PRACTICAL STEPS FOR ACADEMIC LEADERS TO FOSTER SYSTEMIC CHANGE IN SUPPORT OF EXCELLENT STEM UNDERGRADUATE EDUCATION
Conversation Module 6

Presented by Andrea Follmer-Greenhoot at the meeting of the
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WHO IS THIS MODULE FOR?

This module is intended for formal academic unit leaders (e.g., department chairs or heads of academic units) and change agents within departments (e.g., faculty members, program directors, committee chairs, and staff members) who seek to catalyze and guide meaningful departmental transformation. Academic departments--or in some institutions, schools or divisions--play a crucial role in transforming undergraduate STEM education to better serve all students and promote excellence in STEM learning. Drawing on research and frameworks on institutional change, student success, creating healthy STEM education ecosystems (Module 2), and Student-Ready Institutions (Module 4), this module translates the features of student-ready STEM education to the department level and provides practical guidance for department leaders to move these ideas into action. The goal is to help departments move beyond isolated initiatives towards sustained, systemic change that humanizes undergraduate STEM education (e.g., McNair et al., 2016; 2022; Yao et al., 2023) and improves outcomes for all STEM students.

WHAT ARE THE KEY IDEAS IN THIS MODULE?

The shift from focusing on students' college-readiness to becoming a student-ready institution represents a paradigm shift in higher education (see Module 4). Rather than expecting students to arrive fully prepared to navigate existing systems, a student-ready approach involves intentionally designing policies, practices, and learning experiences that meet students where they are. This means understanding students' backgrounds, needs, and aspirations, and creating supportive environments that enable all students to thrive.

While many institutions recognize the importance of becoming more student-ready, progress has been uneven. Focusing on change at the academic unit level—whether department, college, or division—offers a promising path forward because these units are the primary entity shaping academic organization, work allocation, and culture for faculty (e.g., Knight & Trowler, 2000; Roxa & Martensson, 2015). They are also the primary interface between students and their academic experience, making them crucial sites for enacting student-ready practices. Departments also have an important role in higher education institutions by leading from the middle (Reinholz et al., 2019), with the potential to implement changes in practice.

Of course, departments start from different places and face different challenges in this work. Thus, department leaders will also find it useful to use the STEM ecosystems approach (see Module 2) to map their context and to identify potential local and external partners and resources. This mapping process can also reveal opportunities to build a community of support with other change agents within the institution or discipline—a crucial element for sustainable transformation. Change leaders need this supportive community not only for social support during challenging times but also for ongoing idea exchange and thought partnership that can spark innovation and maintain momentum. The approaches and tools discussed in this module can be adapted to each local departmental context.

The rest of this module outlines three steps for units to become more student-ready: (a) using data collection and direct student input to learn about student needs; (b) examining the current curriculum, learning context,

and faculty capacity to identify ways to improve; (c) taking concrete actions to implement student-ready policies and practices.

UNDERSTANDING THE STUDENT EXPERIENCE: HOW CAN ACADEMIC LEADERS LEARN MORE ABOUT THEIR STUDENTS?

The first and most important step in creating a student-ready department is developing a thorough understanding of the students and their experiences. Most institutions collect student-level data on student demographics, academic preparation, academic performance, retention and graduation rates, and more. If academic unit leaders do not have direct access to these data, they can often work with campus offices that analyze institutional data. Yet institutional data provides a limited window into how students are doing; to understand student experiences, needs and aspirations, departments need to ask students directly.

Academic leaders will find it useful to think intentionally about what they want to know that will help them better meet their students' needs. Key questions to consider include:
- What diverse aspirations and backgrounds do our students bring to our academic community?
- What varied educational pathways do they take?
- How does our unit define student success?
- How do our students define success? How does that vary for different groups within our student population?
- How can our unit measure student success and how can we collect the data?

When developing a plan for assessing student needs, it's essential to recognize that many students follow non-linear educational paths. Students may transfereducation orr institutions, take breaks in their education, or transfer to other institutions before completing their degrees. This means that evaluation strategies should be designed to capture the experiences of transfer students and students with discontinuous paths—not just those who follow a traditional four-year trajectory. Various options for gathering data about student needs and experiences include the following (see also the Resources List):

Examining Institutional Data: Institutional data can provide information on students' foundational skills (e.g., what is the level of math readiness of incoming students, what percentage of students have substantial high school exposure to the discipline), academic performance (e.g., which courses have the lowest success rates or the greatest variability in successful course completion), and retention and graduation patterns (e.g., what patterns occur in the characteristics of students who leave the major or leave the university?), and pathways through the curriculum (e.g., the combinations and ordering of courses taken by successful graduates) . Such data can provide important insights into factors related to student success, particularly when analyzed for different subgroups of students. Data may be available in publicly accessible reports developed by institutional research offices or through open-access or password-protected online dashboards. Also, institutional research offices or other offices (e.g., dean's office, center for teaching) will often work with department leaders to develop institutional data reports that address particular questions they have about their specific students and their success.

Conducting student surveys, interviews and focus groups: Surveys, interviews, and focus groups can be used to gather student perceptions of what "student-ready" means, student needs and aspirations, and their experiences in the department learning environment. Sometimes, these methods permit deeper inquiry into patterns initially observed in institutional data (e.g., if students are most likely to leave the major after X course,

why is that?). Those working in units lacking expertise in these methods may find it helpful to collaborate with individuals or campus units experienced in survey or interview design or qualitative research (e.g., institutional research, teaching and learning centers, or assessment offices) to ensure meaningful and ethical data collection.

Engaging students in the design of the learning environment: Students can contribute valuable insights for improving courses, curricula and departmental climate when they have opportunities to be engaged in the design of the learning environment. Possible pathways for such student engagement include inviting students to serve on department committees or advisory boards; employing students as learning assistants or peer tutors who can provide insights from their dual role supporting peers and working with faculty; and establishing student pedagogical partnerships in which students and faculty collaborate on course design and student-centered course improvements (Cook-Sather et al., 2016). All of these strategies can elevate students to active co-creators of the learning environment while providing faculty with authentic insights into the student experience and creating opportunities for faculty and students to work together to strategize ways to improve both course design and department climate.

UNDERSTANDING THE UNIT AS A LEARNING CONTEXT: HOW CAN ACADEMIC LEADERS EXAMINE AND ASSESS THE QUALITY OF THE CURRENT CURRICULUM AND THE CAPACITY OF THE FACULTY TO MEET STUDENT NEEDS?

As discussed in Module 2, systemic change to strengthen undergraduate STEM education is more likely when leaders take an ecosystem approach. This ecosystem approach suggests that, in addition to examining the student experience, academic leaders will also want to assess their department's classroom and laboratory environments, overall program curriculum, and faculty capacity, and the extent to which they are aligned with student needs and assets. Importantly, such assessment focuses on formative evaluation for educational improvement, not summative evaluation of individual faculty performance, to identify opportunities for growth, support, and systemic change that benefit both students and faculty. The goal is to create an academic environment that respects and values the diverse aspirations and backgrounds that the students bring to it, while also supporting faculty as part of that environment. Key questions about the learning environment to consider include the following:

- What norms and expectations do we have in our department? How might these be challenged to create a more inclusive environment (see Module 3)?
- Is our course scheduling optimized for students' progression to degree?
- What instructional methods are faculty in the department using? What norms and practices are typical in the department's classrooms and labs?
- Are the faculty aware of resources on campus so they can direct their students to the appropriate place when they need help beyond the scope of their capacity?
- Do STEM faculty collaborate across units to address knowledge and skills that apply across disciplines? How are shared learning objectives communicated to students? How are those learning objectives supported?
- How have faculty used their student evaluation of teaching, feedback from course alumni, and student performance data to drive changes in their teaching methodology?
- What faculty development is needed to help faculty prepare for the changes that need to happen?
- How can we align incentives and evaluations to value the changes that we are proposing?

Academic leaders may consider these strategies to evaluate their learning environment and identify improvement opportunities:

- **Faculty Self-Assessment**: Invite faculty colleagues in the unit to reflect on their observations of their students' successes, their own teaching practices, and areas where the unit could become more student-ready.
- **Curriculum Assessment**: Revisit program learning outcomes to ensure they align with the varied aspirations and destinations of the student populations, map the curriculum to determine how it supports these outcomes for students with different entry points and pathways, and assess the degree to which students are achieving program learning outcomes.
- **Faculty Class Visits or Peer Reviews**: Arrange for faculty members to visit each others' classrooms or engage in formative peer reviews to learn the instructional practices and classroom climates in the department. These collaborative exchanges can help colleagues discuss what is going well, identify areas for improvement, and establish a shared understanding of the current and desired learning climate. Strategies to support effective peer review and feedback include leveraging the array of tools now available, such as peer observation protocols, structured feedback rubrics, and reflection frameworks designed for formative teaching evaluation.
- **Faculty Readiness Assessments.** Have a neutral facilitator conduct focus groups, discussions or surveys to gauge faculty and staff capacity, interest, and bandwidth for change initiatives. Understanding faculty readiness allows leaders to appropriately plan and resource change efforts and develop professional developmental opportunities to build capacity for change to enhance the learning context.
- **Faculty Discussion Groups**: Gather faculty to reflect together on questions pertaining to the unit's learning context, and/or to review together the information collected through inquiry into the student experience (as discussed in the prior section). Such discussions could take place during regular department meetings or colloquia, or specially-scheduled meetings or retreats. Consider a facilitator (e.g., from a teaching and learning center) who could help foster a student asset mindset during the discussions.

TURNING KNOWLEDGE INTO ACTION: HOW CAN ANALYSIS OF STUDENT AND FACULTY PERCEPTIONS LEAD TO ACTIONS THAT FOSTER A MORE STUDENT-READY DEPARTMENT?

Analysis of student characteristics and experiences as well as the learning context in the unit provides the foundation for creating a more student-ready department. Each department will be unique in the extent and nature of its student-ready environment, depending on the ecosystem in which the department is situated (see Module 2) and the nature of its disciplinary culture (see Module 3).

Specific actions and strategies that departments might consider can be informed by the problems and challenges in the student experience or the learning context identified in the previous two steps. Below are examples of possible actions departments could consider, along with a list of resources that could assist department leaders in carrying them out:

- **Metrics and Assessments**: Identify clear metrics for student success in the department, clarifying how they align with institutional priorities and how they will be measured. Develop a plan for regular assessment to drive continuous improvement.

- **Course Schedule Adjustments**: Adjust course schedules in response to data showing student preferences, access issues, or curricular bottlenecks that are affecting student progression, working with other units as needed.
- **Alternative Pathways**: Create alternative pathways to optimize opportunities for students to achieve prerequisites with time efficiency. Identify other departments that offer relevant courses, and create an active partnership to optimize opportunities for interested students to participate in these courses.
- **Curricular or Course Improvements**: Support modifications to courses or the curriculum to better align with both student needs and aspirations. Leverage an existing curriculum committee or create faculty working groups that also include student partners. Unit leaders could also leverage support and existing resources from teaching and learning centers, such as course design institutes, workshops, and consultations on curriculum design and improvement.
- **Community Partners**: Identify and incentivize relationships with community partners who can contribute to course experiences or provide students with internship opportunities.
- **Student Liaisons**: Create student liaison positions to engage students and ensure student voice in departmental decision making concerning academic issues.
- **Feedback Processes**: Develop a formal and clear process through which students can provide their concerns or complaints in constructive ways.
- **Departmental Shared Resources**: Create departmental resource websites or repositories with departmental syllabi, accessible course materials, assessment requirements, student support resources, and other information helpful to students and faculty.
- **Faculty Development and Community Building**: Offer faculty development opportunities that support faculty as they contribute to efforts to nurture a more student-ready department. Use department meetings or retreats for discussion and exercises to support departmental communities in recognizing and shifting from deficit- to asset-based language, thinking, and approaches.

As they consider possible actions, department leaders and faculty members may want to frame their discussions around these three overarching questions: What actions are reasonable and achievable in light of the department's capacity? Has the unit discussed specific measurable outcomes or deliverables? Is there a specific time in the future identified for reviewing progress, accomplishments, and challenges?

Resources for Further Exploration are listed in the supplemental resources document.

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