Association for
Institutional Research

The AIR Professional File
SPRING 2019 VOLUME

Supporting quality data and decisions for higher education.

Letter from the Editor

Welcome to the Spring 2019 volume of *The AIR Professional File*. This volume presents two "how-to" articles designed to guide readers through implementation processes for assessment and data management.

Association for Institutional Research

Have you ever wished that your institution could have a dedicated assessment day to collect information on student learning? Have you ever wondered what it would take to pull it off? Our colleagues from James Madison University have been doing it for more than 30 years. In University-wide Assessment Days: The James Madison University Model, they share what they have learned about the logistics and challenges of implementing university assessment days. Their blueprint for success may inspire you to adopt some of their strategies for your own institution.

Facing a different kind of situation, our colleagues from University of Western States describe how they took their institution from Data Crisis to Data-Centric by eliminating the data silos and shadow systems that engendered mistrust and replacing them with an integrated data management system commended by regional accreditors. They provide readers with detailed guidance on issues of data governance, personnel, and systems. Their remarkable turnaround is impressive!

These "how-to" articles illustrate ways in which a single institution can serve as a model for others that can benefit from these experiences. Consider sharing your own experiences with your data colleagues through the AIR Professional File.

Sincerely,
Sharron Ronco

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UNIVERSITY-WIDE ASSESSMENT DAYS: THE JAMES MADISON UNIVERSITY MODEL

Dena A. Pastor, Kelly J. Foelber, Jessica N. Jacovidis, Keston H. Fulcher, Derek C. Sauder, and Paula D. Love

About the Authors

The authors are with the Center for Assessment and Research Studies, James Madison University.

Abstract

James Madison University has used dedicated Assessment Days for more than 30 years to collect longitudinal data on student learning outcomes. Our model ensures all incoming students are tested twice: once before beginning classes and again after accumulating 45–70 credit hours. Although each student completes only four instruments during a 2-hour testing period, 25 different assessments are administered, thereby allowing for the examination of student growth on a variety of different outcomes. This article describes our model and outlines the logistics involved in planning for Assessment Day, including the physical and human resources needed for its success. We also address changes we have made over the years and the challenges we continue to encounter. Our intention is to share lessons learned and encourage readers to consider how our model might be adapted for the assessment of programs both large and small at their own institutions.

Keywords: Assessment Days, large-scale assessment, general education assessment, data collection designs

Background

Every campus has wide-reaching programs intended to affect the learning and development of all or most students. Examples include general education, large-scale student affairs programs, and campus-wide initiatives. Given the large number of students served by these programs and the importance of their associated outcomes, the effectiveness of these programs is often of great interest to many stakeholders. Assessment data are therefore collected to reveal the strengths and weaknesses of these wide-reaching programs, and to partially fulfill requirements of accrediting bodies and funding agencies. Procuring assessment data that help universities improve student learning and demonstrate accountability, however, is no trivial task. To acquire meaningful information, colleges must carefully consider the data collection design along with the numerous other details inherent in conducting quality research.

The purpose of this article is to describe the approach James Madison University (JMU) has used for more than 30 years to collect assessment data for its university-wide programs. Like other universities, we use dedicated Assessment Days (Swing, 2001). Our Assessment Day approach enables the university to collect longitudinal data on student learning and developmental outcomes by setting aside 2 days per year dedicated to assessment. All incoming first-year students (excluding transfer students) are required to participate in Fall Assessment Day ($N \approx 4{,}000$ students); all students with 45–70 credit hours (typically sophomores and including transfer students) are required to participate in Spring Assessment Day ($N \approx 4{,}000$ students). During Spring Assessment Day students are administered the same instruments they were administered during Fall Assessment Day (18 months prior), thereby creating a pretest–posttest design that permits evaluation of gains in student learning and development.

Before describing Assessment Day logistics and resources, it is important to explain the two primary reasons why we've used this model for more than 30 years. First, our Assessment Day model addresses major weaknesses

associated with common assessment approaches, specifically those using a posttest-only design, cross-sectional data, or convenience samples. Second, we continue to use the Assessment Day model because it allows many questions about student learning and development to be addressed. We provide several examples below to convey the methodological advantages of our approach, the kinds of questions that can be addressed, and how the results are used.

One of the greatest strengths of our Assessment Day model is the assessment of all incoming first-year students the week before classes begin. Results from Fall Assessment Days are used to explore the appropriateness of allowing course credit for various precollege experiences, as illustrated with the results in Table 1 for the American Experience assessment, which is used to assess our American History and Political Science requirement. The similar performance of incoming first-year students with and without dual-enrollment transfer credit on this and many of our other assessments has fueled a continuous debate at our university as to whether dual-enrollment credit should be permitted.

Most importantly, Fall Assessment Day results allow for a richer and more-nuanced interpretation of Spring Assessment Day results. To illustrate, Table 2 provides the percentage of students meeting the faculty-set standard on a quantitative and scientific reasoning assessment at pretest (Fall Assessment Day) and at posttest (Spring Assessment Day). Because a larger percentage of students met the standard at posttest than at pretest, we can conclude that students are gaining in knowledge over time. If we had only posttest data, it could be argued that the posttest results reflect nothing more than the knowledge students had upon arriving at the university. Thus, Fall Assessment Day results allow us to explore—and often rule out—a plausible and competing alternative hypothesis for the posttest findings.

Table 1. Number Correct Mean and Standard Deviation on the 40-item American Experience Assessment for Incoming First-Year Students (N = 925) in 2017 by Type of Course Credit

Type of Course Credit	N	M	SD
Advanced Placement	57	29.4	5.7
Dual Enrollment	71	21.6	5.7
None	797	21.8	6.1

Table 2. Percentage of Students Meeting Standard on Quantitative and Scientific Reasoning Assessment on Fall and Spring Assessment Days for Two Cohorts

N	Fall Assessment Day (Pretest) Year	%	Spring Assessment Day (Posttest) Year	%
367	2015	21%	2017	46%
412	2016	28%	2018	39%

By having each student complete the same assessment twice during the first 18 months of their college career, we are also able to provide evidence of student learning. To illustrate, effect sizes capturing the number of standard deviation units by which average scores change from Fall to Spring Assessment Day are provided in Table 3 for assessments administered to incoming first-year students in 2014. The effect sizes are positive, which indicates that the college experience adds value. The fact that some of the effect sizes are not as large as we would like them to be is a call to action. For example, when the quantitative and scientific reasoning test results indicated that students who had completed their requirement were still struggling to discriminate between correlation and causation, the program director organized a series of faculty meetings to identify student misconceptions and design learning strategies to implement new pedagogies.

Given that the credit window for Spring Assessment Day captures students at various stages of general education completion, our pretest–posttest design also allows change over time to be explored for different subsets of students (Pieper, Fulcher,

Table 3. Effect Sizes for Six Assessments for Students Tested on Fall Assessment Day, 2014, and Spring Assessment Day, 2016

Acronym	Test Name	Content Area	N	d
NW9	Natural World—version 9	Quantitative & scientific reasoning	194	0.53
GLEX2	The Global Experience—version 2	Global history & issues	243	0.37
AMEX3	The American Experience—version 3	American history & political science	246	0.33
ISNW-A1	Institute for Stewardship of the Natural World—version A1	Environmental stewardship	413	0.40
KWH8	Knowledge of Wellness and Health—version 7	Wellness & health	253	1.33
SDA-7	Sociocultural Domain Assessment—version 7	Sociocultural understanding	295	0.77

Note. Effect sizes (d) were calculated by subtracting the Fall 2014 average score from the Spring 2016 average score and dividing by the Fall 2014 standard deviation. The d values can be interpreted as the number of standard deviation units by which the Spring 2016 average differs from the Fall 2014 average. With the exception of the ISNW-A1, results are based on only those students who had completed their content area requirement through coursework at our university by Spring 2016. Because there is no such requirement in environmental stewardship, results for the ISNW-A1 are based on all students who completed the test in both fall and spring.

Sundre, & Erwin, 2008). For instance, students who have yet to take any courses in a general education program are compared to students who have partially completed or fully completed the program (as shown for our American History and Political Science requirement in Table 4.[1] (See also Hathcoat, Sundre, & Johnston, 2015, Tables 6 and 7.) Furthermore, we consider score differences among students who have completed their requirements elsewhere (e.g., transfer credits, Advanced Placement credits), allowing us to explore the impact of non-JMU coursework.[2]

Because of the advantages of our Assessment Day model, we continue to use it year after year. Of course, the current design looks quite different from how it looked 30 years ago. In response to challenges encountered along the way, many modifications have been made—and continue to be made—to our Assessment Day model. In the sections below, we build on the work of Grays and Sundre (2012) by describing our model and sharing what we have learned from its implementation. Specifically, we detail the logistics involved, highlighting physical materials and communication strategies. We also describe the logistics team and its responsibilities before, during, and after Assessment Day. Furthermore, we describe the important role that proctors play on Assessment Day and the process we use for their hiring and training. The paper concludes with discussion of changes we have made to Assessment Day and the challenges we continue to encounter.

[1] The results in Table 4 are typical of the kind of results we see on many of our assessments. We often see gains in knowledge over time, but not of the magnitude we would like. As well, increased coursework in the domain is often not strongly related to pretest–posttest gains. Faculty reactions and explanations for such results are provided in Mathers, Finney, and Hathcoat (2018).

[2] Of course, because students were not assigned randomly to these different experiences we cannot claim that different kinds or amounts of coursework cause these score changes. To strengthen the causal link between assessment results and experiences we've used alternative analytical techniques (e.g., propensity score analysis; Harris & Horst, 2016) and implementation fidelity studies, which consider the extent to which programs are delivered as intended (Fisher, Smith, Finney, & Pinder, 2014; Gerstner & Finney, 2013; Swain, Finney, & Gerstner, 2013).

Table 4. Number Correct Mean (and Standard Deviation) on the 40-item American Experience Assessment on Fall and Spring Assessment Days by Course Completion Status

	N	Fall Assessment Day (Pretest) 2016	Spring Assessment Day (Posttest) 2018
JMU course completed			
American History	150	23.1 (5.3)	25.3 (5.6)
Political Science	71	24.1 (5.6)	25.0 (5.4)
JMU course not completed			
Not currently enrolled in American History/Political Science course	85	22.7 (5.9)	23.1 (5.7)
Currently enrolled in American History/Political Science course	52	21.6 (5.9)	23.7 (5.4)

Note. These results are typical of the kind of results we see on many of our assessments. We often see gains in knowledge over time, but not of the magnitude we would like. As well, increased coursework in the domain is often not strongly related to pretest–posttest gains. Faculty reactions and explanations for such results are provided in Mathers et al. (2018).

THE JMU ASSESSMENT DAY MODEL

Between 3,800 and 4,800 students are required to attend each Assessment Day, with incoming first-year students (excluding transfer students) tested during Fall Assessment Day and students with 45–70 credit hours tested during Spring Assessment Day. Rather than relying on volunteers or convenience samples, JMU requires all qualifying students to participate in Assessment Days. This helps us represent students who have taken different academic paths and ensures that our results are fully reflective of the JMU experience. If a student is required to participate and fails to do so, a hold is placed on their record, prohibiting modifications to their current schedule and future course registration. This policy not only demonstrates to students and other stakeholders JMU's strong commitment to quality assessment, but also ensures participation. Fortunately, attendance is high with the 5-year attendance rate on Fall and Spring Assessment Days being 94% and 90%, respectively.

The current Assessment Day structure includes three 2-hour testing sessions, with the sessions each separated by about an hour. During each session, one third of the required students (1,200–1,500 students) are tested. To accommodate this number of students in a single session, about 25 different rooms are used, with each room seating between 30 and 170 students. Almost all rooms are located within a single building, which allows our team to be on hand to address any issues. Testing rooms are reserved more than a year in advance and include large lecture halls, small classrooms, and computer labs. To illustrate, the rooms used during Spring 2016 are listed in Table 5.

In the fall, commandeering almost an entire building is not an issue because Assessment Day takes place the Friday before classes begin. Spring Assessment Day, however, takes place on a Tuesday in mid-February; to avoid scheduling conflicts, all classes are cancelled until 4:00pm. This not only frees space on campus for university-wide assessment, but also allows students who are not required to participate in Assessment Day to participate in academic program assessment.

As many as 25 different assessments are administered on Assessment Day; each student completes no more than four assessments during their 2-hour testing session (see Table 6). Thus, large random samples of students

Table 5. Master Plan for Spring Assessment Day, 2016

Room Number	Room Size[a]	Room Size x 3[b]	Test Config.	No. of Proctors[c]	Use[d]	Test1[e]	Test2	Test3	Test4	Time1[f]	Time2	Time3	Time4	Total Time[g]	ID Range[h] Session A	Session B	Session C
0000	101	303	1	3	CBT	SDA-7	OCP2	SD-3	SOS-2	30	30	30	5	120	000–022	344–365	679–698
0201	30	90	2	2	CBT	INFOCORE	OCP2	SD-3	SOS-2	30	30	30	5	120	023–027	366–371	699–703
248	31	93	2	2	CBT	INFOCORE	OCP2	SD-3	SOS-2	30	30	30	5	120	028–033	372–378	704–711
2037	33	99	3	2	CBT	STPA2	SDA-7	SD-3	SOS-2	45	30	30	5	135	034–041	379–383	712–719
250	34	102	4	2	CBT	STPA2	OCP2	SD-3	SOS-2	45	30	30	5	135	042–050	384–391	720–726
336	30	90	5	2	CBT	ER-WRA	OCP2	MFLS	SOS-2	60	30	15	5	135	051–056	392–395	727–732
343	30	90	6	2	CBT	ER-WRA	ERRT	SD-3	SOS-2	60	10	30	5	130	057–064	396–400	733–740
350	48	144	7	2	CBT	ISNW-A1	ERRT	SD-3	SOS-2	50	10	30	5	120	065–074	401–408	741–748
2204	48	144	7	2	CBT	ISNW-A1	ERRT	SD-3	SOS-2	50	10	30	5	120	075–084	409–416	749–756
2203	40	120	8	2	P&P	ERIT-XA	SDA-7	SD-1	SOS-2	50	30	15	5	125	085–095	417–423	757–765
136	90	270	8	2	P&P	ERIT-XA	SDA-7	SD-1	SOS-2	50	30	15	5	125	096–111	424–446	766–783
148	48	144	8	2	P&P	ERIT-XA	SDA-7	SD-1	SOS-2	50	30	15	5	125	112–124	447–455	784–794
1302	160	480	9	5	P&P	NW9X	AMEX3	SD-1	SOS-2	30	40	15	5	115	125–155	456–493	795–822
2301	160	480	9	6	P&P	NW9X	AMEX3	SD-1	SOS-2	30	40	15	5	115	156–191	494–527	823–857
159	170	510	10	5	P&P	NW9	AHQ	SD-1	SOS-2	60	12	15	5	117	192–229	528–566	858–897
1301	126	378	11	4	P&P	ISNW-A1	AHQ2	SD-1	SOS-2	50	27	15	5	122	230–263	567–605	898–929
1204	50	150	11	2	P&P	ISNW-A1	AHQ2	SD-1	SOS-2	50	27	15	5	122	264–277	606–613	930–943
1209	55	165	12	2	P&P	CAT	MFLS	SD-1	SOS-2	60	15	15	5	120	278–288	614–626	944–956
1210	60	180	13	2	P&P	GLEX2	KWH8	SD-1	SOS-2	30	40	15	5	115	289–305	627–641	957–972
2209	55	165	13	2	P&P	GLEX2	KWH8	SD-1	SOS-2	30	40	15	5	115	306–320	642–655	973–985
236	80	240	13	3	P&P	GLEX2	KWH8	SD-1	SOS-2	30	40	15	5	115	321–343	656–678	986–999

[a] The number of students the room can accommodate at one time.
[b] The number of students the room can accommodate across the three testing sessions.
[c] The number of proctors needed in the room.
[d] Whether the room is used for computer-based testing (CBT) or paper-and-pencil testing (P&P).
[e] The names of the measures to be administered first in each room.
[f] The testing times for the first measure.
[g] The sum of each of the testing times for the four measures plus 25 minutes, which is the time needed to orient students to the testing session and collect or disseminate testing materials. In some rooms, Total Time exceeds 120 minutes; test configurations are allowed to exceed 120 minutes if we know, based on previous experience, that the session is not likely to take more than 120 minutes. Regardless of the projected total testing time, in practice we instruct proctors not to let testing sessions last more than 120 minutes.
[h] The range of the last three digits of student IDs assigned to each room and session (e.g., if the last three digits of a student's ID were 405, the student would report to room number 350 for Session B).

Table 6. Assessments Administered in Spring 2016 and Sample Size

Acronym	N	Name	Content Area
AHQ	510	Arts & Humanities Questionnaire	Arts & humanities
AHQ2	528	Arts & Humanities Questionnaire, version 2	Arts & humanities
AMEX3	960	The American Experience, version 3	American history & political science
CAT	165	Critical-thinking Assessment Test	Critical thinking
ERIT-XA	534	Ethical Reasoning Identification Test, version XA	Ethical reasoning
ERRT	234	Ethical Reasoning Recall Test	Ethical reasoning
ER-WRA	180	Ethical Reasoning, Writing, version A	Ethical reasoning
GLEX2	585	The Global Experience, version 2	Global history & issues
INFOCORE	183	Information Literacy Core	Information literacy
ISNW-A1	528	Institute for Stewardship of the Natural World, version A1	Environmental stewardship
KWH8	585	Knowledge of Wellness and Health, version 8	Wellness & health
MFLS	165	Meaningful Life Survey	Purpose & meaning in life
NW9	510	Natural World, version 9	Quantitative & scientific reasoning
NW9X	960	Natural World Short Form, version 9	Quantitative & scientific reasoning
OCP2	486	Oral Communications Pretest, version 2	Oral communication
SD-1	3282	Student Development, version 1	Student development
SD-3	1065	Student Development, version 3	Student development
SDA-7	534	Sociocultural Domain Assessment, version 7	Sociocultural understanding
SOS-2	4437	Student Opinion Survey, version 2	Examinee motivation
STPA2	201	Sociocultural Thought Process Assessment, version 2	Sociocultural reasoning

Note. Seventy percent of the assessments listed here are direct measures of student learning (as opposed to self-report measures of learning or self-report measures of attitudes, feelings, or behaviors). With the exception of the CAT, the direct measures listed here were created by faculty at the university.

complete each assessment, but no student completes all assessments. Assessing every student on all outcomes is not necessary because the data are not used for individual assessment purposes. The vast majority of assessments are used for program assessment purposes and are direct measures of student learning.[3] New and revised assessments are also piloted and evaluated for future use. This is particularly important because many of our assessments are developed by our own faculty and staff to maximize the alignment between program outcomes and instruments. Because the responsibility for the psychometric evaluation of these assessments falls on us, a small proportion of Assessment Day data is devoted to this purpose.

Data are also collected for the psychometric evaluation of instruments developed outside of JMU. Importantly, validity studies are conducted to ensure instruments are appropriate for use with our student population and for the purposes of program assessment. Examples of how Assessment Day data have been used in psychometric evaluations are provided by Brown, Finney, and France (2011), Cameron, Wise, and Lottridge (2007), Kopp, Zinn, Finney, and Jurich (2011), France, Finney, and Swerdzewski (2010), Johnston and Finney (2010), Smiley and Anderson (2011), and Taylor and Pastor (2007).

Planning for Assessment Day

Planning for each Assessment Day begins months in advance with the creation of a spreadsheet known as the master plan that details which assessments and student identification numbers are assigned to the various rooms and sessions (see Table 5). In the section below, we describe how and when these decisions are made, and from whom we gather the necessary information.

One of the first tasks involved in planning for a Fall Assessment Day is deciding which assessments to administer.[4] Four months prior to Fall Assessment Day, assessment coordinators for general education programs and university-wide initiatives are asked to provide information about the measure(s) that their university-wide program wishes to administer. We ask for the length of time it will take to complete the instrument(s), whether computer-based or paper-and-pencil administration is preferred, and the desired sample size. We then create test configurations based on this information (i.e., sets of three to four measures that can be given together and require slightly less than a total of 2 hours to complete).

Once the configurations are determined, we assign configurations to each testing room. In each room the same test configuration is used across each of the three testing sessions for two reasons. First, because proctors remain in the same room across sessions, keeping the test configuration consistent helps to avoid proctor confusion. Second, in paper-and-pencil testing rooms students provide their responses on Scantrons (i.e., optical answer sheets); as such, the paper copies of the tests remain unmarked and the same paper copies of tests can be reused across sessions. This helps keep the number of printed test copies to a minimum, which helps reduce costs and keep Assessment Day environmentally friendly.

The final step is to assign students to rooms and sessions based on the last three digits of their student identification numbers, as shown in the last three columns of Table 5.[5] Because the last several digits of identification numbers are used to assign students to rooms, the sample of students assigned to each room, and subsequently to each test, is random.

The above description characterizes the planning involved for Fall Assessment Days. When developing a master plan for Spring Assessment Days, we use the plan previously configured for

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[3] A direct measure of student learning tests a student's knowledge and skills. For example, rather than asking students to self-report whether they are skilled in information literacy, we use a knowledge test to evaluate whether students are skilled in information literacy.

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[4] Every general education program and university-wide initiative is assessed on every Assessment Day. If there is any concern about whether a program should be assessed, guidance is obtained from the university's Assessment Advisory Council, which is a team of administrators, faculty, and staff whose purpose is to provide guidance on these very issues.

the same cohort of students for their Fall Assessment Day, modifying as necessary. This helps ensure Spring Assessment Day students are assigned to complete the same measures as when they were incoming first-year students.

Human Resources

Substantial human resources are needed to orchestrate each Assessment Day. In this section, we describe two essential groups: the Assessment Day team that works year-round on the planning, coordination, and execution of each Assessment Day; and the Assessment Day proctors.

The Assessment Day Team

The Assessment Day team is a subgroup of the Center for Assessment and Research Studies (CARS), which is the unit on campus responsible for providing guidance regarding the assessment of student learning and developmental outcomes.[6] The Assessment Day team is responsible for planning and coordinating both Assessment Days, as well as for the associated data management that occurs afterward. It consists of a faculty lead, three graduate assistants (GAs), and an administrative assistant. Additionally, the team relies heavily on the CARS's information security analyst, fiscal technician, and three undergraduate work–study students to assist in tasks crucial to a successful Assessment Day (e.g., storing data securely, processing paperwork for paying proctors, packing and double-checking materials).

No member of the Assessment Day team devotes their entire work week year-round to Assessment Day. The current faculty lead of Assessment Day devotes 8–10 hours per week, on average. During the fall and spring semesters one GA on the team has 20 hours per week assigned to Assessment Day, and the remaining two GAs have 10 hours per week. The work–study students assist during the fall and spring semesters, with each of the students spending about 8 hours per week on Assessment Day tasks during the busiest times of the year.

The work associated with Assessment Day is not constant throughout the year; it is heaviest the 2 months before and after each Assessment Day. Each member of the team has different responsibilities prior to, during, and after Assessment Day, which are described below. The tasks typically completed by the work–study students during these times are also provided.

Prior to Assessment Day

Many of the tasks completed prior to Assessment Day were detailed above in the planning section. Examples include soliciting and organizing test requests, compiling test instructions, communicating with students and constituents on campus, printing proctor materials, and packing bins. These tasks are split among the GAs, followed by a rigorous round of quality checks, some of which are completed by the faculty lead and the work–study students. Prior to Assessment Day, the administrative assistant reserves testing rooms, hires proctors, and coordinates meal services. The faculty lead is primarily responsible for coordinating work among the team members and ensuring that work is completed by the prespecified deadlines.

During Assessment Day

During Assessment Day the administrative assistant oversees the completion of paperwork for hiring

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[5] Specifically, we begin by acquiring the list of student identification numbers for all incoming first-year students and sort this list by the last three digits of the identification number. Starting with a value of 000, we assign three-digit values to rooms and sessions, starting with the first room and Session A. Once the number of students reaches the room size, we progress to the next room. After we have progressed through all rooms for Session A in this manner, we repeat the process for Session B and then Session C. Starting in Fall 2018 we began assigning students based on the last four digits of their identification number (instead of three digits) to accommodate increases in the size of the student body.

[6] At our university, the assessment office (CARS) and the Office of Institutional Research are separate and the latter does not assist with Assessment Days. In many universities, assessment falls under the purview of an institutional research office or a larger strategic planning office. How feasible it is to implement the Assessment Day model in these different organizational configurations depends on the number of staff, size of the student body, and the scope of assessment (e.g., number of assessments, number of Assessment Days).

proctors, coordinates delivery of meals, and answers the phone in the room that serves as headquarters. The faculty lead welcomes the proctors and answers questions. Once proctors proceed to their designated rooms and students begin to arrive, two of the GAs act as runners who move throughout the testing rooms to help proctors set up. The third GA and the faculty lead remain in headquarters to respond to any other needs and to monitor the CARS email account for student questions. The CARS information security analyst is also present in headquarters to assist with technology issues. After the final testing session, the team collects materials, packs up the headquarters room, checks all testing rooms for any forgotten materials, and ensures rooms are left the way they were found.

After Assessment Day

After Assessment Day the GAs oversee the work–study students in the unpacking of all materials (e.g., Scantrons, tests, pencils, folders, bins, binders) and their inventory. The work–study students also check technology, such as Chromebooks (i.e., tablet-like laptops), to ensure that everything is in working order. In sum, the work–study students help us ensure that all materials are accounted for and ready for future use.

Scanning and downloading of data is completed within a week of Assessment Day, thereby allowing the team to track attendance. Students who failed to attend (either for legitimate reasons or out of delinquency) have a hold placed on their record and are contacted via email about make-up sessions. There are typically two to six make-up sessions, each accommodating about 100 students, scheduled in the evenings several weeks after Assessment Day. The GAs plan and proctor the make-up sessions, and the administrative assistant removes holds for students who attend.

The management of all data also occurs within a month after Assessment Day and includes data scanning, downloading, cleaning, scoring, and formatting. Using the student identification numbers supplied by the student on each assessment, the data are also merged with other information needed for program assessment purposes; for instance, assessment scores for each student are merged with relevant course information. All GAs aid in data management and subsequent quality checks. Each program's assigned assessment liaison (with assistance from their own GAs) completes the analyses and report writing for each assessment within 3 months of testing.[7] Results are reported to the program faculty and staff, who may choose to disseminate the results more widely. Although it varies across programs, faculty and staff often meet to discuss the results and consider potential changes to their program. They are encouraged to use a learning improvement model, where assessment results obtained after program changes have been made are used to determine if the changes were effective (Fulcher, Good, Coleman, & Smith, 2014).

Assessment Day Proctors

Proctors are an important human resource that we greatly rely on. Although the number of proctors varies, our goal is to have one proctor for every 30 students with no fewer than two proctors in a room, which results in about 55 to 75 proctors. Proctor recruitment begins 2 months before Assessment Day when the team's administrative assistant emails a job announcement and online application form to a list of potential proctors (including JMU graduate students, staff, and people who have previously served as proctors). We have many people in the local community who regularly proctor, many of whom are retired educators. From this referral-based network, completed applications are selected on a first-come, first-served basis. The application is closed once we have enough proctors, which typically occurs within 3 weeks. Proctors are paid a small stipend and are provided breakfast and lunch on Assessment Days.

Because there are at least two proctors per room, it is important that proctors within a room act as a team. To facilitate cooperation, one proctor is assigned to be lead proctor; he or she acts as the spokesperson to the students, directs the testing session, and delegates tasks among other proctors. Both lead and non-lead proctors are responsible for a variety of other tasks. For instance, proctors are responsible for preparing the room for each session and

[7]*Care is taken in reporting so that the results can only be used to evaluate programs, not individual students or faculty members.*

maintaining order (e.g., minimizing noise, disruptions, and inappropriate behaviors). Proctors also convey the importance of the assessments and create an environment that allows and encourages students to perform to the best of their ability. Thus, proctors have an important role in ensuring the quality of the data: they motivate students, ensure tests have been completed correctly, and report any noteworthy issues that could impact the results. How proctors are trained to accomplish these tasks is briefly described below and in more detail by Lau, Swerdzewski, Jones, Anderson, and Markle (2009).

Changes Made to Assessment Day

JMU's Assessment Day model has evolved over time. Many changes have been made in response to increases in the size of the student body, developments in testing technology, and issues encountered after implementing an Assessment Day. Because our model has been in place for more than 30 years, it is impractical to describe all of the changes that have been made. We focus here on large changes that have improved the quality of data, saved money, improved efficiency, or reduced the environmental impact of Assessment Day.

Number of Testing Sessions

Perhaps the most significant change made in recent years is the transition from two 3-hour testing sessions to three 2-hour testing sessions. This change allowed the number of students tested to be distributed over three sessions instead of two, thereby requiring fewer rooms, proctors, and testing materials. For instance, when the Spring 2015 administration, which used the three 2-hour testing session structure, was compared to the Spring 2014 administration, which used the two 3-hour structure, substantial decreases were noted in the number of proctors (↓38%), Scantrons (↓45%), and copies of assessments (↓56%). Not only did this change reduce the amount of time required by any one student for testing, but it also greatly reduced costs as well as the environmental impact of Assessment Day.

Assessment Day Video

Beginning in 2014, we started to show students a 5-minute video at the beginning of each testing session; in this video the president of the university, general education faculty, and student actors explain the purpose of Assessment Day. The purpose of showing the video is two-fold: to increase student motivation and to standardize how information is communicated. By informing students how the data collected on Assessment Day are used to improve student learning on campus we hope to convey how completing the assessments to the best of their ability directly affects the quality of education at JMU as well as its reputation. Readers interested in viewing the video can find the link at JMU (2018, top of page).

Proctor Selection and Training

A few years ago, we made modifications to the way we recruit and hire proctors. We converted our proctor-hiring methods from an informal email process to a formal online application. Under the new hiring method, proctors complete an online application that allows us to collect necessary information before Assessment Day. The online application has also allowed us to ensure that our proctors are comfortable with technology. As we move to testing that is more computer-based, we need proctors who can navigate various types of technology with ease. By having proctors apply through an online form, we create a preliminary screening process for this skill. Additionally, we have started recruiting JMU graduate students to serve as proctors, which provides many benefits. Graduate students are generally familiar with and comfortable navigating JMU's campus and classroom technology and they usually have less hiring paperwork to process because they are often already JMU employees (e.g., GAs). The quality of proctors is somewhat controlled by our detailed job description and online application process. The Assessment Day team also observes proctors during Assessment Day and does not rehire proctors who perform poorly.

Another notable change we have made to Assessment Day is to the timing and format of proctor training. At one time proctors were trained the morning of Assessment Day; however, the training session added an hour to an already long day and was often rushed. There was a lot of information packed into a quick presentation, leaving little time for proctors to reflect on the material and ask questions before being ushered into their rooms. To address these challenges, we moved the training online, which allows us to track which proctors have completed training and allows proctors

to complete the training in their own space and time during the 2 weeks prior to Assessment Day.

Ongoing Challenges

Student Motivation

The primary purpose of Assessment Day is to collect meaningful information about what students know, think, and can do. Our ability to make valid inferences from students' scores relies on the quality of the data we collect. Unfortunately, the quality of the data is undermined when students are not motivated. Although we attempt to convey the purpose and importance of Assessment Day to students, the assessments are still low-stakes for students, and, as in any low-stakes assessment context, examinee motivation can suffer.

Concerns about student motivation are mitigated somewhat by data indicating the majority of students think the assessments are important and try their best (e.g., see Sundre & Wise, 2003, Table 2). This is particularly true of incoming first-year students. However, because these findings do not characterize all students, we are continuously looking for ways to improve motivation. One strategy we use is to train our proctors to use motivational strategies as part of their role. We began intentionally training proctors in 2007 to use motivational strategies (e.g., conveying the importance of the test, being supportive yet firm, etc.) and found that students' self-reported effort on the assessments was higher and less variable on Assessment Days that took place after this training was implemented (Lau et al., 2009).

We have also studied the effects of providing different instructions to students (Finney, Sundre, Swain, & Williams, 2016). During this study students were randomly assigned to one of three sets of instructions: In Condition 1 we told students that their scores would be aggregated and used for institutional decision-making, in Condition 2 we expanded on Condition 1 by telling students they would be able to receive their individual scores, and in Condition 3 we added to Conditions 1 and 2 by informing students that their individual scores would also be shared with faculty. Test performance from pretest to posttest along with test-taking motivation measures were not affected by the kind of instructions the student received.

We have also piloted different assessment designs, such as a planned missingness design, to investigate whether giving students a portion of the assessment rather than whole assessment can improve motivation and performance (Swain, 2015). Although the effects were small, students completing only a portion of the assessment (about 33 items) performed better than students completing the whole assessment (66 items). In addition, their motivation was more favorable, but not significantly so.

As a final example, the use of electronic pop-up messages targeted at students displaying rapid responding behavior on computer-based tests has been investigated (Ong, Pastor, & Yang, 2018; Wise, Bhola, & Yang, 2006), with mixed results regarding the effectiveness of this intervention. In addition to changes aimed at improving student motivation, we are continuously researching different ways to measure motivation (e.g., self-report, item response time; Wise & Kong, 2005), assess its impact on the inferences we make (e.g., Finney et al., 2016), and accommodate the issue during our analyses (e.g., Foelber, 2017; Sundre & Wise, 2003).

Efficiency

Another important challenge we continue to face is the issue of efficiency. We have turned to electronic data collection as a primary way of reducing both our costs and our environmental impact. We consistently prioritize the use of on-campus computer labs to reduce both the number of paper tests and Scantrons needed. Furthermore, we recently incorporated the use of Chromebooks, which are tablet-like laptops, in rooms that were formerly used for paper-and-pencil testing. This allows us to assess around 200 students outside of a computer lab but still without resorting to Scantrons. We have also experimented with having students respond via handheld survey response tools on their smartphones (Sauder, Foelber, Jacovidis, & Pastor, 2016).

With the emphasis on electronic data collection, the challenges we currently face are mostly physical limitations (e.g., number of available computer labs). A similar challenge is the lack of alternative technology for assessing students outside of the computer labs. The Chromebooks continue to be valuable in this regard, but we are limited by the number of Chromebooks we can purchase. Our experiments with handheld responding devices have

been challenged by considerations of cost and ease of use. Our pilot of student-owned smartphones had the advantage of being free for us, but brought its own challenges in terms of test security and student attention. Yet, we are optimistic about the future of technology in Assessment Day to increase our efficiency.

CONCLUSION

While the details can be dense, we hope they convey the thought and intentionality involved in our Assessment Day model. It is our hope that this information benefits institutions wanting to adopt an Assessment Day model for university-wide assessment. For institutions where our model may not be feasible or even desirable to implement on a large scale, aspects of our model can be adopted for assessment on a much smaller scale, even for the assessment of a single program. For institutions with Assessment Days already in place, we hope our description provides ideas for different ways to implement the model and alternative solutions for addressing its challenges. In sum, our intention is to share lessons learned and encourage readers to consider how our model might be adapted for their own purposes.

Although we featured our Assessment Day model, we are open and supportive to any design that facilitates the collection of quality data. In addition, we encourage any institution with a quality process to share its approach and lessons learned with others. Let's share quality practices to better answer the calls for accountability and support legitimate learning improvement efforts.

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The AIR Professional File

ARTICLE 145

Association for Institutional Research

FROM DATA CRISIS TO DATA-CENTRIC

Rebekah Anderson
Nichole Rip

About the Authors
Rebekah Anderson is chief information officer at University of Western States. Nichole Rip is data architect at University of Western States.

Abstract
The main purpose of institutional research (IR) is to provide objective, systematic, and thorough data that support an institution's enrollment goals, planning, policy formation, and decision making. Traditionally, institutions gathered data on their activities, students and staff, programs, management, and operations. University staff then analyzed and interpreted those data to inform decision making down the road. In the case of our institution, there was only limited and non-cohesive data when a reorganization of the personnel and department structure occurred. The purpose of this paper is to explain the strategies and institutional shift University of Western States (UWS) used to facilitate strategic and data-driven decision making; how UWS improved the data, technology operations, and data management to cultivate an environment of data stewards; and how UWS turned these data into valuable information to use for strategic decision support.

Keywords: Institutional research, data governance, infrastructure, alignment, automation, executive buy-in, trust, business analysts, database, data management, information systems

Background
Once known as Western States Chiropractic College, University of Western States (UWS) is a small, private, nonprofit institution located in the Pacific Northwest. In order to respond to increasing needs for integrated health-care education in the region, in 2010 UWS added the College of Graduate Studies, which offers graduate degrees in human nutrition and functional medicine, in exercise and sport science, in diagnostic imaging and residency, and in other subjects, in addition to the doctorate degree offered by the College of Chiropractic. This change supported the UWS's mission and brought greater depth and diversity to its integrated focus on health care.

In 2010 UWS's regional accreditor, Northwest Commission of Colleges and Universities (NWCCU), recommended that the university improve its data collection and assessment efforts. During its mid-cycle visit in 2012, NWCCU found that UWS had made little progress in these efforts and asked the university to resolve the problem before its end-of-cycle review that was scheduled for 2015. In response, the university hired institutional research (IR) personnel who could adequately address its data-related concerns.

By 2015 several different administrative departments were dictating to the Office of Information Technology which projects were of highest priority, thus helping to create an environment of chaos and uncertainty. Ongoing projects were abandoned to start new ones, projects were rarely completed, and the data were siloed. Causing additional issues, department leaders were buying software they thought was most appropriate for their needs without information technology (IT) knowledge, involvement, or consent. These multiple softwares increased the already chaotic environment and led to the creation of a number of shadow systems. Each department was in its own silo and, although some had the same needs, each department had different products and/or licensing agreements, causing inefficiency and wasteful redundancy.

One of the first priorities for the newly hired IR specialist was to find information in the various data silos, which proved to be a difficult and labor-intensive task. Often the data were not in a central location, if the

specialist was able to find them at all. Even when the specialist found the data, there were no obvious or simple ways to link records within and between the various information systems; no one had given thought to the need to get data out of the disparate systems. This situation not only negatively impacted the IR specialist's ability to build statistics about UWS, but also impeded the process of providing operational and recurring information needs.

There was no quick fix for these major issues. UWS began a long journey of revamping the systems, data, and people in order to implement long-term fixes that set the university in motion for a multiple-year plan of leadership changes, reorganization of the personnel structure, and implementation of data governance and project management frameworks.

METHODOLOGY

Development of a Problem Statement

Once the IR specialist understood the current state of UWS, the specialist needed to find colleagues at various levels, skills, and experience at the institution who shared a common understanding of the university's challenges and were willing to help lead the changes. With this in mind, the IR specialist teamed up with the database administrator to work on getting the vice president of institutional effectiveness to understand the situation. The specialist did this by explaining the challenges of providing IR without consistent practices. Eventually, the vice president of institutional effectiveness showed a solid understanding of these concepts and created a visual process diagram that was used to inform the rest of UWS's cabinet of the IR activities at the university. It was also important to determine the strengths of the partners and to divide up responsibilities accordingly. In this case, the IR specialist had a fresh perspective of the issues, but also needed allies from the executive leadership team and IT Department. This group ensured they all had the same understanding of the problem before taking the next steps.

A problem statement (figure 1) was created in order to verify that all three in this group were explaining the issues consistently and accurately. The problem statement noted that the university was in a data quality and availability crisis, which hindered its ability to provide demonstrable outcomes that showed mission and core theme fulfillment (a NWCCU requirement).The two main problems could be summarized by combining several overarching issues: the lack of centralized data, the lack of a project management framework, the lack of resources to provide effective data management, and the lack of integration and centralization of enterprise systems.

After creating the problem statement, the group developed and thoroughly communicated a reorganization plan. Processes were created and implemented to create the frameworks needed for project and data management in a collaborative, systematic, and prioritized way. Stakeholders were educated throughout this process in a series of meetings, committees, and ad hoc conversations. The restructured team provided system and data validation and monitoring to ensure continued success, as well as customized and automated reporting to ensure robust decision support.

Development and Communication of Reorganization Plan

Because of concerns over personnel, the IR group created a reorganization plan (figure 2) in order to move forward on much-needed improvements. At the same time, various IR personnel kept the executive level, as well as stakeholders at the tactical level, informed to attempt to get buy-in and understanding from all levels of the organization. The data management issues identified in the problem statement were also a recurring discussion at the data integrity team meetings to keep the data issues at the top of the list of improvement projects.

The initial proposed reorganization (figure 2) consisted mainly of separating the data management personnel from those working on the IT infrastructure and help desk and infusing the data management side with resources to create a more efficient operating model. It was important to understand that buy-in was needed at all levels to ensure the success of these major changes. The method used was therefore a balanced mix of offering education around the benefits of these changes and evidence

Figure 1. Problem Statement

UWS Data Quality and Availability Problem Statement

December 22, 2015

As amplified in the December 2015 NWCCU "Peer Evaluation Report," UWS is in a data quality and availability crisis, which inhibits the institution's ability to demonstrate verifiable outcomes related to core themes and mission fulfillment. The crisis stems from

1. absence of a supported, centralized data and project management framework and qualified personnel to coordinate and manage the institution's data enterprise; and
2. misaligned and/or unintegrated enterprise application system features and unintegrated or loosely integrated enterprise systems.

These issues are interrelated and, when resolved, will allow for the natural development and incorporation of an institutional data platform. The value of such a data platform is to build a shared understanding and high level of confidence in data related to admissions, enrollments, curriculum and student outcomes, fiscal services, student services, auxiliary services, health services, accreditation, and federal compliance.

Next Steps

Identify and establish a dedicated/focused data enterprise management structure and personnel to accomplish the following characteristics and outcomes:

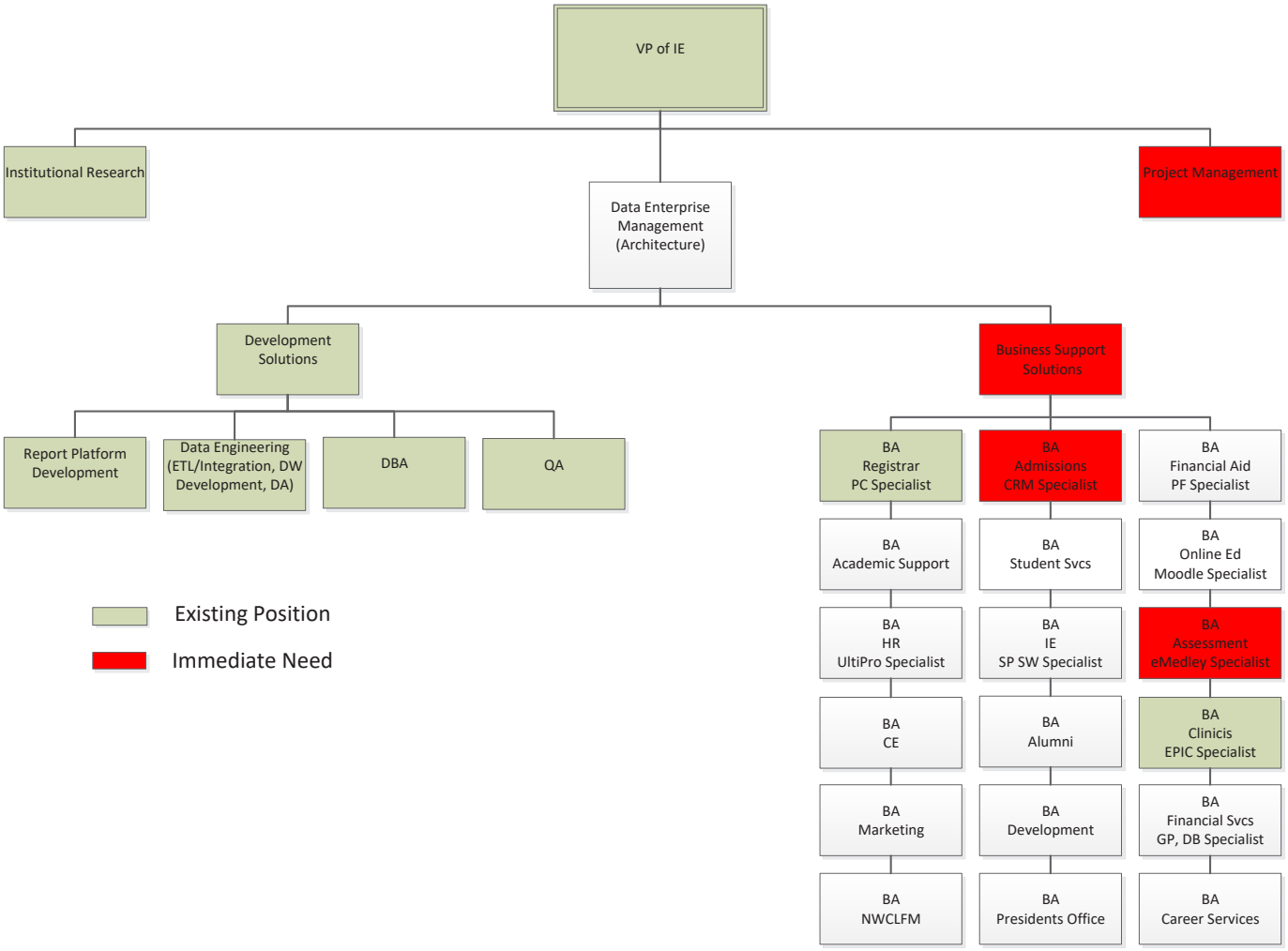
- Streamlined and effective business processes across the university that result in available, accurate, and meaningful data to inform decisions and effective planning that bring about achievement of the UWS mission, goals, and strategies (continuous improvement and institutional effectiveness).
- Alignment of software system features and functionality that support established business processes and data generation across the university.
- Controlled, vetted, and integrated software system purchasing procedure and implementation (project management) on manageable timelines.
- Systematic assessment of student learning outcomes and program evaluation.
- Effective, efficient, accurate data reporting and data applications utilization experience for employees.
- Holistic, uniform, standard pathways of communication and organization for report development and customization, system feature requests and prioritization, issue reporting and solution development and implementation on manageable timelines, data analytics (aka reports and dash boarding) requests and prioritization to meet institutional, research / effectiveness requirements, data enterprise alignment and advocacy, and measured results.

Note: The IR specialist, IT representative, and vice president of institutional effectiveness collaborated to create the problem statement, which summarized the data quality and availability issues UWS was facing and allowed the three of them to separately educate various stakeholders of the university while remaining consistent with the message.

to prove to executives why they needed to support the changes.

The regional accreditation site visit discovered the same data issues that were already internally noted. UWS was unable to provide common key performance indicators toward its mission (e.g., how many alumni donated and referred students to the university, what our historic enrollment numbers were, and how many continuing education hours UWS provided). After several years of requesting that the institution improve its data management practices, UWS regional accreditation went on warning status—due to the state of the data

Figure 2. Enterprise Data Management Structure



Note: Developing the enterprise data management structure assisted the vice president of institutional effectiveness with requesting additional personnel to improve data management.

and its lack of significant efforts toward improvement, and primarily due to the institution's lack of ability to make data-driven decisions.

Development of Processes to Enable Systems and People to Work Together

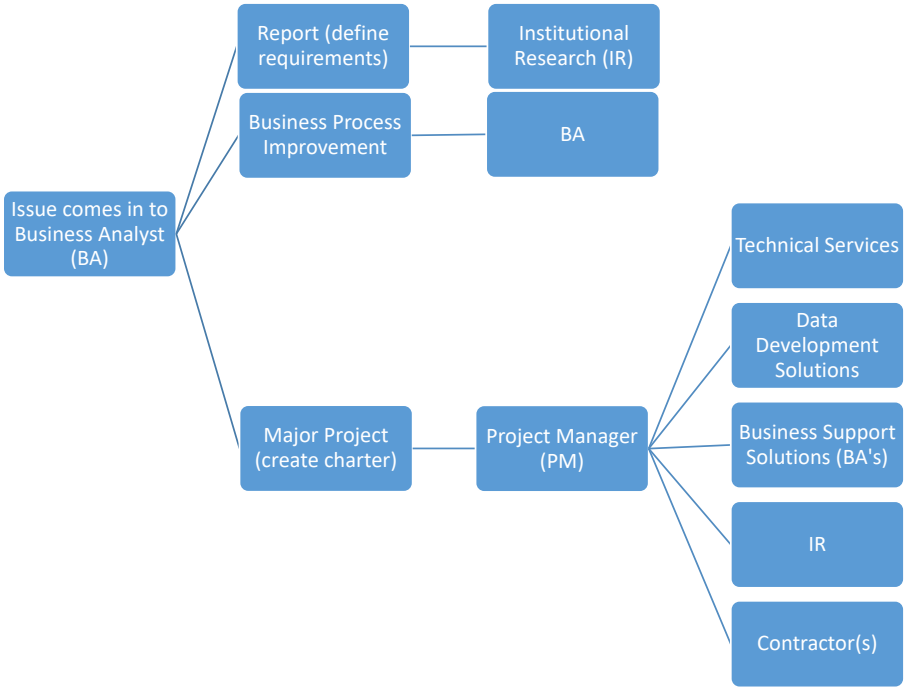
The institutional effectiveness reorganization included adding three additional personnel, two business analysts, and a project manager, as well as increasing the role of the database administrator role to include data architecture. Prior to the shift, the staff were maintaining current applications without business process support, and without integrating systems or improving the technology. Establishing these changes, the focus shifted to a more holistic solution frame of mind. Instead of only looking for a fix inside the existing noncustomized student information system (SIS), the analysts would now look at how the problems could be solved through a business process improvement, a system configuration modification, report, and/or system integration (figure 3). Although it would have been ideal for this group to be under a single leader within IT, UWS executives now recognized that data management

could not be improved at this time without separating these groups and adjusting the current leadership.

The project management framework enabled the institutional effectiveness team to focus on important efforts through prioritization across the entire organization. Project management processes were put into place that allowed each department to monitor the status of its project. The project manager framework enabled institution-wide prioritization and transparency. Prior to this process, IT staff would start projects but then abandon them once something deemed more important came along. There was no evidence of any successfully completed projects prior to this shift. Although these processes were created and implemented in institutional effectiveness, they played little role in deciding which projects the staff were to work on. The IR team created an equitable structure that allowed all staff to suggest a project that was based on principles of need and on that project's benefit to the university. In addition, the institutional effectiveness personnel provided project proposals, charters, requirements documentation, and other important project documents to enable better understanding of the project's value before executive leadership decided on priority.

Around the same time in 2015 the executive leadership team underwent massive changes. Executives that once allowed loopholes in organization-wide prioritization departed and were replaced with an interconnected team

Figure 3. Issue Resolution Process



Note: The issue resolution process was created to show how issues would be resolved after the enterprise data management structure was implemented.

that allowed for transparent and fair processes. New leaders provided much-needed cohesive vision, a clear sense of direction, and open communication; together they worked at providing a more positive environment. Executives were educated about the need for systems integration, and why that integration needed to be prioritized as a critical requirement in the implementation of a customer relationship management system. This education allowed the team to prioritize its work and to focus on the important projects that in the past had been abandoned to make way for a new priority or emergency.

Data Architect Role

There have been many advancements to ease the burden of excessive resources dedicated to maintenance. Just a decade ago the amount of daily activities needed to keep systems afloat was a part-time job. Now, between informative monitoring alerts, cloud-based applications, and self-healing systems, the time dedicated to maintenance has diminished. As a result, IT staff can now dedicate more effort to the development of programs that improve productivity and data quality, and can help UWS distinguish itself from competitor universities. While this is an exciting prospect, one of the challenges in this advancement is whether the university will be able to maintain overall enterprise system balance and prepare for growth.

In order to capitalize on these advancements, systems require handling in a more comprehensive capacity where modules, configurations, and data flows work in unison in an effort to reduce business processes and data redundancy. This directing of technical activities can be done through various roles but is best achieved through a central and senior technologist whose focus is more on systems design and less on people management. Since the notion of having access to and basing decisions on data was an accrediting imperative, UWS needed the skillset of a data architect.

Primarily, the data architect's focus is on business intelligence schema and system design, where the data architect works in concert with the institutional effectiveness team to maximize system resources and direct them toward a common goal of optimal data quality, retention, and speed of delivery. The data architect is constantly being educated on methodologies of systems and data maintenance in light of advancing technologies to plan for future needs. The main value of the data architect at UWS is to provide architectural diagrams of how technologies will be applied to solve various data needs. These diagrams serve to inform and document how to set up environments, configure the technologies, and foster an understanding of business process flow for the purposes of collaboration and improved end-user experience and productivity.

The data architect needs to maintain a certain level of awareness of errors in the system to direct solutions so the whole system is balanced and stabilized. Every configuration and every change within the system radiates an effect that is primarily experienced by the administrative staff. If the configurations are not streamlined, users become overworked due to lack of automation; if a change is made to the system that causes some type of breakage, users are unable to get their work done. Additionally, a poorly functioning administrative staff and ineffective technologies translates into negative student experiences that could result in loss of tuition, revenue, and reputation for the university. The data architect can serve to increase positive experiences by directing those activities that allow changes and growth to occur while maintaining balance.

Reorganization

As is true for most small institutions, while it can be challenging to understand the need for additional staff, actually finding the funds for these additional staff is an entirely different challenge. Once the executive leadership understood the dire nature of the data management deficiencies, they made decisions to find resources for the newly formed Institutional Effectiveness Department (later renamed Information Services Department). This new department resulted in the elimination of many executive-level positions, as well as positions that were not considered critical.

In addition, there was a shift in how resources were used. Prior to the redesign, academic leadership started new programs and specializations often, which inevitably spread resources thin. There was little understanding of the resources involved with planning these changes, which led to rushed implementations and further contributed to data quality issues. Under new leadership the failing academic programs were stopped and no new programs were initiated, which enabled existing resources to be concentrated on efforts to improve data management. This would eventually lead to better-informed and better-supported academic program decisions.

There was also some significant attrition in the IT areas that allowed for the further reorganization. A chief information officer position was eventually created and tasked with overseeing and bringing the departments back together. The chief information officer was able to provide leadership for the technical services side of the house to evaluate and bring attention to its structure and internal processes, and to provide a stable infrastructure for all the work needed to be completed by institutional effectiveness, now renamed as information services. With information services and technical services back under the same leadership, both departments were able to create their own identities while working in unison to support and manage needs for technologies at the university.

With the addition of business analyst positions, the information services team was able to supply resources needed to gather business requirements and translate them into technical requirements. This assisted

the bottlenecked data architect so he could more easily complete the much-needed development work, data cleanup, system customizations, custom integration, and much more (figure 3). The information services team was now able to complete projects started years prior to the organizational changes, projects that had persistently run into roadblocks with disorganization preventing the project completion. The analysts became the hub linking business leaders, subject matter experts, project managers, data architects, quality assurance, technical services, and more.

EDUCATION OF AND COMMUNICATION TO STAKEHOLDERS

Another benefit of the synergy of the information services team, as well as the increasing support of executive leadership, was that it provided education about and allowed focus on the need for clean data. Prior to the formation of the Information Services Department certain departments would refuse to enter data into the SIS because they claimed the system was not reliable. This mistrust resulted in dozens of separate spreadsheets tracking the same data, even within the same department. The analysts developed data stewards throughout the university to help manage the data in each department; these stewards ensured data that entered the systems were clean and consistently followed standards and guidelines. Now that the analysts were helping to improve processes and were working with departments regularly, the data architect was able to create much-needed big-picture plans to ensure all aspects were moving in the right direction. The data integrity team had been disbanded during the more challenging times, so a new committee was thoughtfully and strategically formed.

Formation of Data Governance Committee

Once executives had bought into the concept of data stewards, the stage was set for the information services staff to further refine functionality in the data management process. Ideally, each department would follow its own standard administrative tasks in conjunction with and in the context of a comprehensive streamlined workflow that included pathways for task strategy, planning, and work distribution. Furthermore, with the information services group being so newly formed, it was a challenge for staff in that group to create their own internal processes, given the need to balance the immense number of requests against system breakages. The project management process provided the information services group with some meaningful direction, but day-to-day data system administration needed its own kind of direction. Since UWS was newly focused on data, the Data Governance Committee served as the agent for change in data management.

There was some initial legwork that needed to be completed before UWS could form the Data Governance Committee: information services staff needed to complete the data governance charter (figure 4), the data/information governance framework (figure 5), the data governance process actors (figure 6), data governance process deliverables and metrics (figure 7), the data governance information flow (figure 8), and the quality of data chart from data dictionary guiding principles (figure 9). Specifically, the data governance charter (figure 4) followed a standard UWS governance and committee structure template and laid the foundation for a democratic process for structuring data and information. The data/information governance framework (figure 5) and related diagrams with each component of the framework broken down into further details (figures 6, 7, and 8) ensured the implementation of data standards through the appropriate channels, namely ensuring that data definitions and policies were implemented through technology. The quality of data chart from data dictionary guiding principles (figure 9) offered a beacon of inspiration and desired end goals that could be included in a change control form to ensure the solution met with the vision.

In addition to these elements, some environmental pieces of knowledge also played a part in determining data standards. The first element was a conceptual business architecture that included a representation of all the departments, their members, their functions, the systems they leverage, and the measures for their success. The second was a systems matrix that is an inventory of all the types of technology that engines UWS, from the SIS all the way down to Excel spreadsheets. The final element was to begin to populate

Figure 4. Data Governance Charter

Data Governance Committee

The Data Governance Committee facilitates the coordination of data-related priorities and activities among data producers, consumers, and stewards across the University. The primary purpose of the committee is to facilitate data-driven decision making through the collection of reliable and verifiable data and production of timely and accurate data reports. The committee is charged to:

- Contribute to the fulfillment of the Mission, Core Themes, and Core Theme objectives through the collection, dissemination, and use of reliable and verifiable data.
- Make collective recommendations to the Provost regarding changes procedures, processes, and systems to improve the collection and application of data.
- Create data entry guidelines for data producers, and a data element dictionary for consumers and stewards.
- Review criteria and compare to guidelines to ensure university data meets the requirements of being trustworthy, consistent, accurate, audited, regulated, and secured.
- Provide a forum for proposing and discussing definitions for terms and associated data elements.
- Facilitate initiatives to improve quality or availability of data, information security and data retention, and policies on business processes or system configurations to manage raw elements of information.
- Discuss supplementary matters that pertain to governing data, administrative processes and information delivery.
- Engage in feasibility analysis for data initiatives and overall data infrastructure. Propose project initiatives where applicable.
- Review and provide feedback on information research reports including meaning, format, centralization and automation of reports.
- Perform other functions as may be delegated to the Data Governance Committee.

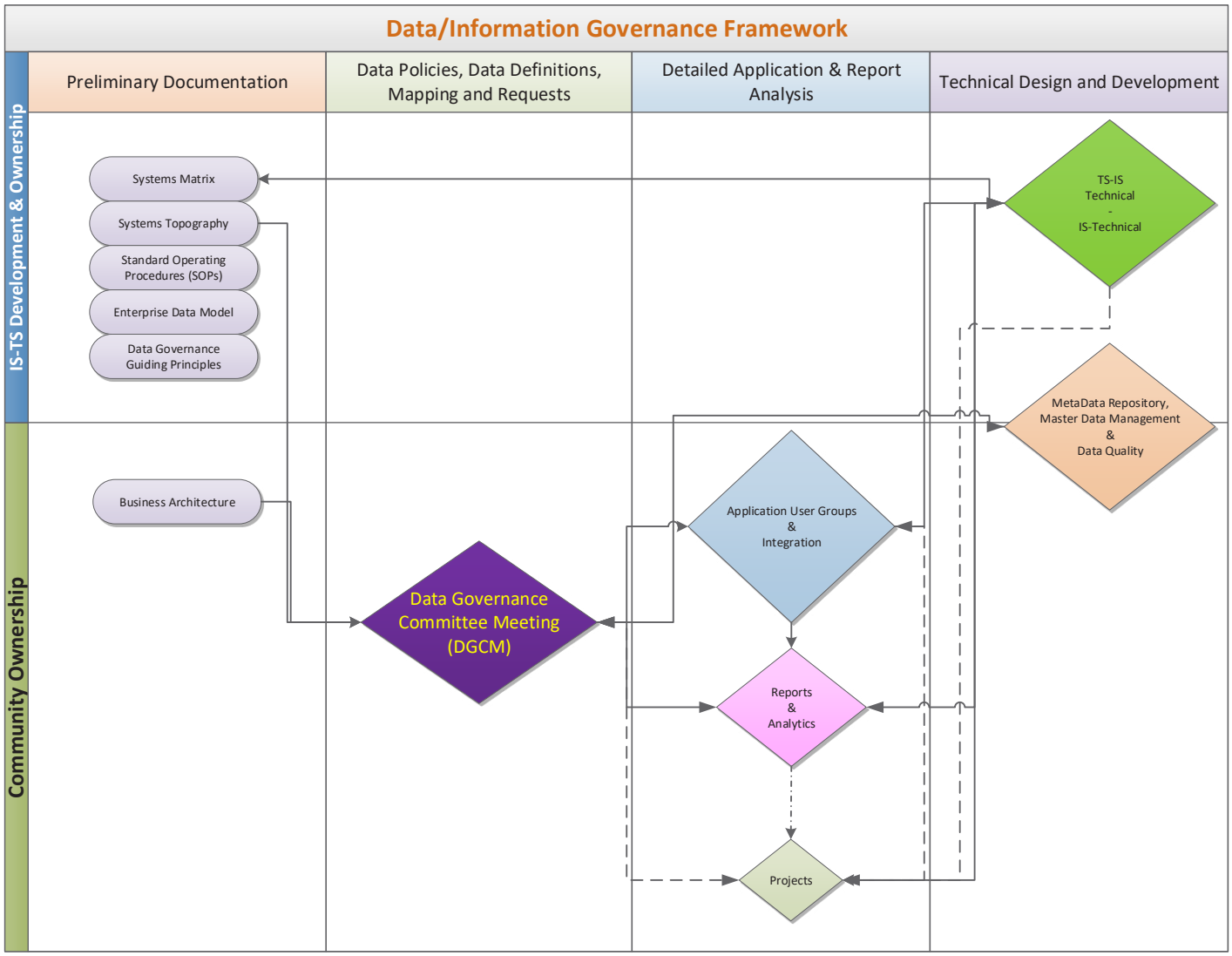
Subgroups: Application & Integration User Groups, Reports & Analytics User Group
Meeting Frequency: Once per month
Committee Authority: Recommend
Accountability: Chairs → Provost → President

The Data Governance Committee is comprised of members of the staff and administration, including:

Application Analyst, Power Campus	Director, Financial Aid
Business Analyst(s)	Director, Institutional Appraisal & Accreditation (chair)
Controller	Executive Manager, Clinical Internship
Coordinator, Student Retention (Student Services)	Manager, Alumni Relations
Data Architect (vice chair)	Manager, Information Services
Director, Administrative Services	Provost/VP, University Affairs (LO)
Director, Admissions	Registrar
Director, Marketing & Communications	

Note: The data governance charter was created to articulate the purpose of the committee, identify committee members, and provide accountability for the committee.

Figure 5. Data/Information Governance Framework



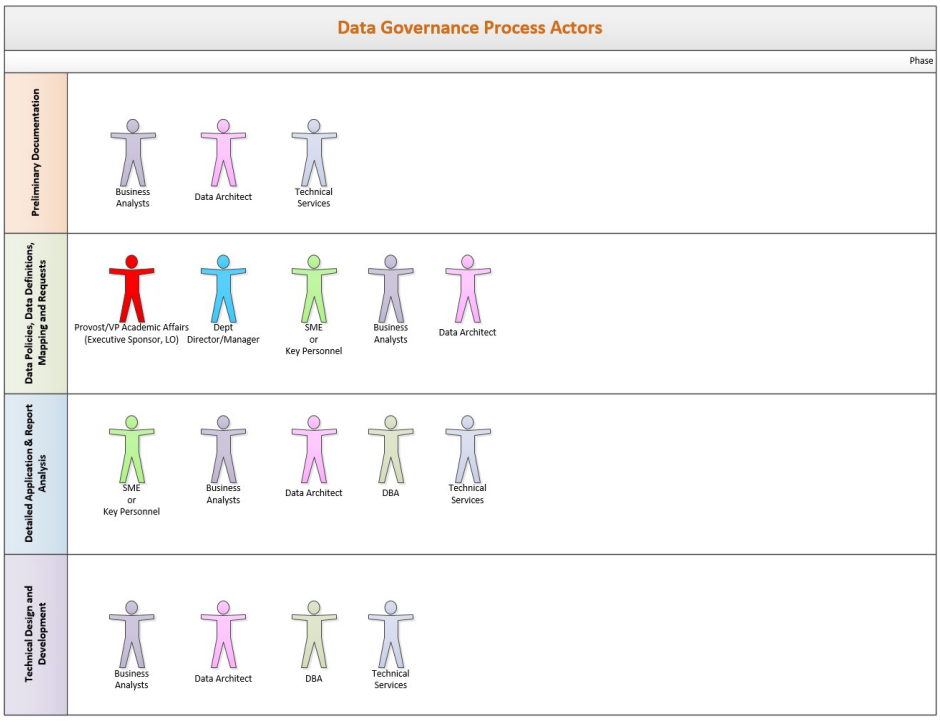
Note: The data/information governance framework was developed to show how the various elements flow to and from the Data Governance Committee meetings, and who owns the processes (left side shows this ownership). In addition, it shows how various documentation, policies, definitions, requests, analyses, and development relate to each other.

the data dictionary and business glossary, which are comprehensive lists of all reference data from the SIS and the main focal point for the Data Governance Committee's initial guidance.

Creation of a Data Dictionary

A data dictionary is another tool that is useful for educating users about the need for consistent and clean data. Although it can arguably be viewed simply as a list of field values and their definitions, a data dictionary is actually an efficient way of extracting and maintaining business and data rules. Example definitions in a data dictionary within the context of a university include values in the enrollment status field (enrolled, dismissed, leave of absence, never enrolled, summer

Figure 6. Data Governance Process Actors



Note: The data governance process actors diagram expands on the data/information governance framework to add further details of which roles are involved with each section of the framework. It helps identify who is accountable for each area.

off, etc.) or course attendance status (added, dropped, withdrawn). The business glossary ties data dictionary definitions together into overarching themes and is a list of terms that describe the components of running an organization. Example terms that were included in the UWS business glossary are those associated with the student life cycle (inquiry, applicant, student, intern, alumnus, etc.) as well as the list of academic programs offered by UWS. The data dictionary (figure 10) and business glossary (figure 11) are tightly linked because both inform each other and create a map between administrative processes, the type of data collected, and how those data need to be entered. More importantly, the data dictionary and business glossary get administrators speaking the same language and help develop a common understanding of the overall picture of what each department is supposed to accomplish.

There are two main approaches to building this common understanding. The first is a bottom-up approach starting with a data dictionary whereby a comprehensive list of all the fields and their possible values is pulled from each database system using the database software-specific metadata tables. A committee discusses and defines each field and value one by one. In creating definitions this way, themes emerge that transform into terms that define larger processes as in a business glossary. This approach can be beneficial, particularly if there is contention between departments highlighted by poor data quality or enterprise systems, and subject matter experts are struggling to agree to the definition or to see their role in a larger context. The drawback of this approach is that the process will be extremely tedious and time consuming, and it likely will take longer for the organization to see the value.

The second approach is a top-down method starting with the business glossary; this is the approach UWS used. A committee agrees to a list of terms and then develops common definitions for those terms; in turn, the data architect can map these terms to system functionality. The definitions emerging from this method would align more tightly with the strategic plan, be more human-focused, and would immediately provide administrators with a common language that they can begin using in daily interactions to raise the level of common understandings and to minimize common misunderstandings. This approach is beneficial if subject matter experts have positive relationships and data quality is reasonably good as a result of standard business practices.

This approach lends itself well to building a master data management system that ties common terms to field values in each of the systems and keeps them in sync. The main drawback of

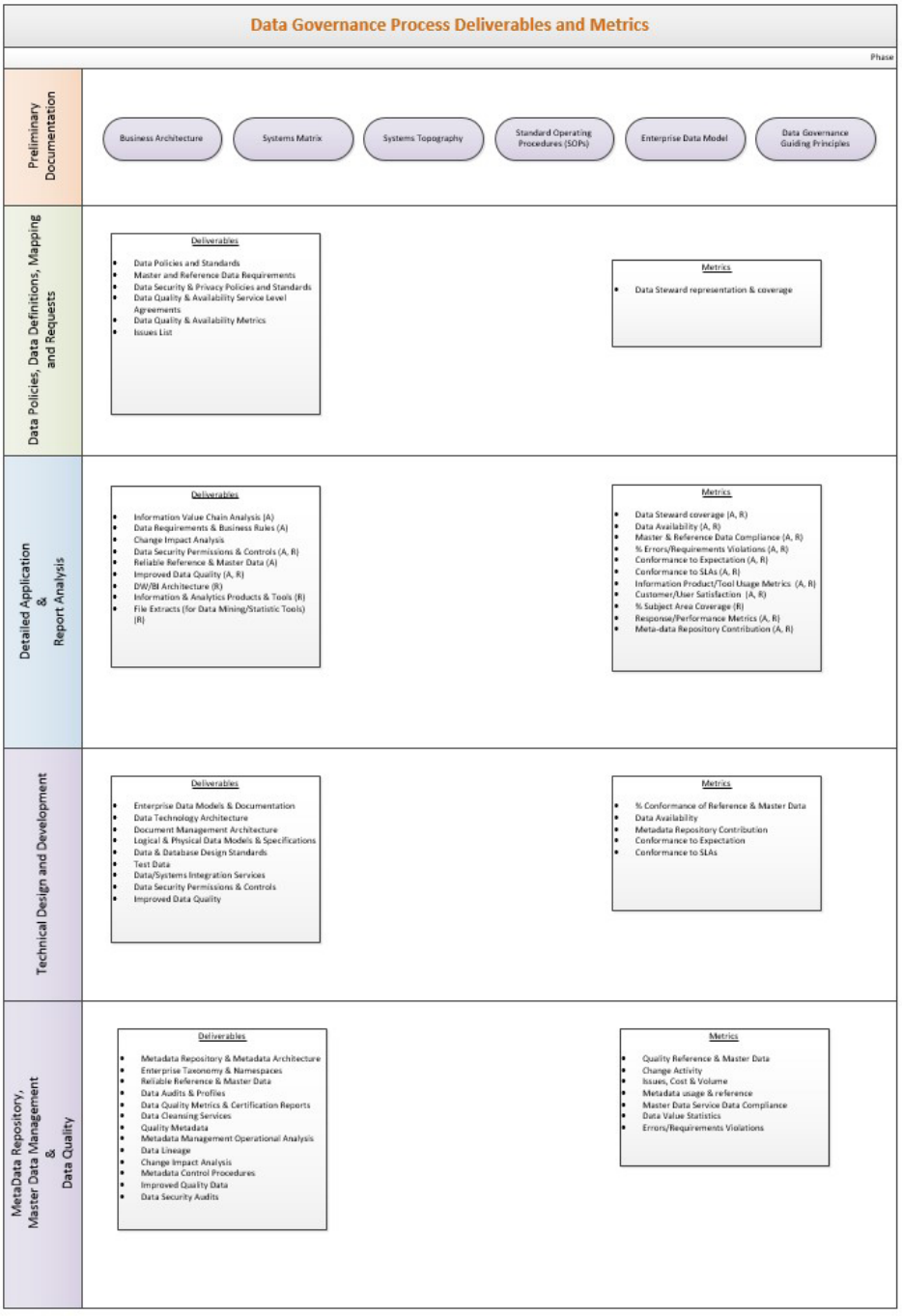
this approach is that if these definitions are not immediately followed up with discussions about the data elements inside the database systems (e.g., the data dictionary, mapping business glossary terms to field values) the value of this exercise is lost. If an institution experiences this it can become more complicated for information services staff members to explain the end product to users, which imposes a constraint on the system and is its own source of frustration for users.

Encouragement of Campus-wide Engagement

The Strategic Planning Steering Committee was formed in the Spring of 2016. This committee provided another avenue to educate colleagues that represented various departments and levels about data governance and the need for a solid technology foundation. The outcome of socializing all the data technical issues at the institution resulted in three of the seven top goals focusing on data management (figure 12) and IT infrastructure. Simultaneous to working on the strategic plan, the university began modifying its core themes in conjunction with the new accreditation cycle.

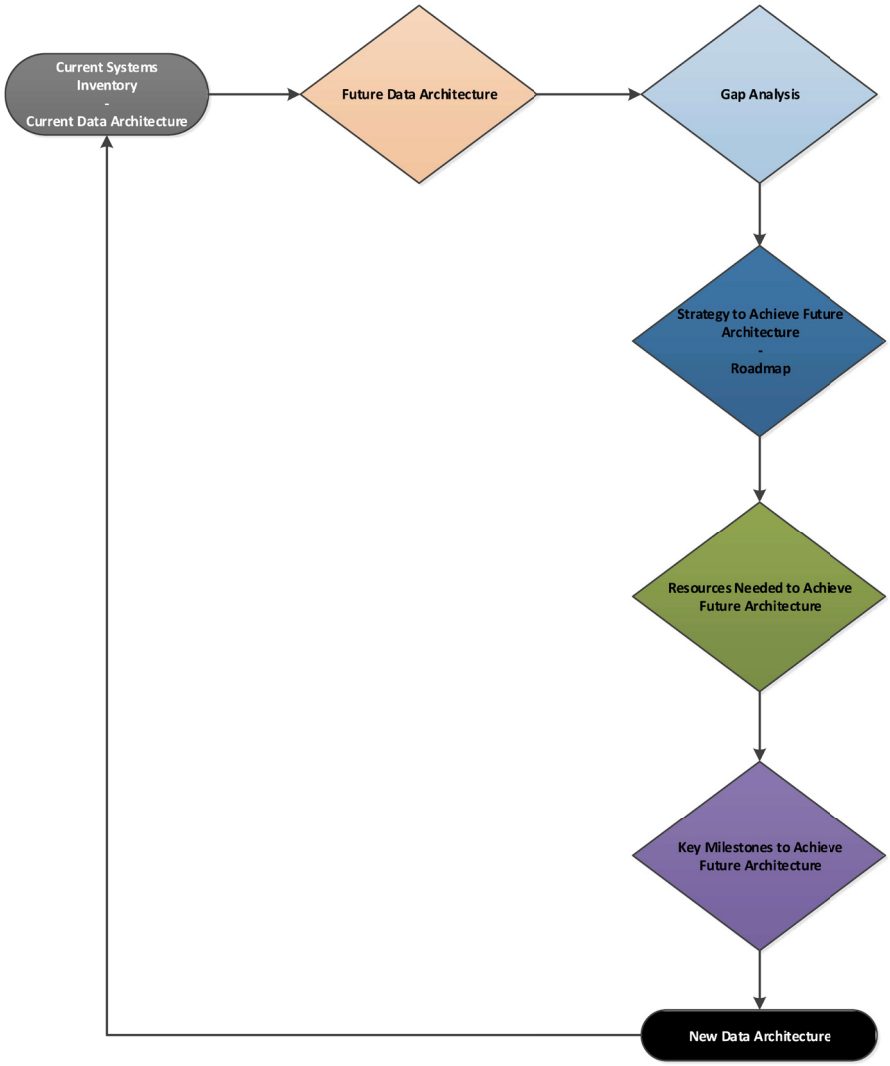
The university updated its mission and core themes at the start of its FY17–FY23 accreditation cycle through a campus-wide engagement project. The academic leadership teamed up with information services to create the Leaning in the Doorways Initiative, during which this academic leadership team interviewed nearly every university employee, asked them how they use data in their work, and

Figure 7. Data Governance Process Deliverables and Metrics



Note: The data governance process deliverables and metrics diagram expand on the data/information governance framework to add further details of what will be created and provided in each area.

Figure 8. Data Governance Information Flow



Note: The data governance information flow diagram expands on the data/information governance framework to add further details of how the deliverables are created and updated.

asked what they needed to fulfill their job duties. In addition to introducing employees to the importance of data, other personnel issues were positively affected by this initiative such as improved morale, with employees saying they felt like they were part of the solution as a result of this initiative.

This initiative helped produce not only an improved mission and vision, but also core theme measures that employees felt they were a part of. Employees began to think about how their positions contributed to the mission and believed that they might have valuable information to share. In the past it was difficult to get individual departments to contribute and to understand how their role fits into the big picture so this change was significant, and resulted in a more robust annual appraisal of the university, as well as a mission that was created by all. This experience also led to increased teamwork between academic affairs and the Office of Information Technology that has increased the fulfillment of data management improvement needs.

User Community Group Meetings

The user community meetings were another mechanism designed to ensure data definitions and standards are imbued into the system in the data governance framework. As terms are defined, business rules can be extracted, traced, and compiled into a coherent flow where system functionality is configured and data are entered according to the rules and standards. These definitions and standards also served as the foundation for increased automation, increased productivity, and more user experiences that were positive. System-user community group meetings help operationalize this process by collecting the subject matter experts to discuss various features, issues, bugs, or limitations with the systems. Also discussed in these meetings are workload and balancing tasks that staff negotiate so that the whole process and the life cycle are carried out more seamlessly. The users also work through a prioritization of building system improvements in conjunction with the

Figure 9. Quality of Data Chart from Data Dictionary Guiding Principles

	Qualities of Data & Information	Definition
Raw Data	*Trustworthy*	Data that is a reliable reflection of reality, complies with definitions and standards and meets user expectation. Trustworthy data is accurate, complete, understood, controlled for quality and consistent.
	Consistent	Data that complies with operational rules, operational element definitions and data management standards.
	Accurate	Data that is a reflection of the way operators understand records and is consistent against defined terms and operational rules and policies.
	Audited	Data that is monitored for operational processing, system functionality and data quality.
	Regulated	Data that is profiled and corrected for accuracy and controlled for organizational definition compliance.
	Secured	Data and information that is accessible only to the right people and entities.
	Organizational Asset	Data is seen as an asset to all organizations across the university. This includes storing it into secured, persistent and accessible data stores (aka, stored in databases and not spreadsheets), quantifying its financial impact to the university and treated as intellectual property.
Information, Reports, Charts, Graphs, Models and Dashboards	*Relevant*	Information that improves the quality of the decision making process. It is data and information that meets or exceeds the needs of the question, is appropriate or pertinent to a situation or the university at large, and is delivered in a timely manner.
	Accessible	Information that is available through user-friendly interfaces and at easy disposal.
	Complete	Information based on records that contain all data required to meet operational policies and rules and create a whole view of a data entity.
	Wholistic	Information based on data that is complete and that positively contributes to a larger understanding of a question, a problem, and the university. It is also built upon an infrastructure that is designed for the long term.
	Actionable	Information that completely answers the questions "what?", "when?", "where?", and "why?" leading to clear decisions and/or action automation.
	Modeled	Data that is statistically profiled for completeness, accuracy and correlative relevance and provides an image of a possible future.
	Visually Communicative	Information is conveyed through graphs, charts and other creative forms in a way that is descriptive, verifiable and improves understanding of concepts.

Note: The quality of data chart from data dictionary guiding principles provides a sample of what was created to show the target data quality features and what is meant by each of these qualities.

Figure 10. Data Dictionary (Excerpts)

TableName	ColumnName	DataType	sNullable	sPK	sFK	ColumnDescription
ABT_ACCOUNTS	ACCOUNT_EMAIL	nvarchar(510)	No	No	No	Email account for user.
ABT_ACCOUNTS	ACCOUNT_ID	nvarchar(16)	No	Yes	No	System-generated ID, independent of the user's people_code_id and their login ID.
ABT_ACCOUNTS	COOKIE_ID	nvarchar(32)	Yes	No	No	Cookie ID for user.
ABT_ACCOUNTS	CREATE_DATE	datetime	Yes	No	No	Row (record) create date. Updated automatically when the row is created. No keyboard access.
ABT_ACCOUNTS	CREATE_OPID	nvarchar(16)	Yes	No	No	Row (record) create operator. Updated automatically when the row is created. No keyboard access.
ABT_ACCOUNTS	CREATE_TERMINAL	nvarchar(8)	Yes	No	No	Row (record) create terminal. Updated automatically when the row is created. No keyboard access.
ABT_ACCOUNTS	CREATE_TIME	datetime	Yes	No	No	Row (record) create time. Updated automatically when the row is created. No keyboard access.
ABT_ACCOUNTS	FULL_NAME	nvarchar(510)	No	No	No	Full name of person either built from name columns in PEOPLE table or user-entered for users that do not have a PCID
ABT_ACCOUNTS	LAST_LOGON_DATE	datetime	Yes	No	No	Date user last logged onto the system.
ABT_ACCOUNTS	LAST_LOGON_TIME	datetime	Yes	No	No	Time user last logged onto the system.
ABT_ACCOUNTS	LOGGED_IN	nvarchar(2)	No	No	No	Account that is logged into PowerCampus.
ABT_ACCOUNTS	LOGIN_ID	nvarchar(510)	No	No	No	Login ID for user.
ABT_ACCOUNTS	ORG_CODE_ID	nvarchar(20)	Yes	No	No	Organization code (O) And ID
ABT_ACCOUNTS	PASSWORD	nvarchar(510)	No	No	No	Password of user.
ABT_ACCOUNTS	PEOPLE_CODE_ID	nvarchar(20)	Yes	No	No	People Code ID for user.
ABT_ACCOUNTS	REVISION_DATE	datetime	Yes	No	No	Row (record) revision date. Updated automatically when the row is revised. No keyboard access.
ABT_ACCOUNTS	REVISION_OPID	nvarchar(16)	Yes	No	No	Row (record) revision operator. Updated automatically when the row is revised. No keyboard access.
ABT_ACCOUNTS	REVISION_TERMINAL	nvarchar(8)	Yes	No	No	Row (record) revision terminal. Updated automatically when the row is revised. No keyboard access.
ABT_ACCOUNTS	REVISION_TIME	datetime	Yes	No	No	Row (record) revision time. Updated automatically when the row is revised. No keyboard access.
ABT_CODEREPORTCOLUMNS	COLUMN_DISPLAY	nvarchar(2)	No	No	No	Column display name.
ABT_CODEREPORTCOLUMNS	COLUMN_DISPLAY_ORDER	int	No	No	No	Order within the code table that the non-standard columns are to be displayed.
ABT_CODEREPORTCOLUMNS	COLUMN_NAME	nvarchar(70)	No	Yes	No	Name of column.
ABT_CODEREPORTCOLUMNS	TABLE_NAME	nvarchar(70)	No	Yes	No	Name of table.
ABT_COMPOBJECTS	ABT_JOIN	nvarchar(2)	No	No	No	Always an asterisk "*".
ABT_COMPOBJECTS	COMPONENT_TYPE	nvarchar(20)	No	Yes	No	Examples are: WEB system, VB system, etc.
ABT_COMPOBJECTS	CREATE_DATE	datetime	No	No	No	Row (record) create date. Updated automatically when the row is created. No keyboard access.

Note: The excerpts from the data dictionary provides a sample of items in the data dictionary, with details of which source table it is from, the column name, data type, whether it is a required field, a primary or foreign key, and the description.

analysts. With users understanding their role in a larger process and system configured to improve their productivity, they begin to increase their trust in the system and the information it provides.

In conjunction with system user group meetings were reporting and analytics user group meetings. The best approach for UWS to enable good information quality and to enhance interdepartmental communications was to build a centralized data repository where users can get the clean, accurate, and transformed data they need for their analyses. This made the reporting and analytics meetings even more important because those meetings are the forum for information stakeholders to discuss whether a

Figure 11. Business Glossary (Excerpts)

PowerCampus Program Code	Official Program Name	Campus Offering this Program	CIP Code	CreditLoadFullMax	CreditLoadFullMin
DOC-EdD-SPSY	Doctorate of Education in Sport and Performance Psychology	Online	31.0508	100.00	9.00
GR-CERT-NUTRIT	Graduate Certificate in Human Nutrition and Functional Medicine	Online	51.3102	100.00	9.00
GR-CERT-POSLD	Graduate Certificate in Positive Leadership and Administration	Online	31.0508	100.00	9.00
GR-CERT-SPTNUT	Graduate Certificate in Sports Nutrition	Online	31.0508	100.00	9.00
GR-CERT-SPTPSY	Graduate Certificate in Applied Sport Psychology	Online	31.0508	100.00	9.00
GR-MS-MDI	Graduate Master of Science in Diagnostic Imaging	Online	60.0411	100.00	9.00
GR-MS-NUTRIT	Graduate Master of Science in Human Nutrition and Functional Medicine	Online	51.3102	100.00	9.00
GR-MS-SPSY	Graduate Master of Science in Sport and Performance Psychology	Online	31.0508	100.00	9.00
GR-MS-SPTMED	Graduate Master of Science in Sports Medicine	Online	31.0508	100.00	9.00
GR-CONC-HLTHWL	Graduate Concentration in Health and Wellness	Online	51.0001	0.00	0.00
GR-CONC-NUTR	Graduate Concentration in Nutrition	Online	51.3102	0.00	0.00
GR-CONC-POSCOA	Graduate Concentration in Positive Coaching	Online	31.0501	0.00	0.00
GR-CONC-SAA	Graduate Concentration in Sports and Athletic Administration	Online	31.0504	0.00	0.00
PROF-DC-CHIRO	Doctor of Chiropractic	Portland Campus	51.0101	100.00	9.00
UG-BS-HUMBIO	Bachelor of Science in Human Biology	Portland Campus	26.9999	100.00	12.00

Note: The excerpts from the business glossary provides a sample of items in the business glossary, with details of the SIS program code, the official academic program name, if it is online or on campus, the classification of instructional programs (CIP) code, and minimum and maximum credits associated.

Figure 12. Data Management Strategic Plan Goal

Goal 1: Enhance our ability to purposely collect and use data

Objectives		Initiatives
1.1.	95% of employee understand how to collect, use, and access data to inform decisions	**1.1.1.** Educate and train departments on the collection, use, and access of data **1.1.2.** Conduct a data audit and gap analysis
1.2.	Establish a data governance structure to improve data integrity by 2019	**1.2.1.** Create data governance committee and subcommittees comprised of key stakeholders **1.2.2.** Develop and implement guiding principles for data governance **1.2.3.** Create and implement a data dictionary
1.3.	Implement a business intelligence framework to optimize data-driven decision-making by 2020	**1.3.1.** Develop and implement a framework to support ongoing data-driven decision making **1.3.2.** Improve and implement data analytics and reporting capabilities

Note: The data management strategic plan goal provides a sample of one of the three strategic plan goals that emphasize the need to improve data management and underlying technology infrastructure, and also provides details on the objectives and initiatives related to the goal of enhancing the university's ability to purposely collect and use data.

report or available data pool meets the definitions, to discuss their information needs, or to discuss how it reflects their sense of accuracy or validity. These weekly meetings can allow stakeholders to discuss the implications of any findings, and will provide the platform for machine learning and correlative analysis in the future.

Both user groups are supported by a more behind-the-scenes set of meetings solely involving the two houses of the IT Department. These meetings serve to delve into the bowels of the system for issue resolution of and direction for capacity and technology planning. Actions taken at this level will require their own internal set of policies and standardized processes in a way that minimizes the need for putting out fires, increases the preemption of failures, and makes way for anticipation of business needs. By having agreement at the business and user levels through the data governance process, IT's role in supporting the business will be made much simpler and more effective.

Validation and Monitoring of System and Data

Data definitions, business glossary terms, and data policies will inform and initiate system functionality change. As each new feature and system configuration is brought online, it needs to be verified it to make sure it aligns with the need, and to evaluate it against

the larger system scope to identify any downstream impacts in a preemptive effort with a postimplementation handling plan. This cycle of user acceptance testing not only is critical to the stability and precision of deploying such new features, but also can aid in improving trust and user experience. A trusty but flexible test environment plays a key role in IT success and increased data quality.

Once features have been tested and implemented into the production environment, they must be monitored. If an issue is found and left untreated, it will erode data quality and reduce trust in the system. By combing through the ticketing system, IT staff can catch, address, and feed back to many other processes (e.g., project, systems management, and/or administrative) these trends for resolution and system restabilization.

The other method for monitoring the health of data is through a data profiling program that alerts users and business analysts to any data anomalies. A data profiling program creates a direct feedback loop to the Data Governance Committee about how data in each system comply with the data policies and definitions. In a data profiling program, the first step is the definition that is stored in a master data schema. Any anomalies discovered can be retroactively rectified and corrected, will help fulfill the goal of the data governance process, and, furthermore, will instill trust in the data.

The data dictionary obtained during the data governance meetings has served to provide the necessary definitions and value maps back to the transactional systems. These definitions have been stored in master data tables that provided the basis for data quality improvement. One means for this improvement is to build controls in the transactional system such that nonstandard values are prevented at the source. The other means for this improvement is that reports can reference these master data tables to pull information out in a way that aligns with definitions and values.

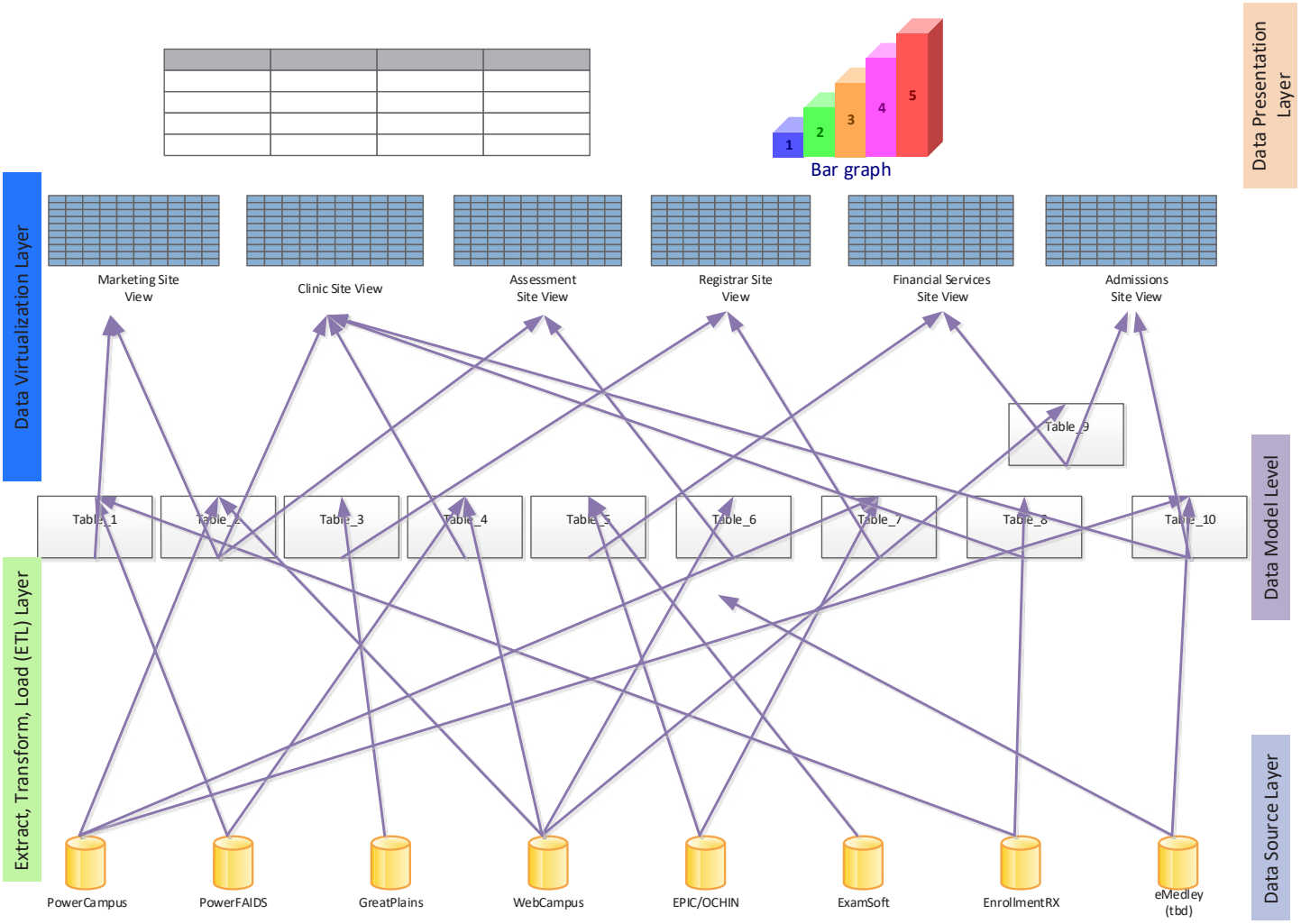
In our endeavor to improve data quality, we began with just a list of academic program offerings and their associated codes. In the SIS a combination of a program code, a degree code, and a curriculum code is what marks an academic program. If any of the codes within this code combination are not standard, information extracted on students and programs yields incorrect results and can negatively impact the SIS system automation. After devising this list of academic programs and inserting it into a table, the data architect built a custom database constraint that gave an error when users tried to save it in the system; this system prevented them, and other applications, from saving incorrect data. The same table was included in report queries to extract student and program information, which was particularly helpful with compliance reports.

Customization and Automation of Reports

UWS created a centralized data repository called the blended operational data store (BODS; see figure 13). This repository introduced the ability for staff to extract data from the SIS and insert it in the BODS where users can be assured of clean, accurate data. One of the first projects BODS was used for was a project to build an automated solution to keep Outlook current-term student distribution groups in synch with the SIS to facilitate timely communication with students. To build toward the future, additional attributes of an academic program, such as the classification of instructional programs (CIP) code and campus location (physical campus or online), have been added to the academic programs master data table to help answer other common questions about students and programs. As the data governance community matures, more master data tables that are similar will follow and the paradigm of building controls as well as reports from the same tables will grow stronger.

Another major reason of implementing a central data repository is that sometimes transactional system data are not in a format that meets the needs of user questions or are not in an environment that can handle the complexity of extracting those data as information. A separate database where transactional data have been transformed is required to achieve these goals. Building a central data repository requires understanding what constituents want to know about the

Figure 13. Blended Operational Data Store Architecture



Note: The BODS architecture provides more details on the architecture to show the multiple back-end and front-end layers on the left and right sides of the diagram. The back-end layers are signified by the lower section of the diagram and include the extract, transform, and load layer and the data sources, and the front-facing layers include data virtualization and presentation. In the middle is the data model layer, which is where the data tables are stored and then flow upward for information to be presented.

university. The data architect designed information in the BODS schema in a way that increases completeness and reduces value redundancy, making the BODS the place from which staff can pull operational information and levels of data analysis and analytics.

As more variables and automated extract, transform, and load processes are added to the BODS, users can more quickly access common information needs with the understanding that all information seekers are working from the same data and definitions.

CONCLUSION

A 2017 *Forbes* magazine study found that 53% of companies have some form of big data analytics they rely on for change decisions with "reporting, dashboards, advanced visualization end-user 'self-service'

and data warehousing [as] the top five technologies and initiatives strategic to business intelligence" (Columbus, 2017). Accreditation standards and compliance policies are driving the education sector in the same direction with demands for decisions based on calculated raw data. At the same time, information analysis and delivery technologies are growing exceedingly sophisticated, which enables quicker decision-making cycles that educational institutions can access once they better streamline administrative processes through cooperative automation. The university's experience with the NWCCU accreditation process has not only demonstrated this trend, but also has positioned UWS on the path of causing analytics to become an intrinsic aspect of running the institution.

There were many things that needed to happen at UWS in order for it to comply with accreditation standards. The main task for the institution was the need to conduct reliable IR. Other tasks included educating executives to prevent end users from working outside the systems, and holding those executives responsible for their actions and any vocal opposition to the changes. The data governance meetings became a platform for educating data stewards about their role and building trust in the systems; the Data Governance Committee leaders provided daily guidance to steer data steward activity to work within the systems. By virtue, trust was also being restored in the data themselves.

With the help of the IR specialist and a now accepting administration, university personnel went from not understanding the need for the position of IR specialist to heavily relying on the specialist's expertise. The IR specialist needed to be a change agent and to have the experience to know how to get the necessary resources to make big improvements to significantly increase data quality and availability in a reasonable time frame. There were many hurdles along the way but the largest was balancing the need for momentum to get all these major changes accomplished while not overwhelming an institution that was already dealing with change fatigue.

As for the status of UWS, there was a happy ending for the regional accreditation issues. In the Winter of 2018 the warnings were officially removed, the university was officially reaccredited, and UWS received commendations on how well they improved in many areas, including data management.

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