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Improving the Assessment (Assurance of Learning) Processes

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Improving the Assessment (Assurance of Learning) Processes

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ABSTRACT

Strategically located in downtown Denver, this state university is a popular destination for working adults and traditional students alike to get a quality education. The university's College of Business was first accredited by the Association to Advance Collegiate Schools of Business International (AACSB) in spring 2016. Five undergraduate programs and one graduate program in Accounting were accredited; an undergraduate program in Economics was excluded from AACSB review. Since the initial accreditation, the college added three undergraduate degree programs and a second graduate program (MBA). AACSB standards stipulate assessing general knowledge & skills and subject-specific knowledge & skills for each program. University also requires each program to conduct program assessment every year. Given this huge challenge of assessment for 11 programs that includes data collection, analysis, and planning & implementing intervention to improve student learning, the faculty team was looking for ways to improve the processes to avoid duplication and data storage for easy retrieval. This paper, the first in a two- part series, explains how this challenge is being addressed by the college. Because of six sigma approaches, a technology solution is developed.

Keywords: Assurance of Learning, Program Assessment, Assessment Technology.

INTRODUCTION - THE PROGRAMS

The College of Business at the university currently offers nine undergraduate programs and two graduate programs. The undergraduate degree programs fall under two categories: Bachelor of Science (BS) and Bachelor of Arts (BA). Bachelor of Science degree is offered in Accounting, Computer Information Systems, Finance, International Business (New), Management, and

Marketing. Bachelor of Arts degree is offered in Economics (excluded from AACSB review), Entrepreneurship (new), and Global Business Studies (new). The two graduate programs offered are Master of Professional Accountancy (MPAcc) and a new Master of Business Administration (MBA).

The college has approximately 3,500+ undergraduate students with most of them concentrated in Management, Accounting, and Computer Information Systems majors. The graduate programs have approximately 150 students with most them in the MPAcc program.

There are six academic departments in the college that has approximately 75 faculty members, most of whom have terminal degrees within their discipline and are research active.

THE CHALLENGES

During initial accreditation, there were only five undergraduate programs and one graduate program. The assessment plan was designed and implemented by a college-level committee (Assurance of Learning (AOL) committee) comprising of an assessment representative from each undergraduate program. For the graduate program (MPA – Master of Professional Accountancy) assessment, Accounting department has an assessment committee comprising of faculty members teaching at the graduate level. The committees, in general, are responsible for developing mission-driven program goals in consultation with stakeholders, creating the course map for each program, designing rubrics for assessment, analyze data, and suggest appropriate interventions to the departments if goals are not met. Data is regularly collected in specific course sections based on the assessment plan. The AOL plan has yet to be completed for the two new BA programs. The graduate committee for MBA has an assessment plan; however, the rubric development and baseline assessment is yet to be completed.

In addition to AACSB’s assessment requirements, the University also requires program level assessments every year. Hence, assessments need to be performed to satisfy the following:

AACSB AOL: General knowledge & skills and subject-specific knowledge & skills for each program.

University requirement: Each program should assess their goals (mostly subject-specific) every year.

General studies assessment: This is another university requirement and these goals are assessed across the general studies core. Some of the business courses fall in this category. The scope of this research does not include this assessment process since it is planned and executed by a university-level committee.

Program learning goals for each program are given in Table 1.

Program	Learning Goals	Assessment Status
AACSB Requirement		
B.S. in Accounting	1. Communications (Written & Oral) skills 2. Decision making skills 3. Business environment that includes global & ethical skills 4. Core Business knowledge	a. Program goals were measured at least twice b. AOL committee worked to reduce number of learning goals from six to four as per AACSB PRT recommendations c. Refining rubrics d. Common goals since business core is common
B.S. in Computer Information Systems		
B.S. in Finance		
B.S. in International Business		
B.S. in Marketing		
B.S. in Management		
B.A. in Economics	NA	NA
B.A. in Entrepreneurship	Work in process	New program. Assessment yet to be completed
B.A. in Global Business Studies	Work in process	New program. Assessment yet to be completed
Master of Professional Accountancy (MPAcc)	1. Ethical awareness 2. Effective communication skills	a. Program goals were assessed at least once

Program	Learning Goals	Assessment Status
	3. Critical thinking/Decision-making skills 4. Teamwork and leadership skills 5. Sound understanding of (5a) accounting regulation and (5b) fraud awareness in practice	b. Committee working on refining measurement rubrics and assessment plan.
Master of Business Administration (MBA)	1. Written, oral, and collaborative communication skills 2. Analytic decision-making skills 3. Ethical skills 4. Global skills 5. Integrate knowledge across business functions	New program. Goals are yet to be assessed.
University Requirement		
B.S. in Accounting	Subject-specific learning goals	Assessed every year
B.S. in Computer Information Systems	Subject-specific learning goals	Assessed every year
B.S. in Finance	Subject-specific learning goals	Assessed every year
B.S. in International Business	Subject-specific learning goals	Yet to be assessed
B.S. in Marketing	Subject-specific learning goals	Assessed every year
B.S. in Management	Subject-specific learning goals	Assessed every year
B.A. in Economics	General studies assessment Subject-specific learning goals	Assessed every year
B.A. in Entrepreneurship	Subject-specific learning goals	Yet to be assessed
B.A. in Global Business Studies	Subject-specific learning goals	Yet to be assessed

Table 1. Degree Programs and Learning Goals

Given the number of programs and complexities involved, there are several challenges associated with the college's assessment efforts.

Data Management: Given the number of programs and assessment volume, a central databank/repository is yet to be identified to store all assessment data and related documentation. Data is currently kept in excel spreadsheets, word documents, and hardcopy format. Initially, Blackboard, a course management system, was used and later found to be ineffective (data was lost when terms rolled over) and therefore abandoned.

Formal process: Communications between stakeholders regarding assessment data collection, analysis, intervention plans, and results are primarily done through email. Faculty members collecting data provide feedback to the assessment committee through a semi-structured process. Lack of structured processes have resulted in communication gap among the committee, chairs, administration, and faculty members.

Buy-in: While faculty buy-in need of assessment has been strong since accreditation effort started, informal processes and lack of structured communications may threaten and weaken this buy-in.

Data analysis: In addition to data management issues, data analysis is another challenge. Assessment data was either analyzed by college admin staff or the AOL committee. Faculty member submit raw data, mostly in hardcopy format, which is then transcribed to spreadsheets and analyzed.

Subject knowledge Assessment: Currently, subject knowledge of students is measured within specific core courses and reported. This was very tedious to assimilate data from all sections. Data was submitted by faculty either on hardcopy format or using spreadsheets. The AOL committee or office staff had to transcribe hardcopy data into spreadsheets and analyze. This approach measures only course outcomes and it is not a substitute for across the core curriculum assessment as measured by the Educational Testing Services' (ETS) Business test. Also, the business core courses offered at the college do not map to all the sub-areas of the 9 core areas of the ETS business test. Hence, administering this test to the business students will not be acceptable. An in-house

assessment needs to be developed to assess students' business core knowledge.

Lack of affordable software: There is no dearth of course management technology in the marketplace. A clear majority are either used for course management (Blackboard, Moodle, Google classroom, etc.) or Faculty Data Management (Digital Measures, Sedona, etc.). For assessment data collection, analysis, and storage, the educational technology industry offers Taskstream (<https://www1.taskstream.com/>), TK20 (<https://www.tk20.com/>) , and LiveText (<https://www.livetext.com/>) that are primarily used in the schools and colleges of education mainly for the purposes of creating and maintaining ePortfolios and assessment. These three companies are now merged under one banner, Watermark (<https://www.watermarkinsights.com/>), since fall 2017. The most common pricing model entails each student paying a one-time fee of \$110 to \$130 for several (four to eight) years of use. Another model is the site licensing option. For a college with 3,500+ students, annual price is in the range of tens of thousands of dollars. There is also an initial setup cost (an additional several thousand dollars) that involves integrating with the university's student information system (SIS).

SIX-SIGMA (6σ) APPROACHES IN ACADEMIA

Six Sigma (6σ) is a set of techniques and tools for process improvement that leads to better quality output. While 6σ was originally created for manufacturing, its concepts also work for a transactional type process and it has been used in higher education for over a decade – from offering remedies to improve the quality of teaching (Madu & Kuei,1993) to applying 6σ to technical education (Sarda et al., 2006; Prasad et al., 2012). Kukreja et al (2009) used 6σ for performance improvement in business curriculum that resulted in improvement of Educational Testing Services (ETS) standardized test scores. Another study (Holmes et al., 2005) used 6σ for

academic program design and development. While several studies exist on 6σ in academia, there is a dearth of studies that focus on using this approach to improve assessment processes. A recent study (Bargerstock & Richards, 2015) at Maharishi University used 6σ to improve efficiency of assessment processes and reduced cycle time to close the loop (CTL) by two-thirds. Approximately 40 faculty and administrative leaders were trained on lean 6σ by an outside consulting group followed by more training by two business school faculty members.

USING THE SIX-SIGMA (6σ) APPROACH FOR ASSESSMENT

While the study at Maharishi University (Bargerstock & Richards, 2015) demonstrated the benefits of 6σ , its scope focused on a departmental level process and not on college level processes. More studies are required in this area to standardize best assessment practices using 6σ . The scope of the current study is at the college level. The research question is: *Will using 6σ approach help a college with several undergraduate and graduate programs to improve efficiency in assessment processes?*

Given the large number of programs and complexities of assessment processes, 6σ techniques can offer improvements to the current assessment practices. The 6σ methodology has five phases: Define, Measure, Analyze, Improve, and Control (DMAIC, Deming, 1986). The define phase objective is to gather the voice of the customer to define the problem. In the measure phase, the goal is to measure what is important to the customers. The analyze phase analyzes the cause and effect relationships to determine the cause of the problem (if any). And the improvement phase comes up with solutions to fix the problem and implement the best solution. Finally, the control phase states a plan to address issues so that the system continues to work as planned.

Define Phase

In this phase, the key is to define the process and the *Voice of the Customer*. The process is defined at a very high level for the define phase, and then broken down further in the measure phase. The biggest challenge to this phase is identifying who the customers are and their needs.

In the manufacturing world, a product is produced and sold to distributors. The distributors sell the product to contractors who install the product for the end user. If the product does not meet the expectations of the end user, it is neither the distributor nor the contractor (or retailer) who will receive most of the blame. The manufacturer will be blamed and subsequently brand image and goodwill will suffer. Hence, the manufacturer should strive to meet the needs of all customers in the value chain. Education process is analogous to manufacturing where the tuition paying student is the customer. Like in manufacturing, education processes should strive to meet the needs of all customers in the value chain. However, some students would like to get a degree with the least amount of effort expended. If the system focuses meeting only their perceived needs without ensuring they have the skills needed for a post college career, then the degree will lose its value soon.

6 σ offers a good tool for defining the customers called the SIPOC (Suppliers, Inputs, Process, Outputs, and Customers). With the SIPOC, the focus is on the process. First, the inputs to the process are identified. Those that provide the inputs are identified as suppliers. Those receiving the outputs from the process are the customers.

Application of SIPOC assessment context is shown in Table 2. The customers are the college, university, faculty, employers, accrediting organizations, community, AOL committee, and students. The next step is to define the requirements for each of the customers:

Faculty – want a process that is not time consuming and provides valuable feedback.

Accrediting organizations – want a process that ensures that a school is meeting its mission or working to meet the mission.

Students – want to have a successful career based on the skills and knowledge they learnt in the program.

Employers – want the students coming out of a program to have the skills and knowledge required for their jobs. This reduces retraining requirements and saves resources.

AOL Committee – want the data collection every semester go smoothly as per plan, organize and analyze data quickly.

College and University – want the students to be successful and the first choice of employers in the region.

Community – wants students to be well-rounded and model citizens.

Suppliers	Inputs	Process	Outputs	Customers
College/University Employers	Industry/University requirements	Define Goals of program	Goals	University Employers Community
AOL Committee	Curriculum map	Decide where to assess	Assessment plan	Faculty
Students Faculty	Assignments, case studies, exams, etc. Rubrics	Decide on how to assess and gather data	Raw assessment data	AOL committee
AOL committee	Raw assessment data	Analyze Results & write report	Goal assessment report	College Accreditation organizations
AOL committee Faculty	Goal assessment report Recommendations	Take corrective action	Curriculum and pedagogical changes	Faculty Students
		Repeat		

Table 2. 6σ SIPOC

5.1. Measure Phase

The measures should be based on the work done in the define phase. Some of the critical measures are as follows:

- Time to define goals of various programs
- Time to design appropriate measurement rubrics
- Time to create a curriculum map to identify where to collect data
- Time to accumulate data
- Time to analyze data and prepare report
- Time to plan for intervention
- Time to implement changes to curriculum/pedagogy

Some of these measures are not relevant since definition of program goals, curriculum mapping, and rubrics development were already complete. As shown in Figure 1, the focus going forward will primarily be on data collection, analysis, and planning & implementation of intervention for improvements (if goals do not achieve targets). The current data collection, analysis, and report dissemination processes are effective, but they are not efficient. There is a long cycle time which means there is a delay in process improvement. Learning Objectives are assessed on a two-year cycle. Faculty gather data every year on the goals. The AOL committee analyzes the data and prepares the report the following semester. From the report, decisions are made as to whether the curriculum/pedagogy needs changes. Then, appropriate changes are made. While pedagogical changes are relatively less time consuming, curriculum modifications take a whole academic year. So, the next year's assessment only has half of the data points reflecting the changes. Hence it takes 4 years to see if the changes are effective (closing the loop). Refer Figure 1.

This long cycle time for improvement is the biggest weakness in the assessment process; hence, it was decided to concentrate efforts on improving it. The goal is to reduce the time to identify weaknesses and fix them.

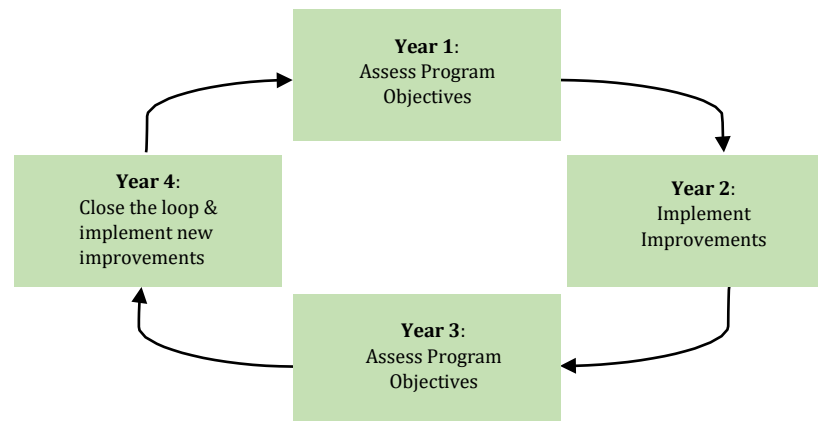


Figure 1. AOL measurement cycle

Analyze Phase

The key problems that were defined in the measure phase are: time to accumulate data, time to prepare the report, and time to implement changes. In the analyze phase, the focus is to identify the root cause of these problems. A fishbone diagram, brainstorming, and 5 Whys techniques were employed to identify the root cause of long assessment cycle time. The primary goal of the 5 Whys technique (Serrat, 2009) is to determine the root cause of a defect or problem by repeating the question why? Each answer forms the basis of the next question. The "5" in the name indicates the typical number of observations on the number of iterations needed to resolve the problem. Once the list of causes was identified, they were ranked and the following were identified as the major causes of the problem:

- Use of a manual system which makes the data gathering more time consuming and less uniform.

- It is very time consuming for an overburdened Faculty who teach four courses and an average of 120 students per semester.
- Poor data management, weak communications and difficulty in data analysis.

The focus of the project now becomes the search for a software solution that is affordable and will eliminate our current problems. Also, an effective software solution would solve the data storage issues.

Improve Phase

The improve phase is about selecting the best alternative and piloting it. It was decided to create in-house custom software solution, a web-based assessment data collection system (ADCS). The ADCS will have two primary components – (a) Aid in collecting data relating to learning goals for the General knowledge and skills, and (b) Aid in assessing students' subject specific knowledge and skills, i.e. the senior assessment test. While Educational Testing Services (ETS) offers the Business Test (MFT) that assesses the core business knowledge of graduating seniors, it was not found to be appropriate for one main reason – the 36-credit hours business core did not cover all the topics/sub-topics identified within the nine sections of the ETS – Business test. Since college's business core did not cover all areas identified in the ETS test, student results will not clearly reflect student learning.

To prove the concept, Associate Dean in-charge of AACSB, whose PhD is in Information Systems, started to design and develop a prototype to collect data for the BS programs. To develop a system, the following inputs are required.

- Assessment goals for each program,
- Rubric for each goal,

- A program map identifying which goal is measured where, and
- Class list for sections of courses identified for assessment on the program map.

Since it is a web-based system, a server is required to host the system. The associate dean was able to secure a virtual Windows server from the Information Technology group at the university at no direct cost to the college. After the necessary software were installed (Visual Studio and SQL server), a web-based prototype using .NET technology with SQL server database as the backend was developed. After careful planning, several tables were created for storing assessment data. Various interface elements and their purpose are listed below.

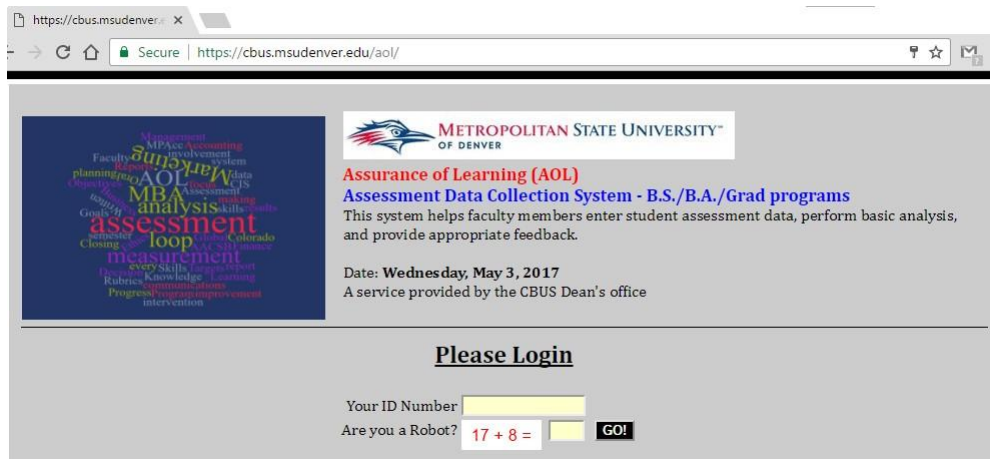


Figure 2: User Login

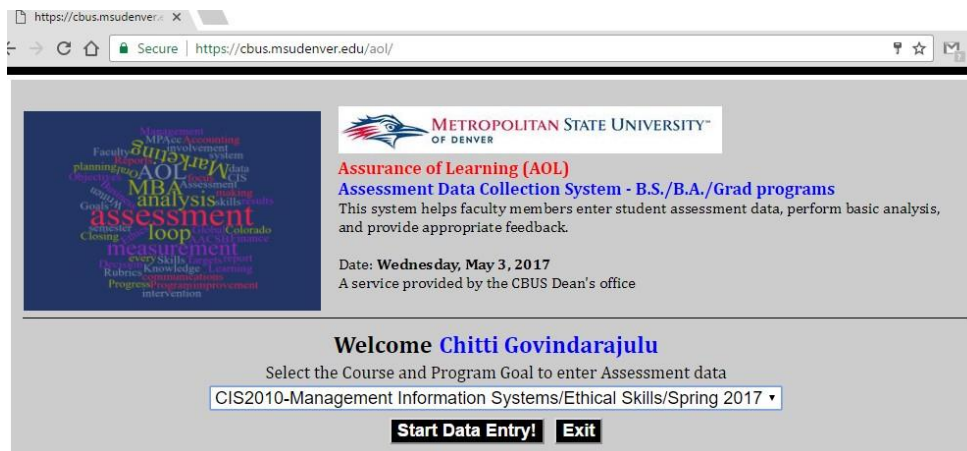


Figure 3: Course and goal selection

Access to ADCS was restricted through simple ID number request and a CAPTCHA to discourage bots from trying to compromise the system. Since this is a prototype, this basic login screen was found to be sufficient (Figure 2).

After successful login, a dropdown list helps the instructor to select the right combination of course and the learning goal to *Start Data Entry*. As it is common in assessment, a course may be assigned to measure more than one learning goal and vice versa (Figure 3).

Ethical Skills

Learning Objectives (LO #)	Below Standard (B)	Meets Standard (M)	Exceeds Standard (E)
Student identifies ethical issues (LO1: Identification)	Fails to identify	Identifies most of the key issues	Identifies all of the key issues
Student identifies stakeholder positions and interests (LO2: Positions)	Fails to identify	Identifies most of stakeholder positions and interests	Identifies all stakeholder positions and interests
Student understands how varying conceptions of equity can result in different conclusions (LO3: Equity)	Shows some understanding of different conceptions of equity	Fair understanding of different conceptions of equity	Thorough understanding of different conceptions of equity
Student recommends decisions based on ethical reasoning (LO4: Ethical Decisions)	Some recommendations are based on ethical reasoning	Most recommendations are based on ethical reasoning	All recommendations are based on ethical reasoning

NOTE: Please describe the tool used for assessing the learning goal. Ex: An exam problem, case study, presentation, assignment, written essay, etc.

A case study was used to measure this learning goal

Upload the Assessment Exercise used to evaluate this Program Goal
 Choose File | CIS2010-Ethics Case Study.docx

Stu ID	Last Name	First Name	Major	LO 1	LO 2	LO 3	LO 4
900456789	Allen	Karah	FIN	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E
900890123	Black	Greg	MKT	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E
900345678	Coffin	Nick	ACC	<input checked="" type="radio"/> B <input type="radio"/> M <input type="radio"/> E	<input checked="" type="radio"/> B <input type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input checked="" type="radio"/> B <input type="radio"/> M <input type="radio"/> E
900123456	Esperiquetta	Hortencia	CIS	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E
900901234	Johnson	John	MGT	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input checked="" type="radio"/> B <input type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E
900789012	Ko	Stephanie	MGT	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input checked="" type="radio"/> B <input type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E
900678901	Oh	Dayoon	ACC	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E *
900234567	Salinas	Yoelia	CIS	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E
900567890	Smith	Mandy	FIN	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E	<input type="radio"/> B <input checked="" type="radio"/> M <input type="radio"/> E *

Submit Data **Submit with missing Data** **Cancel**

Figure 4: Assessment Data Entry (Screen 1)

Given the course and assessment goal combination, the next screen (Figure 4), displays the rubric for the selected goal and student list in that course section. Since this prototype is not linked to university's student ERP system (Banner by Ellucian), the student list was retrieved manually from Banner after the course drop date and uploaded to ADCS. Interfaces (class list and rubrics) shown in Figures 3 and 4 draw data from the SQL server tables. In other words, the interfaces are completely data-driven. ADCS interface provides a text area to describe what tool (assignment, case study, exam, etc.) was used to assess the learning goal. Also, the instructor can upload the actual document used (assignment, case study, or exam). Once all the data were entered for students, a button click submits the data. The system lets the user know if there are any missing data to reduce oversight. But, the system also allows an instructor to *Submit with missing Data* to account for missing and absent students.

cbus.msudenver.edu/aol/ Assess.aspx

Ethical Skills

Learning Objectives	Below Standard (B)	Meets Standard (M)	Exceeds Standard (E)	Results (M + E)
Student identifies ethical issues (LO1: Identification)	11.11%	88.89%	0.00%	88.89%
Student identifies stakeholder positions and interests (LO2: Positions)	11.11%	88.89%	0.00%	88.89%
Student understands how varying conceptions of equity can result in different conclusions (LO3: Equity)	22.22%	55.56%	22.22%	77.78%
Student recommends decisions based on ethical reasoning (LO4: Ethical Decisions)	28.57%	28.57%	42.86%	71.43%

Provide your views/comments/recommendations on how to improve students' skills.

L03 and L04 did not meet targets. May have to have more focused lectures.

Upload documentary evidence of students' work

Choose File CIS2010-Ethics Best Work.docx **Best work**

Choose File CIS2010-Ethics Mediocre Work.docx **Mediocre work**

Choose File CIS2010-Ethics Worst Work.docx **Worst work**

Complete Assessment

Figure 5: Assessment Data Entry (Screen 2)

The next screen (Figure 5) automatically does calculations and displays the results for each learning objective. The instructor then can provide appropriate comments about the results which the AOL committee can review. For documentation purposes, this screen also allows the instructor to upload samples of students' best, mediocre, and worst work. Finally, clicking on the *Complete Assessment* button takes the user back to the *Welcome screen*. In this example, since the instructor had only one assessment assigned to a specific course, assessment is complete (Figure 6).

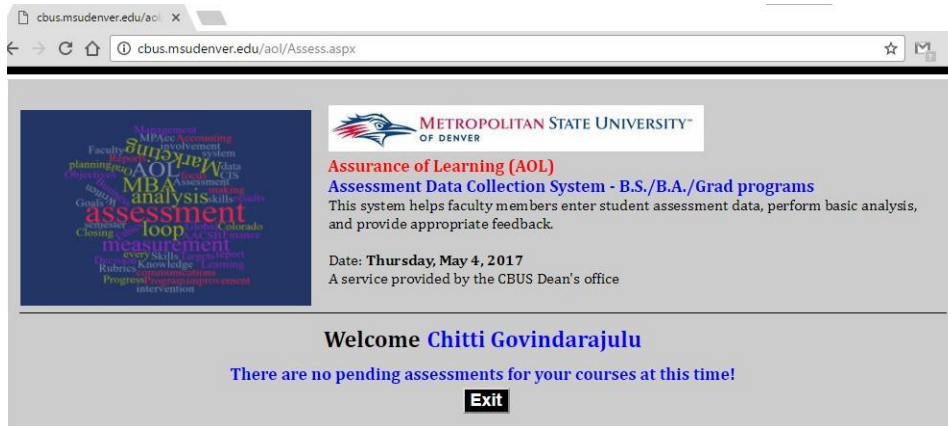


Figure 6: Assessment Complete

After an instructor completes assessment activities for a specific course and goal, an email confirmation (Figure 7) is sent with summary results to the instructor, AOL committee chair, and the system administrator. However, to test the proof-of-concept, assessment data related to two program goals of Master of Professional Accountancy program was collected using the system. After a demo of the prototype to the AOL committee and the Dean, they immediately approved it and steps are underway to improve the interfaces and to add an administrative module to upload class student list to the ADCS. The example shown in figures 2 through 7 are for demonstration purposes only and no actual student names or rubrics are used.

For core business knowledge assessment, AOL committee decided to develop an in-house test (modeled after ETS business test) which will be administered in the capstone Strategic Management course. Currently, work is in progress to identify key areas to assess within each core business area. The prototype will be tested end of summer and assessment is expected to be conducted starting fall 2017.

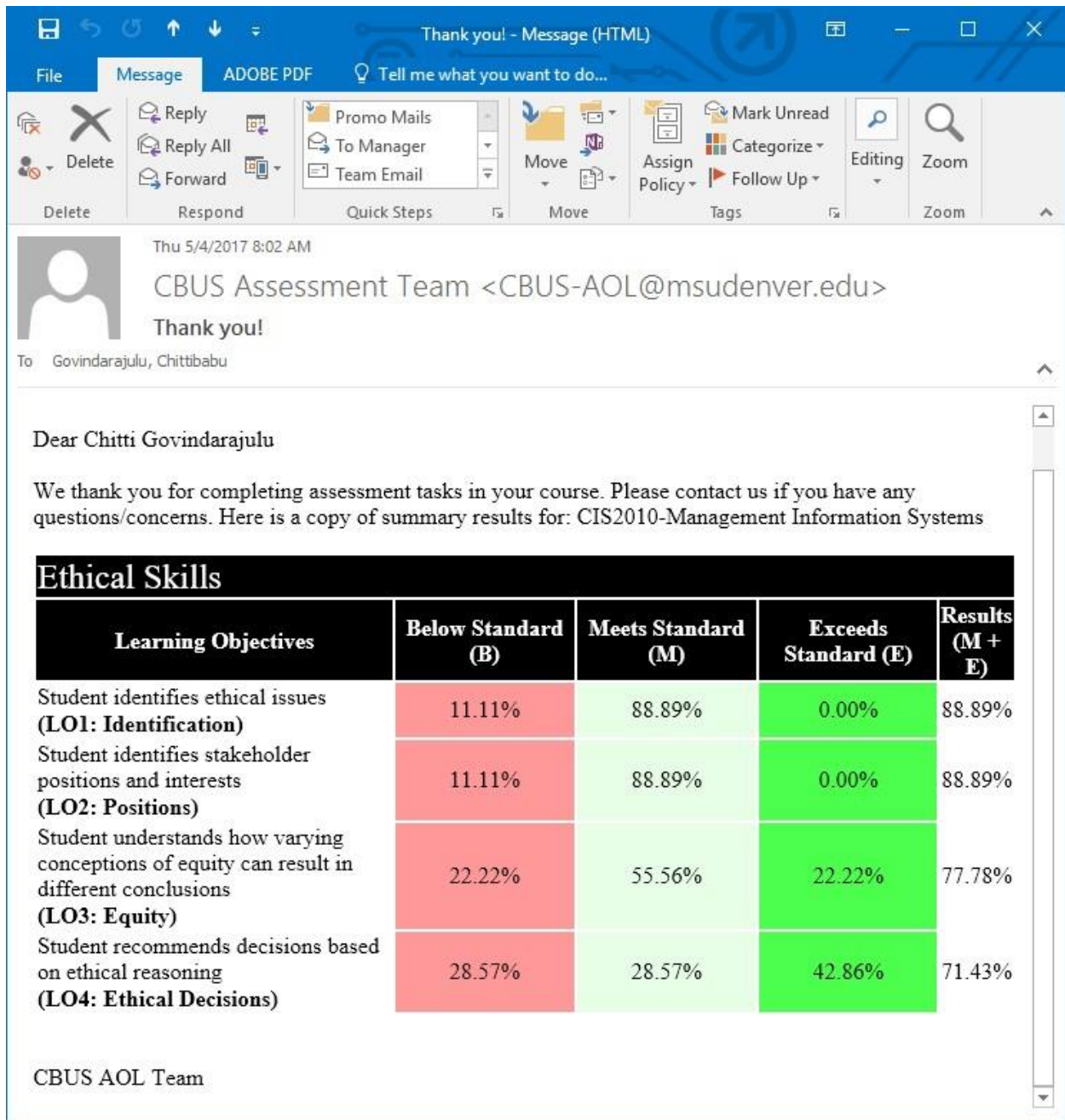


Figure 7: Email Confirmation

Control Phase

There are three parts to the control phase:

- a. Implement the new solution (ADCS)
- b. Create control plan

c. Transition project to future owners

The first iteration of ADCS will be implemented in fall 2017 and monitored by the Dean's office. The control plan helps the transition from the team to the process owners. The control plan should include: process maps, monitoring requirements, dashboards, and a response/contingency plan for changes. The Dean's office will be the owners of ADCS and will maintain assessment data.

SUMMARY

The 6 σ methodology has helped to identify assessment issues and develop a proof-of-concept technology solution that is expected to assist in data collection, analysis, storage, and reporting. The initial prototype of ADCS, that also can perform senior assessment test, was well received by the AOL committee and faculty. However, control phase and the associated control plan is crucial for the adoption and use of the ADCS. In part II of this research, conversion from prototype to initial version of the ADCS system, implementation and related issues, its perceived usefulness, changes to ADCS, if any, and results will be reported and discussed in detail. In other words, part II will primarily focus on control phase of the DMAIC model and provide answer to the research question related to usefulness of 6 σ approaches to improve assessment process efficiency.

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