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Closing the Loop: Development of a Dashboard for Quality Improvement of Business Education Programs

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ABSTRACT

Business schools continuously improve their processes and program assessment activities, but fall short in achieving faculty's awareness of process steps and disseminating results to inform and trigger continuous improvement actions. The assessment process of the Craig School of Business at California State University, Fresno had worked well. It evaluated student learning of core competencies of its Business Administration degree programs. The assessment process had a sound set of program goals and student learning outcomes and metrics. Learning outcomes were measured semiannually, and reports were written annually. Assessment results consistently surpassed benchmarks. Still, the assessment process did not effectively disseminate results and findings, which often led to a lack of process awareness and the inability to motivate and engage faculty in the overall assessment and improvement process. The Assessment Team launched an initiative to design and implement a dashboard that would track assessment scores as a means to address these shortcomings and ensure "closing the loop" with actual improvement results. This article presents the development process of the Assurance of Learning Dashboard and the effects of using the dashboard to facilitate the analysis and dissemination of assessment results. Findings suggest that the dashboard was successful. However, documentation for closing the loop activities continue to be a challenge. Implications for academic institutions and future research opportunities are presented.

Keywords: Data visualization, Assessment, Accreditation, Performance Dashboards, Infographics Data-driven decision making, AACSB

Introduction

The Craig School of Business (CSB) at California State University, Fresno is continuously engaged in assessment activities to ensure the quality and continuous improvement of its Business Administration degree programs. CSB earned its first accreditation from the Association to Advance Collegiate Schools of Business (AACSB) in 1958 and has since gone through several reaccreditation cycles. The designation of AACSB accreditation is the recognized standard worldwide for a quality collegiate undergraduate or graduate business program. While AACSB started as an external accreditation body for programs in the

United States, its domain has expanded globally, a change underscored by its renaming as AACSB International in 1997. When applicants from outside the local region, particularly applicants from outside the U.S., consider CSB's business degree programs, a designation as AACSB-Accredited is an important factor in their decision to apply and attend if accepted. CSB has also developed partnerships with non-U.S. universities, ranging from arrangements where their students attend and enroll in courses at CSB for one semester or one year for transfer credit back to their home degree programs to joint programs where students enroll in CSB courses for their last two years and earn a baccalaureate degree. The possession of an AACSB accreditation is critical to forming those partnerships.

Over the last two decades, AACSB has expanded from focusing primarily on the quality of the curriculum, faculty, and campus environment to paying close attention to student learning outcomes in terms of what happens to students after graduation and what processes are in place to ensure student learning. As such, maintaining AACSB accreditation assures CSB's students and partners that the school cares about and monitors student learning outcomes (AACSB, 2019).

Complying with the expanded AACSB standards was a driving force in motivating the subject of this paper. Early on at CSB, a sound assessment process was in place, which facilitated the collection of data, and as the accreditation demands increased, the assessment process developed further. Still, CSB needed a systematic way to track assessment metrics, such as whether the student demonstrated the ability to make decisions using support technology or to apply appropriate quantitative reasoning, in order to gather timely information. Review of assessment results can trigger improvement actions as needed, promote reassessment to ensure progress, and facilitate documentation. The process in place was weak in terms of effective communication of results, engagement of faculty, active participation, and data-driven improvement actions. Without a means to tie results to specific actions, documentation of "closing the loop" activities was a challenge. Lucio, Campbell, Detres, and Johnson (2018) explained that closing the loop means "using data and assessment results to make changes in programs, courses, pedagogy, course material and processes that impact student learning" (p. 1844). They acknowledged that closing the loop is the most challenging step in the assessment process. Indeed, CSB was systematically collecting data, but faculty were not involved enough in the analysis and were not basing improvements in their courses on the data that had been collected in previous cycles. Anfara and Donhost (2010) warned, "archiving data without analyzing and using it will not help students learn" (p. 62). Analyzing data, trying ways to improve learning, and collecting and using the data again would drive assurance of learning.

Similarly, Banta and Blaich (2010) concluded, "the most important outcome of assessment is not gathering high-quality data, generating reports, or stimulating conversations among colleagues." Instead, they prescribe, what is essential is "using the findings to revise programs accordingly." CSB acknowledged that it was time to shift from mere data collection to program improvement. The School realized that falling short in disseminating results was a deterrent to faculty engagement in assessment, which stalled continuous improvements. Addressing this shortfall would need more and better faculty participation in sharing and documenting closing the loop activities and assurance of learning.

Curtis (2006) wrote:

Transparency is key! If faculty is asked to put effort into assessment but is none the wiser about what their efforts result in, there is no incentive for them to put in any effort at all. By sharing results and how you are using that data for continuous improvement, you might give faculty new insight into the importance of assessment and how it benefits their students, programs, and the institution as a whole.

Likewise, Provezis (2011) highlighted that both sharing assessment data and ensuring data is "digestible" foster interest in assessment results, triggers discussions on improvement actions, and ensures faculty involvement.

CSB launched an initiative that resulted in the development and implementation of an Assurance of Learning Dashboard (Iriberry & Jacobs, 2020). The goal of the initiative was to develop a dashboard that would "visually display goals, current status, and trends over time, presenting data from a wide variety of sources clearly and concisely and providing users with the ability to drill down to identify challenges and opportunities" (Shroyer, 2016, p. 517). The resulting dashboard would disseminate results in an easy to understand graphical presentation to faculty. It would be Web-based for easy access, thereby facilitating the quick review, interactive analysis, and interpretation of results that would trigger and support program improvement actions. The end goal was to create a closer connection between the actions faculty would take and the reassessment results to ensure the authentic data-driven continuous improvement of the programs.

In the following sections, we describe the development and implementation of the Assurance of Learning Dashboard (the Dashboard) at CSB. The goals of this project were:

- a. To facilitate the summarization and analysis of assessment results
- b. To facilitate the dissemination of assessment results to faculty and other stakeholders
- c. To present assessment results in a Web-based easy-to-read, visual format
- d. To promote faculty engagement in assessment and closing-the-loop activities
- e. To support the implementation and documentation of improvement actions

Literature Review

Performance dashboards, as defined by Eckerson, are "multilayered applications built in a business intelligence and data integration infrastructure that enables organizations to measure, monitor, and manage business performance more effectively" (Eckerson, 2010; Few 2006). Negash and Gray (2004) regarded performance dashboard as one of the most useful analysis tools in the Business Intelligence category. Eckerson explained that performance dashboards allow people to:

- Monitor critical business processes and activities using metrics of business performance that trigger alerts when potential problems arise
- Analyze the root cause of problems by exploring relevant and timely information from multiple perspectives and at various levels of detail
- Manage people and processes to improve decisions, optimize performance, and steer the organization in the right direction

Among the various benefits of performance dashboards, increased motivation and delivery of actionable information coincide with the goals of this project at CSB. Eckerson stated, "by publicizing performance measures and results, performance dashboards increase the motivation of business people to work harder in the areas being measured" (p. 8). He added, "performance dashboards provide actionable information—data delivered in a timely fashion that lets users take action to fix a problem, help a customer, or capitalize on a new opportunity before it is too late" (p. 9). Bremser and Wagner (2013) stated, "the potential benefits of dashboards include improving the entity's ability to quickly monitor progress in achieving goals, enhancing efficiency and responding to business events, and improving planning" (p. 63). These statements indicate that dashboards could potentially be the approach needed to encourage faculty engagement in closing the loop activities and thus seem the proper fit for CSB's needs for tracking assurance of learning and ensuring continuous improvement.

Research on dashboards in business organizations is limited. It is even more limited in the adoption of dashboards for the assessment of the quality of educational programs or assurance of student learning. Undoubtedly, dashboards are valuable to business organizations in supporting their decision making and performance management. However, the use of dashboards in public organizations, especially in academic institutions, is scarce and focused narrowly in only two areas. One focus area is reporting of indicators on student enrollment, demographics, retention, and graduation to monitor institutional effectiveness (Denwattana and Saengsai, 2016; Lucio et al., 2018; Schwendimann et al., 2017; Muntean, Sabau, Bologa, Surcel, Florea, 2010). The other focus area is reporting of indicators on the degree of learners' interaction with course material (e.g., textbooks) and its impact on student performance in tests. The latter focus is rapidly gaining interest and is being labeled as Learning Analytics (Martin, Ndoye, and Wilkins, 2016; Roberts, Howell, and Seaman, 2017; Sclater, Peasgood, and Mullan, 2016). A thorough review of the literature of dashboards used to monitor student learning outcomes in business education did not yield results. A few articles were identified in the area of clinical medical education, which seems to be at the forefront of research in developing dashboards to assess student learning for program quality improvement (Shroyer, 2016; Thoma, Bandi, Carey, Mondal, Woods, Martin, and Chan, 2020). The focus of this article is on the development and use of dashboards to assess student learning to ensure continued improvement of business education.

Methodology

In the 2017-18 academic year, CSB initiated the design and implementation of the Assurance of Learning Dashboard (the Dashboard). The goal was to build a dashboard that would help disseminate assessment results and would be accessible to all faculty. The Dashboard would display in a single screen assessment results and trends that would, as described by Yigitbasioglu and Velcu (2012), allow faculty "to identify, explore, and communicate problem areas that need[ed] corrective action" (p. 44). The development and

implementation of the Dashboard followed a designed-based research approach by going through a series of iterative phases. The objective was to create a dashboard that would meet CSB's closing-the-loop needs.

The design-based research approach shares commonalities with the design science research approach in information systems, which was promoted by Hevner, March, Park, and Ram (2004). Both approaches originated from the work of Herbert Simon (2019). McKenney and Reeves (2019) described the design-based research approach as an "authentic contextually aware, collaborative, theoretically focused, methodologically diverse, practical, iterative, and operation-oriented" process (Thoma et al., 2020, p. 18). With the support of CSB faculty and administrators, this project was initiated in the 2017-18 academic year and assigned to the CSB Assessment Team. Faculty in the Assessment Team were coordinators of courses where outcome assessment occurred. The bulk of the underlying research for the project was conducted by one of the coauthors (Iriberry), who assembled a team of collaborators that included two MBA students and two undergraduate seniors specializing, one in Data Analytics and another in Graphic Design. The research was supported by a grant from the University's Office of Institutional Effectiveness and monitored by the CSB Associate Dean (coauthor Stengel.) This project was deemed ethical-review exempt research.

The process went through four iterative phases: 1) Analysis and exploration, 2) Design and construction, 3) Evaluation and reflection, and 4) Implementation and spread (McKenney and Reeves 2019; Thoma et al., 2020). This section discusses each phase. The development of the Dashboard was also informed by business literature on performance dashboards. Bremser and Wagner (2013) outlined five steps in developing a dashboard. These steps are define objectives, define metrics, seek user input, build an initial dashboard and test, and publish and monitor its use. These authors stressed the need to solicit user input since this input is essential for a successful project and emphasized the need for visual design, interactivity, and the use of art and background to engage the users and enhance their experience.

Phase 1. Analysis and Exploration

The Assessment Team implemented the current Business Administration (BA) Student Outcome Assessment Plan (SOAP), which has been in place since the 2014-15 academic year. The SOAP includes the nine student-learning outcomes (SLOs) shown in Figure 1. Note that there are two SLOs for Global awareness.

Figure 1: Program goals.

Business Administration graduates will:

Have discipline-specific knowledge

SLO 1: Demonstrate comprehension of all functional areas of business (e.g., accounting, finance, marketing, organizational behavior, human resources, legal and social issues, and information systems, among others).

Make judgments utilizing business decision support and productivity tools

SLO 2: Demonstrate the ability to make data-informed judgments utilizing spreadsheets and other analytical tools and technology.

Work effectively with others

SLO 3: Demonstrate the ability to work effectively with other people through effective teamwork practices and to contribute substantively to a group product.

Demonstrate an understanding and appreciation for global, cultural, and ethical values

SLO 4.1: Demonstrate awareness of global business environments and cultural diversity in addressing business problems.

SLO 4.2: Apply often-conflicting ethical theories to manage their behavior in business situations.

Demonstrate professional development with applied experience in business

SLO 5: Demonstrate professional career development as a result of at least one applied experience in business.

Meet core competency in oral communication

SLO 6: Prepare and deliver a coherent, professional oral presentation on a business issue.

Meet core competency in written communication

SLO 7: Demonstrate the ability to write a clear, concise, well-organized, and properly framed analysis of a business issue.

Meet core competency in quantitative reasoning

SLO 8: Demonstrate the ability to reason quantitatively

Figure 1. This figure lists the Business Administration program goals and Student Learning Outcomes

Source: Craig School of Business (2015).

Every academic year, CSB assesses all nine SLOs and reports results to the University's Assessment Director in the annual Assessment Report. Reviews and comparisons of CSB's SOAP with the SOAP of other colleges and universities show that CSB's assessment process had reached maturity. The University's Assessment Director's office rated the process four out of four on their assessment report rubric.

CSB uses a variety of direct and indirect measures to assess each of the nine SLOs. The direct measures include written assignments, hands-on practice exercises, presentation video recordings, business simulations, and exam questions. The indirect measures include survey questions. The direct measures are scored using rubrics and checklists that were internally developed by the CSB Assessment Team and multiple-choice question exams designed by core course coordinators. Assessment scores are entered into spreadsheets that are uploaded to CSB's Faculty Organization site or sent directly to the Assessment Coordinator electronically for further consolidation and analysis at the end of every semester.

The Assessment Team and course coordinators analyzed, aggregated, and summarized the data, using MS Excel, on each of the eight SLOs to identify the degree of outcome attainment. Summarized data and

comparison with benchmark and target levels are interpreted, integrated, and documented in CSB's Annual Assessment report submitted to the University's Director of Assessment. The report, a 15-page text-based write up, is made available to all CSB's faculty in CSB's intranet.

CSB's Committee on Undergraduate Program (CUP) is responsible for monitoring the undergraduate program, suggesting curriculum and course changes, and reviewing changes proposed by others. Additionally, the CSB Assessment Team is responsible for overseeing and coordinating assessment activities and result analysis. One member of the curriculum committee is also in the Assessment Team and serves as the liaison between the two entities.

In coordination with CUP, the Assessment Team works with course coordinators to ensure assessment activities are conducted on time, and the measurement instruments are used appropriately. The CSB Deans and members of the Assessment Team analyze assessment results and report these to CUP, Department Chairs, and faculty during faculty meetings. Faculty are asked to emphasize the areas where results are lower than expected. The assessment process is illustrated in Figure 2.

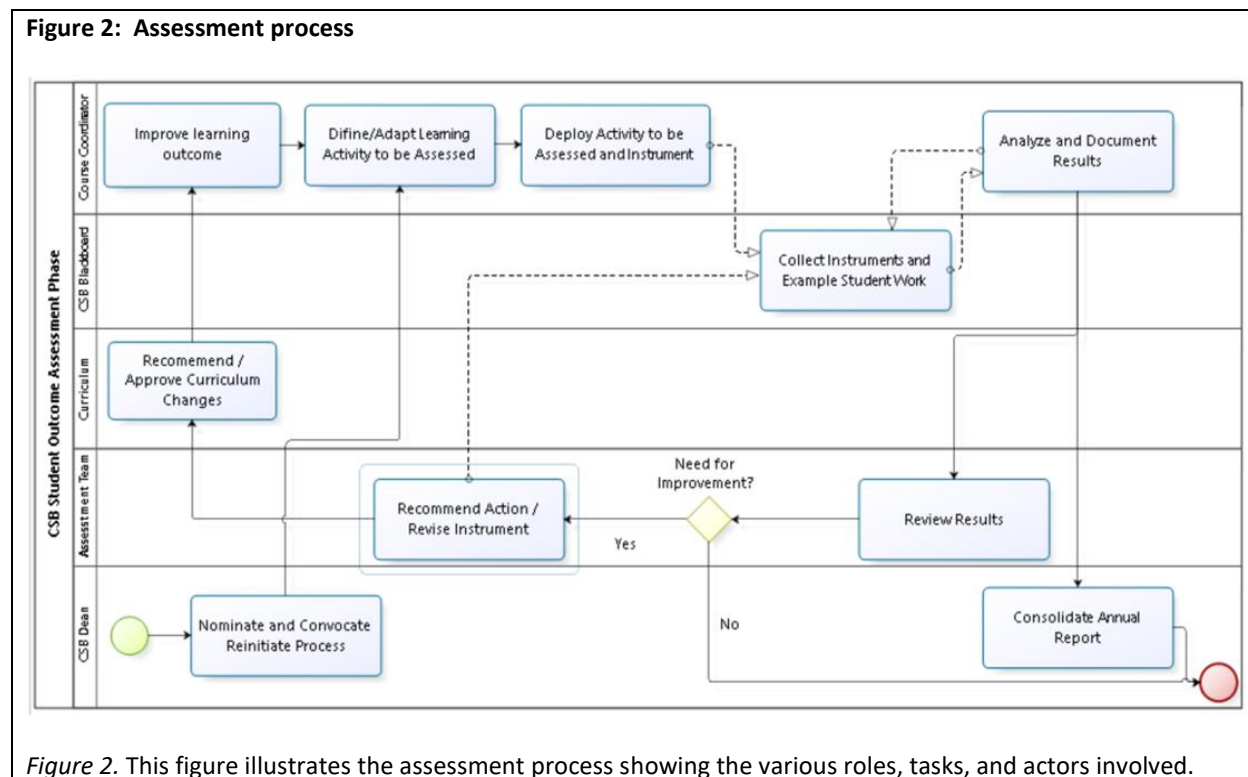


Figure 2. This figure illustrates the assessment process showing the various roles, tasks, and actors involved.

The primary researcher participated in the analysis and documentation of the CSB assessment process. She also collaborated in writing the assessment plan and the assessment report in previous years. In this project, she acted as the subject matter expert and project coordinator. The student collaborators had all completed training in data analytics and data visualization. They were briefed on the user and systems requirements and were clear on what the Dashboard should include.

Phase 2. Design and Construction

The design of the Dashboard was an iterative process. Several tools to build dashboards exist, including SAP BusinessObjects Lumira, QlikView, and Oracle's Business Intelligence Suite. The University had recently acquired a Tableau enterprise license to monitor institutional performance. The license allowed for dashboards to be hosted on a server and be accessible to authorized users.

The project team consolidated and cleansed the assessment data collected by instructors into sets of MS Excel spreadsheets. As expected, this consolidation was time-consuming since files required reformatting to make them suitable to load to Tableau sheets. Multiple Tableau charts were created and presented for feedback to members of the Assessment Team. This feedback, in turn, provided input for changes and adaptations to the Tableau sheets. In parallel, the team graphic designer created the layout and style for the complete Dashboard.

Once the example charts were reviewed and agreed upon, the sheets were integrated into a Tableau dashboard. Finally, the dashboard was published to the Tableau Server and the link to the Dashboard was distributed to the Assessment Team for further review.

Phase 3. Evaluation and Reflection

The Dashboard was presented to the CSB faculty during the annual faculty assembly. The presentation stimulated impromptu discussions of results and praise for the work of the development team. Soon after, the researcher brought the output to CUP for confirmation of the accuracy of the displays and further discussion.

Phase 4. Implementation and Dissemination

The Dashboard was presented to course coordinators to prompt feedback for improvement and to disseminate the most recent assessment results. Additionally, to promote general faculty and student awareness and interest, a set of infographics showing the student learning outcomes, assessment timeline, and assessment measures were designed and posted to walls in faculty and student areas in the building as a constant visual aid and a reminder of program goals. Figure 3 shows one of these infographics. Instructions and server links to access the Dashboard were posted on the intranet as well and sent as an announcement encouraging faculty to view it.

Figure 3: Program goals poster

Figure 3. This figure shows a poster created to bring awareness to the goals of the Business Administration program

Lastly, to reinforce the proper documentation of the improvement actions that instructors had implemented in their courses because of analyzing assessment results, a survey was created. The survey was deployed to all faculty in early fall 2018. This information was consolidated and presented as closing-the-loop activities in the Assessment Report (Craig School of Business, 2018). The AACSB external visitation team had access to the Dashboard during their visit in early 2019.

Results and Discussion

The Dashboard shows, for each student learning outcome, graphics with assessment results, benchmark scores and targets, and a brief description of the method used to assess each outcome. The nine outcomes are represented in the Dashboard. Figures 4 and Figure 5 show a section of the Dashboard displaying the results of two goals.

Survey results were consolidated, and improvement actions were outlined based on deficiencies for each goal (Craig School of Business, 2018). A couple of examples of improvement actions, toward Goal 2 and Goal 8, respectively, are described below.

Figure 4: Assurance of learning dashboard: Decision making goal

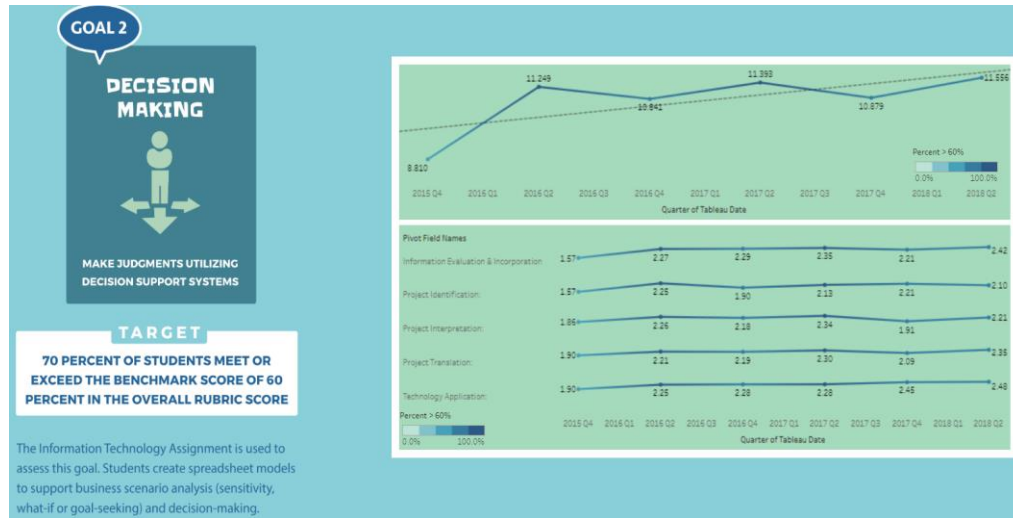


Figure 4. This figure shows the visualizations of one of the goals of the Business Administration program. The graphs show the results of measuring the student learning outcomes on decision making with IT. The visualizations are interactive and can be drilled down. The results seem to be consistently above benchmarks.

Figure 5: Assurance of learning dashboard: Quantitative reasoning goal

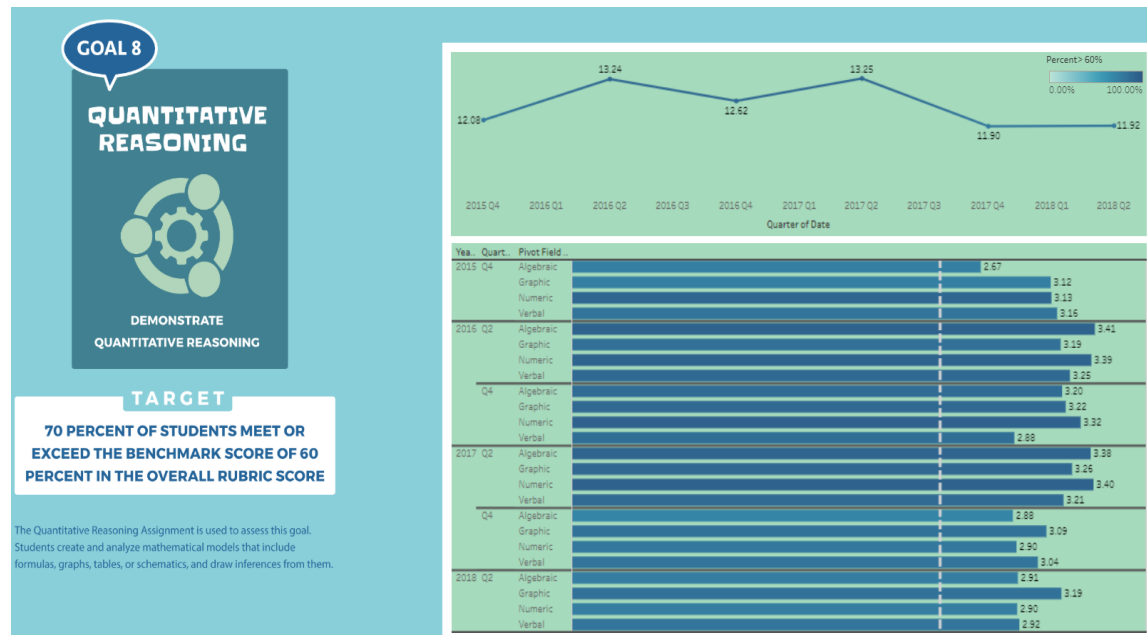


Figure 5. This figure shows the visualizations of one of the goals of the Business Administration program. The graphs show the results of measuring the student learning outcomes on quantitative reasoning. The visualizations are interactive and can be drilled down. The results seem to be consistently above benchmarks.

In an effort to improve the results of Decision-Making with IT (Goal 2), Instructors emphasized the importance of (1) building a decision support system where input variables are easily adjustable and output variables are automatically updated and (2) providing a clear written interpretation of results by all students. Students are now required to suggest possible courses of action and select the most viable option to recommend. The effect of these actions resulted in an increase in scores in the Interpretation category from 62 percent to 75 percent. Additionally, having a write-up allowed more evidence to assess students' ability to interpret results after using the decision support tool. With more evidence to assess, assessment results were more accurate and on target. Other courses, including statistics and accounting, have incorporated the use of software to solve problems such as Excel and statistics software JMP. Furthermore, a spreadsheet modeling course was created to address data decision making while improving Excel proficiency.

Quantitative Reasoning (Goal 8) is an area where additional improvements have been made to increase the benchmarks and targets already being met. CSB requires students to take one quantitative analysis and two business statistics courses as part of the curriculum. The course coordinator, a faculty member, meets with all instructors to discuss assessment results so that improvements can be addressed and implemented. The tight coordination across sections has proven successful and benchmarks and targets are exceeded consistently. One initiative is to offer an elective lab staffed by a faculty member and student tutors for students enrolled in these courses. Students receive help in understanding the concepts discussed in class and solving practice exercises. Another initiative is an extensive set of study materials and videos for students that are available on the campus' learning management system. More recently, instructors are using textbook publisher materials and quizzes to provide further practice for students. New faculty teaching these courses are actively using classroom technology like Excel and JMP for analysis and OneNote and Kahoot to enhance classroom learning. OneNote is used as an electronic whiteboard, so students have immediate access to class notes and problem solutions discussed in class.

Improvements were identified and implemented for most of the learning goals. The faculty contributed to closing the loop activities. The resulting self-evaluation reports and documentation of closing the loop activities supported the extension of AACSB accreditation for the School through the 2023-2024 academic year (AACSB, 2019).

Subsequent to the extension of accreditation, maintaining the focus on assurance of learning and documentation for closing the loop activities has been a challenge. Faculty interest in interacting with the Dashboard waned after reaccreditation was granted. The top CSB administration changed and the Assessment Team disbanded. The buy-in from a new administration and new Assessment Team Dashboard is necessary in order for the Dashboard to be readily updated and again provide structure for tracking assurance of learning and quality improvement.

Discussion and Implications

The intent of outcomes-based assessment and evaluation is to implement the collection of data that are of both sufficient volume and quality, analyze the data to confirm hunches and provide new insights, and take appropriate actions toward improvement. Analytics dashboards are a valuable tool to ensure effective organization of and access to data and to acquire insights. However, to succeed in providing

those insights, the data needs to be accessible, understandable, and engaging to the user. A good dashboard invites a user to become an active analyst, not just a passive viewer, and helps the user to become a more effective stakeholder in their roles.

A desirable facet of a dashboard to support student learning assessment is for the design of the dashboard to cohere to the organizational structure and planning documents of the University, and particularly the unit of the University that will be the primary users of the dashboard. Ideally, the user can easily connect dashboard-reporting options to the organization of courses and majors by college and department, priorities in strategic plans, and goals/objectives in student learning assessment plans. The dashboard presented in this article was associated clearly with the business administration major and courses offered as part of that major. Each component of the Dashboard corresponded to one of the established student learning outcomes. Maintaining such coherence improves the integrity of data collection, avoids confusion in understanding dashboard presentations, and enhances the overall success of both the Dashboard and the programs and plans to which they conform.

While this article focuses on a dashboard to track assurance of learning and quality improvement, another important focus of attention for assessing success in accomplishing the mission of an educational program is performance in terms of enrollments, student demographics, and graduation/retention (Denwattana and Saengsai, 2016; Lucio et al., 2018; Schwendimann et al., 2017; Muntean, Sabau, Bologna, Surcel, Florea, 2010). At CSB, these data are managed and reported by the Office of Institutional Effectiveness, which also uses Tableau and maintains an impressive collection of dashboards. The common technology platform allows easy joins between data sources and improves the ease of learning for a user of the University's dashboards with CSB's dashboard, and vice versa.

Future Research

The ultimate effectiveness of a student learning outcomes dashboard, or any analytics dashboard, is whether the dashboard meaningfully informs key stakeholders like faculty, administration, and community partners. Beyond classifying and evaluating these dashboards in terms of their capabilities, a useful area of future research would be the development and administration of techniques and instruments that query these key stakeholder users as to their awareness, utilization, and evaluation of these dashboards. Such studies would inform those who develop and maintain these dashboards of opportunities to improve the content, capabilities, and promotion of these dashboards. Sharing the results of these studies will advance a collection of best practices for these analytics support systems.

The development of analytics dashboards at colleges and universities are often projects led by faculty, as is the case with the system presented in the article. Often it is faculty who envision and direct these projects because the required understanding of the fundamentals of data analytics and awareness of data analytics tools exists among the faculty. Additionally, again as is the case for CSB's program, external accreditation bodies often require that assessment of learning be largely faculty-driven rather

than an endeavor conducted mostly by administrators or staff. A risk with these efforts being faculty-led is that a faculty may have a change in duties or take a leave, and the dashboards they created and maintained could suffer from inattention and become obsolete. In addition, if the overall collection of analytical activities is heavily focused on external accreditation, and those accreditation/reaccreditation processes occur only periodically, the products of analytics projects may get set aside and not be properly maintained. As dashboards at academic institutions are now fairly common, another area of useful research would be to examine the staffing and organizational location of analytics projects to find out what staff structures do best at making sure these development projects turn into sustained operations. It is likely that an operations team including faculty, administrators, and support staff will assure usefulness and improve sustainability.

Conclusion

The initiative to design and implement the Assurance of Learning Dashboard (the Dashboard) was successful in effectively disseminating assessment results, effectively motivating, and engaging faculty in the overall CSB assessment process. The project team developed and implemented the Dashboard, a system that proved instrumental in disseminating results and engaging faculty participation. The Dashboard presents current and historical assessment results and allows interactive review and data analysis. The Dashboard was a core asset in the current accreditation cycle that ensured the extension of AACSB accreditation of the School's business administration degree programs. The Dashboard also facilitated the production of comparative reports to the University's Assessment Director.

Going forward, the dissemination of assessment results via the Dashboard can continue to foster discussion and trigger the implementation of formal actions to improve further the business administration programs. While our Dashboard project resulted in a capable, effective, and fully operational assessment system, a broader measure of success will be if the Dashboard becomes a routine part of academic programs beyond support to self-studies as part of an external review. Analytics dashboards are extremely effective in enhancing higher-level administration in colleges and universities, particularly in addressing admissions, enrollments, course demand, progress to graduation, and resource utilization. Problems and potential problems can be understood and detected, followed by corrective action. The hope here is that this success can be replicated with dashboards that address student learning outcomes and will be used meaningfully by faculty, leading to closing the loop in achieving student learning goals.

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