there is a problem, we sometimes throw out ideas just to take the focus off of anything that makes us look like we could do anything better than we already do.

In the end, Floyd's kite came unstuck by itself and floated down to him. He was so busy throwing things up in the tree, he had forgotten all about his kite. We sometimes get so busy implementing initiatives that we forget about the problem we were trying to solve in the first place. We implement one student retention or recruitment initiative after another, never coming back to see if what we are doing is making any difference. And sometimes, once we start initiatives, even with data to show they are not providing much in return, we keep doing them, just in case they help one or two students.

Once Floyd's kite came down he was so excited, he took it and flew it the rest of the day. That night as he was lying in bed he kept thinking there was something he had forgotten. Of course, his shoes, the ladder, the paint, the duck, the chair, the bicycle, the car, the orangutan, the milkman, the fire truck, the boat and the whale were all still in the tree where he had left them. And just like Floyd, we sometimes forget about all the work that goes into maintaining initiatives once they are implemented. It is not often that we take the time to create what Jim Collins (2003) calls a "Stop Doing" list, the antithesis to the "To Do" list. We sometimes take on projects or implement initiatives without coming back and evaluating whether we should keep doing or stop doing them. A few years ago we looked at the mission of the Institutional Research office and how what we were doing aligned with our mission. We had a full-time staff member dedicated to developing, printing, scanning, and analyzing the results of surveys for any unit on campus that requested our help. While it was a great service for those units, it was not a part of our mission to perform these tasks. In fact, many of the surveys needed to be moved online. We had taken on the role of providing those services, not because it was part of our mission, but because we had the expertise to do so. We chose to stop providing those services and suggested the units utilize online surveys instead. By taking this step, we gained a full-time researcher and analyst to perform work for us and not a single person complained about us not providing those services.

In this paper we will describe how we stopped throwing ideas at problems and moved toward understanding them enough to find real solutions, at the same time getting the information on the desktop of the faculty and staff in the trenches dealing with the problems on a daily basis. We will also provide examples of the information we have provided to decision makers and those who could make a difference for our students and the results of some of those efforts.

HOW WKU-IR DEVELOPED OVER TIME

In the early 1990's WKU-IR was comprised of a director, two professional staff, and a part-time office associate. Our main tasks included reporting data to the state coordinating board and the federal Integrated Postsecondary Education Data System (IPEDS), producing a fact book and accountability reports, conducting student evaluations of faculty and courses, and administering student and alumni surveys. We reported to the Provost and Vice President for Academic Affairs, so our primary focus was within the academic affairs division. Twenty years later our office is comprised of a director, eight professional staff, and a full-time support services coordinator. Our main tasks each year now include responding to over 30 external surveys, such as *U.S. News and World Report*, completing 250-300 ad hoc requests for data and analyses, administering student evaluations of faculty and courses as well as a bottom-up evaluation of department heads, deans and the Provost. We are still the collectors, editors, and producers of official university data submitted to our state coordinating board and IPEDS. We still produce an annual Fact Book and conduct university-wide surveys as requested. We continue to provide data and analysis for academic program review and university strategic planning. However, in the area of internal data reporting and analysis, our focus has shifted from reporting what happened in the past to predicting enrollment, revenues, retention, graduation, and student success. Our predictions are then used in recruitment and marketing campaigns, student admission and placement, campus-wide retention efforts, and budget discussions.

While our focus has shifted, we remain cognizant of the fact that collecting, editing, and organizing our data is the most important part of our job. And we did not arrive at that conclusion overnight. It took years of going through the annual reporting cycle to realize that continually "improving" our procedures each semester was detrimental to our longitudinal data collection and analyses. Our practice of continually changing how we collected and stored our data from term to term had our analysts fixing data every time they started an ad hoc request or project. In 2007, we spent months editing our data and programs and developed standard operating procedures (SOPs) for collecting, editing, documenting, and storing our data on our internal data warehouse. Those months have paid off exponentially in time savings and data quality.

FROM REACTIVE TO PREDICTIVE

Even in the 1990's WKU-IR was the go-to office for research about the institution. We conducted studies to determine

- which of our many student success initiatives actually made an impact on student success
- whether offering chemistry to students in high school helped students be more successful in college compared to their counterparts
- whether our developmental education courses actually prepared students for college-level courses
- reasons why students who applied to WKU did not enroll at WKU
- reasons why former WKU students transferred to another school.

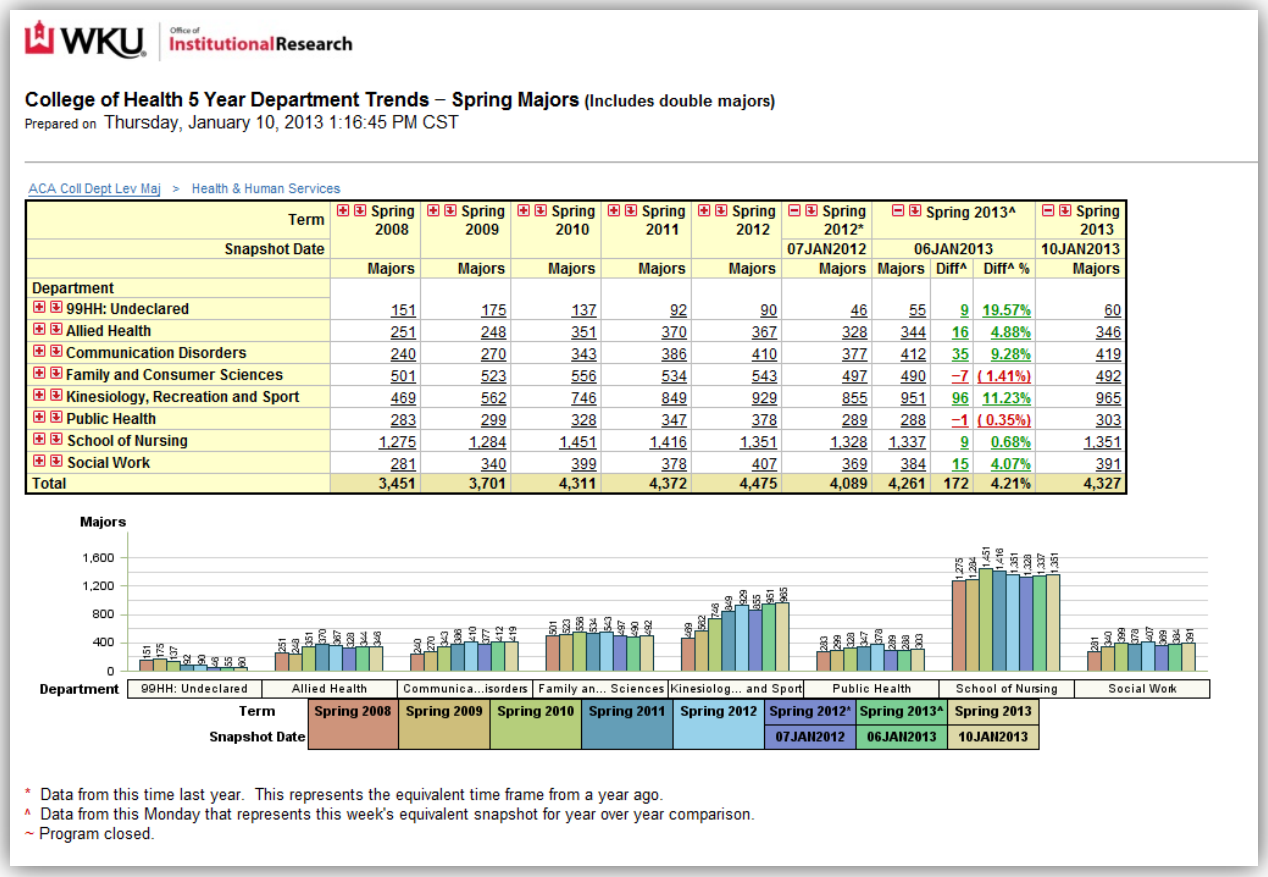
Yet, after spending months on some of these projects, our reports would often receive a "Well, isn't that interesting?" response and nothing would happen.

There were a number of factors that moved us toward being a unit that helped drive decisions. First, we were diligent about consistency. Once we cleaned up our data, we made sure the numbers on every report that came out of our office matched numbers we previously reported or numbers reported elsewhere. When the President saw numbers at a presentation from our coordinating board, they matched numbers in our Fact Book. When we produced faculty workload reports, they matched the number of faculty reported to IPEDS. It took years of consistently reporting the data for the campus community to trust our work. Another factor that influenced our work was a cultural shift on our campus to make decisions only based on facts, not suppositions. Now, major decisions are not made unless our decision makers see the data behind the issues they are evaluating.

IMPLEMENTING SAS® ENTERPRISE INTELLIGENCE SUITE FOR EDUCATION

After we cleaned our data and began reporting it consistently, our next step was to figure out how to provide the information to key decision makers on demand. The SAS® Enterprise Intelligence Suite for Education was available to do just that. Like most other institutional research offices, we produce an annual Fact Book, which provides a five-year snapshot of data about the institution such as enrollment, retention and graduation, faculty and staff, revenues and expenditures, student financial assistance, and alumni. In fact, our Fact Book can be accessed at http://www.wku.edu/instres/fact_book.php. One limitation of the Fact Book is that it just cannot provide all the data needed by our constituents in the format they need it. Also, by the time the Fact Book is published, the data are out of date. Additionally, it can only show so many semesters worth of data. Our Fact Book shows only fall semesters, which is not helpful if someone is planning for the winter, spring, or summer terms.

On the other hand, the SAS® Enterprise Intelligence Suite allows access to the data as soon as it is in the system and allows the user to determine how many and which terms he or she wants to see. It also allows users to add variables to tables and move them from rows to columns, to isolate specific variables and allows users to add or delete measures within the table. The example shown in Figure 1 shows the official counts of majors in the College of Health for spring 2008 through spring 2012. In addition, the table shows a comparison of majors to the same time last year. And finally, the last column on the right, which is updated nightly, shows the most up-to-date count of majors for the current term.



WKU Office of Institutional Research

College of Health 5 Year Department Trends – Spring Majors (Includes double majors)

Prepared on Thursday, January 10, 2013 1:16:45 PM CST

ACA Coll Dept Lev Maj > Health & Human Services

Term	Spring 2008	Spring 2009	Spring 2010	Spring 2011	Spring 2012	Spring 2012*	Spring 2013^			Spring 2013
Snapshot Date						07JAN2012	06JAN2013			10JAN2013
	Majors	Majors	Majors	Majors	Majors	Majors	Majors	Diff^	Diff^ %	Majors
Department										
99HH: Undeclared	151	175	137	92	90	46	55	9	19.57%	60
Allied Health	251	248	351	370	367	328	344	16	4.88%	346
Communication Disorders	240	270	343	386	410	377	412	35	9.28%	419
Family and Consumer Sciences	501	523	556	534	543	497	490	-7	(1.41%)	492
Kinesiology, Recreation and Sport	469	562	746	849	929	855	951	96	11.23%	965
Public Health	283	299	328	347	378	289	288	-1	(0.35%)	303
School of Nursing	1,275	1,284	1,451	1,416	1,351	1,328	1,337	9	0.68%	1,351
Social Work	281	340	399	378	407	369	384	15	4.07%	391
Total	3,451	3,701	4,311	4,372	4,475	4,089	4,261	172	4.21%	4,327

* Data from this time last year. This represents the equivalent time frame from a year ago.
^ Data from this Monday that represents this week's equivalent snapshot for year over year comparison.
~ Program closed.

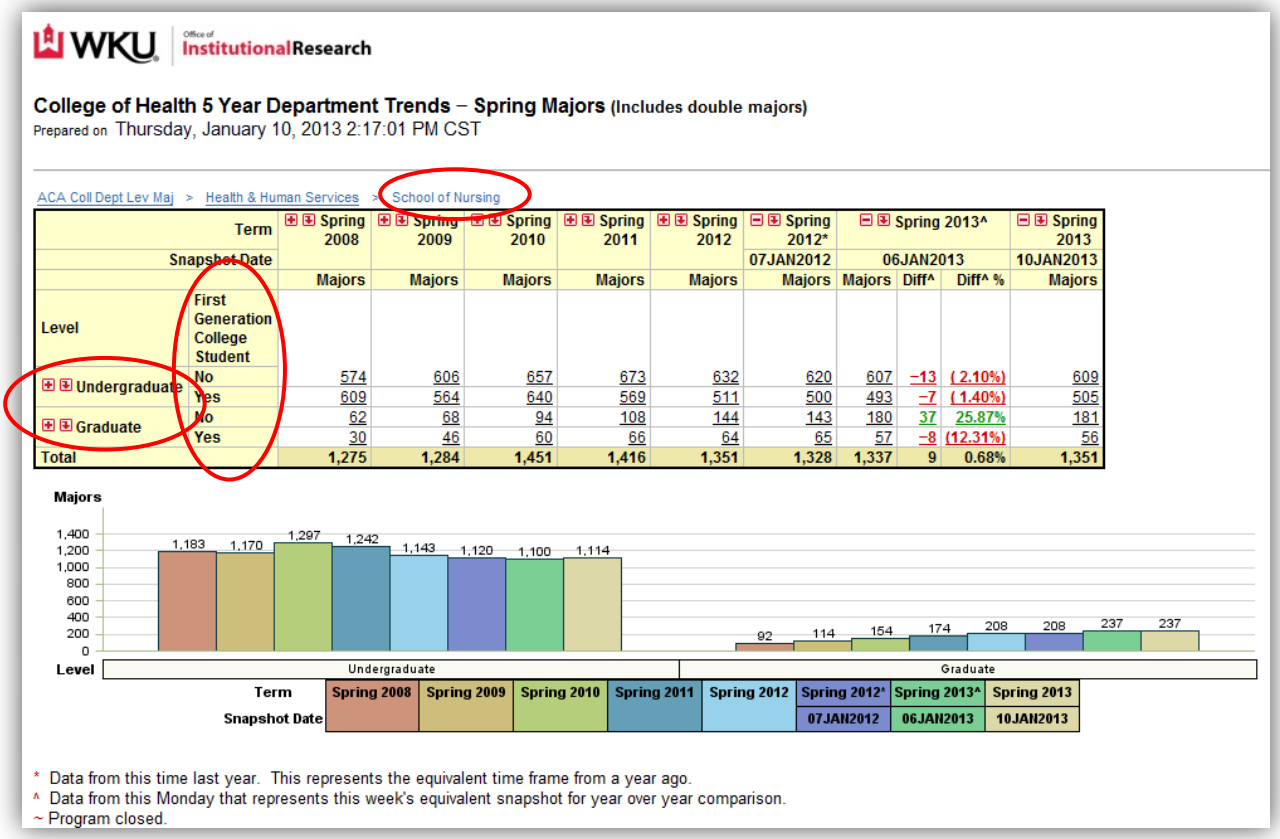
Figure 1. Spring Majors for College of Health

While this is an informative default table, a user might be interested in only the School of Nursing majors, by level and by first generation college student status. By drilling down on the School of Nursing, expanding the level to include undergraduate and graduate and adding first generation students to the table, the table in Figure 1 can easily by transformed into the table in Figure 2.

USING SAS® ENTERPRISE MINER™ AND SAS® TEXT MINER

To take our work a step further we not only have to provide information on what has happened and what is currently happening, we also have to use predictive analytics to help our users understand our students better. To conduct these analyses, we use SAS® Enterprise Miner™ and SAS® Text Miner. An age old problem in postsecondary education is predicting which students will remain enrolled and graduate and which will drop out or transfer to another institution, knowing what factors influence each behavior and being able to use that knowledge to intervene with students who might need help. Using predictive analytics, we not only know what factors have an influence on persistence versus attrition, but we can assess which students are more likely to persist and which are more likely to drop out. Using SAS® Enterprise Miner™ we built models that predict a student's likelihood of being retained from fall to spring, from fall to fall, and from entry to graduation. We then incorporated those models into the SAS® Enterprise Intelligence Suite so the data are easily retrievable by enrollment management personnel, advisors, program coordinators, deans, department heads, and faculty interested in intervening with our students. Figure 3 shows an example dashboard of our fall 2011 first-time student attrition risk analysis. Students are given attrition risk ratings of green (less than 21% chance of dropping out by fall 2012), yellow (21-40% chance of dropping out by fall 2012), light red (41-64% chance of dropping out by fall 2012) and dark red (65% or higher chance of dropping out by fall 2012). You will also notice a group given

the color blue, which indicates those students were not enrolled during the spring 2012 semester, putting them in a an extremely high risk group. The likelihood of a student not enrolled in spring returning the next fall is less than 10%. We separated out the students not enrolled in spring because we felt our users would want to distinguish between the students who were currently enrolled or and those who were not.



WKU Office of Institutional Research

College of Health 5 Year Department Trends – Spring Majors (Includes double majors)

Prepared on Thursday, January 10, 2013 2:17:01 PM CST

ACA Coll Dept Lev Maj > Health & Human Services > School of Nursing

Term	Spring 2008	Spring 2009	Spring 2010	Spring 2011	Spring 2012	Spring 2012*	Spring 2013^			Spring 2013
Snapshot Date						07JAN2012	06JAN2013			10JAN2013
	Majors	Majors	Majors	Majors	Majors	Majors	Majors	Diff^	Diff^ %	Majors
Level: First Generation College Student										
Undergraduate – No	574	606	657	673	632	620	607	−13	(2.10%)	609
Undergraduate – Yes	609	564	640	569	511	500	493	−7	(1.40%)	505
Graduate – No	62	68	94	108	144	143	180	37	25.87%	181
Graduate – Yes	30	46	60	66	64	65	57	−8	(12.31%)	56
Total	1,275	1,284	1,451	1,416	1,351	1,328	1,337	9	0.68%	1,351

* Data from this time last year. This represents the equivalent time frame from a year ago.
^ Data from this Monday that represents this week's equivalent snapshot for year over year comparison.
~ Program closed.

Figure 2. Spring Nursing Majors by Level and First Generation Status

By clicking on the dashboard shown in Figure 3, the user is then taken to a detailed table of the attrition risk of our majors by college, department and major, shown in Figure 4. At this point, the user is able to click on the underlined numbers in the chart to access the detailed data about the students in that specific cell.

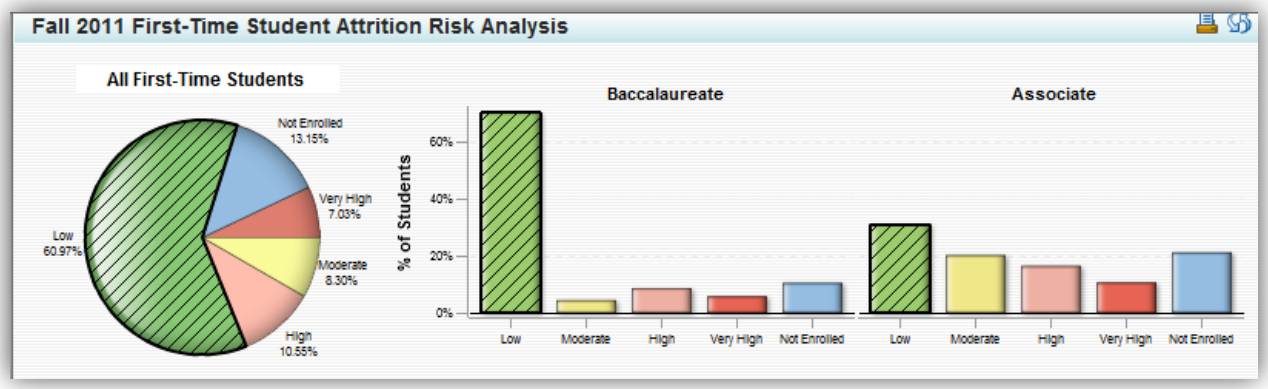
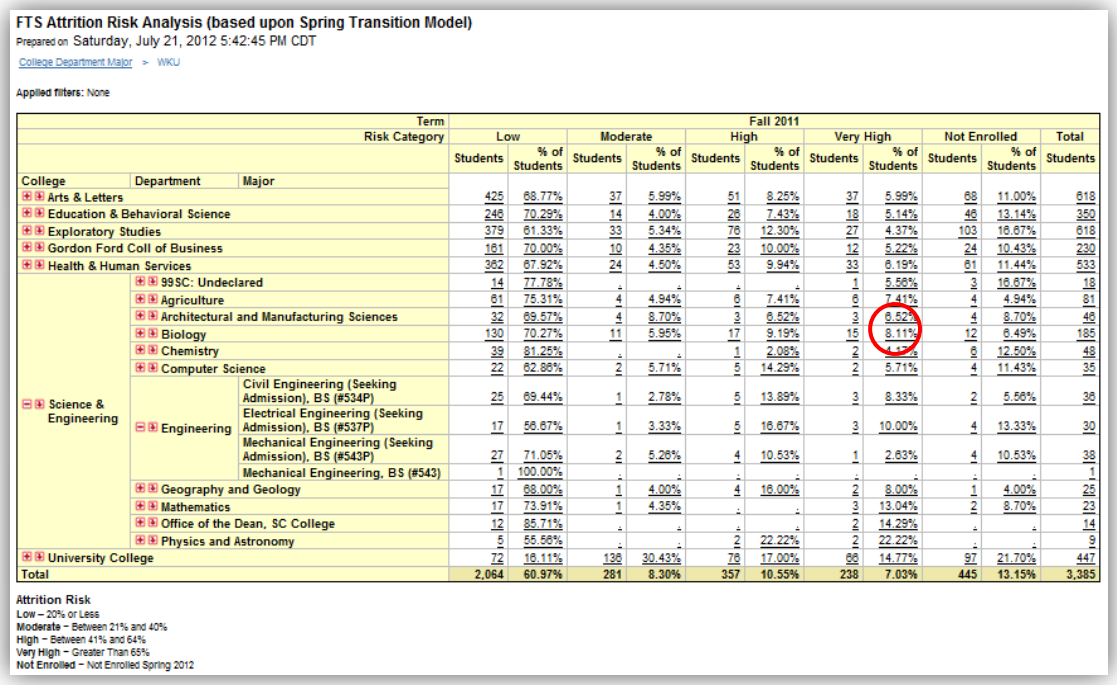


Figure 3. Attrition Risk Dashboard

For example, in Figure 4, an advisor might want to contact the 15 students in biology who are at a high risk of not being retained to fall 2012. The advisor simply clicks on the number 15 and data similar to those shown in Figure 5 are produced. The user can then view 63 columns of detailed data about those 15 students, including their contact information, the top four risk factors that placed them in the very high risk category, test scores, grade point averages, and hours earned, etc.



FTS Attrition Risk Analysis (based upon Spring Transition Model)

Prepared on Saturday, July 21, 2012 5:42:45 PM CDT

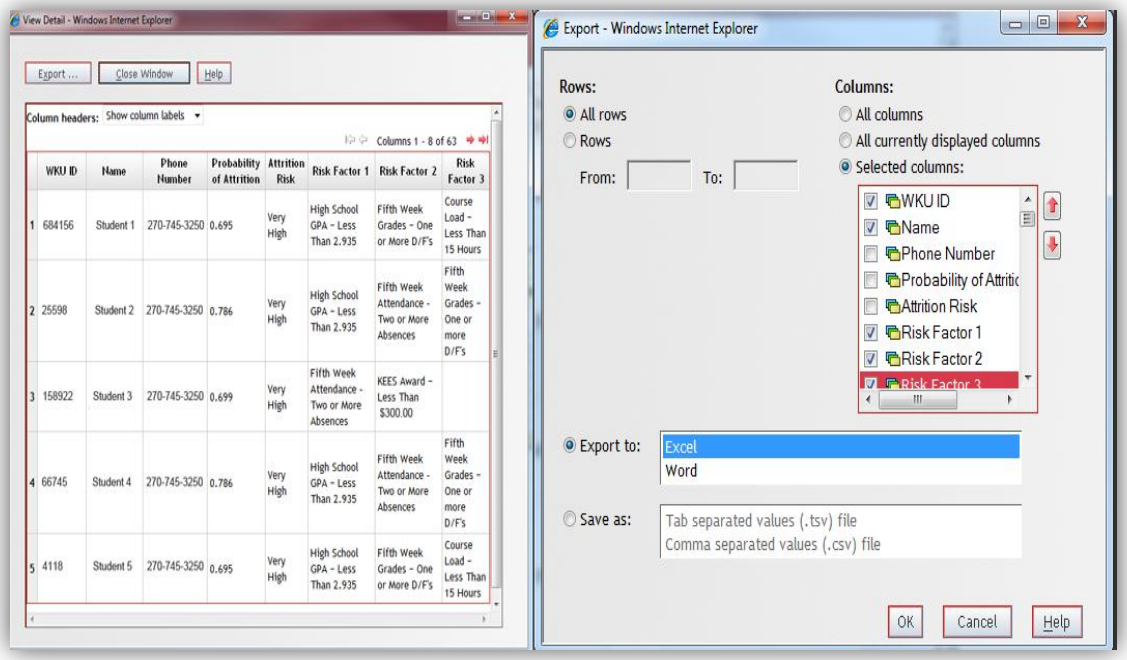
College Department Major > WKU

Applied filters: None

Term			Fall 2011									
Risk Category			Low		Moderate		High		Very High		Not Enrolled		Total
College	Department	Major	Students	% of Students	Students	% of Students	Students	% of Students	Students	% of Students	Students	% of Students	Students
Arts & Letters			425	68.77%	37	5.99%	51	8.25%	37	5.99%	68	11.00%	618
Education & Behavioral Science			246	70.29%	14	4.00%	26	7.43%	18	5.14%	46	13.14%	350
Exploratory Studies			379	61.33%	33	5.34%	76	12.30%	27	4.37%	103	16.67%	618
Gordon Ford Coll of Business			161	70.00%	10	4.35%	23	10.00%	12	5.22%	24	10.43%	230
Health & Human Services			362	67.92%	24	4.50%	53	9.94%	33	6.19%	61	11.44%	533
Science & Engineering	99SC: Undeclared		14	77.78%	.	.	.	.	1	5.56%	3	16.67%	18
	Agriculture		61	75.31%	4	4.94%	6	7.41%	6	7.41%	4	4.94%	81
	Architectural and Manufacturing Sciences		32	69.57%	4	8.70%	3	6.52%	3	6.52%	4	8.70%	46
	Biology		130	70.27%	11	5.95%	17	9.19%	15	8.11%	12	6.49%	185
	Chemistry		39	81.25%	.	.	1	2.08%	2	4.17%	6	12.50%	48
	Computer Science		22	62.86%	2	5.71%	5	14.29%	2	5.71%	4	11.43%	35
	Engineering	Civil Engineering (Seeking Admission), BS (#534P)	25	69.44%	1	2.78%	5	13.89%	3	8.33%	2	5.56%	36
		Electrical Engineering (Seeking Admission), BS (#537P)	17	56.67%	1	3.33%	5	16.67%	3	10.00%	4	13.33%	30
		Mechanical Engineering (Seeking Admission), BS (#543P)	27	71.05%	2	5.26%	4	10.53%	1	2.63%	4	10.53%	38
		Mechanical Engineering, BS (#543)	1	100.00%	.	.	.	.	.	.	.	.	1
	Geography and Geology		17	68.00%	1	4.00%	4	16.00%	2	8.00%	1	4.00%	25
	Mathematics		17	73.91%	1	4.35%	.	.	3	13.04%	2	8.70%	23
	Office of the Dean, SC College		12	85.71%	.	.	.	.	2	14.29%	.	.	14
	Physics and Astronomy		5	55.56%	.	.	2	22.22%	2	22.22%	.	.	9
University College			72	16.11%	136	30.43%	76	17.00%	66	14.77%	97	21.70%	447
Total			2,064	60.97%	281	8.30%	357	10.55%	238	7.03%	445	13.15%	3,385

Attrition Risk
Low – 20% or Less
Moderate – Between 21% and 40%
High – Between 41% and 64%
Very High – Greater Than 65%
Not Enrolled – Not Enrolled Spring 2012

Figure 4. Attrition Risk by College, Department, & Major



View Detail - Windows Internet Explorer

Export ... | Close Window | Help

Column headers: Show column labels — Columns 1 - 8 of 63

	WKU ID	Name	Phone Number	Probability of Attrition	Attrition Risk	Risk Factor 1	Risk Factor 2	Risk Factor 3
1	684156	Student 1	270-745-3250	0.695	Very High	High School GPA - Less Than 2.935	Fifth Week Grades - One or More D/F's	Course Load - Less Than 15 Hours
2	25598	Student 2	270-745-3250	0.786	Very High	High School GPA - Less Than 2.935	Fifth Week Attendance - Two or More Absences	Fifth Week Grades - One or more D/F's
3	158922	Student 3	270-745-3250	0.699	Very High	Fifth Week Attendance - Two or More Absences	KEES Award - Less Than $300.00	
4	66745	Student 4	270-745-3250	0.786	Very High	High School GPA - Less Than 2.935	Fifth Week Attendance - Two or More Absences	Fifth Week Grades - One or more D/F's
5	4118	Student 5	270-745-3250	0.695	Very High	High School GPA - Less Than 2.935	Fifth Week Grades - One or More D/F's	Course Load - Less Than 15 Hours

Export - Windows Internet Explorer

Rows:
- All rows
- Rows
- From: To:

Columns:
- All columns
- All currently displayed columns
- Selected columns:
  - WKU ID
  - Name
  - Phone Number
  - Probability of Attritic
  - Attrition Risk
  - Risk Factor 1
  - Risk Factor 2
  - Risk Factor 3

Export to: Excel / Word

Save as: Tab separated values (.tsv) file / Comma separated values (.csv) file

OK | Cancel | Help

Figure 5. Detailed Student Data from Attrition Risk Model

KEEPING THE SYSTEM RELEVANT AND UTILIZED

Implementing the SAS® Enterprise Intelligence Suite was only half of the battle. Keeping it relevant and utilized is an ongoing process. We have power users who tout the benefits of the system and who often suggest new ways to use the system. We train new administrators and 20-30 new faculty and staff users each year and have presented the system at our state-wide and university student success conferences. The hardest part is finding the time to develop more applications within the system. The key to keeping the system relevant and utilized is putting out applications that a number of users can use to meet their individual needs. We have tried to make the system flexible enough to help the niche consumers on campus, without having to develop special programs just for them. One application we have developed tracks the course taking patterns of students. The application is a stored process in which the users select a specific major, the types of courses to include or exclude, and the type of output they want—a heat map or raw data. The stored process produces results similar to those shown in Figure 6.

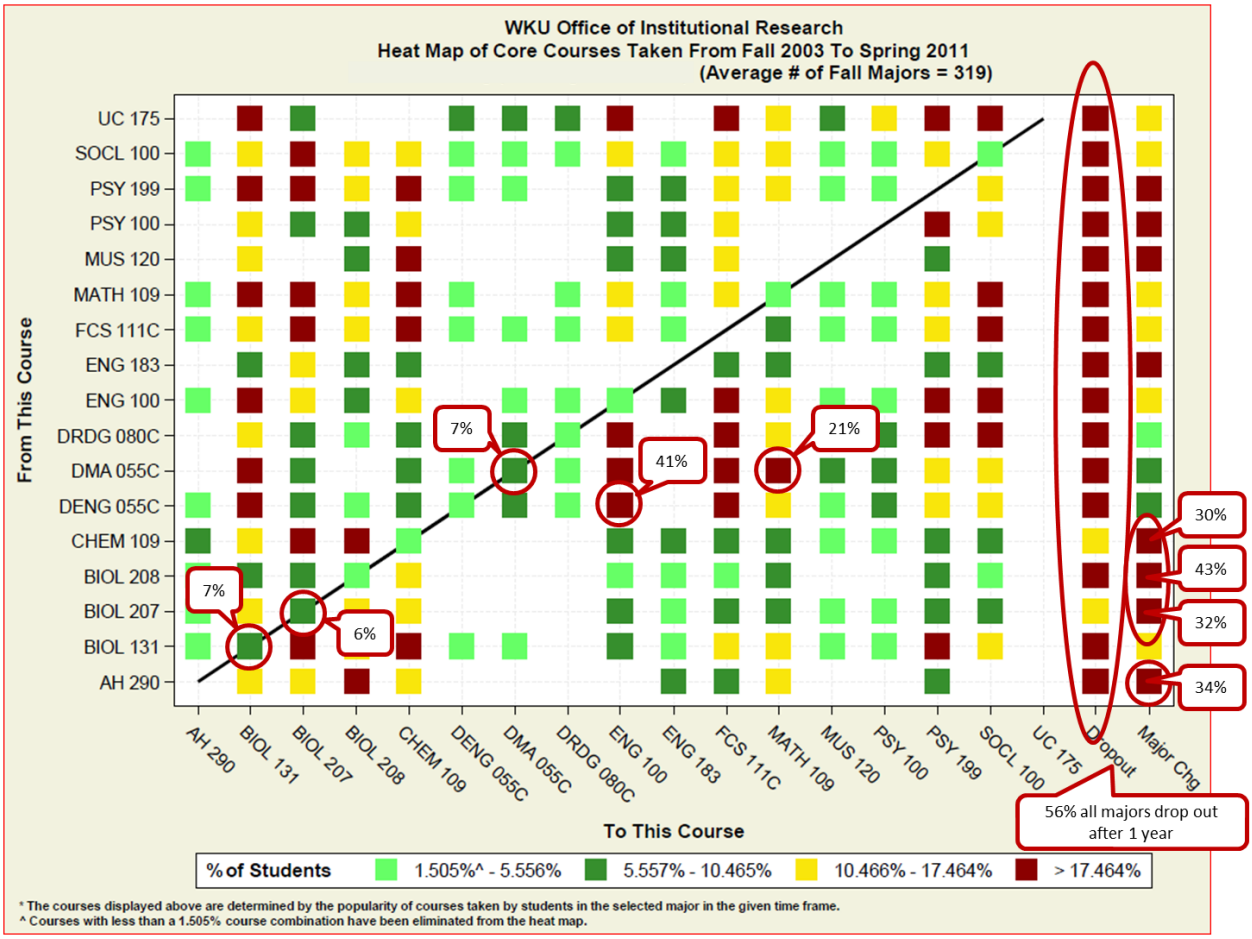


Figure 6. Course Taking Patterns of a Health Related Major

The results show the courses students took on the y axis, by their behavior the following term, shown on the x axis. The x axis shows the courses taken most frequently the next semester, whether the students dropped out of school the next semester or if they changed their major the following term. The first thing to notice about the graph is the diagonal line showing students repeating courses the following semester. You will notice that 7% of these majors repeat BIOL 131 and 6% repeat BIOL 207, both of which happen to be gate keeper courses for this major. The major is actually a place holder for students who are seeking admission to a highly competitive, high demand major, and their chances of admission depend on successfully completing the two biology courses.

The second point to note is that 7% of students taking DMA055C repeat the course the next semester, while 21% take MATH109 the following semester. DMA055C is a developmental math course for which students get no college credit. Students placed into DMA 055C have to pass that course, then take DMA096C, another developmental math course, then take MATH116, a college level algebra course to satisfy the math requirements of some majors. What is most

interesting is that students in this particular program are not required to take MATH116--they can take a general math course, MATH109, which has no developmental courses preceding it. If students successfully complete MATH 109, they have met their math requirement, without taking any developmental courses. You can see that 21% of the students in this health major figure this out after they take DMA055C, then switch to MATH 109 the next semester instead of plowing through two more classes. This highlights an issue we found and brought to the attention of our Retention Task Force, which is charged with improving retention and graduation rates of our students across campus. By default, students were being advised to take the three algebra courses, even though their major required only MATH 109. After the Retention Task Force was made aware of the situation and chose to act, we moved students out of the algebra track and into MATH 109 courses. We saw math completion rates go from 10% to 65%, just by moving students who do not need all three algebra courses into MATH 109. We also made the default placement match up with the student's major, fixing a problem caused by staff placing all students in the algebra track even though only 9% of students ever changed to an algebra track major and needed all three courses.

Another point to notice from the heat map in Figure 6 is that 41% of students who take the developmental course DENG 055C, take the college level English course, ENG 100, the following semester. This percentage is probably lower than one would expect, but not when you consider that 56% of all majors drop out after one year, another issue highlighted on the heat map.

The final take away from the heat map is the large proportion of students who change their major after they take CHEM 109 (30%), BIOL 208 (43%), BIOL 207 (32%) and AL 290 (34%). The large proportion of major changes is somewhat expected as students seeking admission to this health major either realize it is not for them, or they do so poorly in these gatekeeper courses they realize they have little chance of getting admitted to the program.

ACCOMPLISHMENTS AND KEY PLANS FOR THE FUTURE

By delivering relevant data and analyses on demand, our workload has shifted from simply reporting what has happened to predicting future outcomes. We have developed retention models that were used to develop our new admissions criteria. We have developed student success models that have been used to place students into support programs to make sure those students who need additional help are receiving it. We have predicted enrollment and tuition revenues to help with the budgeting process. Our analyses have been used for targeted recruiting, forcing us to think more strategically about whom we are recruiting instead of casting a wide net and hoping the best students will come.

Key plans for the future include developing models to find key check points for success in specific majors, whether it is successfully completing a specific course, taking a specific sequence of courses, or earning a certain number of credits at a critical time. Developing flexible stored processes to allow users to track the success of their students from one term to another, as well as revealing bottlenecks in our processes are all on the table. Additionally, we plan to implement SAS® Visual Analytics in the near future to allow our users to further explore and analyze our data visually.

CONCLUSION

By cleaning up our data, reporting it consistently, and moving from throwing ideas at problems toward analyzing the impact of our efforts and assessing which students will likely need intervention, we have moved IR from “Institutional Reporting” to “Institutional Research.” By providing our constituents with on demand access to the data they need to do their jobs more efficiently, we are now asked to provide analyses that drive many university decisions. From staffing, to recruiting, to student services, to budgeting, our institution is moving toward proactive decision making through the use of analytics.

REFERENCES

Collins, J. (Dec 30, 2003). Best New Year's Resolution? A 'Stop Doing' List. *USA Today*. Retrieved from http://www.jimcollins.com/article_topics/articles/best-new-years.html.

Jeffers, O. (2011). *Stuck*. Great Britain: Harper Collins Children's Books.

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