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Implementing Curricular Change Across the University: Challenges and Successes

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The University of Nevada, Las Vegas (UNLV) was one of four participating institutions in the Association of American Colleges and Universities' (AAC&U) Purposeful Pathways: Faculty Planning for Curricular Coherence Project, funded by the Teagle Foundation. The goal of the project was to examine and improve curriculum coherence in undergraduate programs at our institution. A team of UNLV faculty and administrators developed a framework for curricular review and a consultative model to support programs in the process of reviewing and revising their curricula. We implemented this process with the faculty of nine academic programs and assessed the impact of curricular review and revisions at various levels. To assess the impact of the revisions on curricular complexity, we made pre-post comparisons of complexity scores, as calculated by the University of New Mexico's Curricular Analytics platform (Heileman, Slim, Hickman, & Abdallah, 2017). We used a survey adapted from the Concerns Based Adoption Model (George, Hall, & Stiegelbauer, 2006) to evaluate faculty's perceptions of the curricular review and revision process. Finally, we used a custom rubric to qualitatively assess the outcome of the curriculum revisions and level of alignment with project goals. The results showed that, although faculty expressed high levels of confidence and low levels of concern about the curricular changes they proposed, most of the changes were focused on removing structural barriers to student progression and had little impact on curricular complexity. Future efforts should focus on incentivizing more holistic, ambitious, and substantive curricular revision.

Over the past four decades, higher education scholars and faculty have expressed growing concern about the integrity of undergraduate curriculum at colleges and universities in the US. Degree programs that were once carefully and intentionally designed to produce a set of interdependent, rationally sequenced learning opportunities have drifted, expanded, contracted, and morphed into collections of courses that add up to 120 credits (or more) and meet the requirements of disciplinary accreditors; however, little is done to create coherent learning experiences or support development of skills that academics and employers espouse as important, such as communication, critical thinking, and appreciation of diverse perspectives (Arum & Roska, 2011; Deresiewicz, 2014; Hart Research Associates, 2018). The pressures driving this evolution are numerous, complex, and exerted by stakeholders with competing interests. The end result is widespread frustration for students who do not understand how the courses required for their programs of study fit together to prepare them for life after college, and faculty who feel little control over the curricula they once owned.

At the same time, colleges and universities have grappled with radical shifts in the populations they serve, declining enrollments and, for many public institutions, declining state funding. As institutions serve greater numbers of first-generation college students, students of color, and students from other historically marginalized groups, the stakes for higher education have never been higher. We face a moral imperative to ensure not only that all students successfully navigate the college experience and graduate on a timely basis and with minimal debt but also that they are prepared to thrive in 21st century work and life. This grand challenge requires a renewed commitment to creating coherent and efficient curricula.

Curriculum, Faculty Governance, and Leading Change: UNLV and the Context for Change

Because curriculum change efforts can potentially lead to standoffs between administrators and departmental faculty (e.g., Patel, 2018), it is important to understand perspectives on how to implement change. Trowler, et al. (2003) identified five approaches to change in higher education that are based on the drivers of change, location, and flow of power: (a) technical-rational, (b) resource allocation, (c) diffusionist, (d) Kai Zen/bricolage, and (e) complexity. In both technical-rational and resource allocation approaches, the change agents—typically administrators—have considerable power either to implement policies that drive change (technical-rational) or to incentivize change through resource allocation. In a diffusionist approach, the change agents are influential early adopters who often support a "train-the-trainer" model to disseminate change. In Kai Zen or bricolage approaches, change is driven by communities of practice (e.g., departments or disciplinary groups of faculty), and power is distributed throughout the group. Finally, in complexity approaches, change agents are those capable of creating affordances or conditions under which change is more likely to

occur, but they do not have power to directly influence change. Thus, technical-rational and resource allocation approaches can be categorized as top-down, diffusionist and Kai Zen as bottom-up, and complexity as organic. Here we consider a university-wide curriculum revision initiative that required aspects of each of these approaches at different times during the project.

Curriculum reform is often a contested process. Annala and Mäkinen (2017) pointed out that when curriculum reform begins from a university-level, administrator-driven process, "autonomous academic working cultures are shaken" (p. 1941) as the meaning of the curriculum and the terms governing it are negotiated among the various stakeholders. Those stakeholders often hold different understandings of the purpose and desired outcomes of curricular reform initiatives.

In their analysis of curriculum change in higher education, Blackmore and Kandiko (2012) suggested that, in order to be effective, strategies that begin at the institutional level must be accepted and adapted by the academic departments where teaching and research take place. The faculty of an academic department can be understood as a community of practice (Wegner, 1998) with mutual engagement, a joint enterprise, and a shared repertoire around the process of curriculum development. The department is the significant level at which change can occur, as decisions about curriculum and the specific criteria by which both students and faculty will be evaluated are most often made at the department level. As such, academic departments feel a collective sense of ownership over the curricula of the programs they offer and of the courses that comprise those curricula because they have been empowered to make such decisions. Understanding this sense of ownership, and that departments and courses are the locations for learning and have the most proximal influence on students' academic success, the process of curricular coherence at University of Nevada Las Vegas (UNLV) focused attention at the departmental level, with a faculty-led process.

UNLV is an ideal institution for this project for a number of reasons. First, it clearly serves a diverse population as it is designated a Minority-Serving and Hispanic-Serving Institution by the U.S. Department of Education. UNLV has more than 31,000 students, 3,900 faculty and staff, and offers over 340 undergraduate and graduate degree programs. Over the past six years, undergraduate enrollments have grown by 17.6% (UNLV Office of Decision Support, 2019), and during that time, the institution has embarked on an ambitious strategic plan that includes goals for dramatic increases in both research productivity and student success metrics. In pursuit of these goals, UNLV has carefully examined and disaggregated student progression and completion data. These data revealed that many students were not completing their degrees in a timely manner without multiple course substitutions and waivers. Furthermore, the degree to which results of student learning outcomes assessments were being used to refine curriculum varied widely across programs.

Though every undergraduate program has unique challenges, some types of curricular barriers to student success are more common than others. Kandiko and Blackmore (2010) identified several tensions common in curricular reform efforts, two of which—breadth vs. depth and structure vs. choice—are particularly apparent in the curricular issues we identified at our institution. At two ends of a continuum, some programs have single courses that serve as prerequisites for all other major courses and create bottlenecks to progression, whereas other programs have only a few required courses and challenge students to create a coherent program of study using electives. The latter structure has, in some cases, resulted in proliferation of elective courses, some rarely offered; thus, students are left with too many choices, some of which do not provide viable paths to degree completion. In many cases, sequences of required courses have been built based on faculty availability and scheduling preferences. Changes in the composition or availability of faculty in a department can lead to reduced availability of required courses and prevent students from progressing or graduating.

Naturally, these structural challenges in curriculum were not created intentionally to slow student progression or hamper learning. As Bernstein (1996) described, the historical curricular changes that produced the current curricula at UNLV were driven by processes of introjection (i.e., the internal concerns of the discipline) and projection (i.e., the demands of external entities). For instance, national accreditation standards for some academic disciplines have constrained flexibility of program curricula, either directly by dictating specific learning outcomes and competencies or indirectly by requiring minimum student-to-faculty ratios.

Like many states across the US, Nevada's higher education funding formula has shifted in recent years from an exclusive focus on enrollment to one that includes performance incentives for degree completions. However, the bulk of state funding is still allocated on the basis of weighted student credit hours. At the department level, this model incentivizes maintaining student enrollment counts through large and required courses and may dissuade faculty from exploring innovative curricula that could reduce enrollments in courses within their own disciplines but ultimately better serve the needs of students. Like most institutions, UNLV requires university-level, faculty-led review of all proposed curriculum changes. In addition, the Nevada System of Higher Education has

common course numbering and transfer articulation policies that require an additional layer of inter-institutional review. Thus, the administrative work of curricular revision is considerable and has become, in some cases, a barrier to substantive change. Finally, as part of its strategic plan, UNLV has been pursuing the goal of joining ranks with institutions designated as Carnegie Research-Very High, which relies heavily on research expenditures and doctoral degree production. As such, faculty hiring priorities in many departments have been aligned more with research and graduate program needs than with undergraduate program needs. Such budgetary and administrative constraints on curricular innovation are common across the higher education landscape, and so it is important to develop and disseminate strategies that effectively address them.

With support from the senior vice provost and college deans, UNLV assembled a group of faculty and staff representing multiple units within the university (e.g., assessment, libraries, registrar, liberal arts, sciences; hereafter referred to as the *project team*). This faculty-led and administratively supported group developed a framework to evaluate the coherence of current undergraduate curricula. The team engaged departments and offered the framework to guide an evaluation process that served as a jumping-off point for implementing needed curricular revision focused on (a) increasing degree-program coherence and integrative learning; (b) ensuring adequacy of student learning (i.e., assessment); (c) aligning curricula, demand, and resources (including curricular streamlining when necessary); (d) aligning programs with workforce needs and graduate program pipelines, where appropriate; and (e) promoting desired student outcomes (i.e., retention, progression, and completion). In the sections that follow, we describe our approach to implement curriculum change, the results of our efforts, and some lessons learned.

Method

Participating Departments

Academic departments with potential for significant revision of their undergraduate programs were identified by the project team. A department was identified as a potential participant based on at least one of the following criteria: (a) its faculty were already discussing a possible undergraduate curriculum review, (b) the project team noted elements in the department's undergraduate curriculum that were significant barriers to students' progression or degree completion, and/or (c) a major in the department serves a very large number (i.e., greater than 1,000) of undergraduate students. Departments were recruited to participate by project team members. The recruitment process typically included an introductory e-mail to the department chair explaining the goals of the project and potential benefits of participation followed by a meeting between the department chair and/or the undergraduate coordinator, the vice provost for undergraduate education, and a member of the project team from the college that housed the department. Departments that agreed to participate were provided with the Curricular Coherence Framework (see Appendix A). The framework was organized around three stages of an iterative curriculum planning process: design, implementation, and assessment. Guiding questions for each stage were intended to provoke critical reflection among faculty on whether or not their program curricula were meeting the learning goals they were designed to address and if the curricula had been implemented in a manner that created unintended barriers to student progression (e.g., a rarely offered course was a prerequisite for a number of other courses). We asked questions such as the following:

- Design:
  - "Are important learning outcomes reinforced in multiple courses (e.g., beginning, middle, and end)?"
  - "Are courses appropriately sequenced, including the structure of prerequisites?"
- Implementation:
  - "Do students require exceptions or waivers to satisfy your program requirements?"
  - "Are there courses listed in the catalog that are rarely or never offered?"
- Assessment:
  - "Do you have a plan for systematic assessment of the program learning outcomes at appropriate points in the curriculum?"
  - "Do faculty reflect regularly on assessment results to refine and improve the curriculum?"

Although these questions were intended to provoke critical reflection and discussion among faculty, we did not define acceptable answers or thresholds for affirmative or negative answers. The goal was that these questions would push departments to critically evaluate their curriculum. Importantly, as faculty attempted to answer these questions, additional questions and requests for data would arise.

One or two members of the project team offered to attend a departmental faculty meeting to discuss the curricular revision process, address questions,

and to assist the unit to obtain any data they might need to complete their curricular review process (see Logue, 2018 for perspectives on the importance of using data for curricular updates). Once departments had voted on curricular changes, we also offered to help with the sometimes lengthy university curriculum proposal process; our assistance included completing required proposal forms and expediting their review. Finally, participating departments were compensated for their time and effort with a payment of $1,500, which could be used to support activities or materials related to curricular review and revision, conference travel, or a stipend for a faculty member whose workload was significantly increased by the curricular review/revision process.

Faculty Reactions Survey

After departments completed the entire curricular review and revision process, department faculty were asked to complete a brief survey that assessed their experiences with the curricular review and revision process. The survey was adapted from the Stages of Concern Questionnaire (George et al., 2006). Most important for this project, three items asked participants to rate (a) the usefulness of the process, (b) their confidence in their ability to implement the changes they identified, and (c) their level of concern about implementing those changes, all on a 5-point Likert-type scale (1 = *not at all useful, confident, or concerned*; 5 = *extremely useful, confident, or concerned*). The remaining items were free-response questions that asked about the ease of identifying issues or problems in their curriculum, which resources or assistance were most helpful, and any barriers that were present in their efforts to make improvements.

Rubric Construction

The curricular changes completed by each department were evaluated by the project team using a custom rubric (Appendix B). The rubric was developed using a 3-point scale with common curricular changes as the criteria. A *not-applicable* category was included in the scale to account for the particular needs of departments. After the initial construction of the rubric, the project team met to discuss and further refine the instrument. As a result of this process, several additional criteria were added, and the descriptions within each rubric cell were adjusted to ensure that each element of the rubric measured a unique curricular change. The changes made by each department were categorized according to the eight desired project elements and rated on the degree to which the departments achieved each desired element.

Curricular Complexity Analysis

The Institute of Design and Innovation at the University of New Mexico (UNM) has developed a method for examining the structural complexity of a curriculum (Heileman et al., 2017) based on the required pre and corequisite relationships between courses. Specifically, the method quantifies the level of complexity inherent in chains of courses. In a basic example, if Course A is a prerequisite for Course B, and Course B is a subsequent prerequisite for Course C, then Course A is structurally a prerequisite for Course C as well.

Heileman et al. (2017) created a mathematical model based on the complexity of each course in a curriculum using two factors and provided an online Curricular Analytics platform (https://curricularanalytics.org/) to allow institutions to score their own curricula. The first factor is labeled the "blocking factor" and represents the number of other courses to which student access is blocked through the prerequisite relationship to the course. In the above example, the blocking factor for Course A is equal to 2, as students cannot progress and take either Course B or Course C until they have successfully passed Course A. The second factor is labeled the "delay factor" and represents the total number of courses on the longest prerequisite course chain that includes the course in question. For the above example, the delay factor equals 3, as Courses A, B, and C make up the entire chain. The complexity for any course is the sum of the blocking and delay factors; for Course A this would be equal to 5.

The complexity score of a given curriculum is calculated by summing the complexity of all the courses within the curriculum. Thus, higher complexity scores reflect a curriculum that has more courses that block other courses and are in longer delay chains with other courses in that curriculum. Heileman, et al. (2019) showed that institutions with higher rankings on the *US News and World Report* demonstrate lower levels of curricular complexity. Further, greater curricular complexity is associated with lower graduation rates and longer time to degree, and efforts at UNM to reduce the curricular complexity within the Engineering curriculum have led to large gains in degree completion and graduation rates (Heileman & Abdallah, 2019).

For this project, we analyzed the impact of curricular changes on structural complexity by loading the curriculum of each degree program into UNM's Curricular Analytics platform (Heileman et al., 2017; https://curricularanalytics.org/). For each program, we uploaded a .csv file that included the following information for every required course in the program: course name, term during which students are intended to take the course (as listed in the published 4-year plan of study), the plan's corresponding Classification of Instructional Programs (CIP) codes, all applicable prerequisites and corequisites (as listed in the UNLV

Undergraduate Catalog), and minimum number of credits required to complete the degree.[1] The Nevada System of Higher Education benchmark for new bachelor's degree programs is 120 credits of required coursework. However, some programs are permitted to exceed 120 required credits on the basis of state licensure requirements for the professions for which the programs prepare students (e.g., teacher education) or because they were approved before this benchmark was put in place.

Certainly, courses with lower passing rates impact students' ability to successfully complete a curriculum. In UNM's model, this property is referred to as the instructional complexity of a curriculum. However, for this study we did not include the instructional complexity factor, as our goal in using the tool was to assess structural complexity of our degree programs. Both instructional and structural complexity can contribute to barriers in a curriculum and sometimes converge to create a single course that is a major barrier to completion (e.g., a challenging introductory course with low pass rates that is also a prerequisite for all upper-division courses in a program). The approaches to remedy instructional complexity barriers are different from those used to remedy structural complexity barriers, so we kept the analyses separate. However, we did provide departments with pass rate data for all of their courses alongside the structural complexity data, and courses that had both high complexity and low pass rates (i.e., D/F/Withdrawal/Incomplete grades comprised more than 30% of recorded grades for at least one term in the past five years) were flagged. We compared the pre- and post-revision complexity score and total required credits for each program.

Results

Faculty Reactions to the Process

Eighteen faculty from six departments responded to the adapted Stages of Concern survey. Respondents endorsed high levels of usefulness of the curricular review process (4.23 ± 0.75). All but one respondent reported that their departments were able to identify changes to their undergraduate curricula that would make them more streamlined and coherent. Respondents reported moderate levels of confidence in their ability to implement the changes they identified (3.5 ± 0.55) and correspondingly low levels of concern about implementing changes (1.27 ± 0.46). Faculty reported relatively few/minor barriers to implementing curricular changes; the most commonly cited barriers were reaching agreement among department faculty and navigating university or state system-level administrative processes (e.g., Faculty Senate approval and common course numbering review). Among the most frequently mentioned useful aspects of the process were opportunities to discuss curriculum in a structured way or with an outsider's perspective. Faculty also noted the usefulness of data from a variety of sources in the curricular review process.

Descriptions of Curricular Change

Nine undergraduate degree programs offered by seven academic departments from five colleges and schools underwent curricular revision during the period covered by this study (Fall 2016 to Spring 2019). The categories of curricular change and the degree to which those changes were achieved are summarized in Table 1. The most common types of change were eliminating structural barriers in the curriculum (e.g., unnecessary or ambiguous prerequisites), resequencing courses or content across courses, and providing learning support for students in key required courses. None of the participating programs attempted changes to make learning outcomes transparent to students or to create/expand opportunities for signature work. Signature work is, "focused on a question, issue, or problem chosen by the student because of its importance to him or her as well as to the broader society" (Tritelli, 2015, p. 1) and involves the sustained integration and application of learning over the course of one semester or more (AAC&U, 2015). The types of change with the highest median implementation rating were eliminating structural barriers and "boutique" courses (i.e., those that do not directly address program learning outcomes) as well as expanding capacity in required courses.

Curricular Complexity

The impact of curricular revisions on curricular complexity is summarized in Table 2. On average, there was no change in curricular complexity scores from pre- to post-revision. Four programs had decreased complexity scores post-revision, four had increased complexity scores, and one had no change. In addition, there was no change in the number of credits required per degree program from pre- to post-revision. The courses that increased the overall complexity scores the most (i.e., had the highest course complexity scores) for STEM programs (chemistry, biochemistry, geosciences, and mechanical engineering) were Calculus I and II and General Chemistry. For non-STEM programs, English Composition and College Algebra increased the complexity scores the most.

[1] In some cases, logic errors prevented the .csv file from loading into the platform (e.g., a course intended for students to take in term 2 had a prerequisite that was also intended for them to take in term 2). In those cases, we made modest adjustments to the file so that it accommodated the published 4-year plan of study for the program. For example, a plan that included a course that serves as a corequisite but is listed as a prerequisite was moved to a prerequisite position in the plan of study for uploading into the tool.

Table 1
Summary of Curricular Changes

Change Category	No. of programs engaged	% of programs that completed change	Median progress score
Eliminating "boutique" courses	3	100	3
Expanding capacity in required courses	2	50	2.5
Learning outcomes transparency	0	—	—
Signature work	0	—	—
Assessment planning	1	0	1
Support for key courses	3	33	2
Resequencing	3	33	2
Eliminating structural obstacles	8	100	3

Table 2
Means and Standard Deviations for Curricular Complexity Scores and Credit Totals

		Pre-revision complexity score		Post-revision complexity score		Pre-revision credits		Post-revision credits	
Program type	*N*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
STEM	6	316	158.50	322	177.66	123	2.37	123	3.08
Non-STEM	3	70	9.54	70	11.02	120	0	120	0

Discussion

Types of Curricular Change

By far, the most common type of curricular change undertaken by departments was elimination of structural obstacles to students' progression and completion, such as unnecessary or ambiguous prerequisites. This type of change was carried through to completion by all departments that attempted it, suggesting that such changes represent "low hanging fruit" and may be a reasonable starting point for institutions aiming to implement a basic level of curricular review and revision across all departments.

In contrast, no participating department undertook revisions designed to expand opportunities for signature work or to make learning outcomes more transparent to students. Such changes likely require greater investment of time and effort to negotiate within the department, and sustained investment of resources and effort over time to fully implement and maintain. Provision of additional support from faculty and staff outside the department (e.g., instructional designers or academic advisors) may encourage faculty to engage in these more challenging forms of curricular change. In the early stages of the project, we felt a simple incentive structure, in which any substantive revision was rewarded, was necessary to build faculty buy-in. However, in the future, a tiered structure with larger incentives for departments that undertake more challenging types of change or address multiple sources of curricular incoherence merits consideration.

Curricular Complexity

Overall, we found that the changes departments made to their curricula did not significantly impact complexity scores. Reductions in curricular complexity may seem a desirable outcome of a curricular revision process, but there are explanations for why we did not observe an overall reduction in curricular complexity. First, complexity scores for most STEM programs actually increased after revision. This is likely an artifact of a decision to uncouple lectures and laboratories for 100-level introductory science courses (e.g., General Chemistry), a change that coincided with the curricular revision process. For example, a degree requirement that originally appeared as one 4-credit course in a pre-revision curriculum later appeared as a 3-credit lecture and a 1-credit corequisite laboratory in the post-revision curriculum. Unfortunately, the complexity formulas determine that the addition of pre or corequisites automatically increases overall complexity scores. In this case, the uncoupling of labs was purposely implemented as a curricular improvement that allows students who failed one part of the course (either the lecture or lab component) to only have to repeat the failed portion. A second reason that complexity scores did not decrease as a result of curricular revision was that we did not present

departments with the explicit goal of decreasing complexity. Rather, we presented them with the more holistic goal of improving curricular coherence and suggested a number of potential approaches to accomplish this objective, which addressed not only curricular structure but also instruction and assessment. We learned through this project that decreased complexity does not necessarily equate to improved curriculum.

Indeed, we caution against stating reductions in curricular complexity as an explicit goal for a curricular revision process. Degree plans with very high complexity present challenges to student progression in the form of long prerequisite chains that delay entry into upper-level requirements. However, degree plans with very low complexity can be equally problematic because they often have a heavy emphasis on upper-level electives which, once chosen, may reveal additional pre or corequisites that were previously invisible to the student or place the onus on the student to choose electives to create a coherent learning experience. Thus, we suggest that curricular complexity analyses be used not as a benchmarking tool but as a tool to help faculty understand the degree to which degree requirements are interdependent, and to recognize the unintentional barriers to student progression that interdependence may create.

A final point about complexity analysis is that it can be used to identify previously unnoticed errors in a published curriculum. Surprisingly, we found that several curricula could not be loaded into the Curricular Analytics platform as published in the 4-year plans used as advising tools for students. For instance, the 4-year plan might recommend a course in the same semester as another course that was listed as a prerequisite for it. Such errors could create barriers to progression for students attempting to follow the 4-year plan. Additionally, as in the case of General Chemistry I lecture and laboratory—often taken in a student's first term—outdated plans of study still required Preparatory Chemistry (a remedial course) as a prerequisite. Further inquiry with academic advisors and faculty revealed that the Preparatory Chemistry prerequisite requirement was routinely waived or that students tested out of it—a trend not otherwise evident by simply reviewing and uploading a given plan of study. This experience highlighted the utility of the Curricular Analytics platform for identifying technical problems with the published curriculum that can be easily remedied.

Faculty Reactions to the Process of Curricular Revision

Participating faculty reported high levels of confidence and low levels of concern regarding their ability to implement planned curriculum changes and noted that outsiders' perspectives were useful. These findings suggest that the process we implemented adequately supported faculty. Indeed, most departments were able to complete the curricular changes they planned. However, survey results should be interpreted with caution, as the sample size was relatively small and there was likely some self-selection bias (i.e., those faculty who responded were likely the most committed to the curricular review and revision process and may have had higher levels of confidence and lower levels of concern regardless of the approach or level of support they received).

Lessons Learned and Future Directions

One of the most important lessons learned occurred during the early phases of this project; importantly, we found it necessary to adjust our approach to engaging department faculty in curricular revision. Initially, we started the recruitment process by presenting the opportunity to participate to the entire faculty from a department in the context of a regularly scheduled departmental meeting. Despite efforts to emphasize that participation was voluntary and that the process would be led by a committee of faculty from the department (and supported by the project team), this approach elicited numerous questions and concerns that the project team was expected to address during the meeting. When we were unable to answer these questions or address these concerns immediately, further engagement of the faculty was greatly diminished. Because of these difficulties presenting to the department's full group of faculty, our revised process was to first approach the department chair and the undergraduate coordinator, present the initiative to them, and ask that they present the opportunity to the department faculty. This new approach was much more successful in engaging the faculty at large.

Our assumptions about the needs, desires, and motivations of departments also evolved over the course of our endeavor. For example, during the planning phase, the project team identified certain types of data that we believed would be useful to faculty in exploring how the curriculum of an academic program affects student progression and completion. However, we discovered early in our discussions with departments that many were already familiar with the data we presented or had already identified other metrics that would be useful to them. Thus, rather than continuing to provide every department with a predetermined set of metrics, we asked department chairs which types of data would be most useful to them in leading the curricular revision process and offered to gather and deliver those data to the department. Though it was more time- and labor-intensive for the project team, we think that this customized data approach helped to build a sense of agency among department faculty and improved satisfaction with the process.

An additional lesson learned involved issues regarding motivation to make curriculum changes based on who was leading the change. As described previously, Trowler et al. (2003) identified five approaches to change in higher education based on the drivers of change and location and flow of power: technical-rational, resource allocation, diffusionist, Kai Zen/bricolage, and complexity. Our project employed four of these approaches, with the ultimate goal of empowering and supporting faculty to enact the types of curricular revisions that will contribute to improved student retention, progression, and degree completion. Because leadership for our initiative was situated within the office of the provost, our approach could be described as technical-rational. However, our project team included faculty from academic departments, and we were sensitive to negative perceptions of and reactions against top-down mandates for change. Thus, we incorporated aspects of other categories of change to enhance bottom-up influence on the change process. Though the original conception of resource allocation refers broadly to leveraging institution-level decision making about resource allocation to drive changes desired by senior leadership, provisioning of small incentives to departments to support their engagement in the change process can also be considered part of this second category of change. We were successful in employing a diffusionist approach whereby we worked with early adopters and communicated their successes to other departments to encourage the latter to engage in curricular review and revision. Lastly, we embraced aspects of the complexity approach, which drives change by creating conditions that favor the approach. Specifically, we were able to alleviate certain administrative barriers to change and provided resources that allowed departments to set aside time dedicated to meaningful examination of their curricula.

A final lesson learned was that the curriculum updates in our project tended to focus on courses and sequencing; as noted earlier in the Results section, none of the departments made changes regarding student learning outcomes and signature work. This is an important issue because clear learning outcomes and opportunities for signature work support college students' skill development, and there are clear indications that both employers and academics see gaps in college graduates' skills (Arum & Roska, 2011; Deresiewicz, 2014; Hart Research Associates, 2018). Because these types of curriculum change are more time consuming and effortful, one possible improvement to our process in the future is a multi-step approach with incentives for each step. The first step may focus on courses and sequencing, and the second step might progress to more challenging topics, such as learning outcomes, signature work, and skill development. The latter step could work well by questioning where, when, and how students are developing skills as they progress through the major, emphasizing departmental assessment of student learning, and gathering students' perspectives on what they are learning from the major.

Conclusion

Overall, we believe that our hybrid approach to change management has succeeded in encouraging departments to participate in the process and creating a positive and empowering experience for participating faculty. However, given that most departments opted to implement the least time and effort-intensive types of change, we may need to consider different approaches or rely more heavily on certain existing approaches (e.g., resource allocation) to promote more holistic and substantive change. Furthermore, effective communication of the successes and challenges of the initiative will be important to sustain and build its momentum. Finally, as this project continues and additional data become available, it will be critically important to track the impact of curricular changes on student outcomes, such as achievement of program learning outcomes, graduation, and numbers of substitutions and waivers required for program completion.

References

Annala, J., & Mäkinen, M. (2017). Communities of practice in higher education: Contradictory narratives of a university-wide curriculum reform. *Studies in Higher Education, 42*(11), 1941-1957. doi:10.1080/03075079.2015.1125877

Arum, R., & Roska, J. (2011). *Academically adrift: Limited learning on college campuses.* Chicago, IL: University of Chicago Press.

Association of American Colleges and Universities (AAC&U). (2015). The LEAP challenge: Education for a world of unscripted problems. *Liberal Education, 101*(1/2). Retrieved from https://www.aacu.org/liberaleducation/2015/winter-spring/the-leap-challenge

Bernstein, B. (1996). *Pedagogy, symbolic control and identity: Theory, research, critique*. London, UK: Taylor and Francis.

Blackmore, P. B., & Kandiko, C. (2012). Change: Process and resources. In P. B. Blackmore & C. Kandiko (Eds.), *Strategic curriculum change: Global trends in universities* (pp. 111-127). New York, NY: Routledge.

Deresiewicz, W. (2014). *Excellent sheep: The miseducation of the American elite and the way to a meaningful life.* New York, NY: Free Press.

George, A. A., Hall, G. E., & Stiegelbauer, S. M. (2006). Measuring implementation in schools: The Stages of Concern questionnaire. Austin, TX: SEDL. Retrieved from http://www.sedl.org/pubs/catalog/items/cbam17.html

Hart Research Associates. (2018). *Fulfilling the American dream: Liberal education and the future of work.* Washington, DC: Association of American Colleges and Universities. Retrieved from https://www.aacu.org/research/2018-future-of-work

Heileman, G. L., & Abdallah, C. T. (2019). ABET won't let us do that! *Change, 51*(3), 62-66.

Heileman, G. L., Slim, A., Hickman, M., & Abddallah, C. T. (2017, June). *Characterizing the complexity of curricular patterns in engineering programs.* Paper presented at the Annual Conference and Exposition of the American Society of Engineering Education, Columbus, OH.

Heileman, G. L., Thompson-Arjona, W. G., Abar, O., & Free, H. W. (2019, June). *Does curricular complexity imply program quality?* Paper presented at the Annual Conference and Exposition of the American Society of Engineering Education, Tampa, FL.

Kandiko, C., & Blackmore, P. (2010). *Creating a 21st century curriculum: The King's-Warwick project.* London, UK: King's Learning Institute.

Logue, A. (2018, March 4). Considering curriculum reform? Better do your homework first. *Chronicle of Higher Education*. Retrieved from https://www.chronicle.com/article/Considering-Curriculum-Reform-/242726

Patel, V. (2018, March 4). Want to revamp your curriculum? Here's how to avoid a quagmire. *Chronicle of Higher Education*. Retrieved from https://www.chronicle.com/article/Want-to-Revamp-Your/242725

Tritelli, D. (Ed.). (2015). The LEAP challenge. *Liberal Education, 101*(1/2). Retrieved from https://www.aacu.org/liberaleducation/2015/winter-spring

Trowler, P., Saunders, M., & Knight, P. (2003). *Change thinking, change practices.* York, UK: Learning and Teaching Support Network.

UNLV Office of Decision Support. (2019). *Undergraduate profile dashboard* [data set]. Retrieved from https://analytics.unlv.nevada.edu/analytics/saw.dll?Dashboard

Wegner, E. (1998). *Communities of practice: Learning, meaning and identity*. Cambridge, UK: Cambridge University Press.

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Appendix A
Curricular Coherence Framework

The goal of this effort is to help those offering undergraduate degrees increase the coherence and effectiveness of their curricula. We can define a curriculum as an integrated set of learning activities intended to produce a set of specified learning outcomes. A coherent and effective curriculum is one that is designed, implemented, and assessed well. Each of these elements presents specific challenges. Below, we highlight the benefits of an effective and coherent curriculum, elaborate on each element, and present a series of guiding questions to help you evaluate your curriculum.

Benefits of a Coherent and Effective Curriculum

- Improved RPC metrics for your college
- Improved student learning through alignment and assessment of learning outcomes
- Improved student and faculty satisfaction through more efficient resource utilization

Design: Curriculum design begins with a set of clear, appropriate, and measurable learning outcomes. These outcomes then guide the creation of a set of sequenced learning opportunities (e.g., courses) that are aligned with and intended to produce the desired learning outcomes. Key learning outcomes should be addressed at multiple points within the curriculum with progressive depth or emphasis. The appropriate path through the curriculum and the rationale for that path should be clear to both students and faculty.

Guiding Questions:

- Do you have a set of clear, appropriate, and measurable learning outcomes?
- Is it clear to faculty and students where those learning outcomes will be achieved (i.e., which courses)?
- Are important learning outcomes reinforced in multiple courses (e.g., beginning, middle, end)?
- Does your curriculum include a Milestone and a Culminating Experience?
- Are courses appropriately sequenced, including the structure of prerequisites?
- Is the structure of your curriculum similar to those at peer institutions?
- Are students who complete the curriculum adequately prepared for appropriate employment or graduate/professional study?
- Do you have the resources to deliver the undergraduate curriculum as designed while meeting your other priorities (e.g., graduate education)?

Implementation: This is where the curriculum comes to life and is encountered by students. For effective implementation, courses must be available in the appropriate sequence and with sufficient capacity and frequency to enable students to move through the curriculum in a timely manner. Teaching faculty should know what role their courses play in the larger curriculum. Students should understand why courses are sequenced as they are, and unnecessary barriers to progress should be minimized. If necessary barriers exist (e.g., particularly challenging prerequisite courses), appropriate support services and pedagogies should be employed to increase the probability of student success without sacrificing academic rigor.

Questions:

- Are required courses offered with sufficient frequency and capacity?
- Are required and prerequisite courses offered on a schedule that is consistent with the path through the curriculum? Is that schedule published and available to students?
- Are there courses listed in the catalog that are rarely or never offered?
- Are there required courses in your curriculum with low pass rates?
- If a student has to repeat a course or is unable to enroll in that course in a particular semester, is there a clear path to get back on track?
- Do many students require exceptions or waivers to satisfy your degree requirements?

Assessment: Assessment is evaluation of student learning with the intent to improve it. Effective program assessment is guided by a plan that is aligned with the designed curriculum. This plan should be created collectively by the faculty and should include a process for gathering, reflecting, and acting on meaningful data on student achievement of the established learning outcomes.

Questions:

- Do you have a plan for systematic assessment of the program learning outcomes at appropriate points in the curriculum?
- Does your program have an assessment coordinator, and do faculty know whom to contact if they have questions about assessment?
- Are teaching faculty in the program familiar with the assessment plan and their roles in implementing the plan?
- Do faculty reflect regularly on assessment results to refine and improve the curriculum?

Support for Curricular Change

If the answers to any of these questions are unknown, you may have identified an opportunity to improve the coherence and effectiveness of your curriculum. To support you in your pursuit of these opportunities, we can provide:

Data to Inform Decision-making	Historical enrollment and waitlist data, course offering schedules, pass rates, retention and graduation rates, major switching patterns, time to degree, etc.
Individual Consultations	Curriculum mapping, assessment, instructional design
Administrative Support for Implementation	Help with curriculum proposals, expedited review, communication campaigns for curricular changes

Need more information or support? Contact laurel.pritchard@unlv.edu

Appendix B
Rubric for Evaluating Curricular Change

	Curricular Change	Preparing for Action	Making Progress	Completed Goal	Not Applicable
1	Eliminating "boutique" courses that do not directly address program learning outcomes.	Boutique courses are identified; there may be some attempt to modify learning outcomes and/or course content.	Boutique courses are modified to address some learning outcomes.	Boutique courses are systematically eliminated or made electives.	This change is not applicable to the program.
2	Expanding required courses to meet enrollment demand.	Course demand is examined; some attempt may be made to address enrollment issues in most pressing courses.	Enrollment caps on all high-demand sections are raised.	New sections, either online or face-to-face are created.	This change is not applicable to the program.
3	Making program learning outcomes transparent to students.	Program learning outcomes are passively available to students on the Degrees Directory, but no meaningful attempt is made to bring student awareness to the learning outcomes.	Students know the program learning outcomes exist and where to find them. Program learning outcomes are available on the Degrees Directory and are incorporated in other ways (e.g., materials or course syllabi).	Program learning outcomes are explicitly tied the work students complete in the courses in their major.	This change is not applicable to the program.
4	Creating/expanding opportunities for students to create Signature Work.	Signature work is planned, but not yet implemented.	Opportunities for signature work exist in elective courses.	Signature work is required of all students in the form of a Culminating Experience.	This change is not applicable to the program.
5	Revising assessment plans using authentic assessment.	Assessment plan is minimally revised; student learning outcomes may be updated; some changes to assessment measures may be addressed.	Assessment plan is revised to include meaningful, direct evaluation of student learning outcomes.	Assessment plan is revised to include meaningful, direct evaluation of student learning outcomes at the beginning, middle, and end (Culminating Experience) of the program.	This change is not applicable to the program.
6	Providing support for students to succeed in key, required courses.	Key courses for progression are identified; a plan for supporting students may be in the development stage.	Resources are deployed to provide learning support for students in these courses, or alternate paths are offered to students who do not succeed in them.	A comprehensive student success strategy is implemented, including revision of course structure and teaching practices to support learning, provision of learning support outside the classroom, and advising on alternate paths.	This change is not applicable to the program.

7	Resequencing courses or changing distribution of content to create more coherent pathways.	Sequence of courses and content have been examined.	Some courses have been re-sequenced and/or curriculum changes that shift content to other courses have been submitted.	All appropriate changes to course sequencing and distribution of content have been approved by Curriculum Committee and implemented.	This change is not applicable to the program.
8	Eliminating structural obstacles (e.g., unnecessary or ambiguous prerequisites).	Obstacles have been identified.	Plans have been developed to remove obstacles, and changes have been submitted.	Changes have been approved by Curriculum Committee and implemented.	This change is not applicable to the program.