Assessment in Practice

Data Pathways: Innovative Approaches to Visualizing Assessment Results

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Institutional Context, Assessment History, Processes, and Data Sources

Georgia Southern University is a recently consolidated multi-campus institution with a combined full-time equivalency (FTE) of ~24,000 students (Georgia Southern University, 2020). Within Academic Affairs, the Office of Institutional Assessment and Accreditation's mission is to support Georgia Southern University's pursuit of academic distinction in teaching, scholarship, and service in a student-centered environment by providing leadership for assessment, institutional effectiveness, planning, and accreditation activities to all academic, student support, and administrative units and programs.

One of the many functions of the Office of Institutional Assessment and Accreditation is the facilitation and oversight of academic program student learning outcomes assessment and general education student learning outcomes assessment. University-level committees composed of faculty members from across colleges are responsible for reviewing annual assessment documents. Using committee established institutional rubrics (Georgia Southern University, n.d.; Georgia Southern University, n.d.), each document is reviewed independently by two individual committee members, and, following the independent individual reviews, both reviewers convene to reach a consensus on a single set of scores and comments. A final reconciliation review is submitted reflecting this agreement, and scores from these reconciliation reviews serve as the data source in all analyses that follow.

Guided by a dedication to a culture of systematic self-reflection, evidence-based decision-making, and improvement, the Office of Institutional Assessment and Accreditation sought to gain insights and actions from our rich set of rubric scores. Given consolidation, we focused on the last two assessment cycles.

Academic Program Student Learning Outcomes Assessment

Figure 1 (top panel) provides a summary of assessment documents received for the 2018-2019 (left) and 2019-2020 (right) assessment cycles with a breakdown of total documents scored by college affiliation. Reconciliation scores by year are plotted as a percent of documents scored at each level by each trait for each year. Figure 1 (bottom left panel) shows the percent of documents scored at the Beginning (red), Developing (yellow), Acceptable (blue) and Exemplary (green) levels for 2018-2019 (top bar) and 2019-2020 (bottom bar) for all traits. Although programs vary in the maturity of their assessment processes and cycles, improvements in the assessment process are indicated by a rightward shift in scores. Broadly, this shift should coincide with a decrease in Beginning and Developing scores and an increase in Acceptable and Exemplary scores across years.
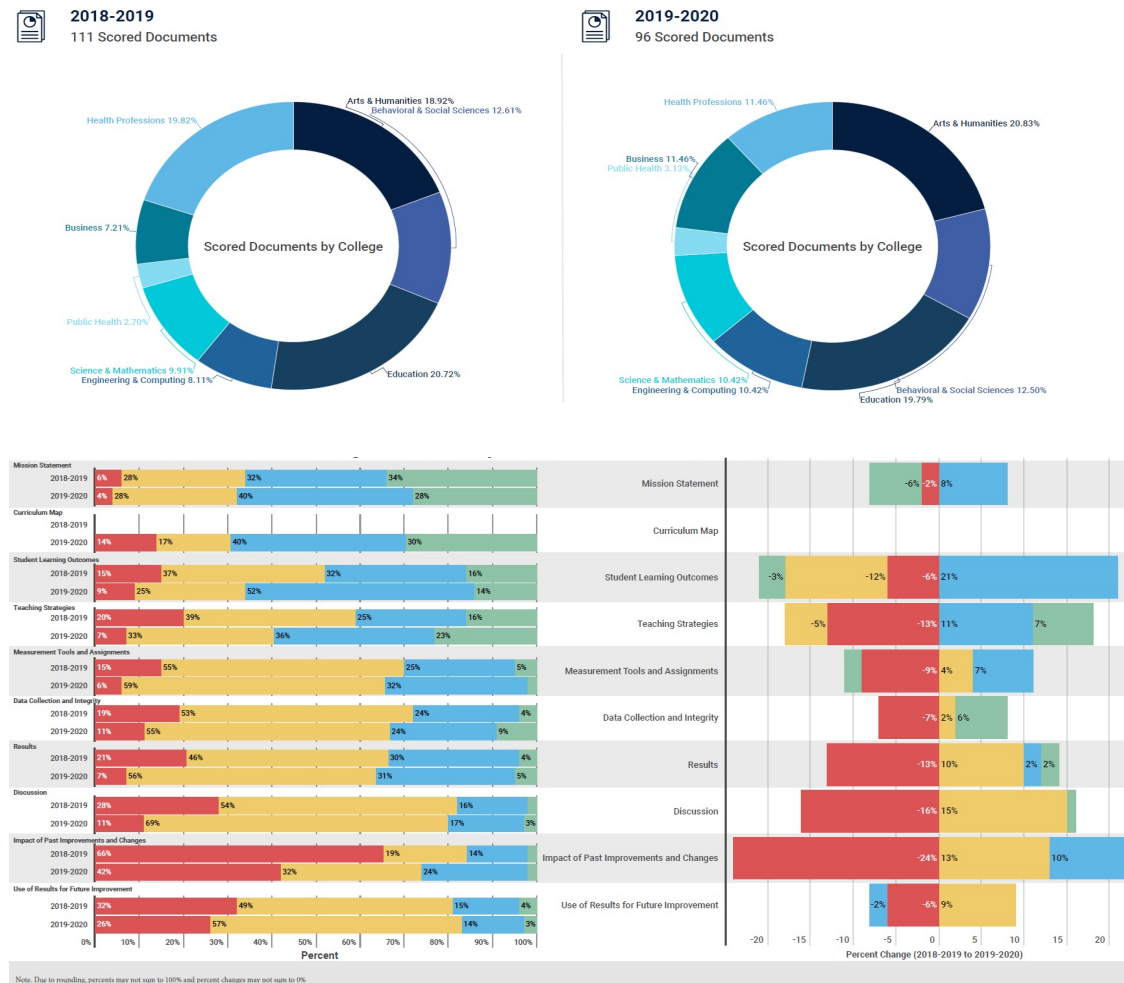
Figure 1. Top panel. Academic Program Student Learning Outcomes assessment documents received and scored using university-level rubric for the 2018-2019 (left) and 2019-2020 (right) assessment cycles by college. Bottom Left Panel. Reconciliation scores by year plotted as a percent of documents scored at the Beginning (red), Developing (yellow), Acceptable (blue) and Exemplary (green) levels for 2018-2019 (top bar) and 2019-2020 (bottom bar) for all traits. Bottom Right Panel. Year-over-year percent change in documents scored at each level for all traits. Note. Due to rounding, percents may not sum to 100% and percent changes may not sum to 0%.

To assist with direct comparisons across years and to more explicitly isolate changes in the allocation of scores at the four levels across years, Figure 1

(bottom right panel) shows the year-over-year percent change in documents scored at each level for all traits. A couple of specific points are worth noting. First, the University mission statement was established during consolidation in 2018 and subsequently revised in 2019, and the decrease in Exemplary scores for the Mission Statement trait was largely due to documents referencing the prior University Mission. Second, the Teaching Strategies trait originally contained reference to both instructional strategies as well as a curriculum map. Following the 2018-2019 cycle, the Teaching Strategies trait was revised such that it referenced only instructional strategies which shifted the curriculum map to its own trait, and the absence of curriculum map scores and year-over-year changes resulted from these rubric modifications. Third, with consolidation, a greater than average number of programs submitted an assessment plan in the 2018-2019 cycle and complicated the assessment of the impact of past improvements. Although more pronounced for some traits than others, there was an overall rightward shift for scores coupled with decreases in Beginning and Developing scores and a resultant increase in Acceptable and Exemplary scores to provide indicators of assessment process improvement.

With a high-level summary of results established, we call attention to a recent NILOA AiP article in which Gaudino-Goering (2021) outlines an approach to identifying assessment challenges faced by individual programs at the institution by creating a rating system on a Likert scale from 0 to 4 for relevant accreditation standards, and then applying a color-coding scheme to the resultant values such that a heat map emerged displaying "hot" and "cool" zones. These zones provided opportunities to quickly identify areas in need of attention, and application of this approach across years provided insight into improvements made over time.

We were especially interested in gaining institutional-level insight into performance on our rubric traits (and by extension individual components of our institutional assessment process), and our approach involved variations from that of Gaudino-Goering (2021). Utilizing our year-over-year changes to the allocation of scores at the four levels for each trait, Figure 2 (top panel) shows a heat map in which red indicated a year-over-year decrease in percentages whereas green indicated a year-over-year increase with color saturation reflective of the magnitude. Interpretation is straightforward with reds indicating a year-over-year decrease and greens indicating a year-over-year increase. Year-over-year improvements are also indicated by reds being spatially located left of greens.

| Trait	Beginning	Developing	Acceptable	Exemplary
Mission Statement	-2.0%	0.0%	8.0%	-6.0%
Student Learning Outcomes	-6.0%	-12.0%	21.0%	-3.0%
Teaching Strategies	-13.0%	-5.0%	11.0%	7.0%
Measurement Tools and Assignments	-9.0%	4.0%	7.0%	-2.0%
Data Collection and Integrity	-7.0%	2.0%	0.0%	6.0%
Results	-13.0%	10.0%	2.0%	2.0%
Discussion	-16.0%	15.0%	0.0%	1.0%
Impact of Past Improvements and Chan..	-24.0%	13.0%	10.0%	0.0%
Use of Results for Future Improvement	-6.0%	9.0%	-2.0%	0.0%
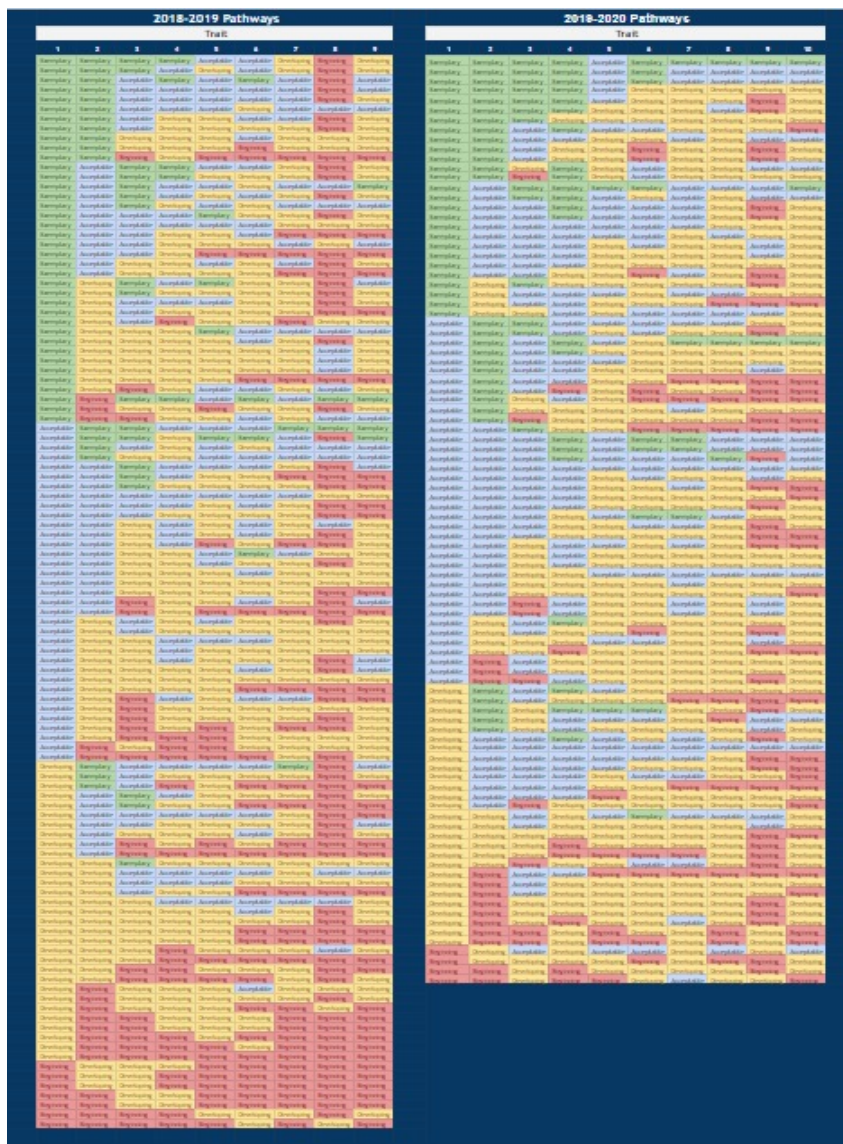
Figure 2. Top Panel. Heat map of year-over-year percent change in academic program student learning outcomes assessment documents scored at each level for all traits. Red indicates a decrease. Green indicates an increase. Color saturation is representative of change magnitude. Note. Due to rounding, percent changes may not sum to 0%. Bottom Panel. Heat map of individual academic program assessment document trait scores (Beginning = red, Developing = yellow, Acceptable = blue, Exemplary = green) for 2018-2019 (bottom left) and 2019-2020 (bottom right) sequentially sorted by subsequent level and trait.

Of note, an ideal state would be characterized by reds being isolated to Beginning and Developing and greens being isolated to Acceptable and Exemplary. Although interpretation of the heat map does not differ from the percent change plots, the heat map serves as an alternative visualization that highlights the flexibility and scalability of heat maps to aid in providing quick insights into the assessment process.

In addition to our interest in these institutional-level summaries, we were also interested in drilling into specific programmatic results. To this end, we created additional heat maps more analogous to those outlined by Gaudino-Goering

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(2021) in that we utilized a color-coding scheme with single colors reflecting a Likert-style rating of levels (Beginning = red, Developing = yellow, Acceptable = blue, Exemplary = green). This scheme was applied to individual academic program documents for the 2018-2019 (Figure 2, bottom left) and 2019-2020 (Figure 2, bottom right) academic program student learning outcomes assessment cycles. To aid in interpretations and insights we also sequentially sorted the heat maps by level and trait. Starting with the Mission Statement Trait, we sorted program documents from Exemplary to Beginning. The next trait was then also sorted from Exemplary to Beginning but in such a way that it occurred within each category of the previous trait. This procedure of sorting within each category of the antecedent trait continued for all subsequent traits and resulted in the emergence of what could be categorized as trajectories or pathways through the rubric traits. The conception of progression through the rubric trait levels as pathways prompted discussion about pathway complexity and how we might best visualize this complexity to permit qualitative and quantitative insights.

Fortunately, flow diagrams can represent changes in structure or allocation, and Sankey Diagrams (Heslin, 2017), specifically, can visualize the flow of one set of values to another. Nodes are connected via links, and Sankey diagrams are used to show a many-to-many mapping between two domains or multiple paths through a set of stages (Google, n.d.). Although there is some taxonomic debate, an alluvial diagram is a specific type of Sankey diagram that visualizes allocation across categorical dimensions (Bojanowski, 2016; OriginLab, n.d.; Peterson, 2020), and we applied this alluvial visualization to illuminate the pathways of our 2018-2019 (Figure 3, top panel) and 2019-2020 (Figure 3, bottom panel) assessment data through the four levels of our 10 traits.

Specifically, we started with total number of documents and visualize how these documents distribute across the four levels of the Mission Statement trait with Beginning (red), Developing (yellow), Acceptable (blue), and Exemplary (green). This process was repeated for each trait, and the resulting visualization provided us with a rich source of information from which to draw insights about our assessment process.
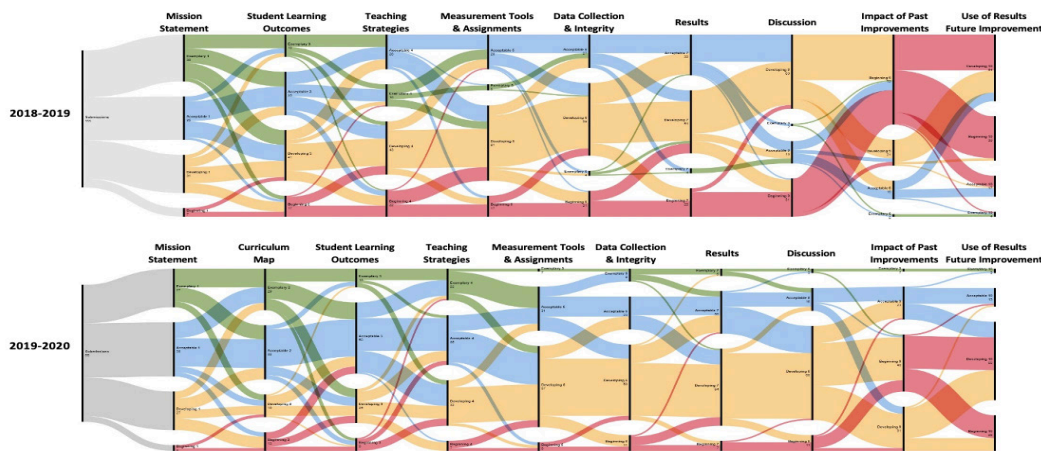

Figure 3. Alluvial visualization of 2018-2019 (top panel) and 2019-2020 (bottom panel) academic program assessment data through the four levels of the rubric's 8 traits. Numbers reflect counts. Colors reflect levels. Beginning (red), Developing (yellow), Acceptable (blue), and Exemplary (green).

General Education Student Learning Outcomes Assessment

We adopted an identical approach to general education student learning outcome documents received for the 2018-2019 and 2019-2020 assessment cycles and presentations of these analytic strategies shown in Figures 4-6 parallel those previously shown for Academic Program Student Learning Outcome Assessment. Of note, all core courses fall into one of our general education and core curriculum student learning outcome areas:

- Area A1 - Communication Skills
- Area A2 - Quantitative Skills
- Area B - Institutional Option (Global Engagement)
- Area C - Humanities, Fine Arts, and Ethics
- Area D - Natural Sciences, Math, and Technology
- Area E - Social Science

Distribution of documents scored by these core areas are shown in yellow in Figure 4 top right panel.

Figure 4. Top panel. General Education Student Learning Outcomes assessment documents received and scored using university-level rubric for the 2018-2019 (first) and 2019-2020 (second) assessment cycles by college (blue) and Core Area (yellow). Bottom Left Panel. General Education Student Learning Outcomes assessment document reconciliation scores by year plotted as a percent of documents scored at the Beginning (red), Developing (yellow), Acceptable (blue) and Exemplary (green) 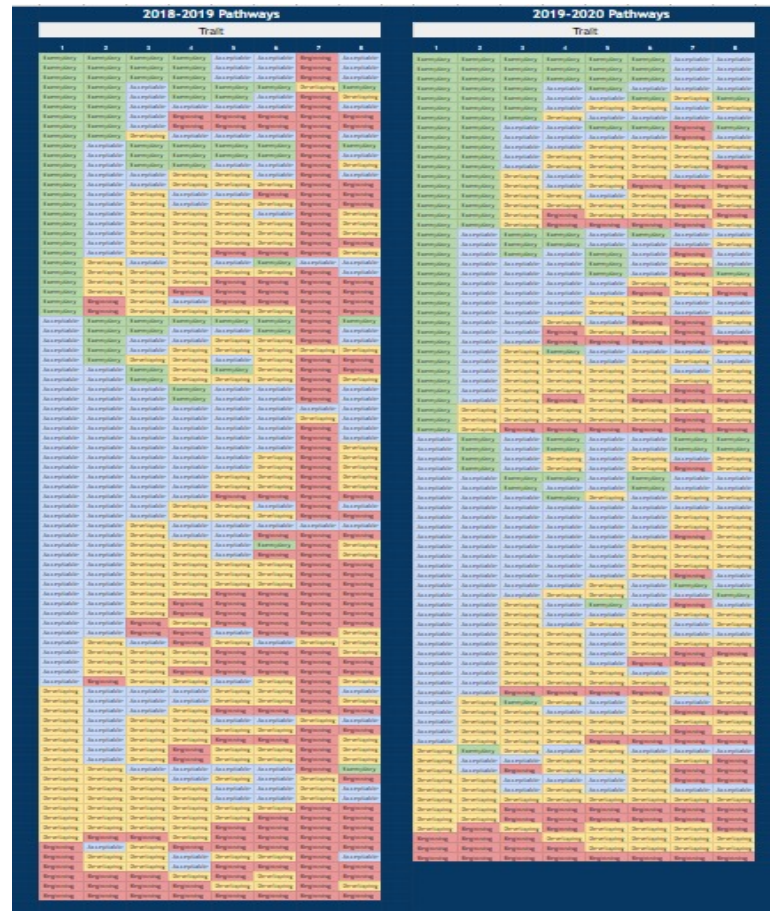levels for 2018-2019 (top bar) and 2019-2020 (bottom bar) for all traits. Bottom Right Panel. Year-over-year percent change in General Education Student Learning Outcome assessment documents scored at each level for all traits. Note. Due to rounding, percents may not sum to 100% and percent changes may not sum to 0%.

Trait	Beginning	Developing	Acceptable	Exemplary
Course Alignment	-3.0%	-7.0%	-5.0%	16.0%
Teaching Strategies	-3.0%	-4.0%	-4.0%	12.0%
Measurement Tools and Assignments	3.0%	-12.0%	6.0%	5.0%
Data Collection and Integrity	-1.0%	-8.0%	8.0%	-1.0%
Results	-15.0%	5.0%	8.0%	4.0%
Discussion	-14.0%	17.0%	-4.0%	2.0%
Impact of Past Improvements and Changes	-53.0%	26.0%	25.0%	4.0%
Use of Results for Future Improvement	-20.0%	17.0%	0.0%	2.0%

Figure 5. Top Panel. Heat map of year-over-year percent change in General Education Student Learning Outcomes assessment documents scored at each level for all traits. Red indicates a decrease. Green indicates an increase. Color saturation is representative of change magnitude. Note. Due to rounding, percent changes may not sum to 0%. Bottom Panel. Heat map of individual general education course assessment document trait scores (Beginning = red, Developing = yellow, Acceptable = blue, Exemplary = green) for 2018-2019 (bottom left) and 2019-2020 (bottom right) sequentially sorted by subsequent level and trait.
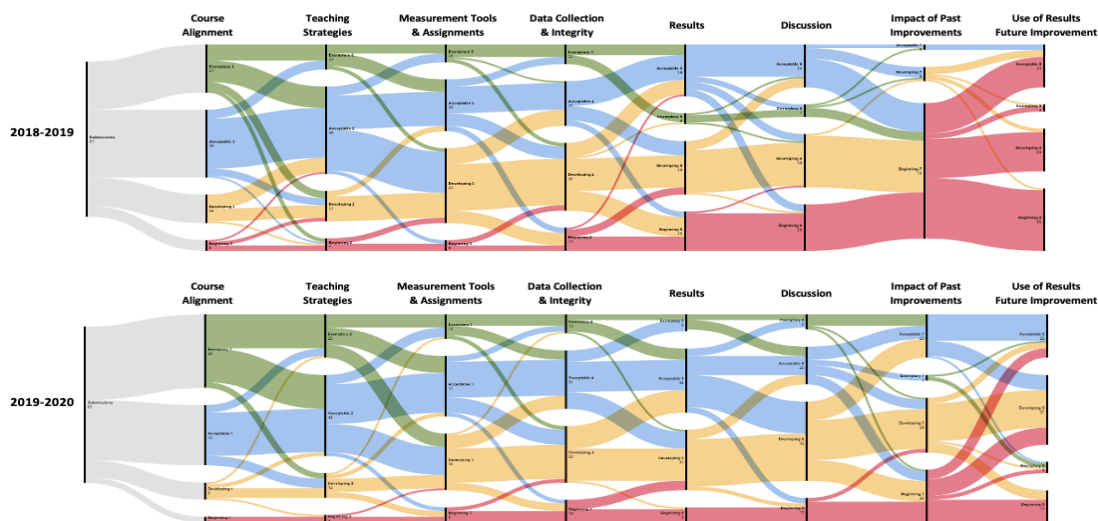
Figure 6. Alluvial visualization of 2018-2019 (top panel) and 2019-2020 (bottom panel) general education student learning outcomes assessment data through the four levels of the rubric's 8 traits. Numbers reflect counts. Colors reflect levels: Beginning (red), Developing (yellow), Acceptable (blue), and Exemplary (green).

Interpretations, Insights, and Actions

As these visualizations illustrate, assessment is an ongoing and evolving process in which stages are interdependent. Starting with a solid mission statement and clear, measurable student learning outcomes is an essential foundation for an assessment cycle that yields meaningful insights for improvement of student learning. For this reason, we adapted professional development training and resources for faculty following a more process-based approach with a focus on asynchronous accessibility. We developed student learning assessment handbooks with annotated examples of each stage of the assessment process, including practical tips for effectively documenting the process. We also leveraged existing campus technology, including our learning management system (LMS), library resource guides, and videoconferencing, to offer asynchronous and hybrid reference guides, mini-courses and workshops to support assessment coordinators and faculty serving on peer-review committees. Initial internal assessment has shown positive impacts on faculty knowledge of assessment best practices and confidence in abilities relevant to leading assessment activities, as well as improvement on peer-review scores of assessment documents for those who have participated in process-focused professional development workshops.

Ultimately, our visualization strategies provided us with a wealth of information from which to gain actionable insights about our assessment process while providing a mechanism by which to continuously ask additional and nuanced questions about improvement. We will continue to leverage these visualization strategies to assist us in identifying the most challenging aspects of our assessment process, illuminating the best predictors of overall assessment cycle success, and informing the development of targeted professional development resources while simultaneously informing and improving the ability of our office to fulfill its core mission of institutional support and leadership.

Author Note

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- The NILOA website contains free assessment resources and can be found at http://www.learningoutcomesassessment.org.

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- The NILOA research team has scanned institutional websites, surveyed chief academic officers, and commissioned a series of occasional papers.

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