

National Institute for Learning Outcomes Assessment

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Carnegie Mellon University: Building an Infrastructure for Data-Informed Learning Improvement

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Foreword

Pat Hutchings

As part of an ongoing effort to track and explore developments in student learning outcomes assessment, the National Institute for Learning Outcomes Assessment (NILOA) has published a number of institutional case studies which are [housed on its website](#). We are now revisiting and updating some of those earlier examples in order to understand more concretely how campus assessment practices evolve over time—through lessons learned from local experience but also as a result of changes in institutional priorities, the launch of new initiatives, leadership transitions, and trends in the larger assessment movement. This report on Carnegie Mellon University is an update of NILOA’s original case study from 2012 by Jillian Kinzie.

Carnegie Mellon University (CMU) is a private research university with seven schools and colleges and with more than 14,000 undergraduate and graduate students and 4,000 faculty and staff. Located in Pittsburgh, CMU was founded in 1900 by industrialist/philanthropist Andrew Carnegie as a technology and arts school for the children of the city’s working class. It has evolved into an institution renowned for its programs in computer science, engineering, arts, business and policy, and the learning sciences. It is consistently ranked among the leading research universities in the world, recognized for its commitment to collaboration across disciplines and for its innovative leadership in education. Research with a problem-solving impact is a cornerstone of CMU’s institutional identity.

CMU was originally selected as a case study site for the insights it offers about the character of assessment in a research university setting with a strong commitment to interdisciplinarity and innovative teaching and learning. More specifically, the aim of the case was to explore how assessment was shaped by the institution’s long-standing reputation for groundbreaking work in the learning sciences and educational technology, its decentralized, faculty-driven culture, and the commitment of leadership to data-driven decision making and improvement through “strategic-reflection” (Kinzie, 2012, p. 2).

These features were clearly reflected in the 2012 report on CMU’s assessment work, including a process of external review (the President’s Advisory Board) aimed at improving program quality; a curriculum review and revision process required of all units; and, primarily through the Eberly Center for Teaching Excellence, robust programming to support faculty in improving their instructional practices. Building on these features, an Assessment Task Force (2007) was established to build further institutional capacity for assessment—formulating guiding principles for assessment, designing a website with assessment-related reports and resources; and recommending the appointment of a program assessment coordinator. In these ways and others, assessment at CMU, even in its early days, was alive and well, with activity at many levels, and a strong commitment to evidence-informed improvement. But as the 2012 case study makes clear, there

was a sense, as well, spurred in part by regional accreditation, that it was time to develop “a more systematic and consistent approach to assessment” (p. 2) and more attention to documenting its practices and impact.

What does this more systematic approach look like today? Many of the factors that shaped earlier work continue to be important. Support for assessment from high-level leaders was strong in 2012 and continues to be strong today, though with a new cast of characters in some quarters, and a major new venture—the Simon Initiative, established in 2012—dedicated to advancing the institution’s commitment to learning science research and educational technologies to improve learning for all students. Assessment continues to be organized primarily around programs and departments, reflecting the decentralized structure of the institution—and pointing to the importance of leadership from deans, and respect for different disciplinary (and interdisciplinary) cultures.

At the time of the original case study, assessment was closely identified with innovative teaching and research in the learning sciences. The Eberly Center for Teaching Excellence (now the Eberly Center for Teaching Excellence and Educational Innovation) was designated as “the hub” of assessment activity (Kinzie, 2012, p. 1). Since then the role of the Center—and its capacity to provide leadership and support for assessment—has grown in all kinds of ways, with resources and support for individual faculty (working on assignment design, for instance), a strong focus on data science and learning analytics, and a commitment to documenting evidence-informed changes and their effects on program quality and student learning. That a teaching center can play a major role in student learning outcomes assessment—and that assessment and faculty development can both benefit from a closer relationship—is an idea that is emerging on a growing number of campuses today (Kinzie, Landy, Sorcinelli, & Hutchings, 2019), and this updated account of work at CMU offers important lessons for what this closer relationship might look like.

We are grateful to Marsha Lovett, director of the Eberly Center and Associate Vice Provost for Teaching Innovation and Learning Analytics, for her willingness to provide this updated account of CMU’s commitment to the assessment of student learning outcomes. Like other NILOA case studies, her report ends with lessons for other campuses.

Building an Infrastructure for Data-Informed Learning Improvement

Marsha C. Lovett

Nurturing the Connections Among Evidence-Based Teaching, Innovation, and Assessment

CMU’s teaching center, now the [Eberly Center for Teaching Excellence and Educational Innovation](#), was first established in 1982, with a clear focus on pedagogy and support for faculty in their role as educators. As noted in the 2012 case, the Center’s role in assessment was “elevated” over a number of years as the institution worked to make assessment activities more visible and consequential. That role has continued to develop as the Eberly Center has grown and strengthened the links between teaching excellence, educational innovation, and assessment.

In 2013, the Center was expanded to include its sister unit, the Office of Technology for Education. This merger created a single organizational unit designed to address both pedagogy and technology at a time when the trend in higher education went the other direction: creating new, separate units—housed outside of the institution’s teaching center—to focus exclusively on developing online learning resources and tools (e.g., building MOOCs). In contrast, CMU saw the advantage of having a single office to support faculty in *jointly* applying the best pedagogy and educational technology in their teaching—all with the common goal of enhancing student learning.

As a result of that merger, the Eberly Center was composed of two complementary, oft-collaborating teams: one emphasizing pedagogy and the other educational technology. Both were working to help faculty implement

innovative strategies—be they pedagogical and/or technological. This led us to more frequently ask the question: Is this newly implemented approach really working to support student learning? Around the same time, more faculty were seeking Eberly Center support to engage in the Scholarship of Teaching and Learning (SoTL), and we were glad to expand our Eberly Center offerings to help faculty become more knowledgeable consumers of educational research and to conduct educational research in the context of their own courses (what we call [Teaching as Research projects](#)). We found ourselves leveraging the natural link between teaching innovation and assessment as we helped faculty collect, analyze, and interpret learning data on their course-level innovations and interventions.

We were also seeing a slow but steady rise in requests for data and assessment support at the program level. For example, when departments or academic programs were launching a curricular review or were seeing a change in their students' academic needs, they would ask for Eberly's help to collect, analyze, and interpret data for the purposes of program assessment. As with all of our services, the focus of this work was—and continues to be—formative assessment. In other words, we work to put meaningful data in our faculty colleagues' hands to guide iterative improvement. The principle of data-informed, iterative improvement has long woven throughout our work, whether it involves a teaching consultation for an individual course, the design and integration of a new technology tool, or an official educational assessment project per se.

Leadership and Institutional Commitments

It is important to acknowledge that these developments and themes within the Eberly Center's work did not occur in a vacuum. The institutional culture and leadership at CMU have played—and continue to play—a crucial role in promoting the value of assessment. Consistent with the 2012 case study, top-level leaders at CMU today clearly support a focus on learning outcomes, the role of the university in educating students for an ever-changing world, and our responsibility to create the best learning experience possible. Indeed, those values have deepened over time, such that in 2020 there is an even stronger commitment to and engagement with continuous, data-informed improvement. For example, when CMU launched our self-study process in preparation for the 2017 Middle States Accreditation Review, our then-Provost, now President, Farnam Jahanian framed our upcoming work as motivated 100% by a desire to improve students' educational experience and outcomes; not just checking a box!

Thanks to this view of assessment “from the top,” it is not surprising that our community has raised the value of and levels of comfort with using data for learning improvement. As was true at the time of the original case study, not everyone is fully on board, but resistance or lack of engagement has significantly lessened. For example, teaching center directors or assessment directors at some other institutions have to be cautious about invoking the “A” word to describe their work, but that is not true here. More importantly, the practices of assessment are now more widely adopted across CMU programs and more deeply integrated into our processes and structures in ways that make a difference.

Building Institutional Capacity for Improvement by Broadening the Teaching Center's Work

Given that several aspects of Eberly Center activities were more heavily relying on data and assessment work, we made the case for adding a third (smaller) team within the Center to focus on assessment and learning data. Thanks to the support and commitment of CMU's leadership, namely the Vice Provost for Education, Provost, and President, we have established the organizational infrastructure to support teaching excellence, educational innovation, and assessment, all within a cohesive unit.

At present, the Eberly Center has three teams with distinct areas of expertise (see Figure 1 for further descriptions of each and rough numbers of FTEs). But the key point is that they do not function as silos. Rather, members of each team often work together and, as such, have come to appreciate each others' important contributions. Additionally, they are able to recognize when to pull another team into a given project or consultation. For

example, program assessment projects are generally led by members of the assessment team (in partnership with program heads and some representative faculty), but when the time comes to prepare faculty in implementing the targeted intervention, Eberly assessment specialists naturally bring in an Eberly teaching consultant (from the pedagogy team) and/or technology specialist (from the edtech team) to support faculty in designing and then implementing the intervention across the relevant courses in their curriculum. And in the other direction, when a teaching consultant or technology specialist is working with faculty on a course (or program) innovation, they will often pull in an Eberly assessment specialist *from the start of the project* so that assessment and backwards design can work together throughout the process, rather than assessment being relegated to after-thought status.

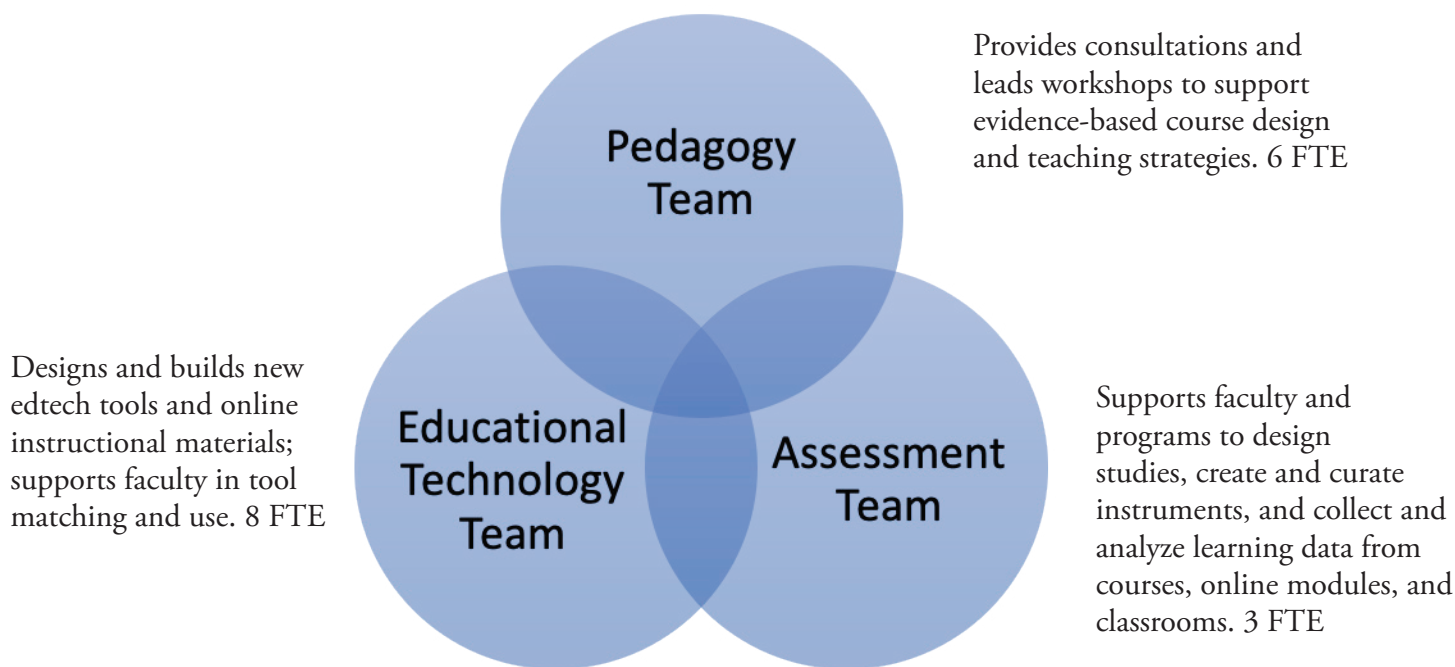


Figure 1. The Eberly Center’s three, inter-operating teams focus on pedagogy, educational technology, and assessment.

In addition to pulling other teams into a project as the need arises, we find great value in proactively creating cross-functional teams (e.g., with one teaching consultant, one technologist, and one assessment specialist) to support many of our signature initiatives and programs. This approach has enabled us to deliberately incorporate assessment into the start of such projects and set the expectation that course design and educational innovation should always involve data-informed iteration. As foreshadowed in the foreword (cf. Kinzie et al., 2019), this Eberly Center structure of inter-operating teams is at the heart of how CMU integrates faculty development with assessment.

Developing Community Around Data-Informed Teaching

As the professional development hub for faculty, the Eberly Center has always centered its work on evidence-based strategies, i.e., helping faculty leverage research results from learning science and other related fields. We have layered onto that research-based foundation an increasing emphasis on helping faculty collect learning data within their own educational contexts. In this sense, our work often starts by working with faculty to apply strategies from the literature that are expected to be effective (i.e., based on past data and theory from others’ research, see left half of Figure 2) and then continues by using data collected from the local innovation (see right half of Figure 2) to inform iterative improvement.

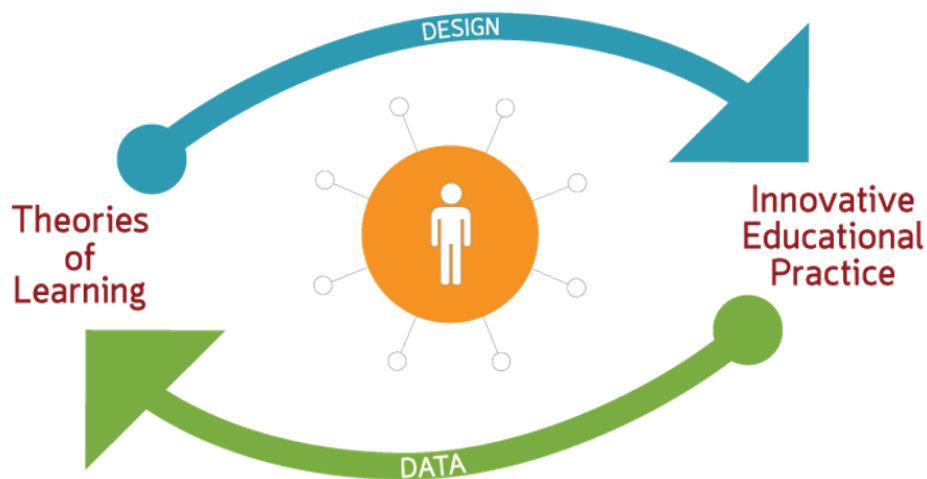


Figure 2. The cycle of data-informed instructional design that uses learning theory (past data) to design educational innovations and then collects new data on those innovations to re-cycle, informing learning theory and subsequent instructional design.

Since the 2012 case study, we have been more explicit about this second piece of data-informed teaching and have infused it into our programs and services (Lovett & Hershock, 2020). For example, the Teaching and Learning Summit, a mini-conference for CMU educators that was initiated as an annual event in 2016, is designed to “celebrate and showcase exciting ideas and evidence-based approaches... [and for attendees] to learn about educational research by CMU instructors and learning scientists” (see: www.cmu.edu/teaching/summit/). When CMU educators attend the Summit, they see their colleagues’ work presented—applying evidence-based strategies and technologies to their teaching as well as collecting and analyzing learning data from their courses—and they often come away with the sense that “if my colleagues can do that, maybe I can too.”

Over the past several years, we have also hosted numerous faculty Special Interest Groups on the topic of collecting data to inform one’s teaching. In addition, our edtech service for designing and developing online instructional modules highlights the value of collecting learning data as a starting point and ongoing expectation. And as mentioned earlier, we proactively support faculty interested in conducting research in their own courses through our annual Teaching as Research (TaR) Institute, a four-day professional development program, and the follow-on consultation and support for faculty to pursue their individual [TaR projects](#). All of these efforts, combined with support from CMU leaders and regular statements highlighting the value of data-informed teaching, have led to a notable shift in our community’s knowledge of and positive attitude toward assessment-for-improvement.

Synergies with University Initiatives

Three education-related initiatives at CMU have also contributed to an institution-wide emphasis on using learning data for iterative improvement. The [Simon Initiative](#), launched in 2013, seeks to leverage CMU’s strengths in learning science and educational technology to improve learning outcomes for all students—at CMU and beyond. A key component of the Simon Initiative’s strategy to achieve this goal involves disseminating tools, techniques, and workflows—the [Open Simon Toolkit](#)—that are capable of producing demonstrable benefits for students’ online learning. For example, the cornerstone of the Simon Toolkit is the Open Learning Initiative (OLI), an online learning environment that also serves as a learning research platform. Rich clickstream data is collected as students learn in OLI, and then the data can be processed by a suite of analytic tools to inform teachers (on how to adapt their teaching to students’ current needs), instructional designers (on where to refine learning and assessment activities to maximize student outcomes), and learning scientists (on adjustments and elaborations to learning theory based on authentic results from students in actual courses rather than laboratory experiments).

Another institutional commitment to learning data and educational improvement and innovation is illustrated by a new facility that was built for the Eberly Center. This new facility includes two “instrumented classrooms” for collecting data on learning in live physical learning environments (analogously to OLI’s data collection in the online learning environment). These state-of-the-art classrooms not only have multiple touch-screen monitors and moveable furniture to promote modern pedagogies, they also are instrumented with a grid of microphones and cameras so that audio and video data can be collected (with student consent) to help faculty gauge student learning and/or engagement, test new pedagogies, and iteratively refine their classroom teaching skills. Instructors interested in studying in-class activities and behaviors can request to teach in one of these classrooms (either for a specified set of dates or for the full semester), and those selected receive Eberly Center support and consultation to do so.

Last but not least, CMU recently launched its Core Competencies Initiative designed to make explicit the shared outcomes we have for all CMU graduates, including core skill areas such as communication, collaboration and teamwork, intercultural awareness, and more. While the core competencies initiative involves much more than assessment per se, it is grounded in defining clear learning outcomes for each competency area and then assessing our students’ current state relative to those outcomes so that we can better leverage the various formal and informal instructional opportunities students experience to enhance their learning outcomes. Because CMU has never had a university-wide general education program, this core competency initiative is a huge step in coordinating instructional efforts and assessment activities across our seven schools and colleges. It is also a great opportunity to leverage our educational technology strengths to help scale the instruction (to all of our approximately 14,000 students) and facilitate data collection and analysis across a variety of assessment artifacts and instruments. Given the broad reach that the core competencies initiative will have across the institution, it is great to see outcomes assessment and an ethos of data-informed improvement play such a central role.

Cycles of Improvement

One of the questions facing assessment as a movement is whether the evidence it generates actually leads to real changes (e.g., in a course, program, or other educational practice) and, further, whether those changes are, in fact, improvements. At CMU, some of the most notable examples of improvement are at the course level, but we also see examples at the degree program level. We use the phrase “closing the loop” to describe an assessment process that involves collecting baseline data on outcomes, analyzing those data to identify strategies for improvement, implementing the improvement, and then collecting data again to measure the impact of the intervention (cf. Fulcher et al., 2014). When applying this cycle of data-informed improvement at the program level, we are additionally mindful of the energy needed to keep program assessment projects moving through the full cycle to (hopefully) achieve demonstrable improvements. Sometimes we work with program heads to extend additional cycles of assessment and iterative refinement in order to achieve the desired outcomes. Below I describe one course-level and two program-level examples.

The first (course-level) example involves a preparatory course designed for students entering the School of Computer Science, to prepare them for a required first-year course focused on theoretical mathematics. This preparatory course was designed to provide practice and feedback on key pre-requisite concepts and skills that students would need in the theory course. The preparatory course was built in the form of three online OLI modules, each with a post-module quiz. Naturally, the Eberly team supporting this project included both members of the edtech team and the assessment team. Students’ quiz scores from 2016 were, on average, reasonable, but the functions module clearly needed work (see blue bars in Figure 3). Based on these results, the Eberly edtech team member supported the faculty member involved to create more practice exercises across all modules but especially related to functions. The next year’s data showed some improvement but functions still had the greatest need (see orange bars in Figure 3). Then, the edtech specialist suggested incorporating a new kind of online learning activity that would allow for more open-ended practice and feedback, and in the subsequent year all three modules showed solid quiz performance (see green bars in Figure 3). It is worth

noting that in addition to this quiz data from within the preparatory course, we also collected and analyzed data from the first-year theoretical math course and found further evidence that the preparatory modules were indeed reducing the difficulties students encountered there, thus addressing the problem that originally motivated this whole project.

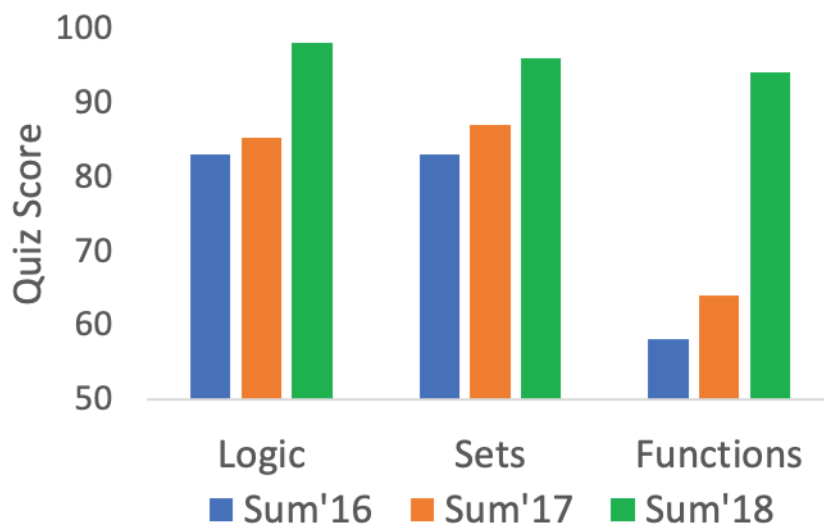


Figure 3. Post-module quiz scores for three modules (logic, sets, and functions) across multiple iterations of data-informed change (summer 2016, summer 2017, summer 2018).

The next example, at the program level, involves an engineering department where we are working with a group of faculty to formatively assess their undergraduate program. This program has an introductory course that all future majors must take and a project-based capstone course, also a program requirement, that is usually taken during the senior year. We use these two courses as program “bookends” to assess students’ development of technical knowledge and also to look at students’ non-technical skills and affective development, e.g., changes in attitudes, mindset, and sense of belonging. One of the baseline results we obtained with this program was that students were exiting the first-year course without as much technical knowledge and skills as expected/desired. These topics were being “covered” but, given the relatively high enrollment (approximately 200 students), the course did not provide much practice and feedback on these concepts and skills. Seeing a possible opportunity for intervention, the assessment team members supporting this program assessment mentioned to the clients that their Eberly Center colleagues from the technology team might be able to help address the challenge of providing *scalable* practice and feedback to students in the introductory course. This suggestion led to a collaborative project to develop educational technology resources that would provide students with more immediate, automated feedback on critical skills. Teaching consultants from the pedagogy team also joined in the project by helping the faculty members teaching this introductory course adjust their in-class activities to provide more targeted first-exposure practice. Based on one cycle of change and assessment, we have seen notable improvements in several of the knowledge and skill areas assessed. And this project is still continuing as the team looks for further areas for improvement and designs aligned pre/post assessments accordingly.

Another program-level example involves our writing program, where the curriculum was being revised to offer a new path to meeting a particular writing requirement. Specifically, students could now complete two half-semester-long courses or take the traditional full-semester course. This adjustment was motivated by earlier data showing that students taking the full-semester course had difficulty transferring their writing skills to different genres. By taking two half-semester courses that focus on different genres, the idea was that students would get more practice at transfer and be better able to tackle writing in yet other genres. In addition to testing this hypothesis, the program director was interested in whether the new option was as successful in helping students achieve other program outcomes (e.g., organizing one’s writing to meet readers’ expectations

and needs, viewing writing as a process of problem solving and revision, developing positive self-efficacy as a writer). Although the Eberly Center was not involved in baseline data collection (before the new option was first launched), we were able to collect data during a period of time when both the old and new option were being offered. We collected pre/post data from multiple sources that aligned with the program outcomes, e.g., artifacts of students' work rated on a common rubric and survey responses from a research-based instrument designed to assess students' writing process and beliefs. On most measures—e.g., both direct measures of students' writing skills via rubric-scored artifacts and survey results on students' beliefs and attitudes about writing—the two course types showed rather similar results. In only a couple areas did the results show a statistically significant difference (after accounting for incoming SAT scores and section). And one of these measures showed an advantage for the two mini-courses, and the other measure showed an advantage for the full-semester course. The assessment colleagues analyzing the data noted that the individual student variables (e.g., SAT) had a significant effect (i.e., students entering with higher SATs had higher rubric scores), and students were not uniformly distributed across course types. After further analyses by student sub-groups—namely, students whose incoming SAT score was above versus below the median—the results revealed that students with lower incoming scores performed better in the two mini-course option, whereas students with higher incoming scores did not show a difference across course options. Thus, in addition to some targeted program changes that were suggested by particular results, an adjustment was made to inform advisors (who helped students with course choices) that the mini-course option seemed to be a good match for students with lower incoming SAT scores. Data from the most recent run of the two mini-course options is still being analyzed (after a bit of a pandemic-related delay), and we will look for improvements related to the program changes made and continue investigating the course option by student group interaction.

Audiences and Stakeholders

Assessment projects like these are powerful ways of communicating our work to our colleagues within the institution, but also to those outside. Two external audiences are particularly relevant here.

One relates to accreditation, most notably the Middle States Commission on Higher Education (MSCHE) of which CMU is a part. As documented in the earlier case study, regional accreditation had been a key catalyst for more systematic attention to assessment. While accreditation continues to be an important impetus for our institution's assessment work today, we now aim to engage in formative assessment as a *standard operating practice*—not just when the accrediting agency is coming to town. Our view is that if you are doing formative assessment sufficiently well, when it comes time to report to accreditors, you will be ready. At CMU, we aspire to enact that approach and are seeing it happen more and more.

Thanks to our most recent Middle States visit in April 2017, we had the opportunity to share our assessment work with individuals from beyond the institution. Beyond the positive responses from the visiting team, we were glad to see many examples of the Eberly Center's supporting role in the assessment processes and results documented. Perhaps just as importantly as sharing our work with these external accreditors, we appreciated the opportunity to share our good work with one another, learn from each other, and propagate productive approaches and models.

A second group of outside stakeholders is represented by the President's Advisory Board (PAB) described in the 2012 case study. The PAB was designed to provide programs regular opportunities for self-study and external review with a more disciplinary focus. Comprised of two members of the university's board of trustees, and up to eight external members, these groups traditionally reviewed program quality on a rotating basis. The PAB model has recently been modified after a hiatus of several years. Among several other changes (e.g., it occurs at the school/college level rather than the department level), there is now more attention to including direct measures of student learning in the reports and discussion.

Areas for Further Work

This case study has mentioned several areas in which CMU is continuing to weave assessment and learning improvement work into the fabric of our educational practices. An area not yet mentioned but ripe with

future opportunities is learning analytics. Like many other institutions, CMU is exploring the promise of learning analytics to improve our educational processes and practices. We are aiming to leverage analytics in a deliberate way to learn more about what is and is not working for our students so that we can better support their persistence and success. This work requires attention to two important issues. First, there is a need to educate all the stakeholders involved so they can better understand how the data are being collected and used and how the corresponding results should be interpreted. A second key issue is to ensure that we cultivate an asset-minded approach throughout this work. It is all too easy to judge a student (or group of students) predicted to have a lower likelihood of success, and consider them incapable or lacking in some way. Instead, a lower prediction of success should be framed in terms of what we as an institution—our systems, policies, and practices—are not doing sufficiently well to support that student. To keep these two key points in mind, several principles are guiding our work: transparency, shared understanding, and an outcomes-oriented, asset-based approach (Kurzweil & Stevens, 2018). CMU has a lot more activity in this arena than there was in 2012, and we have already found that looking for patterns in the data can help us better understand and support student persistence and success.

As we continue to engage in this work, a key step involves examining the data infrastructure that is potentially creating barriers to “data flow” so that we can identify and resolve them. Like many other institutions, CMU is navigating this work amidst data silos. A common lament I hear across institutions including at CMU is that the data are “out there” but somehow unable to be accessed or integrated into insight and action. The consequence is that we do not have a sufficient flow of information to make the best data-informed improvements. This particular problem is a technical one that is kind of like fixing the plumbing: it is not the most exciting work, but it is critical for all the other layers that rely on it.

There are also issues on the human side of learning analytics, in terms of data stewardship as well as culture and conventions around using the data effectively. For example, a common issue involves establishing common data dictionaries that consistently define what is being measured in different data sets. Other questions involve where the data should reside and who should have access to it. And of course the topics of data ethics and responsible use of data are essential to this work. In this sense, tackling learning analytics is a social-technical endeavor. There is a need for technical infrastructure that produces well defined data with integrity and for an educated community of stakeholders that share common knowledge and values. We are not exactly where we want to be yet, but we are working on this. It is a big area for ongoing work.

A second area of work going forward involves creating sustainable assessment practices within our institution’s organizational structures. An important lesson learned relative to the approach we took back in 2012 is that a stand-alone task force responsible for assessment work is not easy to sustain. To address sustainability head on, we are now looking to leverage standing bodies at CMU that have the appropriate membership to be champions for and contributors to the institution’s assessment work. These bodies include the University Education Council, the Deans’ Council, and our undergraduate and graduate associate deans. We have built assessment responsibilities into those standing bodies, relying on their long history in the university to carry this work forward in an ongoing manner. Having built assessment discussions and updates into the agendas of these groups’ meetings for the last two years, we have a promising start with this approach. This feels like a really good move for us, and my hope is that soon enough the members of those groups will naturally expect assessment to be a regular part of their conversations.

Conclusion

Assessment at CMU is more discussed, more presumed today than it was in 2012. Our practices are much more focused on direct performance measures to demonstrate real improvements in student outcomes. CMU’s organizational knowledge about assessment has grown immensely, as has our appetite for using data to inform action. Altogether this speaks to a positive culture shift that I hope and expect will continue. A key reason for that hope is CMU’s sustained commitment from 2012 to 2020 and beyond – to be good guardians of our resources to make education as effective as possible for our students.

Lessons for Other Campuses

1. Top-level administrative leadership is critical to developing an effective approach to the assessment of student learning outcomes. Signals from the office of the president or provost can help to frame assessment as part of a larger commitment to the value of data for guiding decision making. In this way, assessment is more likely to be seen not as an external imposition but as a reflection of a core value, a part of the institutional culture.
2. Situating assessment consultants in a teaching center can be a powerful strategy for linking it to the institution's commitment to teaching excellence and educational innovation. Assessment at its best is about building faculty habits of and capacity for asking questions about their students' learning, exploring those questions, and using resulting insights to make improvements at both the course and program level.
3. Relatedly, assessment is more likely to make a difference when the responsibility is shared among a number of relevant institutional structures and groups. The teaching center, as just noted, is one of those, but others might include faculty governance, the deans' council, and other standing bodies.
4. Data science and learning analytics bring new possibilities to the assessment of student learning outcomes. A community- and culture-driven approach, linking these activities, can uncover new questions to explore and new approaches to enhancing student learning and success.
5. Online learning and other uses of educational technology make the learning process visible in new ways. With online learning data and other approaches to "instrumenting" students' learning in authentic situations, it is possible to ask and answer new questions about teaching and learning.
6. Effective assessment, leading to real improvements, entails a continuous cycle of inquiry and intervention. The goal is not to simply gather data, make a change, and pat yourself on the back. What is needed, rather, is an approach that goes through multiple phases of evidence gathering, meaning making, and innovation, always seeking further improvements based on the data.
7. Assessment raises important issues on the human side above and beyond any technical hurdles. These involve the stewardship of data and establishing conventions around its appropriate and responsible use. Making progress on this involves paying attention to engaging and educating the campus community.

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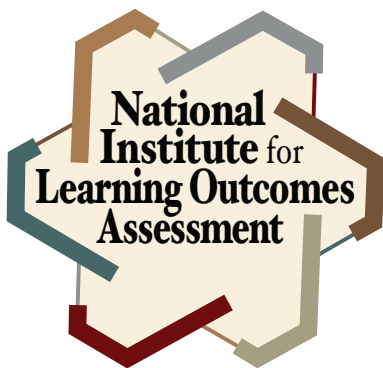
About NILOA

- The National Institute for Learning Outcomes Assessment (NILOA) was established in December 2008.
- NILOA is co-located at the University of Illinois and Indiana University.
- The NILOA website contains free resources and can be found at <https://www.learningoutcomesassessment.org>
- NILOA supports institutions in designing learning experiences and assessment approaches that strengthen the experience of diverse learners within a variety of institutional contexts.
- NILOA works in partnership with a broad range of organizations and provides technical assistance and research support to various projects focused on learning throughout the U.S. and internationally.
- NILOA's Vision is to broaden the dialogue and conversation on meaningful and sustainable assessment practices that address issues of design and implementation, and position institutions, organizations, and individuals to achieve their goals.

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