

Center Roles in Undergraduate STEM Education

A Guide for Self-Evaluation



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Deborah L. Carlisle



NSEC

Network of STEM Education Centers

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A Guide for Self-Evaluation

MARCH 2022

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ISBN for the ebook: 978-1-945764-21-9

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Suggested citation: Carlisle, Deborah L. (2022). Center Roles in Undergraduate STEM Education: A Guide for Self-Evaluation. The Network of STEM Education Centers. © 2022 Association of Public and Land-grant Universities. Available at <https://doi.org/10.7275/e5r6-pv66>

* In addition to STEM Education Centers, the Network of STEM Education Centers (NSEC) is inclusive of Centers for Teaching and Learning with an emphasis on STEM education, bringing together over 286 national centers.

ACKNOWLEDGMENTS

The author would like to acknowledge the support of the following individuals:

Kacy Redd, *Associate Vice President for Research and STEM Education at the Association of Public and Land-grant Universities (APLU)*

Gabriela C. Weaver, *Special Assistant to the Provost for Educational Initiatives and Professor of Chemistry at the University of Massachusetts Amherst*, for her contributions and support during the data gathering phase and research upon which this guide is based.

Review Team

The review team shared their expertise and suggestions throughout two intensive rounds of collaborative discussion, edits, and revision, lasting several months. I am grateful for their insight and significant contributions to these resources.

Jennifer Frederick, *Executive Director of the Yale Poorvu Center for Teaching and Learning at Yale University.*

Ken Griffith, *Director of the STEM Teaching, Engagement, and Pedagogy Program at the Teaching, Learning and Professional Development Center at Texas Tech University.*

Sharon Locke, *Professor and Director of the Center for STEM Research, Education, and Outreach, at Southern Illinois University Edwardsville.*

Shanna Shaked, *Director of the Center for Education, Innovation, and Learning in the Sciences (CEILS) at the University of California in Los Angeles (UCLA).*

Kacy Redd was also an important contributor during the review process.

This material is based upon work supported by Association of Public and Land-grant Universities (APLU), the Network of STEM Education Centers (NSEC), and the National Science Foundation under Grant No. (1524832). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of APLU or the National Science Foundation.

More information on the Network of STEM Education Centers (NSEC) is available at <https://www.aplu.org/projects-and-initiatives/stem-education/stem-education-centers-network>



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Introduction to Resources

This publication provides a guide for STEM Education Centers (SECs) and Centers for Teaching and Learning (CTLs) to carry out a self-assessment process focusing on their role(s) in undergraduate STEM education. These resources and The Model for Center Practices in Undergraduate STEM Education were created and informed by research carried out as part of an Association of Public and Land-Grant Universities (APLU) and the National Science Foundation (NSF) funded project titled, the Network of STEM Education Centers, NSEC. Research conducted by Dr. Gabriela C. Weaver and Dr. Deborah L. Carlisle studied the roles of STEM Education Centers and Centers for Teaching and Learning with an emphasis in undergraduate STEM Education on their campuses. As part of the culmination of our research we offer this guide to support the NSEC community, and the center community broadly, in their mission to improve undergraduate education.

These resources were developed to assist centers in framing their contributions to undergraduate STEM education based on a national-scale research project about the work of centers and their roles on campus. To effectively focus the use of these resources on centers' unique roles and priorities on individual campuses, we invite centers to consider their identity and how it overlaps with the goal of improving undergraduate STEM education. Centers may wish to revisit this during or after the self-evaluation process. Clarifying center identities in the undergraduate STEM education improvement space will be helpful in advancing the whole community, and build further opportunities for centers seeking to expand their work.

Throughout these resources we will use the term centers to refer to STEM Education Centers (SECs) and Centers for Teaching and Learning (CTLs) with a strong focus on undergraduate STEM education.

The Role of Centers in Higher Education

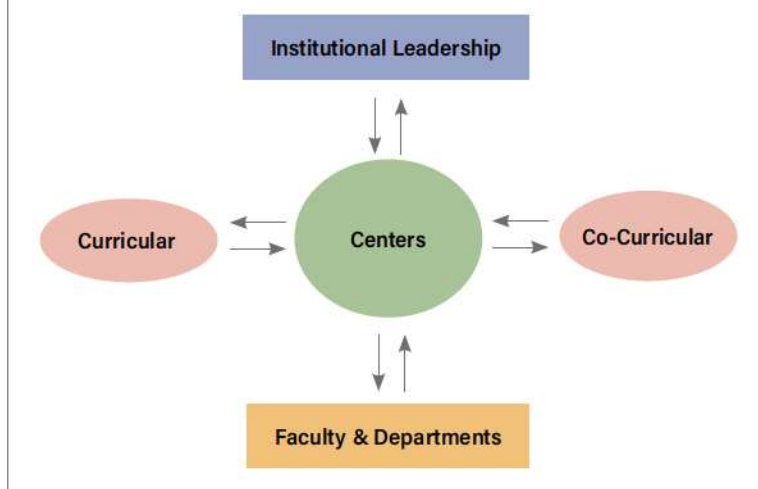
In higher education centers represent a form of “middle management” similar to that in business organizations, operating between institutional leaders and faculty/departments. See Figure 1. Centers may be viewed as a strategic asset to enhance core values and competencies, increase visibility of key initiatives, catalyze reform, and in many cases provide value-adding entrepreneurial ideas, thus

enhancing the capability of the institution and providing a competitive advantage (Huy 2001). Centers are also seen to champion core academic values and foster identity development by connecting a wide community of scholars (Clegg and McAuley 2005).

As organizational units, centers play a key role in shaping the relative status of teaching and learning. Because centers sit outside the departmental and upper administrative units they are capable of influencing norms within and across levels. Through their programming, initiatives, and research, centers influence the social framework in which individual learning interacts with

collective learning, which leads to key opportunities for scaling and sustaining innovations and best practices. ***Centers strengthen organizational learning by providing support to stabilize successful efforts shown to have impact, and this is an area rich with potential that has only begun to be recognized by some institutions.*** Importantly, many centers assist their institutions by offering direct student programming and initiatives, which assists the institution by keeping it close to the student, and offers societal contributions (i.e., STEM workforce and culture).

FIGURE 1. The Role of Centers in Higher Education

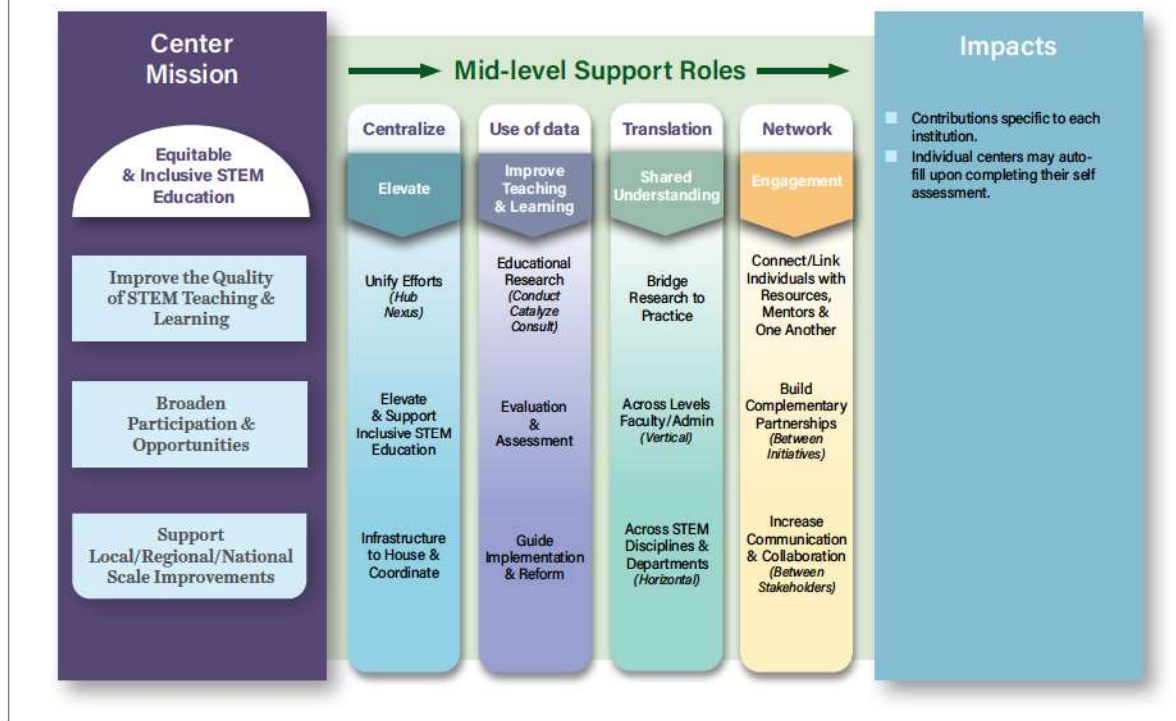


Overview and Description of Model for Center Practices in Undergraduate STEM Education

As described above, organizationally centers sit in the middle, where they play a wide variety of roles at their institutions. Our research deepens the understanding of center operations by identifying four primary mid-level support roles carried out by centers. The Model for Center Practices in Undergraduate STEM Education, shown in Figure 2, incorporates these four areas to frame the ways in which centers make significant contributions to undergraduate STEM education and more broadly undergraduate education as a whole.

As centers apply these resources, the model provides guidance to assist with conceptualizing the sequence and steps involved. Although we suggest that centers assess each role in the order presented by the model, centers will recognize and experience a variety of pathways in which the mid-level support roles are, or can be, integrated to support one another to achieve center priorities. Understanding the way in which the mid-level roles work together to catalyze and stabilize improvements in undergraduate STEM education can be explored once each of the four areas have been assessed. A center's emphasis/focus in each area may be represented on a continuum as they establish and refine their priorities based on mission, local needs, and resource availability.

FIGURE 2. Model for Center Practices in Undergraduate STEM Education



To frame and organize the resources, the Model for Center Practices in Undergraduate STEM Education, shown in Figure 2 is described. Center mission, shown on the left side of the graphic, is guided by a strategic priority for equitable and inclusive STEM education. Each of the three rectangles listed below highlight the important ways centers work in this space to improve the quality of STEM teaching and learning, to broaden participation and opportunities, and to support local/regional/national scale improvements. The four mid-level support roles are centrally positioned and vertically arranged. Each are titled at the top, with the key impact displayed below the title in a colored arrow, with three key subareas listed vertically below. Subareas are also research-based and describe the core aspects of each mid-level role. On the right, there is a column for impacts, which will be fillable to allow individual centers to call out their identified impacts, recognizing these are specific to each institution.

How to Use this Guide

This *Guidebook* contains a set of self-assessment resources, composed of four modules, each representing one of the four mid-level support areas¹ identified by our research² (Carlisle & Weaver 2020, Carlisle & Weaver 2018). Each module includes research-based implications to describe how each adds

- 1 Each of the 4 mid-level support areas: Centralize, Use of Data, Translation, and Network represent primary center roles identified across institutions in our national research on centers. Each mid-level support area is further described/delineated by 3 key sub-areas.
- 2 Data was drawn from a cross-case analysis of a purposive sample of 12 national centers. Data was gathered at each of the 12 institutions during a 3-day site visit that included interviews, observations, and artifacts. A systems approach informed the data gathered at each institution and included 1) upper administrators (Provost, Deans, VPR, Academic Affairs), 2) department chairs and faculty, 3) center leadership and staff); therefore, center roles were studied as nested within their institutional contexts. The cross-case analysis was used to inform a national survey of center leaders, and the survey data further extended the generalizability of the purposive sample.

value to center operations, followed by a clarification of resources, drivers, and rationale. In addition, each module contains tools to support self-assessment: guiding questions, tables to map activities and resources, and rubrics for centers and stakeholders. While the resources are focused on undergraduate STEM education, you will see they also apply more broadly to the university/college wide mid-level support roles carried out by centers that are not STEM specific.

These resources guide centers through each of the four mid-level support areas, and associated subareas, for the purpose of benchmarking current practices against national trends. Centers can explore their practices in undergraduate STEM education, recognize areas of strength, and select areas of interest to develop further. Centers will also be able to assess how they use the four mid-level roles collectively to achieve their desired goals in undergraduate STEM education.

Each of the four mid-level support areas are available as individual modules. The suggested sequence for center assessment is: 1) centralize, 2) use of data, 3) translation, and 4) network, as shown in Figure 2. Our research identified fundamental attributes that suggest this sequence is beneficial. Being a centralized unit positions centers to unify efforts and to have a broad and informed knowledge of campus initiatives, activities, and engagement. A center's use of data enhances its ability to promote shared understanding through translation, and each mid-level role strengthens a center's capacity to network and increase engagement in undergraduate STEM education.

Flexibility: Because each mid-level support area has its own module centers are able to select one at a time and may self-assess areas of interest out of sequence. Alternatively, centers may choose to focus on just one area at a time.

(Note: Steps 1–9 described below are repeated for each of the 4 modules.)

- 1) **Consider Implications:** These address the "so what" describing why each area is important to center operation and goals. Centers should begin by reading the implications for each mid-level role to understand the value and benefit of each.
- 2) **Review Current Status:** This section is intended to encourage reflection at the beginning of the process. To prepare for the steps that follow the center gathers evidence, and uses this to review, reflect, and articulate its role in the mid-level support area of focus.
- 3) **Clarify Rationale, Drivers, and Resources:** In this step center priorities are considered, and rationale, drivers, and resources are clarified. This section consists of broad framing questions pertaining to each mid-level role. These broad questions about the center's overarching role set the center up to go into more depth and provide the information necessary to delve into specific subareas in the next section.
- 4) **Answer Guiding Questions:** These questions take a focused look at three key subareas associated with an individual mid-level support role and guide centers in documenting activity/achievement in each. In this step, as centers answer the guiding questions they develop a more detailed understanding of their center operations related to the mid-level area of focus.
- 5) **Map Center Activities:** Centers use the tables accompanying each support area to map programs/activities/initiatives/research to each of the four mid-level roles. Completing this table allows the center to document contributions and facilitates the consideration of center engagement in each subarea. In many cases programs/activities/initiatives/research contribute to several subareas and this mapping exercise is valuable in showing overlap and connections.
- 6) **Map Center Resources:** Next, centers fill out a table to map resources: human (e.g. staff FTE, affiliated faculty, students), structural (e.g. space, location), and financial to the associated mid-level support area using the table above as a reference to facilitate.

7) **Centers Complete A Rubrics:**

The A rubrics capture dimensions/parameters for center work in each of the four mid-level support areas by exploring roles in depth through each of the associated subareas.

The rubrics provide benchmarks³ identified through our research, to guide centers in their exploration of each area. The rubrics also assist centers in evaluating the degree to which they work in each mid-level area and where it may be beneficial to expand their role if so desired.

Center leaders may choose to fill these out with input from center staff through discussion and written feedback. Alternatively, centers may find it useful to have individuals within the center fill out the A rubric and gather those to inform the overall assessment.

8) **Centers Distribute B Rubrics:** The B rubrics capture dimensions/parameters for center work in each of the four mid-level support areas as it pertains to key stakeholders. The B rubric is intended to provide a systems perspective of the center's work in each mid-level area. Centers distribute unique B rubrics to: STEM faculty and departments, institutional leadership (Provost, Deans, Vice President for Research, Sr. Academic Affairs, etc.), and Undergraduate STEM Curricular and Co-curricular stakeholders engaged with the center.

9) **Centers Score Rubrics:** After centers complete steps 1–8 for a given module/mid-level support area, they then score the A and B rubrics using the appropriate scoring sheet. Centers fill out scoring sheets for each area as they move through the modules. Centers can then identify strengths, as well as areas for opportunity and growth, as they progress through each of the modules.

Utility of Resources for Various Stakeholders

On the following page, Table 1 describes the ways in which various audiences may find these resources useful.

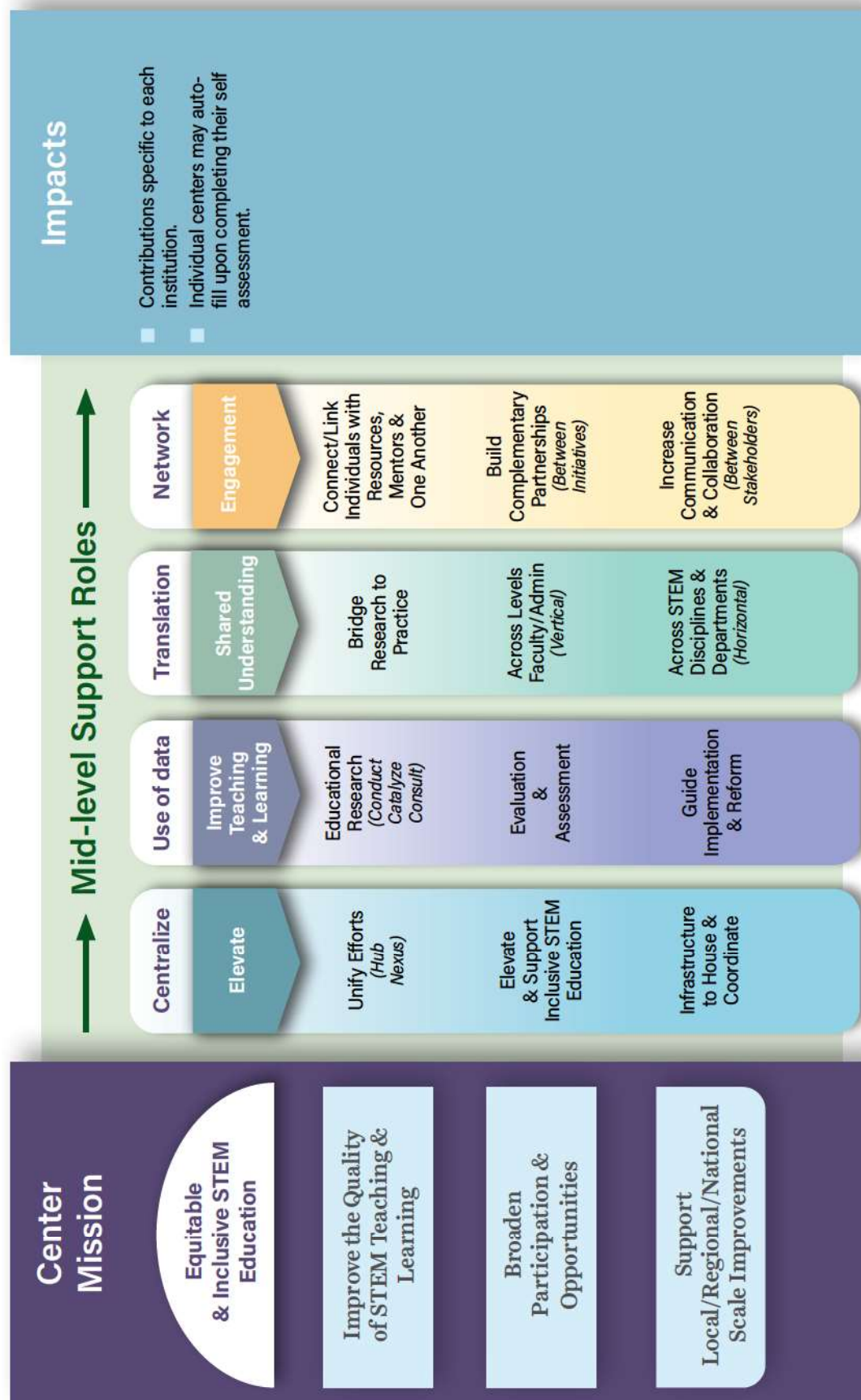
3 The benchmarks developed within the rubrics provide parameters/dimensions that reflect where a center lies along a continuum relative to each mid-level support area. It is important to acknowledge that the highest level (4) may not be a desired goal for all centers in each area, or subarea. A Center's mission may be effectively achieved at a level of 2 or 3, particularly in some sub-areas. Some centers may choose not to focus in particular subareas due to mission and/or staffing.

TABLE 1. Utility of Resource for Various Audiences

Audience	Application	Purpose
Center Leadership	Benchmark center operations relative to the 4 mid-level support areas.	Gathering initial benchmarking information provides the opportunity to reflect on strengths and opportunities in each mid-level area.
	Strategic Planning: to strengthen/expand the center's role in undergraduate STEM education.	To study center practices: how center utilizes and integrates each of the 4 areas to support their mission.
	Select one mid-level area to study. For the purpose of: • Developing evidence for needed resources • Evidencing center value add/ key contributions • Review the implications section for each mid-level support role and use that to guide the selection of which area to study.	This approach allows for the exploration & development of one need area to build the case for desired resources. To highlight strengths in a particular area for upper administration and/or stakeholders.
	5-year review	To provide information and guidance for an informed reflection on strengths and opportunities in each mid-level area.
	Communication tool	To improve understanding of the center's role on campus.
	On-boarding a new center director	To understand the center's role within the broader context of center operations. The review of benchmarking information provides context & opportunities for reflection on center mission/goals.
Center Staff	Educational value	To understand the center's role(s) within the broader context of center operations.
Upper Administration (Provost, Deans, VPR, VP Academic Affairs)	How to position and best utilize a center to contribute to institutional goals; Ways to support a center to achieve its mission	These resources provide guidance and suggest ways to position a center. The four mid-level support areas provide framing for effective strategies.
	On-boarding administration	To understand the center's role within the broader context of institutional goals, operations, and priorities.
Department Chairs/ Faculty	To understand the ways the center can contribute to departmental goals in teaching and learning; Ways to best utilize the center	To engage in support/opportunities/ programs/research offered by the center.
Stakeholders Internal/External	Partner with the center as a resource	To utilize programs run through or by the center to improve teaching and learning and/or integrate real world applications/ internships/ opportunities.

Reference Page: Consult this larger version of Figure 2 as you move through each of the modules in the following pages.

Model for Center Practices in Undergraduate STEM Education



Center structures *Centralize*

This section provides the framework for the assessment of the Centralize construct. Centers are guided through 8 steps outlined below. Each of the 4 mid-level support areas follow the same format.

Centralization is a key role played by centers. Centers are often established for this purpose on campuses, and are credited with creating an environment that fosters undergraduate STEM success and improvement. Centralize is operationalized as a process that sets up the infrastructure for centers to elevate, bring together, and lead campus efforts that support equitable and inclusive STEM teaching and learning, research, initiatives, opportunities, and various partnerships, which strengthen and contribute to student success in STEM.

1) Implications for Centralize

1. As a centralized unit, the center has broad awareness of and connections to campus efforts, which positions them to strategically provide support and to effectively utilize available resources and opportunities (internal/external).
2. By both catalyzing and facilitating the implementation of evidence-based instructional practices through center-led initiatives and support, centers elevate and champion equitable and inclusive educational strategies, which improve teaching and learning for all students.
3. Due to their centralized role on campus, centers have a unique ability to be responsive to current/real-time campus needs, and to advise of need areas in a timely manner. Thus, centers provide a "fast track" approach to the improvement/transformation of undergraduate STEM Ed.
4. Centers centralize efforts that support and nurture the transformation of undergraduate STEM education, bringing them together for collective impact, thus create an environment that leads to improvement in the institutional climate over time.

2) Review Current Status for Centralize

To prepare for the following steps, the center gathers evidence, and uses this to review, reflect, and articulate its role in each of the *centralize* subareas.⁴ This preparation is used to inform the center's self-assessment within these subareas. Particular areas of strength will be recognized and desired areas for growth will be considered.

⁴ Centralize is captured in 3 subareas described by the Model of Center Practices in undergraduate STEM education (unify efforts, elevate and support equitable & inclusive STEM education, and provide infrastructure to house and coordinate). Collectively these subareas represent key aspects of a center's role as a centralizing unit.

3) Clarify Rationale, Drivers, Resources

Respond to any/all that apply to your center's mission.

- **Rationale:** How does the center view its role in this area?
- **Prioritization:** What level of priority does the center assign to each of the 3 centralize subareas listed below? *Apply the following scale: Not a Focus Area (0); Not really a focus (1); Some focus (2); Significant Focus (3); Established Focus (4)*
 - Unify efforts
 - Elevate and Support Equitable & Inclusive STEM Education
 - Infrastructure to House and Coordinate
- **Reporting structure and autonomy:** Consider any structural aspects related to the center's centralizing role:
 - List those that assist with centralization. For example, the center's organizational positioning, location, reporting line, etc.
 - Briefly discuss whether the center's organizational position limits or otherwise poses obstacles to the center achieving its mission. Include the degree of autonomy your center has.
 - What could improve the center in this area?
 - Identify units that compete with your center for funding, space, and resources.
- **Contextual drivers:** Describe any key contextual drivers possibly influenced by the origin story of the center, and/or identified need areas, funding, partnerships, etc. for the purpose of situating the center's role within the larger institutional context.
- **Resources:** Consider the ways in which the drivers (listed above) are connected to human, financial, and structural resources. Describe as appropriate.
- **Importance of Centralization:** Consider the center's overarching mission and the ways in which centralize (both acting as a centralized unit and assisting in the centralization of efforts) has been instrumental.
 - Describe the ways in which acting as a centralized unit has strengthened the credibility of center strategies, processes, and/or activities in undergraduate STEM education.
 - ◆ Please include any degree of centralization e.g. internal (within a STEM department, college, or university wide), external (local, regional, national), which is relevant to your center's operation.
 - Provide a few examples of the ways in which the center assists in the centralization of campus efforts focused on the improvement of undergraduate STEM education.
 - Provide a few examples of the ways in which the center assists in the centralization of external efforts (e.g. local community, business/industry, K-12, regional, etc.) focused on the improvement of undergraduate STEM education.
 - Describe other centers or organizations that focus on complementary areas of ug STEM education and how your center's mission is unique.
- **Campus Needs:** Consider the degree to which your center is broadly aware of campus needs in undergraduate STEM education.
 - Explore parameters for this and reflect on how the center gathers information.
 - ◆ Who are the partners looked to? (i.e., who is informing?)
 - ◇ Administrators, faculty, department chairs, other stakeholders
 - ◆ What kinds of mechanisms does the center rely on?
 - ◇ Reflect on both personal relationships and/or more formal facilitation processes e.g., participation on relevant committees.
 - ◇ To what degree are these mechanisms broadly accessible and inclusive?

- ◆ How often does the center gather new information to update its understanding of campus needs?
- ◆ How are new stakeholders introduced to the center as a resource when they join the institution?

4) Guiding Questions for Centralize

Explore how your center both acts as a centralizing unit and assists in the centralization of initiatives, resources, activities, people, and opportunities, to strengthen undergraduate STEM education in each of the following areas.

Respond to any/all that apply to your center's mission.

A. Unify efforts

1. Centers are often described as one of the following. Consider whether one or more of these describes your center. Briefly discuss those that apply.
 - a) Hub
 - b) Nexus
 - c) Collaborative
 - d) Clearinghouse
 - e) Other?
2. How does your center communicate the value of its role as a hub or nexus? (ie messaging to the community).
3. Consider the ways your center unifies efforts in ug STEM education.
 - a) What types of initiatives, research, activities, programs and services does your center bring together on your campus?
 - b) And who does your center bring together on your campus in order to achieve this? (faculty, dept chairs, students, upper administration, external stakeholders, etc.)
4. Considering your answers to 2a & 2b, what are (or might be) some of the indicators that demonstrate the center has unified efforts in undergraduate STEM education?
 - a) Has the center explored its unifying role at the college/institutional/regional level?
 - b) Do some of these indicators correlate to improved student or faculty outcomes as a result?
5. Consider whether your center plays a key role in shaping the social context (w/in departments, colleges, or university wide), which facilitates communication and collaboration in undergraduate STEM education teaching and learning? Provide an example(s) and briefly describe.

B. Elevate STEM Education & Support Inclusive STEM Education

1. Consider your center's role in elevating undergraduate STEM education. Briefly discuss those that apply.
 - a) Catalyzing & championing reform processes
 - b) Showcasing and increasing the recognition of faculty, department, and campus efforts
 - c) Expanding campus efforts
 - i. Increasing support for initiatives
 - ii. Providing opportunities and points of entry for engagement

- d) Increasing awareness of and connections to current research-based efforts, external to the institution, to improve undergraduate STEM Education Nationally? Regionally? Locally?
 - e) Obtaining grant funding
 - f) Other?
- 2. Consider the ways in which your center provides focused support for undergraduate STEM education. Briefly discuss areas that apply.
 - a) Increasing institutional capacity e.g., staff hires to support DEIJ (diversity, equity, inclusion & justice)
 - b) Faculty use of evidence based instructional practices, EBIPs
 - c) Departmental interventions & innovations aimed at improving T & L at the course level and/or programmatic/curricular level
 - d) Center programs & learning communities
 - e) Externally funded curricular initiatives
 - f) Internally funded curricular initiatives
- 3. Does your center receive recognition for its role in elevating undergraduate STEM education? And if so, what form does this take? (e.g., recognition from upper administration (top-down messaging e.g. center initiative highlighted in a campus address), recognition from faculty (bottom-up messaging e.g. faculty praise/referrals), communication and publicity (from the center itself, and/or university/college e.g. newsletter, annual magazine).
To what degree are these:
 - a) Structured and deliberate?
 - b) Unstructured and informal?

C. Provides Infrastructure to house and coordinate efforts

- 1. Having a center to house initiatives and coordinate efforts strengthens the credibility of these contributions. List some of the unique activities, initiatives, resources, programs/services related to undergraduate STEM education that the center:
 - a) Houses and/or incubates
 - b) Designs and/or organizes/manages
 - c) Facilitates and/or hosts
- 2. Provide 1–2 examples of ways in which (1a, b, c above) strengthen undergraduate STEM education at your institution.
- 3. What would you say are the top 3 benefits related to the center's infrastructure that create/shape/nurture the environment for undergraduate STEM education?
- 4. If applicable, describe any programs/initiatives/activities/research that the center has incubated which became institutionalized and/or otherwise scaled-up.

5) Map Programs/Activities/Research/Initiatives to Subareas

Use the Table C1 provided on page 19 to map center programs/activities/initiatives/research to each Centralize Subarea.

6) Map Resources to Subareas

Next complete Table R1 on page (xx) to map center resources to each Centralize subarea. Use Table C1 as a resource as you fill out Table R1, which includes: human resources (e.g., staff FTE, affiliated faculty, students), structural resources (e.g. space, location), and financial resources devoted to Centralize.

7) A Rubrics

The center fills out **Rubric A** for each of the three corresponding sub-areas associated with **Centralize**, and applies the guiding questions filled out above.

- Rubric A1—Unify Efforts
- Rubric A2—Elevate and Support Inclusive STEM Education
- Rubric A3—Infrastructure to House and Coordinate

8) B Rubrics

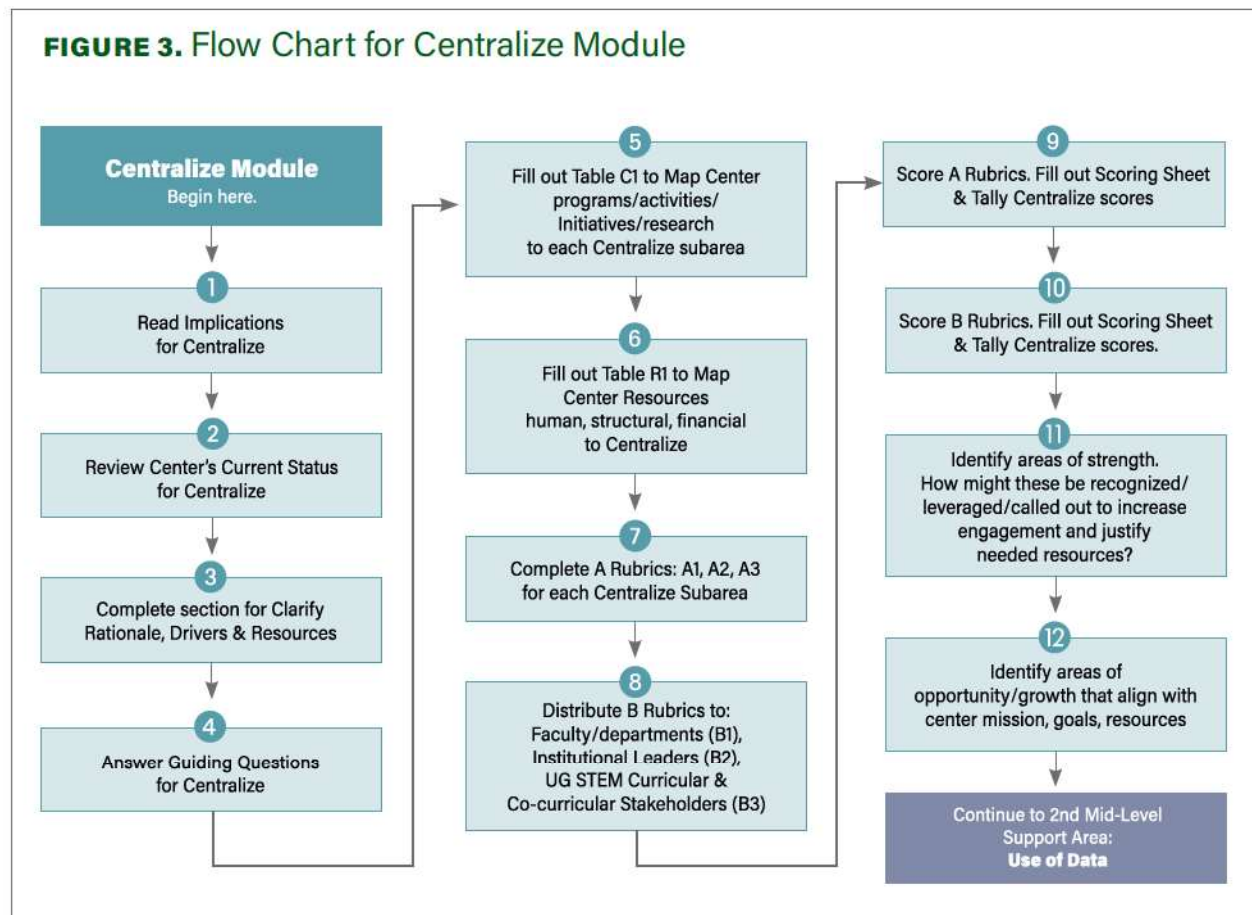
To gain a systems perspective of the center's Centralize role within the institutional context the center distributes **Rubric B** to 3 groups:

- Rubric B1—Faculty and Departments
- Rubric B2—Institutional Leaders (Deans, Provost, Vice President for Research, etc.)
- Rubric B3—UG STEM Curricular and co-curricular stakeholders (internal and/or external as applicable to the center's mission)

Rubrics should be filled out by a representative sample of each group (i.e. several faculty/ departments, etc.)

For a visual overview of the Centralize module described above refer to Figure 3 below

FIGURE 3. Flow Chart for Centralize Module



All A Rubrics are to be filled out by the center after completing steps 1-6 for this mid-level support area.

RUBRIC A1. Centralize: Unify Efforts

At what level does the center unify efforts in undergraduate STEM education?

Level	Description	Centralize—Unify Efforts: Hub, Nexus
0	N/A	The center is not directly engaged in bringing together activities/initiatives/research to improve ug STEM education
1	Emerging (Nascent phase)	The center may be new and/or expanding its focus in ug STEM education. The center is developing its knowledge of and connection to campus efforts/initiatives focused on ug STEM education. The center begins to develop strategies to bring together and coordinate campus efforts to contribute to the center's mission.
2	Progressing	The center begins to develop its role as a hub/nexus, which increases awareness and engagement across some departments and colleges. The center's growth in this area has led some disparate efforts to unify. The center continues to learn about and expand its partnership with existing campus efforts (activities/initiatives/research) focused on the improvement of ug STEM education. The center's role as a hub may also include local and regional stakeholders.
3	Accomplished	Center unification has enhanced communication & awareness of campus efforts and initiatives in ug STEM ed. The center is recognized and relied upon as a hub/nexus, which provides valuable connections to activities/initiatives/research and resources to improve ug STEM education. Recognition and reliance include high campus/institutional participation, and may include some local/regional/national stakeholders. Unification has led some resources to be shared/utilized across campus initiatives and center projects.
4	Advanced	The center has an established role as a hub/nexus, is widely relied upon by both internal and external stakeholders, providing valuable connections to activities/initiatives/research and resources which contribute to the improvement of ug STEM education. The center's ability to unify is bolstered by its comprehensive awareness of efforts in ug STEM education, which effectively sustains engagement and participation. The center has developed strategies to encourage and facilitate resources being shared/utilized effectively across campus initiatives and center projects.

Evidence for Assessment: Centers summarize the reason for their assessment (e.g. we are advanced and here is why, pointing to guiding questions for evidence).

RUBRIC A2. Centralize: Elevate and Support Inclusive STEM Education

At what level does the center elevate and support inclusive undergraduate STEM education?

Level	Description	Centralize: Elevate & Support Inclusive STEM education
0	N/A	Not directly engaged
1	Emerging (Nascent phase)	Establishing a center structure elevates the importance of undergraduate STEM education on campus. Empowered by its centralized role on campus, the center begins to develop strategies and add resources to elevate and support inclusive ug STEM education.
2	Progressing	The center's mission is becoming known and it receives visible support from internal and external stakeholders (upper administration, departments/faculty, business/industry) as applicable to its mission. Visible support grows interest and engagement with the center. The center has participation from a few STEM departments engaged in improving ug STEM education.
3	Accomplished	The center receives recognition from some internal and external stakeholders (upper administration, departments/faculty, business/industry) for the ways it contributes to the ug STEM education environment on campus. The center has participation from several STEM departments engaged in improving ug STEM education.
4	Advanced	The center has made important contributions, which elevate and promote collective engagement in the improvement of the ug STEM education environment on campus. Center affiliation is sought after and is widely viewed as influential. The center has participation from many STEM departments engaged in improving ug STEM education. Center support has increased student success, which has further elevated associated initiatives and programming.

Evidence for Assessment: Centers summarize the reason for their assessment.

RUBRIC A3. Centralize: Infrastructure to House and Coordinate

At what level does the center provide the infrastructure to house and coordinate efforts to improve undergraduate STEM education?

Level	Description	Centralize: Infrastructure to house & coordinate
0	N/A	N/A
1	Emerging (Nascent phase)	The center may be new and/or expanding its focus in ug STEM education. The center refines its mission, considers campus needs, and what programs/initiatives/research/activities to house & incubate and how to manage associated resources.
2	Progressing	The center houses some key programs/initiatives/and research activities that are aligned with its mission and campus needs. The center develops strategies that allow for integration and a coordinated approach. The center houses and/or facilitates initiatives and programs ¹ that previously were disparate and spread across campus.
3	Accomplished	The center houses several key programs/initiatives/research/activities that are aligned with its mission. The center's integration supports a coordinated approach and increases access to resources, partners, and opportunities which improve ug STEM education and equitable access to opportunities.
4	Advanced	The center houses programs/initiatives/research/activities that are an integral part of progress towards ug STEM student success. Center infrastructure has significantly elevated the importance of and focus on equity and access to undergraduate STEM education experiences and the contributions of programs/initiatives and innovations.

Evidence for Assessment: Centers summarize the reason for their assessment.

¹ E.g., SECs house bridge programs, 2–4yr transition programs, LA programs and CTLs often house tutoring and peer support. Both centers coordinate initiatives related to improved gateway courses, sequencing, etc.

All B rubrics are to be filled out by a variety of institutional leaders, faculty/department chairs, and curricular and co-curricular stakeholders.

RUBRIC B1. Faculty/Department perspective on the center's Centralize role.

At what level does the center elevate and unify campus efforts, as well as house and incubate programs/activities/initiatives/research that improve undergraduate STEM education?

Prior to rating, please estimate your level of engagement with the center on a scale of 1–5, with 5 being the highest.

LOWEST ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 HIGHEST

Read the description for each level, and select the one that represents your experience with the center's contribution, and provide support for your selection in the comment column.

Level	Description	Faculty/Department Engagement	Comments
0	Autonomous	The center is not engaged in undergraduate STEM education. Faculty and departments work independently of the center.	
1	Emerging	The center is beginning to establish connections within & across STEM departments. The center infrastructure elevates ug STEM education efforts and begins to emerge as a focal point of activity.	
2	Progressing	The center's support is building collaborations, resources, and opportunities for ug STEM improvement. The center has the engagement and support from several STEM faculty and departments. The center begins to showcase departmental efforts & initiatives.	
3	Accomplished	The center has unified efforts, increased visibility, and elevated ug STEM education w/in departments and across campus. Center consistently showcases departmental efforts & initiatives.	
4	Advanced	The center has made significant contributions to ug STEM education on campus, and has elevated the institution in the area of ug STEM education. Through its partnerships the center has unified some inter-departmental efforts.	

RUBRIC B2. Institutional Leadership perspective on the center's Centralize role.

At what level does the center elevate and unify campus efforts, as well as house and incubate programs/ activities/initiatives/research that improve undergraduate STEM education?

Prior to rating, please estimate your level of engagement with the center on a scale of 1–5, with 5 being the highest.

LOWEST ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 HIGHEST

Read the description for each level, select the one that represents your experience with the center's contribution and provide support for your selection in the comment column.

Level	Description	Institutional Leader Engagement	Comments
0	Autonomous	Center is not engaged in undergraduate STEM education. Institutional leaders work independently of the center.	
1	Emerging	The center infrastructure elevates ug STEM education efforts and begins to emerge as a focal point of activity. The center receives initial support from institutional leaders, which elevates its institutional role, and supports the center's ability to unify current efforts and initiatives.	
2	Progressing	The center's support is building collaborations, resources, and opportunities for ug STEM improvement. The center continues to receive visible support from institutional leaders. This assists the center in situating its role within the institution.	
3	Accomplished	The center has unified efforts, increased visibility, and elevated ug STEM education w/in departments and across campus. The center receives recognition & sustained support from institutional leaders for its role in the improvement of ug STEM education.	
4	Advanced	The center has made significant contributions to ug STEM education on campus, and has elevated the institution in the area of ug STEM education. The center is celebrated and recognized for its role and receives sustained support from institutional leaders.	

RUBRIC B3. Undergrad STEM Curricular/Co-Curricular perspective on the center's Centralize role.

At what level does the center elevate and unify campus efforts, as well as house and incubate programs/ activities/initiatives/research that improve undergraduate STEM education?

Prior to rating, please estimate your level of engagement with the center on a scale of 1–5, with 5 being the highest.

LOWEST ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 HIGHEST

Read the description for each level, select the one that represents your experience with the center's contribution, and provide support for your selection in the comment column.

Level	Description	UG STEM Curricular/ Co-Curricular Engagement	Comments
0	Autonomous	Center has not yet developed connections to ug STEM curricular/co-curricular	
1	Emerging	The center begins to make productive connections with internal and external stakeholders on campus, as well as business/industry and community.	
2	Progressing	The center begins to grow and build connections & partnerships to curricular and co-curricular pathways. Center begins to initiate and expand links to real world/applied context for ug STEM education.	
3	Accomplished	Center provides resources, opportunities, and entry points which enhance and inform curricular and co-curricular pathways. Center is relied upon for this purpose. Center provides links to real world/ applied context for ug STEM education.	
4	Advanced	The center has established partnerships, which provide on-going resources, opportunities, and entry points that enhance and inform curricular and co-curricular pathways. The center is relied upon for this purpose. The center has integrated links to real world/applied context for ug STEM education.	

TABLE C1. Map Center Programs/Activities/Research/Initiatives to Each **Centralize** Subarea

To use this table, Centers list relevant programs/activities/initiatives/research in column 1, in column 2 check off the subareas that apply those listed in column 1, and record notes/evidence in column 3.

Programs/activities/ research/initiatives	Centralize Subareas			Notes/ Evidence
	Unify Efforts in UG STEM Education	Elevate & Support Inclusive STEM Education	Infra- structure to House & Coordinate	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	

Center Use of Data

This section provides the framework for the assessment of the Use of Data construct. Centers are guided through 8 steps outlined below.

The center's use of data catalyzes, informs, and facilitates the improvement of teaching and learning in undergraduate STEM education. Use of data is operationalized to include the ways in which the center uses data, gathered by the center and/or that the center has access to, to guide reform and the implementation of best practices, as the center carries out its mission in undergraduate STEM education.

1) Implications for Use of Data

1. Educational Research empowers centers to communicate horizontally (across disciplinary boundaries) and vertically across organizational levels (faculty/administrative).
2. External funding, linked to STEM initiatives and/or research, incentivizes communication between the center and STEM faculty/departments, and the center and upper administrators.
3. Assessment and evaluation carried out by the center increases engagement with STEM faculty/departments and enhances the value of its role in undergraduate STEM education improvement.

2) Review Current Status for Use of Data

To prepare for the following steps, the center gathers evidence, and uses this to review, reflect, and articulate its role in each of the use of data subareas.⁶ Particular areas of strength will be recognized and desired areas for growth will be considered.

3) Clarify Rationale, Drivers, Resources

Respond to any/all that apply to your center's mission.

- **Rationale:** How does the center view its use of data role?
- **Prioritization:** Consider the ways in which the use of data has been instrumental to the center's role in undergraduate STEM education. What level of priority does the center assign to each of the

⁶ Center roles related to the use of data are captured in 3 subareas described by the Model of Center Practices in undergraduate STEM education (educational research, evaluation & assessment, and guide implementation and reform). Collectively these represent key aspects of the ways in which centers use data to improve teaching and learning.

following subareas? *Apply the following scale: Not a Focus Area (0); Not really a focus (1); Some focus (2); Significant Focus (3); Established Focus (4)*

1. Educational research
2. Evaluation and assessment
3. Guiding implementation and reform

** Note 1-3 may pertain to leading projects, supporting and/or collaborating w/projects.*

- **Contextual Drivers:** Describe any relevant contextual drivers, including identified need areas, funding, and stakeholder partnerships that have contributed to the center's use of data in the 3 subareas listed above.
- **Resources:** Consider the ways in which the drivers (listed above) are connected to human, financial, and structural resources. Describe as appropriate.
- **Importance of Use of Data:** In what ways does the center use data to increase the quality of the undergraduate STEM education experience? For example, data may increase awareness and make need areas explicit, which increases accountability for change and improvement (e.g. gateway courses in STEM, the nature of pathways (both type of pathway and persistence in), etc.).

4) Guiding questions for Use of Data

Explore how the center uses data to improve teaching and learning in each of the following areas.

Respond to any/all that apply to your center's mission.

A. Educational Research

1. How important are each of these to your center's mission? Rate on scale 1–5 (5 highest).
 - a) conducting STEM education research
 - b) catalyzing STEM education research among faculty/departments
 - c) consulting to support faculty/departments who carry out STEM education research
 - d) consumer of STEM education research
2. Identify the types of educational research your center engages in?
 - a) Organizational development and change/transformation
 - b) Scholarship of Teaching and Learning, SoTL⁷
 - c) Discipline-Based Education Research DBER⁸
 - d) Science education K–16
 - e) Other. Any educational research pertaining to STEM.
 - f) None. The center is exclusively a consumer and does not carry out educational research.
3. Briefly describe how the center engages in educational research 1(a–d) above.
 - a) What offices or partners does your center engage with in its role in STEM education research? Describe briefly why these are important to your centers work.
 - b) If the center conducts educational research independently (on and/or off campus), what type (2a–d above)? And who carries it out (i.e. director and/or staff)?
 - c) If the center catalyzes educational research, who is involved and how is this done?
 - d) If the center consults for others engaged in educational research, who is involved and how is this done?

⁷ SoTL Research in the Scholarship of Teaching and Learning (SoTL) focuses on scholarly empirical studies that improve teaching and learning.

⁸ Discipline-Based Educational Research (DBER) focuses STEM specific educational research, scholarly empirical studies that improve student learning.

- e) If the center is currently a consumer of educational research, who is involved and how does this inform the center's role?
- 4. Does your center provide support to departments/faculty for the Internal Review Board (IRB) process required for educational research? If so, does this lead to partnerships with the center?
- 5. Has your center *increased the credibility* of STEM Education research at your institution? Regionally? Nationally? Explain and identify forms of evidence on which your assessment was based.
- 6. Are there indicators that suggest engagement in STEM education research has *elevated the status of your center*? If yes what are the indicators? (e.g. the center is asked to collaborate on institutional proposals and/or asked for letters of support, faculty are influenced to take a scholarly approach, center staff are invited to talk about their research to STEM departments, center staff serve on strategic planning committee, etc.)

B. Evaluation and Assessment (E&A)

- 1. Briefly describe the center's engagement in each of the types of evaluation and assessment.
 - a) Center programs
 - b) Faculty implementation of evidence based instructional practices, EBIPs
 - c) Departmental interventions & innovations at the course level
 - d) Bridge programs and mentoring programs for DEI initiatives
 - e) Externally funded curricular initiatives
 - f) Internally funded curricular initiatives
 - g) Faculty grants with educational components
- 2. What is the center's role in the evaluation process?
 - a) Design
 - b) Measurement
 - c) Interpretation
 - d) Process/implementation focused
 - e) Other
- 3. What offices or partners does the center rely on with respect to evaluation and assessment?
- 4. What more might your center do with additional resources?
- 5. Does the center have a strategy/rationale for prioritization of projects, if the volume of requests is too high?
- 6. Are there indicators that suggest engagement in assessment and evaluation in STEM education has *elevated the status of your center* on campus? If yes what are the indicators? Indicators may include: the center is invited to lead STEM initiatives and/or serve on institutional grants, the center is invited to share E&A gathered from its programs/initiatives/ research to influence institutional decisions.

C. Guide Implementation and Reform

- 1. Describe a few ways the center uses data to expand engagement and catalyze the use and implementation of best practices by STEM departments and faculty.
- 2. In what ways does the center use data to support teaching and learning innovations at the department/faculty level? Across STEM departments and disciplines?
- 3. Is the center engaged with STEM departments to analyze data for courses, course sequences, and curricular pathways e.g. post intervention/innovations to measure student learning?
- 4. What other offices (e.g., registrar, office of institutional research) does the center partner with to gather information on curricular pathways and student success to inform how it uses its resources?

5. To what extent does the center gather data to assess student experience and/or outcomes (e.g., exit interviews with graduating students) and share these with departments and faculty? These may serve as a point of entry for a center to begin to work with a STEM department.
6. Are there specific ways your center could contribute more with additional resources?

5) Map Programs/Activities/Research/Initiatives to Subareas

Use the Table D1 provided on page xx to map center programs/activities/initiatives/research to each Use of Data subarea.

6) Map Resources to Subareas

Next complete Table R1 on page (xx) and map center resources to the Use of Data mid-level support area. Use Table D1 as a resource as you fill out Table R1, which includes: human resources (e.g., staff FTE, affiliated faculty, students), structural resources (e.g. space, location), and financial resources devoted to the center's Use of Data.

7) A Rubrics

The center fills out Rubric A for each of the three corresponding sub-areas associated with Use of Data, and applies the guiding questions filled out above.

- Rubric A4—Educational Research
- Rubric A5—Evaluation and Assessment
- Rubric A6—Guide Implementation and Reform

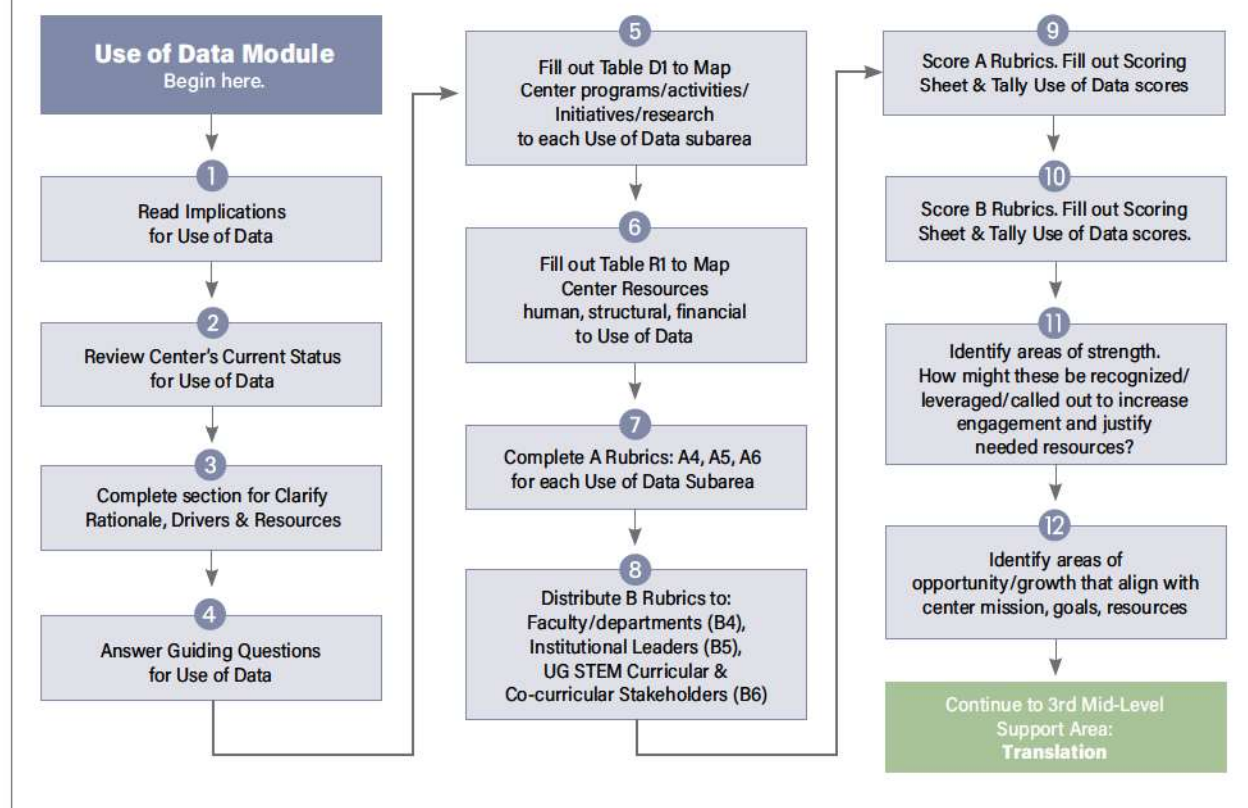
8) B Rubrics

To gain a systems perspective of the center's Use of Data role within the institutional context the center distributes Rubric B to 3 groups:

- Rubric B4—Faculty and Departments
- Rubric B5—Institutional Leaders (Deans, Provost, Vice President for Research, etc.)
- Rubric B6—UG STEM Curricular and co-curricular stakeholders (internal and/or external as applicable to the center's mission)

Rubrics should be filled out by a representative sample of each group (i.e. several faculty/departments, etc.)

FIGURE 4. Flow Chart for Use of Data Module



All A Rubrics are to be filled out by the center after completing steps 1-6 for this mid-level support area.

RUBRIC A4. Use of Data: Educational Research (conduct, catalyze, consult)

At what level does the center engage in the use of data from educational research to improve undergraduate STEM education?

Level	Description	Educational Research: Conduct, Catalyze, Consult
0	N/A	The center is not directly engaged in producing STEM education research; Center may be a consumer of STEM ed research.
1	Emerging (Nascent phase)	The center considers ways to engage in STEM education research to assist with its mission in undergraduate STEM education. Center begins to develop STEM faculty/department partnerships for research. The center begins to conduct some research on the impact of center initiatives in undergraduate STEM education.
2	Progressing	The center increases its activity in this area. The center actively seeks external funding to further its goals, and/or collaborates with a few STEM departments to write proposals. The center becomes engaged with some faculty grants with educational components. The center may use some of its internal funding to offer small awards to faculty or departments to encourage and support innovative practices in teaching and learning. The center conducts some STEM education research related to center initiatives, faculty partnerships, and/or external funding awarded to the center.
3	Accomplished	STEM education research has become a priority for the center. The center has local recognition for its role in STEM education research, and is looked to for partnerships by faculty/departments engaged in this area. The center brings in external funds and/or is a key collaborator facilitating the acquisition of external funds to lead campus projects. This has served to increase faculty interest and engagement in STEM education research. The center's role in research has made contributions to teaching and learning in undergraduate STEM on campus, and possibly regionally, and/or nationally.
4	Advanced	The center is nationally/internationally renowned for STEM education research, and has elevated the institution in this area. The center is regularly awarded external funding, and is a key collaborator facilitating the acquisition of external funds to improve undergraduate STEM education on campus. In this role, the center collaborates across many undergraduate STEM initiatives. The center director and other center staff regularly publish in peer reviewed scholarly journals. Center projects make significant contributions to the improvement of teaching and learning and to student success in undergraduate STEM education on campus, and possibly regionally/nationally.

Evidence for Assessment: Centers summarize the reason for their assessment (e.g. we are advanced and here is why, pointing to guiding questions for evidence).

RUBRIC A5. Use of Data: Evaluation & Assessment (E&A)

At what level does the center use data from evaluation and assessment to improve undergraduate STEM education?

Level	Description	Evaluation & Assessment (E&A)
0	N/A	Center is not engaged in E & A focused on undergraduate STEM education. Center may gather data that includes STEM faculty/department participation in center programs & services.
1	Emerging (Nascent phase)	Center carries out E&A of its STEM programs & services. Center uses data to enhance utility and engagement for STEM faculty/departments. Center begins to partner with faculty to measure the success of evidence-based instructional practices (EBIPs). Center may provide some consultations for faculty/departments to assist with E&A at the course and/or curricular level.
2	Progressing	As a result of on-going E&A, center programs & services have increased utility for STEM faculty and the center experiences increased engagement in related programs/institutes/workshops/services. The center begins to advise on design & data collection to measure outcomes of curricular interventions; center assists with data interpretation. The center provides information on course sequences, curricular innovations, and iterative improvement for individual faculty implementing EBIPs. The center provides messaging to enhance awareness of its E&A role.
3	Accomplished	The center has developed broad E&A partnerships with STEM faculty and departments. The center regularly advises on design, data collection, and interpretation to measure outcomes of curricular interventions. This includes assistance by the center to measure course/curricular learning objectives (LOs) and associated learning outcomes. The center regularly provides data for faculty implementing EBIPs to foster and support iterative improvement. The center continues to showcase its role in E&A to encourage engagement across all STEM departments.
4	Advanced	STEM departments seek center partnership for E&A of initiatives aimed at reform in teaching & learning. The center guides longitudinal efforts to assess effectiveness of teaching and learning innovations and EBIP implementation broadly across STEM departments. The institution considers E&A data provided by the center when reviewing student success. The center is invited to contribute to broader campus-wide efforts featuring E&A, such as accreditation work or new initiatives.

Evidence for Assessment: Centers summarize the reason for their assessment.

RUBRIC A6. Use of Data: Guide Implementation & Reform

At what level does the center use data to guide implementation of best practices and reform in undergraduate STEM education teaching and learning?

Level	Description	Guide Implementation & Reform
0	N/A	Center may work with individuals for this purpose, but is not focused here. Center may not have the staff necessary for this role.
1	Emerging (Nascent phase)	The center becomes engaged with a few departments & faculty to review existing data, and/or to gather data, to inform and guide improvement in courses/curricula within STEM departments.
2	Progressing	The center expands engagement with STEM faculty & departments to explore ways to use data to inform improvement/reform of curricular goals in courses & course sequences. STEM departments gather data as they implement course and/or curricular goals, with guidance and support from the center.
3	Accomplished	The center has developed strategies that allow it to effectively consult & support STEM faculty and departments in identifying the data necessary to inform/ guide curricular improvement & reform decisions. The center has developed a partnership with institutional research and is able to apply both institutional & departmental data to explore need areas, and review STEM curricula & pathways. STEM departments continue to gather data as they implement course and/or curricular goals, and the center offers guidance and support.
4	Advanced	The center's programs/initiatives and research provide data that informs reform and improvement efforts in undergraduate STEM education. Upper administrators, colleges, and/or departments include the center's input in decision making. The center uses data from STEM curricula & pathways to guide its research & initiatives to improve student success, as well as to target externally/ internally funded programs.

Evidence for Assessment: Centers summarize the reason for their assessment.

All B rubrics are to be filled out by a variety of institutional leaders, faculty/department chairs, and curricular and co-curricular stakeholders.

RUBRIC B4. Faculty/Department perspective on the center's Use of Data role and how it serves to broadly improve teaching and learning in undergraduate STEM education.

At what level does the center's use of data contribute to the improvement of undergraduate STEM education? Use of data may include: data gathered from center led initiatives or educational research; evaluation & assessment carried out by the center; guidance on implementation and reform efforts. Centers may also partner with the Office of Institutional Research to obtain data and/or analyses.

Prior to rating, please estimate your level of engagement with the center on a scale of 1–5, with 5 being the highest.

LOWEST ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 HIGHEST

Read the description for each level, and select the one that represents your experience with the center's contribution, and provide support for your selection in the comment column.

Level	Description	Faculty/Department Engagement	Comments
0	Autonomous	The center is not engaged in the use of data for ug STEM education. Faculty and departments work independently of the center.	
1	Emerging	The center begins to expand the use of data to improve ug STEM education. The center works with faculty and departments to share existing data & gather new data from T & L initiatives/innovations. Center facilitation has led to a few STEM faculty/departmental collaborations.	
2	Progressing	The center's use of data is building collaborations and partnerships to improve undergraduate STEM education. The center's engagement in educational research and/or evaluation & assessment increases interest and begins to grow collaborations and partnerships with STEM faculty/departments to gather data from T & L initiatives/innovations. The center consults and facilitates experimental design, measurement, and interpretation of data.	
3	Accomplished	The center's use of data has informed and established partnerships and collaborations w/in and across departments. Faculty partnerships with the center around the use of data for courses/curricula/ initiatives are solidly established; (in place for 1–2years). The center is looked to for partnerships and support.	
4	Advanced	Center's use of data makes recognized contributions to the improvement of ug STEM education. The center widely assists STEM departments in some or all of these areas: application of existing research, the design, gathering & analysis of departmental data. The center contributes to the use of data to inform courses, pathways, and curricula w/in STEM departments.	

RUBRIC B5. Institutional Leadership perspective on the center's **Use of Data** role and how it serves to broadly improve teaching and learning in undergraduate STEM education.

At what level does the center's use of data contribute to the improvement of undergraduate STEM education? Use of data may include: data gathered from center led initiatives or educational research; evaluation & assessment carried out by the center; guidance on implementation and reform efforts. Centers may also partner with the Office of Institutional Research to obtain data and/or analyses.

Prior to rating, please estimate your level of engagement with the center on a scale of 1–5, with 5 being the highest.

LOWEST ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 HIGHEST

Read the description for each level, select the one that represents your experience with the center's contribution and provide support for your selection in the comment column.

Level	Description	Institutional Leader Engagement	Comments
0	Autonomous	Center is not engaged in ug STEM education. Institutional leaders work independently of the center.	
1	Emerging	The center begins to include the use of data to improve ug STEM education. Institutional leaders are aware that the center's role in educational research and/or evaluation & assessment is beginning to provide data resources to inform decisions and progress in T & L in ug STEM education.	
2	Progressing	The center's use of data is building collaborations and partnerships to improve undergraduate STEM education. Institutional leaders begin to consider data provided by the center to inform some decisions on the progress and reform of T & L in undergraduate STEM education.	
3	Accomplished	The center's use of data has informed and established partnerships and collaborations w/ in and across departments. Institutional leaders often include/consider data provided by the center to inform decisions on the progress and reform of T & L in ug STEM education.	
4	Advanced	Center's use of data makes recognized contributions to the improvement of ug STEM education. Institutional leaders include and rely on data provided by the center to inform decisions on the progress and reform of ug STEM education. (e.g. STEM pathways, gateway courses, bridge programs, T & L innovations, etc.)	

RUBRIC B6. Undergrad STEM Curricular/Co-Curricular perspective on the center's **Use of Data** and how it serves to broadly improve teaching and learning in undergraduate STEM education.

At what level does the center's use of data contribute to the improvement of undergraduate STEM education? Use of data may include: data gathered from center led initiatives or educational research; evaluation & assessment carried out by the center; guidance on implementation and reform efforts. Centers may also partner with the Office of Institutional Research to obtain data and/or analyses.

Prior to rating, please estimate your level of engagement with the center on a scale of 1–5, with 5 being the highest.

LOWEST ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 HIGHEST

Read the description for each level, select the one that represents your experience with the center's contribution and provide support for your selection in the comment column.

Level	Description	UG STEM Curricular/ Co-Curricular Engagement	Comments
0	Autonomous	Center is not engaged in ug STEM and/or center has no connection to undergraduate STEM curricular/co-curricular	
1	Emerging	The center begins to include the use of data to improve ug STEM education. The center begins to consider how to provide data to various stakeholders to build connections and grow support for curricular and co-curricular activities, initiatives, and pathways.	
2	Progressing	The center's use of data is building collaborations and partnerships to improve undergraduate STEM education. The center begins to provide data to various stakeholders to grow support and build connections for curricular and co-curricular activities, initiatives, and pathways.	
3	Accomplished	The center's use of data has informed and established partnerships and collaborations w/in and across departments. The center often provides data (from its STEM programs & services, educational research, initiatives, E&A) that supports and informs curricular and co-curricular activities, initiatives, and pathways.	
4	Advanced	Center is relied upon to provide data (from its STEM programs & services, educational research, initiatives, E&A) that supports and informs curricular and co-curricular activities, initiatives, and pathways.	

TABLE D1. Map Center Programs/Activities/Research/Initiatives to Each Use of Data Subarea

To use this table, Centers list relevant programs/activities/initiatives/research in column 1, in column 2 check off the subareas that apply those listed in column 1, and record notes/evidence in column 3.

Programs/activities/ research/initiatives	Use of Data Subareas			Notes/ Evidence
	Educational Research	Evaluation & Assess- ment	Guide Implemen- tation & Reform	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	

Center Role in *Translation*

This section provides the framework for the assessment of the Translation construct. Centers are guided through 8 steps outlined below.

The center's role in translation increases shared understanding and serves to broadly improve undergraduate STEM education. Translation is operationalized as the interpretation and communication of meaning and relevance from one context to another to build shared understanding as the center carries out its mission in undergraduate STEM education.

1) Implications for Translation

1. The strength and ability of a center to translate empowers it to be influential in institutional efforts to advance undergraduate STEM education.
2. A center's ability to bridge research to practice is enhanced through externally funded awards which elevates the center's status on campus.
3. Working across STEM departments promotes/facilitates discourse, which supports the center's work in undergraduate STEM education (i.e., understanding of disciplinary norms to improve facilitation and access).
4. The ability of the center to translate horizontally and vertically influences the vitality of the center.

2) Review Current Status for Translation

To prepare for the following steps, the center gathers evidence, and uses this to review, reflect, and articulate its role in each of the translation subareas.⁹ This preparation is used to inform the center's self-assessment within these subareas. Particular areas of strength will be recognized and desired areas for growth will be considered.

3) Clarify Rationale, Drivers, Resources

Respond to any/all that apply to your center's mission.

- **Rationale:** How does the center view its role in translation?
- **Prioritization:** Consider the center's overarching mission and the ways in which translation has been instrumental within each subarea. What level of priority does the center assign to each of the

⁹ Center translational roles are captured in 3 subareas described by the Model of Center Practices in undergraduate STEM education (research to practice, vertical (between administrative leaders and faculty), horizontal (across STEM departments) each represents the ways in which centers work to improve shared understanding.

subareas? *Apply the following scale: Not a Focus Area (0); Not really a focus (1); Some focus (2); Significant Focus (3); Established Focus (4)*

1. Translator of STEM education research to practice
 2. Vertical translator—across administrative/faculty levels
 3. Horizontal translator—across STEM disciplines and departments
- Consider some of the ways each translational subarea may strengthen the center's ability to carry out its mission in ug STEM education. Provide 1–2 examples.
 - **Drivers:** Identify the primary drivers that have promoted translation in the three subareas identified above. (Answer those that apply to your center).
 - Describe contextual drivers *internal to the institution* that may have promoted translation in these areas. For example, identified/prioritized need areas, existing linkages/points of entry, partnerships, skills/expertise, institutional culture, strategic goals, institutional demographics, etc. to situate the center's translational role within the institutional context.
 - Describe contextual drivers *external to the institution* that may have promoted translation in these areas. For example, cultural/community, business/industry, identified regional priorities to situate the center's translational role in the broader local context.
 - **Resources:** Consider the ways in which the drivers (listed above) are connected to human, financial, and structural resources. Describe as appropriate.
 - Consider the human resources that facilitate the center's ability to carry out translational activities.
 - ◆ Identify the individuals *within* the center who effectively translate research to practice? (i.e. Offer guidance/support that leads to effective learning & application of research-based educational methods).
 - ◆ Identify the individuals *within* the center who effectively initiate, develop, and foster horizontal connections? Vertical connections?
 - ◆ Identify administrators, department chairs, and faculty, who effectively initiate, develop, and foster horizontal connections across STEM depts? Vertical connections?
 - ◆ Using your responses to the 3 sub-bullets above related to individuals, consider:
 - ◇ Whether the center's ability to translate is well distributed and diverse or reliant on a few (or even one) key individual(s).
 - ◇ How the center strategically learns from different individuals approaches and skills.

4) Guiding questions for Translation

Explore how your center applies translation to strengthen undergraduate STEM education in each of the following areas.

Respond to any/all that apply to your center's mission.

A. Translator of STEM Education Research to Practice

1. Describe a few of the ways that your center bridges the gap that exists between STEM education research and its application to STEM teaching and learning.¹⁰ For example, initiatives, research, programs, services, and other activities your center is engaged in that provide learning opportunities in this area.
2. Are there indicators that demonstrate the center has increased the use and improved the implementation of research-based teaching practices and learning experiences? If yes

¹⁰ This gap exists across STEM fields where current educational research has the potential to improve student learning, engagement, and success, yet is often not utilized. Practitioners require exposure and guidance for the use and application of educational research in their field.

- what are the indicators? Consider both tangible indicators (e.g., x number of teaching faculty in STEM departments have adopted/attended, course level interventions have been implemented, departments/faculty are reflecting on traditional practices, etc.) AND less quantifiable parameters that are *cultural and community based*, which influence the adoption of research-based educational improvements.
3. Are there ways that your center has influenced the adoption of research-based educational improvements through student programming? This applies to SECs and CTLs engaged in programming to support student success e.g., Learning Assistant (LA) Programs, Louis Stokes Alliances for Minority Participation (LSAMP) programs, undergraduate research experiences (UREs), and other similar initiatives, as well as broad tutoring/student support programs. Centers often house programs, create community, and provide opportunities for inclusive undergraduate STEM education, which influence the culture and students' sense of belonging. These in turn create/nurture an environment conducive to the adoption of research-based practices and increase success for all students.
 4. How has the translation of STEM education research to practice been important to your center's mission? Briefly describe.
 5. What additional resources would allow your center to strengthen/enhance its goals in this area?

B. Vertical Translator Across Administrative/Faculty Levels

1. Consider the ways in which your center establishes, maintains, and enhances connections to upper administrators, which supports its work in undergraduate STEM education.
 - a) Reporting line
 - b) Institutional goals/priorities that relate to the center's mission
 - c) External funding awarded to the center
 - d) Intramural funding awarded to the center
 - e) Center contributions to educational innovations and interventions to improve STEM teaching and learning
 - f) Educational research expertise used to gather data to inform STEM pathways
 - g) Center involvement in national initiatives and/or networks
2. In what ways, do the center's relationships with administrators assist its goals in undergraduate STEM education?
Some examples may include: the center offers guidance on strategies used to improve undergraduate STEM education, gaining insight into institutional priorities and positioning the center to contribute effectively, center receives increased recognition on campus.
3. Describe a few of the ways in which center-led initiatives *bring together* STEM faculty and upper administrators (e.g. Provost, Vice Provost, VPR, Deans) to work toward common goals.
 - a) Some examples are listed below.
 - Educational research initiatives and/or innovations
 - Center engagement in national initiatives
 - Externally funded initiatives awarded to the center
 - Internally funded curricular initiatives
 - Student programs
 - Proposal writing team for extramural funding
 - b) How frequently during the semester, school year, summer, do these occur? Are these once-a-year events? A few times a semester? Or?

4. Are there other ways the center *increases* communication between STEM faculty/departments and upper administrators?
5. Does your center need to strengthen vertical communication? If so, in what ways would this benefit the center? (e.g., in the event of administrative turn-over)

C. Horizontal Translator Across STEM Disciplines and Departments

1. Consider *the ways* in which your center establishes, maintains, and enhances connections across STEM departments and disciplines. Which have been the most impactful for your center? Briefly describe and include whether these have been responsive or proactive. Some examples include:
 - Center as a meeting place, STEM programs and learning communities
 - External and internal funding awarded to the center
 - Seminars to showcase faculty work and accomplishments
 - Center contributions to educational innovations and interventions to improve STEM teaching and learning
 - Educational research expertise used to gather data to inform STEM courses and pathways
 - Center involvement in national initiatives
 - Proposal writing team for extramural funding
2. Who *has helped* your center to establish and maintain connections to STEM departments and faculty? Please describe any key attributes that have assisted your center. Some examples include:
 - Center director has a dual appointment, and is also a STEM faculty member
 - Center staff have a dual appointment in a STEM department (e.g. DBER faculty, center staff w/advanced STEM degree)
 - STEM faculty who are affiliated with the center, faculty champions, etc.
 - Students engaged in center initiatives
 - External stakeholders who provide internships, workplace, and research experiences
 - Internal stakeholders who provide internships, workplace, and research experiences
 - Other?
3. Consider your response to question C1 above, which methods used to communicate across STEM departments & disciplines have been the most effective in fostering cross-pollination and interdisciplinary ideas?
4. What are the ways in which your center incentivizes STEM department and faculty engagement (e.g., seed funding for curricular improvement)? What resources would be helpful to assist the center in this area?
5. Provide a few examples of how working across STEM departments has helped your center to identify methods and approaches to promote desired outcomes (i.e., tailored to local needs) in undergraduate STEM education.

5) Map Programs/Activities/Research/Initiatives to Subareas

Use the Table T1 provided on page xx to map center programs/activities/initiatives to each of the 3 Translation subareas.

6) Map Resources to Subareas

Next complete Table R1 on page (xx) and map center resources to the Translate mid-level support area. Use Table T1 as a resource as you fill out Table R1, which includes: human resources (e.g., staff FTE,

affiliated faculty, students), structural resources (e.g. space, location), and financial resources devoted to the center's Translational role.

7) A Rubrics

The center fills out Rubric A for each of the three corresponding sub-areas associated with Translation, and applies the guiding questions filled out above.

- Rubric A7—Research to Practice
- Rubric A8—Across levels Faculty/Leadership (Vertical)
- Rubric A9—Across STEM Departments (Horizontal)

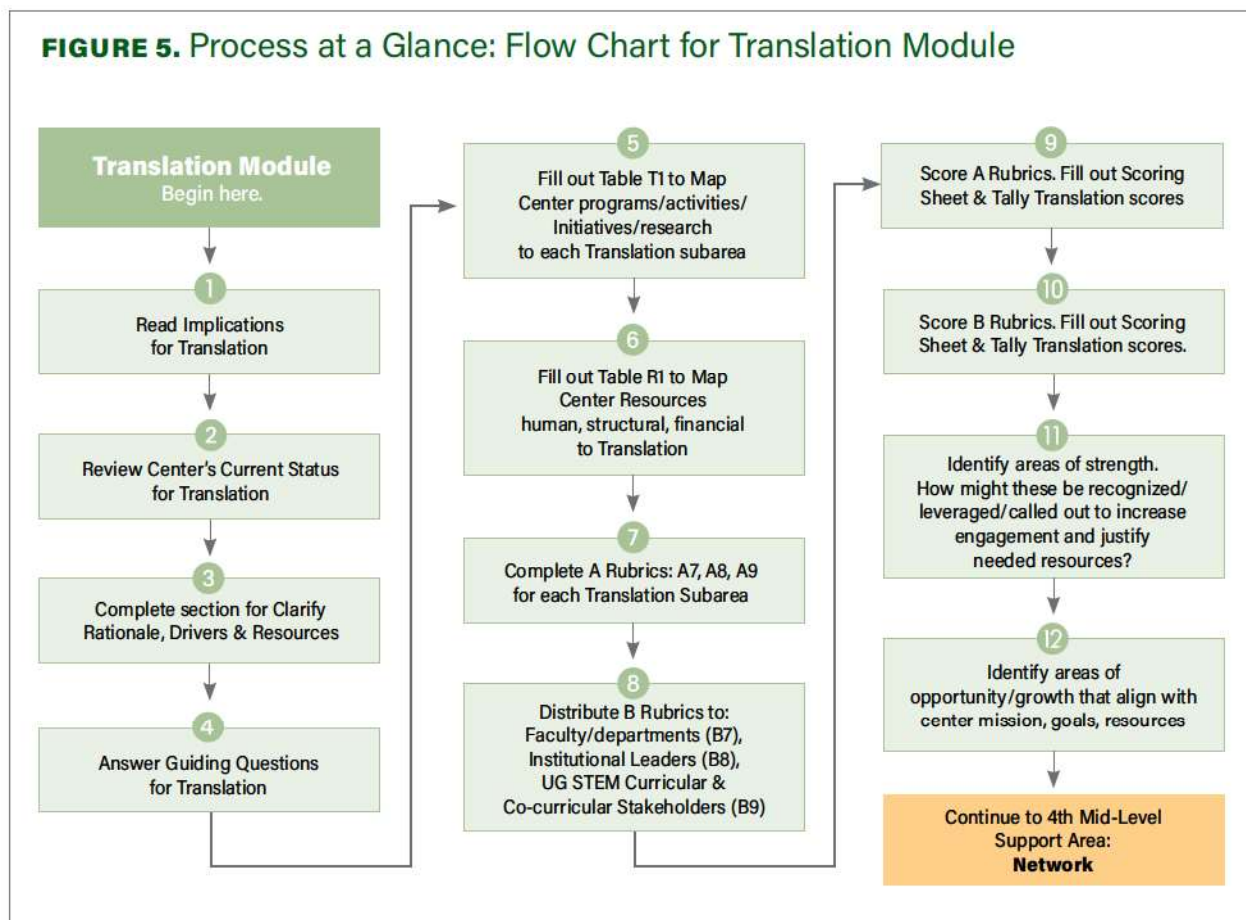
8) B Rubrics

To gain a systems perspective of the center's Translational role within the institutional context the center distributes Rubric B to 3 groups:

- Rubric B7—Faculty and Departments
- Rubric B8—Institutional Leaders (Deans, Provost, Vice President for Research, etc.)
- Rubric B9—UG STEM Curricular and co-curricular stakeholders (internal and/or external as applicable to the center's mission)

Rubrics should be filled out by a representative sample of each group (i.e. several faculty/departments, etc.)

FIGURE 5. Process at a Glance: Flow Chart for Translation Module



All A Rubrics are to be filled out by the center after completing steps 1-6 for this mid-level support area.

RUBRIC A7. Translation: Translator of STEM Education Research to Practice

At what level does the center bridge research to practice in undergraduate STEM education?

Level	Description	Translation: Bridge Research to Practice
0	N/A	Center programming around the application of research to practice is not differentiated for STEM faculty and departments. STEM faculty and departments may engage in general programming.
1	Emerging (Nascent phase)	The center may be new and/or expanding its focus in ug STEM education. Center begins to provide some programming and showcases research (SoTL/DBER ¹¹) to increase awareness and provide opportunities to learn about research-based teaching practices. Center is developing STEM specific resources in this area.
2	Progressing	The center continues to develop STEM specific programming and resources to assist faculty & departments. Center has partnerships with some STEM faculty and departments and actively uses these partnerships to guide resource development. Center places focus on individual STEM department needs as faculty explore and implement various research-based practices. Center continues to showcase SoTL/DBER research to increase awareness and provide opportunities to learn about research-based teaching practices.
3	Accomplished	The center has developed STEM specific programming and resources to support STEM faculty/departments. The center has experienced increased engagement and is viewed as a resource by STEM faculty/departments. The center continues to expand its partnerships with STEM faculty and departments to implement various research-based practices to improve student learning outcomes. The center showcases DBER/SoTL research, now often in partnership with local faculty, to provide opportunities to learn about research-based teaching practices.
4	Advanced	The center is widely recognized by STEM departments as a strong resource to guide, facilitate, and measure research-based practices that lead to improved student learning. The center assists with the alignment of these practices to desired student learning outcomes. Center has several/many STEM partnerships and has effectively built relationships within departments that foster the application of STEM education research to teaching practices.

Evidence for Assessment: Centers summarize the reason for their assessment (e.g. we are advanced and here is why, pointing to guiding questions for evidence).

11 SoTL and DBER represent scholarly educational research. Research in the Scholarship of Teaching and Learning (SoTL) and Discipline-Based Educational Research (DBER) focus on empirical studies that improve student learning.

RUBRIC A8. Translation: Vertical Translator Across Administrative & Faculty Levels

At what level does the center increase vertical communication to improve undergraduate STEM education?

Level	Description	Vertical: Across Administrative & Faculty Levels
0	N/A	NA; Center may not play a specific vertical role. It communicates with administration, and with faculty/departments independently. Center is not intentionally acting to create vertical linkages.
1	Emerging (Nascent phase)	Center recognizes it is well positioned to increase vertical communication and begins to explore this opportunity. Center identifies ways to improve vertical communication between upper administration and faculty to strengthen shared understanding of goals in ug STEM education.
2	Progressing	The center organizes/facilitates a few events (institutes/symposia/ workshops), and possibly (1-2) on-going programmatic initiatives that bring faculty & administrators together and provide opportunities for discussion/collaboration (e.g. ug poster session, grant initiatives, teaching symposia where faculty display their work in course/curricular innovation). Events and initiatives draw modest attendance.
3	Accomplished	The center organizes/facilitates several events (institutes/ symposia/ workshops), and (1-2) on-going programmatic initiatives that bring faculty & administrators together and provide engaging opportunities for discussion/ collaboration. The center and center events/initiatives/activities are recognized and utilized by STEM faculty and upper administrators as a mechanism to build communication that advances administrative and faculty goals in ug STEM education. The center stimulates interest via grant writing teams/initiatives, research & evaluation and assessment opportunities.
4	Advanced	Center brings together admin & faculty through a wide variety of educational initiatives/programs/research, including national initiatives. The center also applies data driven assessment and evaluation practices, serving to enhance communication and increase shared understanding across levels. The center organizes/ facilitates many events (institutes/symposia/ workshops), and several on-going programmatic initiatives that are well attended by STEM faculty and administrators.

Evidence for Assessment: Centers summarize the reason for their assessment.

RUBRIC A9. Translation: Horizontal Translator Across STEM disciplines & departments

At what level does the center facilitate horizontal communication to improve undergraduate STEM education?

Level	Description	Horizontal: Across STEM Disciplines & Departments
0	N/A	NA; Center may not play a horizontal role within STEM. Center communicates independently with individual departments and faculty. Center may have influence w/in departments, but this does not extend across to provide linkages.
1	Emerging (Nascent phase)	The center considers ways to increase horizontal communication and facilitate STEM departments/faculty sharing across disciplines. Center begins to place emphasis on developing horizontal communication & collaboration through its programs and initiatives.
2	Progressing	The center has developed clear strategies, and coordinates programs/ initiatives/grant writing teams that bring together STEM faculty and/ or departments. Center director, staff, and faculty champions stimulate engagement. Some interdisciplinary collaborations promote and facilitate discourse between faculty and/or chairs and the center.
3	Accomplished	The center provides (programming/resources/ expertise) which elicit strong engagement, and increase STEM faculty/department communication with each other and with the center. Several interdisciplinary collaborations increase communication between faculty and the center. The center utilizes these collaborations to make progress towards achieving its goals in ug STEM teaching and learning.
4	Advanced	The center provides (programming/resources/ expertise) that have increased collaboration between STEM faculty/departments and the center. Horizontal communication has led departments to share and/or adopt innovative practices (increased efficiency in scaling best practices). The center is recognized as a central liaison between departments through which to share and improve ug STEM teaching and learning.

Evidence for Assessment: Centers summarize the reason for their assessment.

All B rubrics are to be filled out by a variety of institutional leaders, faculty/department chairs, and curricular and co-curricular stakeholders.

RUBRIC B7. Faculty and Departmental perspective on the center's Translation role.¹²

At what level does the center improve shared understanding across STEM disciplines/departments, assist in interdisciplinary collaborations, and further develop an understanding of faculty/department efforts outside of one's own department to broadly improve undergraduate STEM education?

Prior to rating, please estimate your level of engagement with the center on a scale of 1–5, with 5 being the highest.

LOWEST ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 HIGHEST

Read the description for each level, and select the one that represents your experience with the center's contribution, and provide support for your selection in the comment column.

Level	Description	Faculty/Department Engagement	Comments
0	Autonomous	Center is not engaged in undergraduate STEM education. Faculty/departments work independently of the center.	
1	Emerging	The center's translational role begins to increase the use of research-based teaching practices, improve horizontal communication/collaboration, and encourages interdisciplinary partnerships. The center's STEM specific programs, resources, and events increase awareness & opportunities to learn about research-based teaching practices.	
2	Progressing	Engagement in the center's STEM specific programing and resources has led a few STEM faculty & departments to develop partnerships with the center to explore & implement various research-based practices. The center's programs/initiatives and resources encourage and facilitate communication and seed collaborations across STEM disciplines. Faculty/department engagement w/center continues to increase.	
3	Accomplished	Engagement in the center's STEM specific programing and resources has led several STEM faculty & departments to develop partnerships with the center to explore & implement various research-based practices. Center programs/ initiatives/ events are valued for bringing STEM faculty from different departments into dialogue. The center experiences increased participation and engagement in research-based teaching practices.	
4	Advanced	The center has established on-going interdisciplinary & disciplinary partnerships engaged in the implementation of research-based teaching practices, and these have made significant contributions to the improvement of ug STEM education. The center's programs/initiatives and events have high engagement and are widely valued for facilitating communication & collaborations across STEM disciplines.	

¹² The center's role in translation includes 3 subareas: 1) translation of educational research to increase application in teaching practice and improve student learning, 2) vertical translation across levels—between faculty and administration, 3) horizontal translation across STEM departments and disciplines.

RUBRIC B8. Institutional Leadership perspective on the center's **Translation** role.¹³

At what level does the center improve shared understanding across STEM disciplines/departments, and across administrative levels between faculty and institutional leaders to further understand and align goals to broadly improve undergraduate STEM education?

Prior to rating, please estimate your level of engagement with the center on a scale of 1–5, with 5 being the highest.

LOWEST ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 HIGHEST

Read the description for each level, select the one that represents your experience with the center's contribution and provide support for your selection in the comment column.

Level	Description	Institutional Leader Engagement	Comments
0	Autonomous	Center is not engaged in undergraduate STEM education. Institutional leaders work independently of the center.	
1	Emerging	The center begins to engage a few institutional leaders in events, grants, initiatives, seminars, and programming. Through this engagement vertical communication between faculty and administrators begins to increase awareness of faculty/department efforts and administrative priorities in ug STEM.	
2	Progressing	The center engages institutional leaders in events, grants, initiatives, seminars, and programming. Through this engagement vertical communication between faculty and administrators increases focus and aligns goals, which assists teaching and learning in ug STEM.	
3	Accomplished	The center is viewed as a mechanism to influence & stay in touch with ug STEM improvement efforts on campus. The center receives requests to lead programs or invitations to collaborate in STEM education initiatives. The center is recognized by faculty and leadership for its role in improving communication across administrative levels, increasing shared understanding of ug STEM education goals.	
4	Advanced	The center is valued as a mechanism to influence & stay in touch with ug STEM improvement efforts on campus and assists in developing policies to reward and support such efforts. The center experiences sustained engagement by institutional leaders in events, grants, initiatives, seminars, and programming that sustain vertical communication.	

¹³ The center's role in translation includes 3 subareas: 1) translation of educational research to increase application in teaching practice and improve student learning, 2) vertical translation across levels—between faculty and administration, 3) horizontal translation across STEM departments and disciplines.

RUBRIC B9. Undergraduate Curricular and Co-curricular perspective on the center's Translation role.¹⁴

At what level does the center improve shared understanding across STEM disciplines/departments, and assist in linking these to undergraduate curricular and co-curricular resources to broadly improve undergraduate STEM education?

Prior to rating, please estimate your level of engagement with the center on a scale of 1–5, with 5 being the highest.

LOWEST ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 HIGHEST

Read the description for each level, select the one that represents your experience with the center's contribution and provide support for your selection in the comment column.

Level	Description	UG STEM Curricular/ Co-Curricular Engagement	Comments
0	Autonomous	Center is not engaged in undergraduate STEM education. Institutional leaders work independently of the center.	
1	Emerging	The center begins to develop and/or link to learning supports for undergraduate STEM education (e.g., tutoring, peer mentoring, advising). And/Or The center begins to communicate with a few internal stakeholders on campus, as well as external stakeholders such as business/ industry and/or local community, to enhance opportunities in and connections to work force/real world applications in ug STEM curricular and co-curricular contexts.	
2	Progressing	The center offers/facilitates some learning supports for undergraduate STEM education (e.g., tutoring, peer mentoring, advising). And/Or The center continues to expand & foster communication with internal stakeholders, as well as external business/ industry and local community to enhance opportunities in & connections to work force/real world applications in ug STEM curricular and co-curricular contexts.	
3	Accomplished	The center offers/contributes/ links to several learning supports for undergraduate STEM education (e.g., tutoring, peer mentoring, advising), and these have broad participation. And/Or The center has developed and sustained several partnerships with internal and external stakeholders, which have increased connections to work force/real world applications in ug STEM curricular and co-curricular contexts. These connections have led to expanded opportunities for faculty and students in ug STEM education.	
4	Advanced	The center's learning supports for undergraduate STEM education (e.g., tutoring, peer mentoring, advising), have become a key part of institutional strategies to improve student success. And/Or The center has established numerous partnerships with internal and external stakeholders, which have made recognized contributions to academic opportunities through the integration of work force/real world applications in ug STEM education.	

¹⁴ The center's role in translation includes 3 subareas: 1) translation of educational research to increase application in teaching practice and improve student learning, 2) vertical translation across levels—between faculty and administration, 3) horizontal translation across STEM departments and disciplines.

TABLE T1. Map Center Programs/Activities/Research/Initiatives to Each Translation Subarea

To use this table, Centers list relevant programs/activities/initiatives/research in column 1, in column 2 check off the subareas that apply those listed in column 1, and record notes/evidence in column 3.

Programs/activities/ research/initiatives	Translation Subareas			Notes/ Evidence
	Research Practice	Vertical	Horizontal	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☒	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	

Center *Network*

This section provides the framework for the assessment of the Network construct. Centers are guided through 8 steps outlined below.

The center's network broadly increases engagement of stakeholders both internal and external to the institution to improve undergraduate STEM education. Network is operationalized to include how a center's network acts as a resource, and builds engagement and cohesion with the various constituencies it works with, both external and internal to the institution, to carry out its mission related to undergraduate STEM education.

1) Implications for Network

1. The degree to which a center's network is instrumental in its mission is connected to center leadership and their ability to establish influential connections.
2. A center's ability to network is enhanced through externally funded awards and engagement in national initiatives, which elevate the center's status on campus.

2) Review Current Status for Network

To prepare for the following steps, the center gathers evidence, and uses this to review, reflect, and articulate its role in each of the network subareas.¹⁵ This preparation is used to inform the center's self-assessment within this subarea. Particular areas of strength will be recognized and areas for growth will be considered.

3) Clarify Rationale, Drivers, Resources

Respond to any/all that apply to your center's mission.

- **Rationale:** How does the center view its network role?
- **Prioritization:** What level of priority does the center assign to each of the network subareas listed below? *Apply the following scale: Not a Focus Area (0); Not really a focus (1); Some focus (2); Significant Focus (3); Established Focus (4)*
 1. Connect/Link *individuals* to resources, mentors, and one another
 - Make connections for individuals to center resources, to mentoring opportunities, to mentors, and to one another.

¹⁵ Center network roles are captured in 3 subareas described by the Model of Center Practices in undergraduate STEM education (1) linking individuals with resources, mentors, and one another, 2) building complementary partnerships between initiatives, and 3) increasing communication and collaboration between internal/external stakeholders each represents the ways in which centers work to improve engagement.

2. Build complementary partnerships between initiatives
 - Center initiates/establishes ways to build complimentary partnerships by connecting existing initiatives, and new and existing initiatives, to build complimentary partnerships and maximize available resources. The center may coordinate complementary SEC/CTL contributions to these initiatives.
 3. Increase communication & collaboration between stakeholders, both internal and external to the institution
 - Explore the ways in which the center's network acts as a resource, which builds engagement among stakeholders.
- **Drivers:** Identify any key drivers that have developed center networks in the three areas above.
- **Resources:** Consider the ways in which the drivers (listed above) are connected to human, financial, and structural resources. Describe as appropriate.
- Consider where the emphasis is placed. How does this align with the center's mission?
 - Does the center have the resources to both *maintain* its established network (internal and/or external) and to *grow/expand* the network?
 - ♦ Is there an emphasis placed in both areas?
 - ♦ How does this influence the center's opportunities?
- **Key Contributors:** Consider how the center positions itself to establish a robust network to support undergraduate STEM education.
- Who are the key individuals *within* the center responsible for the network's vitality and growth in undergraduate STEM education? Include individuals who effectively initiate, develop, and foster engagement.
 - Identify the key individuals *outside* the center, who effectively initiate, develop, and foster engagement in its network? (note: this may include students)
- **Stakeholders:** Identify all stakeholders that rely on the center's networks.
- How does this align with center strengths and priorities? Are the center's strengths and priorities closely tied to specific stakeholders?

4) Guiding questions for Network

Explore how the center uses its network to strengthen undergraduate STEM education in each of the following areas.

Respond to any/all that apply to your center's mission.

A. Connect/link individuals to resources, mentors, and one another

1. What are the key resources specific to undergraduate STEM education that your center connects individuals to? (*Note: key resources may be internal/external as applies to individual center operation.*)
2. Some examples of center resources may include: student-centered learning spaces, various supports for evidence-based teaching and learning practices, diversity initiatives, mentor training, fellowships, support navigating STEM ed pathways, etc.
3. Describe *a few of the ways* center networks connect individuals to the resources mentioned above.
4. Does the center provide opportunities and points of entry for individuals to engage in externally and/or internally funded initiatives? If yes describe a few of the key ways the network facilitates this process.

5. Identify mentoring opportunities, specifically related to undergraduate STEM education, that your center connects individuals to? (individuals = any engaged w/the center e.g., faculty, students, external stakeholders)
6. Some examples of mentoring opportunities may include: undergraduate research experiences, course-based research, internships, community service/STEM outreach.
7. Describe a few of the ways the center's network connects individuals (e.g. faculty, business/industry, community) to mentoring opportunities and if applicable to undergraduate student mentees.
8. Are there ways in which the center's network connect students to other students engaged in undergraduate STEM education initiatives/programs to increase awareness of opportunities, build community, and strengthen participation. How important is this to your center's mission?
9. Consider indicators that could be used by the center to demonstrate its network has connected individuals to each of these areas (resources, mentoring opportunities, mentors, and one another). List and briefly describe any that come to mind. (e.g., cross-pollination between center programs, recommendation of center program(s) by participants (students and/or faculty), students finding internships, faculty mentors working together on undergraduate research experiences).

B. Build complementary partnerships between initiatives

Through its network, the center initiates/establishes connections between existing initiatives, and new and existing initiatives, to build complimentary partnerships and maximize available resources. The center may also coordinate complimentary SEC/CTL contributions to these initiatives.

1. Describe a few of the ways the center's network brings initiatives together.
 - a) Some examples are listed below.
 - i. Center engagement in educational research initiatives and/or innovations seeds collaborative efforts
 - ii. Center engagement in national initiatives broadly encourages participation by a diverse array of campus initiatives
 - iii. The center builds partnerships for externally funded proposals & advises on grant funding
 - iv. Center's internally funded curricular initiatives allow for a coordinated approach
 - v. The center coordinates student programming which engages the participation of a diverse array of campus initiatives
 - b) Are there particular strategies that have worked well for your center?
2. Describe a few of the ways the center's network has facilitated the coordination of SEC/CTL resources and expertise to support initiatives? (i.e., playing to center strengths.)
3. Are there ways in which the partnerships and coordinated approach facilitated through/by the center have strengthened the impact of these initiatives? Briefly describe.
4. Consider the various forms of evidence your center could use to demonstrate the impact of its network in this area?
5. In what ways does the center build awareness among initiatives of this role?
6. Could your center strengthen the ways it uses its network to coordinate initiatives? If so, in what ways would this benefit the center?
7. What additional resources would assist the center in advancing their goals in this area?

C. Increase communication & collaboration between stakeholders, both internal/external to the institution

1. Consider the ways your center increases communication among stakeholders. Which have been the most impactful for your center? Briefly describe.
Some examples include:
 - a) Use of the center as a meeting place for stakeholders engaged in STEM programs & initiatives
 - b) Center contributions to and engagement in externally funded awards & broader impacts
 - c) Through its network the center facilitates communication between stakeholders engaged in undergraduate STEM education
 - d) Center involvement in regional and/or national initiatives
 - e) Center involvement in local community and with business/industry
2. What resources have assisted your center the most in this area? Please describe the key aspects.
Some examples include:
 - a) Center director
 - b) Center staff
 - c) STEM faculty who are affiliated with the center, faculty champions, etc.
 - d) External and internal funding for STEM education initiatives
 - e) Educational research and/or assessment and evaluation expertise in teaching and learning
 - f) Partnerships with local community? Business/industry?
3. What would assist your center the most in developing this area further?
4. Are there ways in which your center incentivizes engagement among key stakeholders?

5) Map Programs/Activities/Research/Initiatives to Subareas

Use the Table N1 provided on page xx to map center programs/activities/initiatives/research to each Network Subarea.

6) Map Resources to Subareas

Next complete Table R1 on page (xx) and map center resources to the Network mid-level support area. Use Table N1 as a resource as you fill out Table R1, which includes: human resources (e.g., staff FTE, affiliated faculty, students), structural resources (e.g. space, location), and financial resources devoted to the center's Network.

7) A Rubrics

The center fills out Rubric A for each of the three corresponding sub-areas associated with Network, and applies the guiding questions filled out above.

- Rubric A10—Link Individuals
- Rubric A11—Build collaborations/partnerships between initiatives
- Rubric A12—Increase communication/collaboration between stakeholders

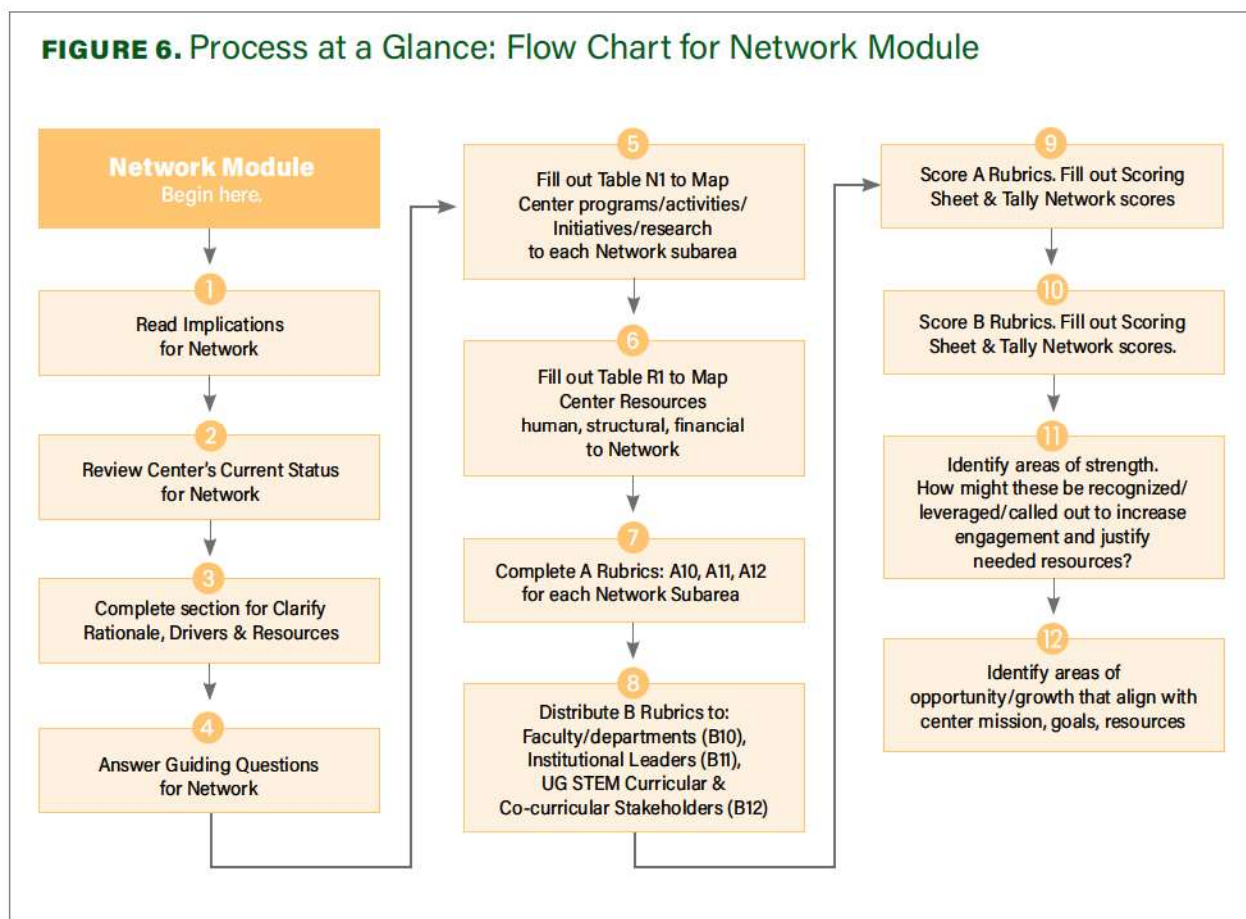
8) B Rubrics

To gain a systems perspective of the center's Network role within the institutional context the center distributes Rubric B to 3 groups:

- Rubric B10—Faculty and Departments
- Rubric B11—Institutional Leaders (Deans, Provost, Vice President for Research, etc.)
- Rubric B12—UG STEM Curricular and co-curricular stakeholders (internal and/or external as applicable to the center's mission)

Rubrics should be filled out by a representative sample of each group (i.e. several faculty/departments, etc.)

FIGURE 6. Process at a Glance: Flow Chart for Network Module



All A Rubrics are to be filled out by the center after completing steps 1-6 for this mid-level support area.

RUBRIC A10. Network: Link Individuals

At what level does the center's network connect/link individuals engaged in undergraduate STEM education improvement?

Level	Description	Link individuals to resources, mentors, and one another
0	N/A	The center is not directly engaged in this area. It may link individuals through its programming and services.
1	Emerging (Nascent phase)	The center may be new and/or expanding its focus in ug STEM education. The center begins to develop/establish its network as a resource for individuals engaged in ug STEM ed teaching and learning. The center begins to link individuals to resources, mentoring opportunities, mentees, and one other.
2	Progressing	The center's network experiences a modest increase in engagement as the center expands resources, opportunities and connections, which enhance the utility of its network for individuals in ug STEM. The center begins to collect data to understand how individuals are utilizing the network to inform its programming /activities.
3	Accomplished	The center's network has become a central resource that links individuals to valuable resources, mentoring opportunities, mentees, and external/internal stakeholders in ug STEM education. The center's network experiences high engagement and is relied upon across campus, and/or regionally. The center tracks network development and/or activity data to refine its resources and programming to strengthen its impact on ug STEM education.
4	Advanced	The center's network is relied upon, experiencing high engagement, which continues to sustain its role and effectiveness across campus, regionally, and/or nationally. The network continues to expand as a central resource which increases its ability to link individuals to valuable resources, mentoring opportunities, mentees, and external/internal stakeholders in ug STEM education. The center continues to track network activity data to refine its resources and programming.

Evidence for Assessment: Centers summarize the reason for their assessment (e.g. we are advanced and here is why, pointing to guiding questions for evidence).

RUBRIC A11. Network: Build collaborations/partnerships between initiatives

At what level does the center's network build collaborations/partnerships between initiatives engaged in undergraduate STEM education improvement?

Level	Description	Build collaborations/partnerships between Initiatives
0	N/A	The center is not directly engaged in this area. It may link initiatives through its programming and services.
1	Emerging (Nascent phase)	The center network begins to increase communication between initiatives as it develops as a resource/partner to support ug STEM education. The center identifies ways to integrate initiatives and apply center resources. Some collaborations between initiatives begin as a result of the center's network.
2	Progressing	The center's network continues to develop as a resource/partner to support ug STEM ed which increases its ability to initiate collaborations between ug STEM initiatives and develop a coordinated approach. The center develops strategies to support the integration of initiatives and apply SEC/CTL resources. More collaborations form between initiatives.
3	Accomplished	The coordinated approach facilitated through/by the center has strengthened collaborations between initiatives in ug STEM ed. The center has developed strategic partnerships to apply center resources to enhance participation within and across initiatives. Initiatives across campus and regionally have an increased knowledge of others working in ug STEM ed.
4	Advanced	The coordinated approach facilitated through/by the center has strengthened the impact of ug STEM ed initiatives. Several initiatives have formed on-going collaborations. The center's strategic partnerships apply SEC/CTL resources which enhance participation within and across initiatives. Initiatives across campus, and/or regionally, and nationally have an increased knowledge of others working in ug STEM ed.

Evidence for Assessment: Centers summarize the reason for their assessment.

RUBRIC A12. Network: Increase communication/collaboration between stakeholders

At what level does the center's network increase communication and collaboration between stakeholders engaged in undergraduate STEM education improvement?

Level	Description	Increase communication & collaboration between stakeholders
0	N/A	The center is not directly engaged in this area. It may link stakeholders through its programming and services.
1	Emerging (Nascent phase)	The center network begins to develop as a resource, which facilitates communication between internal/external stakeholders. Center identifies ways to enhance internal/external stakeholder communication around common goals for ug STEM education.
2	Progressing	The center's network has increased communication between some key internal/external stakeholders. A few new collaborations lead to increased interest & momentum in center programs and resources. Internal/external stakeholders recognize ways they can work with the center to have increased impact.
3	Accomplished	The center's network is recognized by internal/external stakeholders as a useful resource, and experiences high engagement. Several new collaborations have continued to drive stakeholder interest in and contributions to center programs and resources for ug STEM education. The center's network enhances student opportunities, interest, and retention in ug STEM.
4	Advanced	The center's network provides a key communication portal among internal/external stakeholders. Increased communication and collaboration elevate stakeholder engagement & continue to drive contributions to programs and resources for ug STEM education. The network provides a sustained contribution to student opportunities and retention in ug STEM education.

Evidence for Assessment: Centers summarize the reason for their assessment.

All B rubrics are to be filled out by a variety of institutional leaders, faculty/department chairs, and curricular and co-curricular stakeholders.

RUBRIC B10. Faculty/Departmental perspective on the center's Network role.

At what level does the center's network broadly increase engagement in the improvement of undergraduate STEM education?

Prior to rating, please estimate your level of engagement with the center on a scale of 1–5, with 5 being the highest.

LOWEST ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 HIGHEST

Read the description for each level, and select the one that represents your experience with the center's contribution, and provide support for your selection in the comment column.

Level	Description	Faculty/Department Engagement	Comments
0	Autonomous	The center is not engaged in a network role for ug STEM education. Faculty and departments work independently of the center.	
1	Emerging	The center's network is developing as a resource and begins to engage faculty and departments by linking individuals to resources, mentoring opportunities, mentees, initiatives, and various stakeholders in ug STEM education.	
2	Progressing	The center's network has expanded faculty collaborations/partnerships, and assists in making connections to initiatives and stakeholders in ug STEM education. A few STEM departments and faculty utilize the center's network & associated resources.	
3	Accomplished	Several STEM departments and faculty utilize the center's network & associated resources. The network has increased interdisciplinary collaborations/partnerships in ug STEM education, enhances communication, and assists in coordination among initiatives and stakeholders.	
4	Advanced	The center's network experiences high engagement and makes significant contributions to ug STEM ed by connecting individuals, coordinating initiatives and increasing communication between stakeholders. The center's network assists faculty/departments in making contributions to the improvement of ug STEM education at the local institution, regionally, and/or nationally.	

RUBRIC B11. Institutional Leadership perspective on the center's **Network** role.

At what level does the center's network broadly increase engagement in the improvement of undergraduate STEM education?

Prior to rating, please estimate your level of engagement with the center on a scale of 1–5, with 5 being the highest.

LOWEST ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 HIGHEST

Read the description for each level, select the one that represents your experience with the center's contribution and provide support for your selection in the comment column.

Level	Description	Institutional Leader Engagement	Comments
0	Autonomous	The center is not engaged in a network role for ug STEM education. Institutional leaders work independently of the center.	
1	Emerging	The center's network is developing as a resource and begins to engage faculty & departments by linking individuals to resources, mentoring opportunities, mentees, initiatives, and various stakeholders in ug STEM education. Institutional leaders are aware that the center is developing a network to increase engagement in ug STEM education.	
2	Progressing	The center's network grows as a resource and experiences increased engagement of individuals (faculty/students/ departments and internal/ external stakeholders), which increases its ability to link individuals to resources. A few institutional leaders visibly support and acknowledge the value of the center's expanding network, and begin to utilize the center's network for dissemination, and as a resource.	
3	Accomplished	The center's network is recognized for its important contributions to ug STEM education. Institutional leaders regularly utilize the center's network to gather information for effective ways to obtain & allocate resources, to gather input, and to disseminate information on STEM specific priorities. The center's network has also increased the connection of institutional leaders to local, regional, and national initiatives in ug STEM education.	
4	Advanced	The center's network is valued for the key contributions it has made to improve engagement and link individuals/initiatives/ stakeholders in ug STEM education. The center's network continues to sustain engagement of institutional leaders in local, regional, and national initiatives in ug STEM education. This engagement strengthens the centers network and promotes visibility.	

RUBRIC B12. Undergraduate Curricular and Co-curricular perspective on the center's **Network role.**

At what level does the center's network broadly increase engagement in the improvement of undergraduate STEM education?

Prior to rating, please estimate your level of engagement with the center on a scale of 1–5, with 5 being the highest.

LOWEST ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 HIGHEST

Read the description for each level, select the one that represents your experience with the center's contribution, and provide support for your selection in the comment column.

(To be filled out by a variety of undergraduate STEM curricular and co-curricular stakeholders.)

Level	Description	UG STEM Curricular/ Co-Curricular Engagement	Comments
0	Autonomous	The center is not engaged in a network role for ug STEM education. UG STEM curricular/co-curricular work independently of the center.	
1	Emerging	The center's network is developing as a resource and begins to engage and connect internal and external stakeholders who contribute to ug STEM education curricular/co-curricular resources & opportunities.	
2	Progressing	The center's network experiences increased engagement by internal and external stakeholders, which enhances its capacity to contribute to curricular and co-curricular resources and opportunities in ug STEM education.	
3	Accomplished	The center's network has strong engagement from individuals, initiatives and stakeholders. The network has enhanced its ability to provide linkages to real world/applied opportunities (research, internships, K-12 education, community service, etc.) for ug STEM education and has expanded curricular and co-curricular contributions.	
4	Advanced	The center's network makes significant contributions to ug STEM education by connecting individuals and increasing communication between stakeholders. The network offers extensive linkages for STEM education curricular/co-curricular resources & opportunities. The center's network assists stakeholders in developing a coordinated approach to apply resources & increase impact.	

TABLE N1. Map Center Programs/Activities/Research/Initiatives to Each **Network** Subarea

To use this table, Centers list relevant programs/activities/initiatives/research in column 1, in column 2 check off the subareas that apply those listed in column 1, and record notes/evidence in column 3.

Programs/activities/ research/initiatives	Network Subareas			Notes/ Evidence
	Link Individuals	Build Partner- ships btw Initiatives	Incr. Comm & Collab btw Stake- holders	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☒	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	
	☐	☐	☐	

Resource Mapping

Refer to the Model for Center Practices in Undergraduate STEM Education on page 7.

TABLE R1. Purpose: To map resources to each mid-level support area

Resource Allocation		Centralize	Use of Data	Translation	Network
Human	Staff				
	Faculty				
	Student (undergrads, grads, post-docs)				
	Other				
Structural	Location				
	Reporting				
	Meeting space				
Financial	Budget %				
	Intramural				
	Extramural				

SCORING SHEET: A Rubrics

Center Perspective from within: Overall Self-Assessment of Center's Mid-Level Support

Directions for filling out this scoring sheet:

- Gather all A rubrics
- For each mid-level support area, enter scores for each corresponding subarea in the boxes.
- Add the three subarea scores for each mid-level support area together, and enter the total score in the box provided.
- Use the scale to obtain a benchmark assessment for the center in each of the four mid-level support areas.

Scale												
0	1	2	3	4	5	6	7	8	9	10	11	12
Not present	Emerging				Progressing		Accomplished			Advanced		

1) Centralize: Tally Scores for Rubric Subareas

A1 Unify:

A2 Elevate:

A3 Infrastructure:

Total (A1+A2+A3): _____ →

2) Use of Data: Tally Scores for Rubric Subareas

A4 Educational Research:

A5 Evaluation and Assessment:

A6 Guide Implementation and Reform:

Total (A4+A5+A6): _____ →

3) Translation: Tally Scores for Rubric Subareas

A7 Bridge Research to Practice:

A8 Across Levels Faculty/Admin (Vertical):

A9 Across STEM Departments (Horizontal):

Total (A7+A8+A9): _____ →

4) Network: Tally Scores for Rubric Subareas

A10 Connect Link w/Resources & Mentors between individuals:

A11 Build Complementary Partnerships between initiatives:

A12 Increase Communication & Collaboration between stakeholders:

Total (A10+A11+A12): _____ →

See next page for Rubric B.

SCORING SHEET: B Rubrics

Systems Perspective within Institution: Overall Feedback on Center's Mid-Level Support

Directions for filling out this scoring sheet:

- Gather all B rubrics
- For each mid-level support area, enter scores for each corresponding subarea in the boxes.
- Add the three subarea scores for each mid-level support area together, and enter the total score in the box provided.
- Use the scale to obtain a benchmark assessment for the center in each of the four mid-level support areas.

Scale												
0	1	2	3	4	5	6	7	8	9	10	11	12
Not present	Emerging				Progressing		Accomplished			Advanced		

1) Centralize: Tally Scores for Rubric Subareas

B1 Faculty/Departmental:

B2 Institutional Leadership:

B3 Curricular/Co-curricular:

Total (B1+B2+B3): _____ →

2) Use of Data: Tally Scores for Rubric Subareas

B4 Faculty/Departmental:

B5 Institutional Leadership:

B6 Curricular/Co-curricular:

Total (B4+B5+B6): _____ →

3) Translation: Tally Scores for Rubric Subareas

B7 Faculty/Departmental:

B8 Institutional Leadership:

B9 Curricular/Co-curricular:

Total ((B7+B8+B9): _____ →

4) Network: Tally Scores for Rubric Subareas

B10 Faculty/Departmental:

B11 Institutional Leadership:

B12 Curricular/Co-curricular:

Total (B10+B11+B12): _____ →

Reference Page: Consult this larger version of Figure 2 as you move through each of the modules.

Model for Center Practices in Undergraduate STEM Education

