LEADERSHIP FOR INTERDISCIPLINARY LEARNING:
A PRACTICAL GUIDE TO MOBILIZING, IMPLEMENTING, AND SUSTAINING CAMPUS EFFORTS

BY SUSAN ELROD AND MARY J. S. ROTH
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LETTER FROM THE AUTHORS

Colleagues,

We are pleased to release this guide, entitled “Leadership for Interdisciplinary Learning: A Practical Guide to Mobilizing, Implementing, and Sustaining Campus Efforts,” that translates the recommendations from Project Kaleidoscope’s (PKAL) What Works in Facilitating Interdisciplinary Learning in Science and Mathematics Summary Report (AAC&U 2011) into a strategic flow of leadership actions. This report grew out of the Keck/PKAL Facilitating Interdisciplinary Learning project. The intent in this guide is to offer campus leaders—both formal and informal—a roadmap for planning, implementing, and sustaining innovative interdisciplinary programs. This guide is organized in a process-oriented manner to help leaders get started with key strategies and benchmarks for beginning the planning process with the end in mind—that is, with key questions and actions that will increase the odds that interdisciplinary programs will be effectively implemented and maintained over the long term.

The guide outlines key questions for each of three phases in the process: mobilizing, implementing, and sustaining. Each question is intended to drive critical thinking about institutional intent, assumptions, and context for interdisciplinary learning. Each question is followed by a set of benchmarks for checking to see if the campus has adequately addressed the question as well as strategies, from the experiences of twenty-eight campus teams who participated in the project, for “getting to yes” in addressing the question.

In the final section of this guide, which focuses on institutionalizing and sustaining, we apply Bolman and Deal’s “four frames” model of organizational theory from Reframing Organizations (2004) to the most challenging aspect of interdisciplinary program development—long term sustainability. Our rationale in taking this approach was to help institutional leaders view challenges they may face when institutionalizing an interdisciplinary program from multiple perspectives. We hope that this approach will help leaders “reframe” the issues, clarify thinking, and test assumptions in order to create sustainable programs. As suggested in Reframing Academic Leadership by Bolman and Gallos (2011), “Reframing is the deliberate process of looking at a situation carefully and from multiple perspectives, choosing to be more mindful about the sense-making process by examining alternative views and explanations.”

Finally, while this project engaged campus teams around programs in undergraduate STEM (science, technology, engineering and mathematics) learning, we believe that leaders who are working on any type of interdisciplinary program will benefit from the guide.

All the best,
Susan Elrod, Executive Director
Project Kaleidoscope
AAC&U

Mary J. S. Roth, Associate Provost and PKAL Fellow
Lafayette College
INTRODUCTION

Interdisciplinary learning is a twenty-first-century imperative. We are continually faced with societal and global challenges that require interdisciplinary thinking to identify suitable solutions, such as finding new energy sources, dealing with the effects of our changing climate, and ensuring populations across the globe have adequate food and healthy living environments. In addition, research in the STEM (science, technology, engineering, and mathematics) disciplines is increasingly crossing traditional disciplinary lines with scientists and engineers collaborating in both basic and applied research projects.

In *A New Biology for the 21st Century*, a 2009 report from the National Academies, the interdisciplinary and integrative nature of the biological sciences is described with respect to issues related to global food, health, environment, and energy challenges. This report follows on the heels of others from the National Academies, such as the 2004 report *Facilitating Interdisciplinary Research*, which outlined specific strategies for making research environments more conducive to collaboration. Thus, all college graduates—STEM majors as well as non-majors—must be able to traverse the complexities of our interdisciplinary and integrated world effectively.

In order to identify specific strategies for facilitating interdisciplinary learning, teams from twenty-eight colleges and universities—representing a broad spectrum of postsecondary missions—participated in the Keck/PKAL Facilitating Interdisciplinary Learning project, funded by the W. M. Keck Foundation. During the course of the project, more than three hundred faculty and campus leaders were engaged, participating in five national meetings, including two roundtables focused on assessment and leadership. Teams were chosen based on
their vision for and commitment to an interdisciplinary learning project; most teams were at the beginning of a process for creating a new interdisciplinary program or facility on their campus (selected campus case study summaries are found in appendix A). Teams were surveyed at the beginning and the end of the project regarding institutional structures, barriers, climate, and other issues. Teams submitted annual reports as formative measures of progress.

This guide translates the recommendations from this initiative into a roadmap for campus leaders who are seeking to plan new or create revised interdisciplinary programs that can be sustained over the long term. The recommendations from the initiative are described in the project’s summary report and additional details about the project can be found on the project’s website: www.aacu.org/pkal.

How to Use This Guide

This guide is devised as a roadmap that is framed as a series of questions that leaders can use to develop an action plan for planning, implementing, sustaining, and evaluating interdisciplinary learning experiences for students. The roadmap follows the process of building and sustaining interdisciplinary programs described in the Keck/PKAL summary report (see fig. 1).

The process begins with mobilizing a team of faculty and campus leaders to plan the program or projects. Once planned, programs are implemented, starting small with pilot programs that are tied to deliberate assessment methods that will measure the initial success and point to places for improvement and

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scale-up. The final stage, sustaining, is the most difficult. To achieve this stage, campuses must commit to the program, reviewing the evidence of its success and then refining infrastructure and resource requirements, and persisting in supporting the program over the long haul.

The guide uses a flow chart approach that is aligned with the model described above and that creates a framework for developing and implementing an action plan for more intentional and successful interdisciplinary programs. Each of the three boxes in the figure represents one of the main phases in the process: mobilize, implement, and sustain. This guide is organized in three main sections corresponding to the main phase in the process. Each section relates key questions to ask regarding each phase, the strategies for completing the phase, and the benchmarks for success regarding each of the three main phases shown in figure 1.

In addition, summaries of selected campus case studies from the project are provided in appendix A, and a mapping of campus projects to the five recommendations identified by the initiative is provided in appendix B.
I. MOBILIZING INTERDISCIPLINARY PROGRAMS

Critical issues at the mobilization stage are defining the interdisciplinary vision and goals, knowing the institutional context, and providing an experimental space for idea generation and the testing of new ideas. Communication, inclusiveness across disciplines, and transparency of process are important factors during this stage, which can take from three to twelve months or more.

Figure 2. Getting Started
Are you planning new or revised interdisciplinary programs? Here’s how to mobilize your campus for action.

QUESTION 1
Is interdisciplinary learning a part of your mission and/or strategic priorities?

YES

STRATEGIES
See page 7

NO

BENCHMARKS
See page 6

QUESTION 2
Do you know what your broader goals are for interdisciplinary learning?

YES

STRATEGIES
See page 9

NO

BENCHMARKS
See page 8
Have you assembled an interdisciplinary team?

Is there a culture of interdisciplinary teaching, research, and/or learning on your campus?

“Is it hard to mobilize faculty for any type of change if there is not an understanding of or vision for the recommended curricular reform.”

Adrianna Kezar and Susan Elrod, Change Magazine

Figure 2 (see below) shows the flow of critical questions campus leaders should ask during the mobilization phase to get started. If you answer “yes” to a question, then check the Benchmarks box to learn about indicators of success. If you answered “no” to a question, refer to the Strategies box to identify approaches and resources you might use to help you “get to yes.”
QUESTION 1

Is interdisciplinary learning a part of your mission and/or strategic priorities?

In order for programs to be sustained over the long-term, they have to be connected to the institutional mission and priorities. Otherwise, programs are doomed to compete with other more established institutional priorities. Therefore, the campus must be clear on the rationale and vision for interdisciplinary learning as it relates to the local context. It is the role of leaders to facilitate that process and do the communicating. They are critical voices for communicating the importance of interdisciplinary learning.

BENCHMARKS

- The campus has a clear, institution-wide definition of interdisciplinary learning. For example:
  - Students are able to solve problems that draw on multiple disciplines and able to seamlessly integrate information, data techniques, tools, perspectives, concepts, and/or theories from two or more disciplines or bodies of specialized knowledge to advance fundamental understanding to solve problems whose solutions are beyond the scope of a single discipline or area of research practice.
  - Students understand the inherent complexity of nature and society, have the desire to explore societal problems and questions that are not confined to a single discipline, and recognize the need to solve problems. (Adapted from National Research Council report *Facilitating Interdisciplinary Research* [2004])

- Interdisciplinary learning is articulated in key institutional documents, such as the campus mission statement, institutional strategic plan, or mission statements of appropriate academic units.

Proceed to Question 2, see page 8.
STRATEGIES

• Start by articulating a common understanding of STEM interdisciplinary learning goals that will drive the cycle of curricular innovation, development, assessment, and improvement.

• Relate the need for STEM interdisciplinary learning to national and global needs.

• Solicit and utilize insights from alumni, employers, and other stakeholders about the value of and/or experiences with interdisciplinary learning and learners.

• Examine curricular and pedagogical approaches to determine their potential to serve established interdisciplinary learning goals.

• Survey existing campus programs and practices (including assessment) to leverage resources to facilitate interdisciplinary learning and to aid in institutionalizing interdisciplinary learning.

• Stay informed of national trends, relevant resources, and projects of peers to ensure the latest methods and metrics are being employed, as well as to build from the work of colleagues.

• Remember that it is about the student as learner.

• Educate campus leaders regarding the benefits and value of interdisciplinary learning in the context of the campus mission as well as goals for students and faculty.

• Engage in the difficult conversations about the process of change and transformation.

• Use both formal and informal campus structures to have conversations and to communicate about interdisciplinary learning.

• Do a SWOT (strengths, weaknesses, opportunities, and threats) analysis focused on interdisciplinary issues as part of the planning process.

• Include non-STEM faculty and administrators in the conversations to provide broad perspective and gain buy-in from other, possibly unanticipated, corners of the campus.

• Make the case for interdisciplinary learning in the context of the changing nature of scientific research in the twenty-first century (more interdisciplinary and more focused on addressing real-world problems) as well as workforce development needs.

• Start with targeted, strategic areas of science that relate to emerging research or industry trends (e.g., nanotechnology, sustainability, climate science).

• A focus on global education may enable interdisciplinary learning in STEM and bring in other disciplines for broader campus participation.

Selected Readings on Establishing Interdisciplinary Learning as a Strategic Priority


QUESTION 2

Do you know what your broader goals are for interdisciplinary learning?

This question is focused on high-level institutional goals for learning, not specific program or course goals. For example, our goal is to foster students who understand the inherent complexity of science, nature, and society; have the desire to explore STEM problems and questions that are not confined to a single discipline; and recognize the need to solve problems whose solutions are beyond the scope of a single discipline or area of research practice. This vision for interdisciplinary learning is supported by an institutional culture in which there are articulated goals for students to be engaged as integrative learners.

BENCHMARKS

- AAC&U’s LEAP (Liberal Education and America’s Promise) Essential Learning Outcomes or another national framework of outcomes have been used to frame broad learning goals for all students.
- Student learning outcomes include statements that address interdisciplinary learning outcomes.

PROCEED TO QUESTION 3, SEE PAGE 10.
STRATEGIES

• Have discussions at various levels about what students should know and be able to do as a result of their undergraduate interdisciplinary learning experiences; keep all stakeholders informed about the process and outcome of those discussions.

• Engage in a campus-wide conversation, including students, student affairs, admissions, advancement, facilities, etc., regarding interdisciplinary learning to develop a shared vision. Take a holistic view of student learning across the entire experience, inside and outside the classroom. Connect interdisciplinary learning goals to campus-wide student learning goals.

• Connect interdisciplinary learning goals to institutional vision, mission, and strategic plans.

• Connect discussions of learning goals to accreditation processes and institutional student learning outcomes.

• Connect interdisciplinary learning goals to other learning goals—e.g., quantitative reasoning, critical thinking, personal and social responsibility; particular attention must be paid to the balance between breadth and depth when planning interdisciplinary learning experiences.

• Conduct an informal campus survey of faculty, staff, and students to gain broader feedback on interdisciplinary goals and/or activities. Ask students what their goals are and how they think they might be best achieved.

• Make interdisciplinary goals explicit in accreditation plans and reports.

• Use interdisciplinary programs as a way to create more inclusive learning environments that may be more attractive to women and underrepresented minority students.

Selected Readings on Setting Broader Goals for Interdisciplinary Learning


When completed, use the Question 2 BENCHMARKS on page 8 as a point of reference.
Is there a culture of interdisciplinary teaching, research, and/or learning on your campus?

Without the culture to support interdisciplinary learning, it will be difficult to sustain these kinds of programs over the long term. For maximum impact, there are a number of characteristics that a truly interdisciplinary campus culture should exhibit.

**BENCHMARKS**

- On your campus:
  - There is a visible and secure location in the campus organizational hierarchy for interdisciplinary programs (Klein 2010).
  - There are strong and experienced leaders (Klein 2010).
  - There is a sense of community and shared experiences (Klein 2010).
  - Faculty development programs support interdisciplinary teaching and learning (Klein 2010).
  - Faculty are engaged in interdisciplinary research projects.
  - Hiring, reviewing, and promoting faculty with interdisciplinary appointments is possible and occurs successfully.
  - Students are engaged in interdisciplinary capstone or other culminating projects.
  - There are existing interdisciplinary courses and programs.
  - It is relatively easy to get interdisciplinary courses and programs through the curriculum approval process.
  - Recognized faculty leaders are running interdisciplinary programs.
  - There are programs that help faculty teach and do scholarship in interdisciplinary areas.

Proceed to Question 4, see page 12.
STRATEGIES

- Start small and work within campus culture.
- Organize workshops and programs.
- Continue campus-wide conversations, with students, student affairs, admissions, advancement, facilities, etc., regarding interdisciplinary learning to develop a shared vision; take a holistic view of student learning across the entire experience, inside and outside the classroom; connect interdisciplinary learning goals to campus-wide student learning goals.
- Send faculty and staff to teaching, learning, and assessment conferences, meetings, and workshops. AAC&U, PKAL, and the Council for Environmental Deans and Directors are particularly useful resources.
- Invite faculty from other campuses to talk about their programs.
- Organize visits to institutions that have aspirational programs or facilities that include “deep dive” immersion experiences with programs or spaces that promote interdisciplinary learning.
- Seek collaborations and partnerships with other institutions sharing common programmatic issues or goals; it may also be useful to have comparative programmatic data to inform program improvement.
- Support and reward faculty work in assessing and improving existing interdisciplinary courses, programs, and student experiences.
- Be prepared to talk openly about the disciplinary “territory” issues and create mechanisms for dealing openly with them.
- Pay deliberate attention to the development and support of emerging campus leaders with interdisciplinary visions, interests, and responsibilities.

FROM THE INDIANA UNIVERSITY, BLOOMINGTON CASE STUDY

“A campus conversation was launched with the support of university administration, bringing faculty and students together to explore the meaning of an interdisciplinary program in human biology for the Indiana University Bloomington Campus. A shared vision began to emerge affording just the right push or tipping point for mobilizing an interdisciplinary learning community. Campus conversations were intentionally structured to challenge faculty and student thinking about interdisciplinary and educational paradigms that facilitate connections across disciplines.”

When completed, use the Question 3 BENCHMARKS on page 10 as a point of reference.
QUESTION 4

Have you assembled an interdisciplinary team?

The process of building and sustaining an interdisciplinary program or project requires mobilizing a team of faculty and campus leaders. Critical steps at this stage include knowing the institutional context (e.g., student interest, faculty expertise, local opportunities, funding opportunities, etc.), communication, inclusiveness across disciplines, and transparency of process.

BENCHMARKS

• Interdisciplinary team members:
  - Represent different disciplines
  - Include change agents
  - Include open skeptics
  - Include administrators
  - Include staff
  - May involve students

• The team has a well-defined purpose and goals.

• The team meets and communicates regularly, and is inclusive of a variety of viewpoints, experiences, and backgrounds.

Proceed to IMPLEMENTING INTERDISCIPLINARY PROGRAMS Question 1, see page 14.
STRATEGIES

• Include change agents, “on-the-fence folks,” and people who connect the work to administration and finance on project teams or committees.

• Membership should be flexible as the project evolves.

• Provide a clear charge for the team that is supported and reinforced by high-level institutional leadership.

• Establish realistic and achievable deadlines for team work.

• Create an ad hoc committee with a goal to develop a sustainable program such that the team is replaced by permanent support structures.

• Ensure teams have cross-disciplinary representation as well as administrative representation.

Selected Reading on Assembling Interdisciplinary Teams

When completed, use the Question 4 BENCHMARKS on page 12 as a point of reference.
II. IMPLEMENTING INTERDISCIPLINARY PROGRAMS

Figure 3 (see below) shows the flow of critical questions campus leaders should ask when moving from mobilization to implementation. If you answer “yes” to a question, then check the Benchmarks box to look for indicators of success. If you answered “no” to a question, refer to the Strategies box to identify approaches and resources you might use to help you “get to yes.”

Figure 3. Moving from Mobilization to Implementation
You have a vision, goals, a supportive culture, and a team...now how do you begin to implement?
Once faculty have been mobilized through cross-campus dialogues regarding interdisciplinary learning goals, assessment, and pedagogy, a strong campus team is in place to drive the initiative, and a critical mass of faculty support for interdisciplinary learning environments exists, then faculty can safely move to implementing their visions and plans. Implementation is facilitated by measuring interdisciplinary learning goals, obtaining needed resources, adjusting campus processes and policies, creating pilot courses and programs, developing incentives, and ensuring interdisciplinarity is included in governance and decision-making.

Adrianna Kezar and Susan Ebrod, Change Magazine
QUESTION 1

Do you have specific student learning outcomes for your program?
Without clear student learning outcomes, students’ learning experiences, our pedagogical methods, and our assessment of student learning become ambiguous and unsatisfactory.

YES

BENCHMARKS

• Learning outcomes for the program are SMART—specific, measurable, attainable, results-oriented, and time-bound.
• They relate to overall student learning goals for campus.
• They were collaboratively developed by the team.

Proceed to Question 2, see page 18.

LAFAYETTE COLLEGE
INTERDISCIPLINARY HEALTH
AND LIFE SCIENCES STUDENT LEARNING OUTCOMES

After completing the minor, students will
• Understand context of health and life sciences
• Demonstrate scientific literacy
• Apply the scientific process
• Describe the historical context of an interdisciplinary problem
• Recognize and be able to explain when an interdisciplinary approach to a problem is warranted
• Demonstrate communication skills required to work on interdisciplinary teams
• Analyze ethical issues underlying an interdisciplinary problem
• Use analytical, computational, and assessment skills necessary to integrate information
STRATEGIES

• Don’t rush—take the time to develop outcomes well.
• Consult Bloom’s taxonomy as a starting point to define student outcomes.
• Be certain that the outcomes you define are measurable.

Selected Readings on Developing Student Learning Outcomes


When completed, use the Question 1 BENCHMARKS on page 16 as a point of reference.
**QUESTION 2**

**Do you have a program type in mind?**

Interdisciplinary learning programs can come in a wide variety of forms, including course modules, bridge programs, first-year experiences, learning communities, community-based learning, research experiences, courses, certificates, general education requirements, minors, and majors. All of these programs can be successful as long as the program is a good fit for the mission and vision of the institution and is structured so that the students have a reasonable expectation of achieving the desired student learning outcomes.

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**BENCHMARKS**

- The student audience and purpose of the program are defined.
- The program type is structured to help students achieve the defined student learning outcomes.
- The program type is aligned with faculty, space, and other resources (either existing or planned).

Proceed to Question 3, see page 20.

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**INTERDISCIPLINARY CAMPUS PROGRAM TYPES**

- General education science course/series of courses
- Science courses for majors—introductory and upper-division courses
- Student learning communities organized around interdisciplinary topics or experiences
- Summer bridge programs
- Certificates
- Minors
- Majors
- Research experiences
- Faculty learning communities

Note: See appendix C to cross reference campus projects with different program types.
STRATEGIES

• Align program goals with campus mission, resources, faculty support, and student interests.

• Identify current area(s) of strongest potential for facilitating interdisciplinary learning, seeking to leverage new programmatic development in terms of student interest and existing interdisciplinary activity through courses, curriculum, and/or faculty research.

• Negotiate the difficult territory between the cultures of different campus units, departments, divisions, and colleges.

• Create collaborations and partnerships—internal and external—focused on established interdisciplinary learning goals.

• Use students as champions and advocates.

• Consider general education as a place to develop and implement interdisciplinary learning in STEM (and beyond)—leverage existing general education committee and review processes to support interdisciplinary outcomes.

• Leverage existing program or research strengths to foster interdisciplinary learning (e.g., marine science program, interdisciplinary research center, service learning program).

• Take advantage of opportunities in the local community to create interdisciplinary programs (e.g., study of a complex bioregion, environmental cleanup site, community organizations).

• Talk openly about the disciplinary “territory” issues and create mechanisms for dealing openly with them.

• Start small and work within campus cultures and environments to create the appropriate level and scope of interdisciplinary learning (e.g., freshmen seminars, linked courses, clusters of electives, gateway and capstone courses, and minors).

Selected Readings on Establishing an Interdisciplinary Learning Program


When completed, use the Question 2 BENCHMARKS on page 18 as a point of reference.
Do you have a plan for assessing student learning?

Institutions need to assess student learning for two primary reasons: program improvement and accountability. Assessment improves the quality of teaching, learning, planning, and decision making. Assessment also demonstrates the effectiveness of the program to concerned constituents.

BENCHMARKS

- The assessment plan relates directly to student learning outcomes.
- The assessment plan includes direct and indirect measures of student learning.
- The plan includes formative and summative assessment.
- The assessment plan has faculty and other resources assigned to it in order to make it sustainable over time.

SOME ASSESSMENT INSTRUMENTS REFERENCED IN CAMPUS REPORTS

- National Survey of Student Engagement (NSSE)
- Faculty Survey of Student Engagement (FSSE)
- Collegiate Learning Assessment (CLA)
- Association of American Colleges & Universities (AAC&U) VALUE rubrics
- Summer Undergraduate Research Experiences (SURE), Classroom Undergraduate Research Experiences (CURE), and/or Research on Integrated Science Curriculum (RISC)
- Student Assessment of Learning Gains (SALG)
- Field-Tested Assessment Guide (FLAG)
- Views about Science Survey (VASS)
- Course evaluations/student evaluations of faculty
- Embedded exam questions
- Other institutional data (course/program retention, Higher Education Data Sharing (HEDS))
- Biology Self-Efficacy Scale, Science Literacy Scale, Self-Determination Scale
STRATEGIES

• Accept that assessment is a dynamic and continual process that occurs over time.
• Align assessment methods with interdisciplinary STEM learning outcomes and goals; determine and adapt what works best for your community.
• Use or adapt existing instruments (e.g., National Survey of Student Engagement, Collegiate Learning Assessment, VALUE rubrics)—don’t reinvent the wheel unless absolutely necessary.
• Work with colleagues within and beyond the campus to explore, design, and pilot assessment approaches; participate in building a broader, informed community of assessment practitioners, locally and nationally.
• Document and publicize the impact of your efforts on student learning.
• Integrate interdisciplinary assessment tools and approaches into ongoing campus-wide program review, assessment, and accreditation efforts.
• Include students as collaborators in the processes of designing interdisciplinary pedagogies, assessment methods, and curricula.
• Take small steps—focus on measuring one learning outcome first, reviewing the data and making improvements on that outcome before attempting to measure and adjust others.
• Use a sampling approach when monitoring populations of students over time. It isn’t always necessary to measure the learning of every student all the time.
• Utilize faculty in science education with expertise in learning and assessment.
• Seek external funding to support initial phases of planning and assessment. Once program is up and running, ensure that assessment becomes institutionalized through appropriate campus processes and structures.
• Use an external evaluator to help monitor program progress when funds and expertise exist.

Selected Readings on Assessing Student Learning


When completed, use the Question 3 BENCHMARKS on page 20 as a point of reference.
QUESTION 4

Have you aligned the pedagogy to the program type, outcomes, and assessment?

Aligning the pedagogy is about creating the actual learning experience for the students. This is where faculty development plays a role. This is where you need to create pilot programs and to make improvements before scaling the approach up to all intended students. For example, after a new course is developed, create a small section to pilot it and use data to evaluate results before planning a full fledged section.

BENCHMARKS

• Faculty can document the connections between pedagogy and program type, outcomes, and assessment.
• The interdisciplinary program team has run a pilot that tests the connections and establishes meaningful baseline data for student learning or other program goals.
• The interdisciplinary program team has been engaged in the analysis of the pilot data.
• The interdisciplinary program team has made improvements before either offering a second pilot or scaling up the effort.

FROM THE OHIO STATE UNIVERSITY CASE STUDY

Interdisciplinary learning is important because we want to encourage students to become passionate about STEM majors and authentic interdisciplinary learning inquiry tasks have been shown to help students apply scientific concepts that might otherwise be abstract. When students can see the connections among concepts in the different STEM disciplines, they are better able to understand the importance and applicability of those concepts. The authentic interdisciplinary learning inquiry tasks also allowed students to develop scientific investigation skills and habits of mind, as well as encouraged intrinsic motivation to learn.

www.aacu.org/pkal/interdisciplinarylearning/guide.cfm

Proceed to SUSTAINING INTERDISCIPLINARY PROGRAMS Question 1, see page 26.
STRATEGIES

- Seek collaborations and partnerships with other institutions sharing common programmatic issues or goals.
- Use comparative programmatic or student success data to inform program improvement.

Selected Readings on Aligning the Pedagogy


When completed, use the Question 4 BENCHMARKS on page 22 as a point of reference.
III. SUSTAINING INTERDISCIPLINARY PROGRAMS

At this point in the interdisciplinary learning program roadmap, campus leaders have outcomes, a programmatic approach, an assessment plan, and have piloted the program. The challenge now is how to move from implementation to sustaining the program and institutionalizing it over the long term. Unfortunately, this is often the point when support for interdisciplinary programs falls apart. Specifically, if a program was created by a single faculty member or a small group of faculty working in isolation and is unconnected to institutional mission, goals, and culture, no foundation exists for institutionalization. However, if the strategies and approaches recommended in this guide have been used, the likelihood that the program can be sustained by the institution is high.

Institutionalization depends on alignment of supporting infrastructures with program needs in order to support the desired outcomes. This section of the roadmap is essentially about infrastructure and resources broadly defined and institutional cultures embracing and celebrating interdisciplinary programs.

The approach in this section no longer includes benchmark boxes because if you can answer yes to questions about sustaining interdisciplinary programs, you have already succeeded. Instead this section uses Bolman and Deal’s “four frames” model from Reframing Organizations (2004) as benchmark questions to focus the discussion and strategies on framing questions used by that model. In summary, the four frames are associated with the following points of view:

**QUESTION 1**
(Human Resource Frame)
Do you have (and can you keep) the right people?

**QUESTION 2**
(Structural Frame)
Do you have enabling structures?

In summary:
- Yes: Move forward with strategies.
- No: Consider the strategies below.

**STRATEGIES**
See page 27

**STRATEGIES**
See page 28

Figure 4. Moving toward Institutionalization
You have outcomes, a programmatic approach, and an assessment plan...
how do you move toward institutionalization?
• Human resources frame: Do you have (and can you keep) the right people?
• Structural frame: Do you have enabling structures?
• Political frame: Have you worked and created alignment with faculty governance?
• Symbolic frame: Do you celebrate faculty work in interdisciplinary areas and recognize achievement of key milestones in reaching interdisciplinary goals?

In the following sections, the strategies are focused on these four frames and the particular issues within those frames (subquestions) that are important to consider in order to achieve long-term success in interdisciplinary programs.

Figure 4 (see below) shows the flow of critical framing questions campus leaders should ask when moving toward institutionalization. Each question is followed by strategies that are grouped to reflect common issues that may impede sustainability of programs that you might use to help you “get to yes.” In addition, case studies from the project that addressed issues with respect to institutionalization can be found in appendix C.
QUESTION 1. (Human Resource Frame)

Do you have (and can you keep) the right people?

*People have a great capacity to learn and often an even greater capacity to defend old attitudes and beliefs. From a human resource perspective, the key challenge is to tailor organizations to individuals—to find a way for people to get the job done while feeling good about what they are doing.*

*Lee Bolman and Terrence Deal, Reframing Organizations (2004)*

*Effective academic leaders create caring and productive campus environments where all find ways to channel their full talents to the mission at hand and to work cooperatively with important others.*

*Lee Bolman and Joan Gallos, Reframing Academic Leadership (2011)*

As noted by Bolman and Deal, the following steps are key basic human resource strategies (136, 3rd edition):

- Build and implement a human resource management strategy
- Hire the right people
- Keep them
- Invest in them
- Empower them
- Promote diversity

If you have people with (1) appropriate interdisciplinary expertise, (2) appropriate incentives, and (3) appropriate faculty development, you have the essential elements for this frame.

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**Proceed to Question 2, see page 28.**
STRATEGIES

Strategies for hiring faculty and staff with appropriate interdisciplinary expertise
- Institute hiring procedures that permit the hiring of faculty who are not affiliated with specific departments but are instead affiliated with multiple departments and/or an interdisciplinary program.
- Seek new faculty lines that target areas of teaching and research at the interface of more than one discipline, in the context of an anticipated interdisciplinary initiative; for campuses with adjunct faculty, hire individuals with industry or other relevant work experiences that will bring the real world closer to students.
- Incorporate interdisciplinary teaching and assessment strategies in educational training programs for graduate students.
- Use memoranda of understanding to clearly outline expectations and responsibilities.
- Use Council of Environmental Deans and Directors documents on hiring and promoting interdisciplinary faculty: http://ncseonline.org/interdisciplinary-hiring-and-career-development-guidance-individuals-and-institutions
- Include a phrase about “interest in and/or experience with interdisciplinary programs” in disciplinary job advertisements; include related questions during the interview process.
- Create a clearinghouse list of faculty whose appointments are exclusively or partially in interdisciplinary programs.
- Engage early-career faculty at all levels. They have fresh relevant ideas and experiences, especially in the research realm.
- Provide refreshments at gatherings, when possible.

Strategies for faculty development and engagement
- Promote formal and informal conversations (within divisions, through learning/teaching centers, within campus committees, during retreats) that offer recurring opportunities for collective discussions about the value of interdisciplinary learning for students for whom faculty have common responsibility.
- Create faculty learning communities.
- Promote formal and informal conversations between interdisciplinary faculty as mentors and advisers with students pursuing and exploring interdisciplinary learning opportunities.
- Create campus faculty development opportunities to ensure competence in developing, assessing, and teaching in interdisciplinary learning environments.
- Promote faculty learning communities around interdisciplinary learning goals, program planning, and assessment.
- Offer workshops and programs through campus centers for teaching and learning that focus on interdisciplinary learning outcomes and assessment.
- Create and participate in regional networks of campuses or colleagues that leverage experience and expertise to create collaborations around interdisciplinary research and learning environments.

Selected Readings on the Human Resource Frame

After using one or more of these strategies, proceed to Question 2; see page 28.
QUESTION 2. (Structural Frame)

Do you have enabling structures?

Structures—commonly depicted by organization charts—are designed to fit an organization’s environment and technology. Organizations allocate responsibilities to participants... They then create rules, policies, procedures, and hierarchies to coordinate diverse activities into a unified strategy. Problems arise when structure is poorly aligned with current circumstances.

Lee Bolman and Terrence Deal, Reframing Organizations (2004)

Academic leaders succeed when they create an appropriate set of campus arrangements and reporting relationships that offer clarity to key constituents and facilitate the work of faculty, students, staff, and volunteers.

Lee Bolman and Joan Gallos, Reframing Academic Leadership (2011)

STRATEGIES

Strategies for creating workload policies that support interdisciplinary pedagogy and teaching

- Align budgetary structures, allocation, and reallocation procedures to support interdisciplinary programs, faculty, students, and spaces. It isn’t always about adding on, but often about redistributing—and the structures for both need to be transparent.

- Align institutional fundraising initiatives, including the search for federal agencies and private organizations, with support for programmatic and institutional goals regarding interdisciplinary learning.

- Integrate efforts to renew, recycle, renovate, and create new learning spaces in the process of making decisions about institutional priorities and budgets.

- Establish formal administrative structures and leadership positions in support of interdisciplinary programs (e.g., Center for Interdisciplinary Studies, dean of Interdisciplinary Studies, Center for Materials Science).

Strategies for review, promotion, and tenure (RPT) policies to support interdisciplinary teaching

- Review RPT policies for interdisciplinary support.

- Consider mechanisms for ensuring that divisional or campus-wide voices are heard in tenure and promotion decisions as they relate to interdisciplinary learning.

- Use memoranda of understanding to clarify how RPT decisions will be made for interdisciplinary faculty.

Strategies to create appropriate physical space for interdisciplinary programs/projects

- Integrate efforts to renew, recycle, renovate, and create new learning spaces in the process of making decisions about institutional priorities and budgets.

- Establish formal administrative structures and leadership positions in support of interdisciplinary programs (e.g., Center for Interdisciplinary Studies, dean of interdisciplinary studies, Center for Materials Science).

- Consider the adjacencies of faculty offices and gathering spaces for students; determine if they promote interdisciplinary interactions among faculty and students and between faculty and students.

- Repurposing space and other infrastructures allows institutions to address creatively needs for interdisciplinary learning in ways that aren’t additive, which ensures more complete integration into institutional culture.

After using one or more of these strategies, proceed to Question 3; see page 30.
• Create/renovate spaces and facilities to promote interdisciplinary learning. New spaces aren’t always required—renovations offer an opportunity to consider developing spaces that will facilitate interdisciplinary learning.

Strategies for funding interdisciplinary programs/projects
• Include development staff in planning meetings, or meet with them separately, to ensure interdisciplinary learning and program goals are on the fundraising agenda.

• Ensure interdisciplinary programs have the same rights and responsibilities as disciplinary programs, from approval to program review; ensure that interdisciplinary program faculty and/or directors are present at budget and other institutional planning meetings; create governance documents or memorandums of understanding to make explicit the support of interdisciplinary programs.

• Create transparent financial policies, including criteria for how budgets are established and reviewed; align program aims with needed resources.

• Negotiate or adjust indirect costs from interdisciplinary grants to go to interdisciplinary faculty development or interdisciplinary teaching buy out.

Strategies for communication to communities both internal and external to the institution
• Use the following communications channels to get the word out:
  – Web pages on the program, department, and university levels
  – Newsletters (print and electronic)
  – E-mail blasts or listserv postings
  – Blogs
  – Tweeting
  – Publishing articles in trade and education journals
  – Conference presentations

Selected Readings on the Structural Frame

QUESTION 3. (Political Frame)

Have you created alignment with shared governance?

[The political frame] sees organizations as arenas, contests, or jungles. Parochial interests compete for power and scarce resources. Conflict is rampant because of enduring differences in needs, perspectives, and lifestyles among competing individuals and groups. Bargaining, negotiation, coercion, and compromise are a normal part of everyday life. Coalitions form around specific interests and change as issues come and go. Problems arise when power is concentrated in the wrong places or is so broadly dispersed that nothing gets done.

*Lee Bolman and Terrence Deal, Reframing Organizations (2004)*

Skilled academic administrators are compassionate politicians who respect differences, manage them productively, and respond ethically and responsibly to the needs of multiple constituencies without losing sight of institutional goals and priorities.

*Lee Bolman and Joan Gallos, Reframing Academic Leadership (2011)*

One of the greatest perceived barriers to sustaining interdisciplinary programs is conflict within departmental silos/territories/expectations—particularly conflict associated with competition for resources (financial, student, faculty, space). Most institutions are organized in a departmental structure that can create silos that are difficult to negotiate. However, departments don’t have to be a barrier and the strategies below provide approaches to navigating this complicated political terrain.

In addition, considerations must be given to including the leaders of interdisciplinary programs in appropriate faculty governance structures.

Other common stumbling blocks are the curriculum approval procedures that are frequently aligned with traditional departmental and governance structures.

Proceed to Question 4, see page 32.
STRATEGIES

Strategies for including departments in the conversation

• Create strategies to address perceived departmental barriers early in the process—don’t ignore departments in the process. Include them early on, especially the department chair or other department leaders.

• Look for ways to align interdisciplinary learning discussions with faculty research interests and projects.

• Work to ensure interdisciplinary programs have the same rights and responsibilities as disciplinary programs, from approval to program review; ensure that interdisciplinary program faculty and/or directors are present at budget and other institutional planning meetings; create governance documents or memorandums of understanding to make explicit the support of interdisciplinary programs.

Strategies for including interdisciplinary faculty on faculty governance committees

• Ensure multiple disciplines are present, including those not obviously connected with current interdisciplinary programs.

• Put out a campus-wide call for volunteers—you never know who might have interdisciplinary interests and/or research programs.

Strategies for achieving curricular approval and establishing review procedures that are friendly to interdisciplinary programs/projects

• Ensure campus curricular approval and review processes enable the development of interdisciplinary learning courses and programs.

• Create a new structure or subcommittee to review interdisciplinary course and program proposals.

• Check that the curriculum forms allow courses and programs to be identified as interdisciplinary, and provide space for various department level approvals and comments.

Selected Readings on the Political Frame


After using one or more of these strategies, proceed to Question 4; see page 32.
QUESTION 4. (Symbolic Frame)

Do you celebrate faculty work in interdisciplinary areas and recognize achievement of key milestones in reaching interdisciplinary goals?

The symbolic frame, drawing on social and cultural anthropology, treats organizations as tribes, theaters, or carnivals. It abandons assumptions of rationality more prominent in other frames. It sees organizations as cultures, propelled more by rituals, ceremonies, stories, heroes, and myths than by rules, policies, and managerial authority. 

Lee Bolman and Terrence Deal, Reframing Organizations (2004)

Good theater fuels the moral imagination, and successful campus leaders infuse everyday efforts with energy and soul.

Lee Bolman and Joan Gallos, Reframing Academic Leadership (2011)

Yes  

Congratulations! You are well on your way to sustaining interdisciplinary learning on your campus.

No
STRATEGIES

Strategies for celebrating faculty work

• Celebrate achievement of key interdisciplinary milestones and successes.
• Submit press releases regarding program accomplishments, outings, or events to the campus newspaper.
• Organize an alumni panel of the program during freshmen orientation or at homecoming.
• Host a speaker series on topics related to the interdisciplinary program goals.
• Ensure that program reports and accomplishments are sent to all levels of the administration.
• Visibly support interdisciplinary projects with travel funds, meeting space, and course release/reassignment.
• Ensure that formal campus leaders attend interdisciplinary project/program planning meetings.
• Support interdisciplinary faculty research alliances and partnerships by creating visible support mechanisms (funding and space allocation).

Selected Readings on the Symbolic Frame


FROM THE INDIANA UNIVERSITY, BLOOMINGTON CASE STUDY

“Students were eager to be a part of shaping the proposed degree program. They formed a student advisory group during the early campus conversations and this group would go on to become the student government within the program—electing officers, ratifying a constitution and electing a student member to the program’s advisory committee. These students assumed a leadership role in the program, convening student call outs, organizing movie nights, and coordinating unique learning opportunities for students and faculty. Students served as peer instructors in the program’s core courses and mentors and resident experts in area schools through their outreach activities. The student voice has played an important part in the program’s intellectual work, visioning and governance.”

www.aacu.org/pkal/interdisciplinarylearning/guide.cfm
APPENDIX A. SELECTED CASE STUDY SUMMARIES

The summaries in this appendix represent key strategies undertaken by the listed participating campuses. Listed artifacts can be found on the associated website or by contacting the campus representative directly. Mapping of these strategies to the mobilizing, implementing and sustaining flow chart questions described in this report is shown in appendix C. Note: For links to case study resources, go to www.aacu.org/pkal/interdisciplinarylearning/guide.cfm.

Bradley University
Peoria, Illinois

Objective
To develop new interdisciplinary STEM courses appropriate to meet the institution’s general education requirements

Successful Strategies
• Articulate alignment of the initiative with institution’s strategic plan
• Identify champions (faculty and administrative) from all STEM units on campus
• Identify barriers to faculty participation
• Align learning goals for interdisciplinary STEM courses with learning goals for general education program
• Provide incentives and professional development for faculty to engage in course development and assessment
• Create opportunities for faculty to collaboratively brainstorm interdisciplinary course topics and how they could contribute to these topics from their unique disciplinary perspectives (Imagineering of hypothetical new courses)

Artifacts
• Student learning outcomes
• Assessment plan

Contact
Kelly McConnaughay, Associate Dean
kdm@bradley.edu
CUNY New York City College of Technology
New York, New York

Objective
To engage student interest in interdisciplinary learning and to establish a faculty interdisciplinary STEM community

Successful Strategies
• Create faculty learning communities
• Conduct faculty workshops
• Connect to national and global needs (e.g., climate change, energy issues)
• Use a web site to create a synchronous and asynchronous environment for STEM learning
• Audit existing campus interdisciplinary initiatives
• Celebrate/publicize of interdisciplinary undergraduate research projects

Artifacts
• List of criteria for recognition as an interdisciplinary course

Contact
Reneta Lansiquot, Associate Professor of Technical Writing
rlansiquot@citytech.cuny.edu

Davidson College
Davidson, North Carolina

Objective
Increase opportunities for interdisciplinary learning for students: create policies for the hiring of interdisciplinary faculty, create greater stability for existing interdisciplinary programs, create more interdisciplinary majors

Successful Strategies
• Review of best practices both internal and external to Davidson
• Full administrative support
• Publicity for interdisciplinary successes
• Ramping up existing in-house interdisciplinary models
• Open and frequent communication with all stakeholders

Artifacts
• Structure for hiring, tenure, and promotion of interdisciplinary faculty

Contact
Scott Denham, Professor of German
scdenham@davidson.edu
Florida Agricultural and Mechanical University
(Florida A&M University)
Tallahassee, Florida

Objective
Establish a learning community to support a holistic approach to STEM education

Successful Strategies
• Implemented integrated research projects with STEM and non-STEM faculty
• Integrated interdisciplinary assessment into university’s Quality Enhancement Plan
• Developed interdisciplinary orientation course for first-year students
• Implemented seminar series to increase faculty and student engagement
• Held discussions with key stakeholders

Artifacts
• Syllabi for interdisciplinary orientation course for first-year students

Contact
Bernadette Kelley, Associate Professor of Education
Bernadette.kelley@famu.edu

Grinnell College
Grinnell, Iowa (with Carleton College, Hope College, and Indiana University)

Objective
Understand and assess student learning in science-rich interdisciplinary courses

Successful Strategies
• Interviewed faculty and students
• Conducted RISC survey (Research on Integrated Science curricula) at seven institutions
• Supported classroom research projects examining specific student learning outcomes

Artifacts
• RISC survey (Research on Integrated Science Curricula)

Contact
Jim Swartz, Dack Professor of Chemistry
swartz@grinnell.edu
**Indiana University**  
Bloomington, Indiana

*Objective*
Develop integrative undergraduate degree program in human biology

*Successful Strategies*
- Backward design approach
- Faculty driven development of curriculum and assessment
- Support from campus teaching and learning offices
- Partnerships with students and campus education experts
- Support for conference attendance and use of external experts to facilitate faculty learning related to assessment and evidence-based teaching practices

*Artifacts*
- Developmentally staged core competencies with longitudinal student e-portfolio assessment rubric for undergraduate interdisciplinary life science degree

*Contact*
Whitney Schlegel, Associate Professor of Biology  
wreilly@indiana.edu

**Jacksonville University**  
Jacksonville, Florida

*Objective*
Develop interdisciplinary project between biology and engineering

*Successful Strategies*
- Participation in a national research competition on a real-world problem

*Artifacts*
- Course syllabus

*Contact*
Lee Ann Clements, Professor of Biology and Marine Science  
lclemen@ju.edu
James Madison University  
Harrisonburg, Virginia  

**Objective**  
Development of courses and interdisciplinary research and learning experiences to develop connections between biology and mathematics  

**Successful Strategies**  
- Use of task forces with broad representation across disciplines  
- Academic program reviews  
- Planning new academic buildings and renovations to improve student learning  

**Artifacts**  
- Course syllabus  

**Contact**  
David Brakke, Dean, College of Science and Mathematics  
brakkedf@jmu.edu  

Lafayette College  
Easton, Pennsylvania  

**Objective**  
Development of a multidisciplinary life sciences minor program  

**Successful Strategies**  
- Inclusion in college’s strategic plan  
- Multidisciplinary team including administrators  
- Audit of faculty interest and ongoing initiatives  
- Review of best practices at other institutions  
- Learning community approach for team  
- Focus on mission and student learning outcomes—backward design  
- Development of hiring and review policies for interdisciplinary faculty positions (in conjunction with other multidisciplinary campus initiatives)  
- Faculty conversations program  
- Meetings with department heads in all areas of the college  

**Artifacts**  
- Summary of program elements  
- Rubric for assessment of student learning outcomes (to be used during annual retreat including students and faculty and focusing on presentations and discussions related to the students’ capstone projects)  

**Contact**  
Mary Roth, Associate Provost for Academic Operations  
rothm@lafayette.edu
The Ohio State University
Columbus, Ohio

Objective
Development of an integrated science course as part of Bridge Program for STEM majors

Successful Strategies
• Interdisciplinary steering committee
• Regular committee meetings
  – to facilitate opportunities for joint assignments and multi-disciplinary examples in skill courses
  – to discuss feedback and possible revisions
• Use of authentic problems for both faculty and students to learn importance of interdisciplinary learning
• Review of best practices from other institutions

Artifacts
• Course syllabus

Contact
Judith Ridgway, Assistant Director of the Center for Life Sciences Education
ridgway.14@osu.edu

University of Richmond
Richmond, Virginia

Objective
Design of first-year integrated quantitative science course

Successful Strategies
• Course release for faculty involved in project
• Realistic project schedule for development and implementation
• Regular meetings of project faculty
• Use of semester themes to integrate material

Artifacts
• Course syllabus

Contact
Lisa Gentile, Associate Professor of Chemistry
lgentile@richmond.edu
Willamette University
Salem, Oregon

Objective
To expand the interdisciplinary nature of Fundamentals of Neuroscience course—an introductory course in the sciences that is interdisciplinary and fulfills the science general education requirement while also serving as the gateway course for a major in neuroscience—and better understand how the course facilitated science literacy in order to create a model for other interdisciplinary science courses.

Successful Strategies
• Conduct pre- and post-assessment of students in the neuroscience course as well as students in traditional non-interdisciplinary introductory science courses
• Engage as many stakeholders as possible (focus on relatively new faculty)
• Parlay seed funding into new grant proposals
• Share information openly and advocate for other interdisciplinary stakeholders

Artifacts
• Break an argument task

Contact
Mark Stewart, Professor of Psychology and Associate Dean
mstewart@willamette.edu
## APPENDIX B. MAPPING OF CASE STUDY SUMMARIES TO FIVE KEY RECOMMENDATIONS

This appendix shows key strategies undertaken by the listed participating campuses organized by the key recommendations in PKAL’s summary report publication, *What Works in Facilitating Interdisciplinary Learning in Mathematics and Science* (AAC&U 2011). In this table, N/A represents recommendations that are not addressed in the case study summaries.

<table>
<thead>
<tr>
<th>CAMPUS</th>
<th>KEY RECOMMENDATIONS</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Articulate a common understanding of STEM interdisciplinary learning goals</td>
</tr>
<tr>
<td>Bradley University</td>
<td>Use assessment to connect interdisciplinary learning goals with program structure, content, and pedagogy</td>
</tr>
<tr>
<td></td>
<td>Build a critical mass of faculty from within and with new hires</td>
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<td></td>
<td>Incorporate interdisciplinary program needs into the process of campus governance and resource distribution</td>
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<tr>
<td></td>
<td>Align interdisciplinary learning with the institutional vision, mission, and identity</td>
</tr>
<tr>
<td></td>
<td>• Developed mission/ vision and learning outcomes for interdisciplinary STEM courses appropriate for inclusion in current general education program</td>
</tr>
<tr>
<td></td>
<td>• Aligned learning goals of interdisciplinary STEM courses with goals in place for general education program</td>
</tr>
<tr>
<td></td>
<td>• Took advantage of faculty who had been involved with previous interdisciplinary initiatives</td>
</tr>
<tr>
<td></td>
<td>• Identified champions, both in faculty and administration, from all STEM units on campus</td>
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<td></td>
<td>• Established formal structures for the administration of interdisciplinary STEM programs, including near-departmental status and the creation of a Center for STEM Education</td>
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<td></td>
<td>• Adopted strategic plan, which “ensures that our graduates are prepared for life and professions in a changing world, able to cross academic, geographic, and cultural boundaries…”</td>
</tr>
<tr>
<td>CUNY NYC College of Technology</td>
<td>• Developed criteria for interdisciplinary courses at institution</td>
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<td></td>
<td>• Inventoried ongoing interdisciplinary activities on campus</td>
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<tr>
<td></td>
<td>• Created interdisciplinary faculty learning community</td>
</tr>
<tr>
<td></td>
<td>• Established formal structures for the administration of interdisciplinary STEM programs, including near-departmental status and the creation of a Center for STEM Education</td>
</tr>
<tr>
<td></td>
<td>• Adopted strategic plan, which “ensures that our graduates are prepared for life and professions in a changing world, able to cross academic, geographic, and cultural boundaries…”</td>
</tr>
<tr>
<td>Davidson College</td>
<td>• Developed a strategic objective: “integration of knowledge”</td>
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<tr>
<td></td>
<td>• Made new hires in interdisciplinary areas</td>
</tr>
<tr>
<td></td>
<td>• Developed new interdisciplinary hiring, tenure, and promotion structures</td>
</tr>
<tr>
<td></td>
<td>• Aligned project with ongoing strategic planning and implementation process</td>
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<tr>
<td>CAMPUS</td>
<td>KEY RECOMMENDATIONS</td>
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<tr>
<td></td>
<td>Articulate a common understanding of STEM interdisciplinary learning goals</td>
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<td>Use assessment to connect interdisciplinary learning goals with program structure, content, and pedagogy</td>
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<td>Build a critical mass of faculty from within and with new hires</td>
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<td></td>
<td>Incorporate interdisciplinary program needs into the process of campus governance and resource distribution</td>
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<tr>
<td></td>
<td>Align interdisciplinary learning with the institutional vision, mission, and identity</td>
</tr>
<tr>
<td>Florida A&amp;M University</td>
<td>• Integrated interdisciplinary assessment through the university’s Quality Enhancement Plan</td>
</tr>
<tr>
<td>Grinnell College</td>
<td>• Established a research collaboration across five colleges to assess student learning in STEM interdisciplinary courses</td>
</tr>
<tr>
<td></td>
<td>• Conducted Research on Integrated Science Curricula (RISC) survey</td>
</tr>
<tr>
<td>Indiana University</td>
<td>• Used campus conversation program to explore meaning of interdisciplinary program</td>
</tr>
<tr>
<td></td>
<td>• Incorporated authentic assessment strategies (e.g., scientific poster sessions and peer review) were in each course</td>
</tr>
<tr>
<td></td>
<td>• Required e-portfolio for longitudinal assessment of interdisciplinary learning outcomes</td>
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<tr>
<td></td>
<td>• Established partnership with campus education experts (rubric developed)</td>
</tr>
<tr>
<td></td>
<td>• Held summer institute and later retreat to bring faculty into the program and to help them explore interdisciplinary learning</td>
</tr>
<tr>
<td></td>
<td>• Aligned program mission intentionally with mission of institution</td>
</tr>
<tr>
<td>Jacksonville University</td>
<td>• Ensured broad communication of project results through web page, posters, etc.</td>
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<tr>
<td></td>
<td>• Aligned project with campus goal to improve health of nearby river</td>
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<tr>
<td>CAMPUS</td>
<td>KEY RECOMMENDATIONS</td>
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<tr>
<td>----------------------------</td>
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<tr>
<td>James Madison University</td>
<td><strong>Articulate a common understanding of STEM interdisciplinary learning goals</strong></td>
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<tr>
<td></td>
<td><strong>Use assessment to connect interdisciplinary learning goals with program structure, content, and pedagogy</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Build a critical mass of faculty from within and with new hires</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Incorporate interdisciplinary program needs into the process of campus governance and resource distribution</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Align interdisciplinary learning with the institutional vision, mission, and identity</strong></td>
</tr>
<tr>
<td>Lafayette College</td>
<td>• Held full-day retreat to develop mission statement and learning outcomes for program</td>
</tr>
<tr>
<td></td>
<td>• Established faculty conversations program</td>
</tr>
<tr>
<td></td>
<td>• Used capstone courses to directly assess program outcomes (rubric developed)</td>
</tr>
<tr>
<td></td>
<td>• Conducted inventory of current faculty with interdisciplinary interests aligned with initiative</td>
</tr>
<tr>
<td></td>
<td>• Developed new interdisciplinary hiring, tenure, and promotion structures</td>
</tr>
<tr>
<td></td>
<td>• Optimized use of existing courses and space resources</td>
</tr>
<tr>
<td>The Ohio State University</td>
<td>• Steering committee developed course and learning outcomes</td>
</tr>
<tr>
<td></td>
<td>• Used rubrics to assess student learning in bridge program</td>
</tr>
<tr>
<td></td>
<td>• Immersed faculty in authentic interdisciplinary learning situations to motivate them to learn more about interdisciplinary teaching</td>
</tr>
<tr>
<td>University of Richmond</td>
<td>• Articulated clear interdisciplinary program goals for students and faculty</td>
</tr>
<tr>
<td></td>
<td>• Use of RISC (Research on the Integrated Science Curriculum) survey</td>
</tr>
<tr>
<td></td>
<td>• Hired new faculty with interest in interdisciplinary education</td>
</tr>
<tr>
<td></td>
<td>• Adopted new strategic plan that called for “a distinctly integrated student experience”</td>
</tr>
<tr>
<td>Willamette University</td>
<td>• Built initiative on a faculty motion to create a more interdisciplinary curriculum</td>
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<tr>
<td></td>
<td>• Held campus conversations</td>
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<td></td>
<td>• Used Biology Self Efficacy scale (BSE)</td>
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<td></td>
<td>• Used science literacy questionnaire to conduct a survey</td>
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<tr>
<td></td>
<td>• Established faculty growth initiative</td>
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<tr>
<td></td>
<td>• Institutional support for faculty collaborations, team-taught courses, and new cross-disciplinary courses and programs</td>
</tr>
</tbody>
</table>

LEADERSHIP FOR INTERDISCIPLINARY LEARNING
**APPENDIX C. MAPPING OF CASE STUDY SUMMARIES TO ELEMENTS OF ACTION PLANNING DIAGRAM**

This appendix maps key strategies undertaken by participating campuses listed in appendix A to the mobilizing, implementing, and sustaining flow chart questions described in this guide. Shading represents strategies already begun when the campus joined the project; an X represents a key strategy implemented during the project period; N/A represents strategies that are not addressed in the case study summaries.

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<tr>
<th>CAMPUS</th>
<th>MOBILIZING</th>
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<td>Vision/ Mission</td>
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<td>CUNY NYC College of Technology</td>
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<td>James Madison University</td>
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<td>Lafayette College</td>
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<td>The Ohio State University</td>
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<td>University of Richmond</td>
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<tr>
<td>Willamette University</td>
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</tbody>
</table>

(ID= interdisciplinary)
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<thead>
<tr>
<th>Implementation</th>
<th>Sustaining</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Student Learning Outcomes</strong></td>
<td><strong>Choice of Program Type</strong></td>
</tr>
<tr>
<td>X</td>
<td>Gen Ed., ID science courses</td>
</tr>
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ABOUT THE AUTHORS

SUSAN ELROD is the executive director of Project Kaleidoscope (PKAL) at the Association of American Colleges and Universities (AAC&U). She holds a PhD in Genetics from the University of California–Davis and a BS in Biological Sciences from California State University–Chico. At PKAL, she leads national initiatives aimed at advancing what works in undergraduate STEM (science, technology, engineering and mathematics) education, facilitates regional and national conferences and workshops, and serves as a consultant to colleges and universities around the country. Elrod came to PKAL from Cal Poly–San Luis Obispo where she has been a professor of biological sciences since 1997. Elrod has taught extensively, conducted scientific and educational research, and most recently served at Cal Poly, San Luis Obispo, as associate dean in the College of Science and Mathematics and as director of the Center for Excellence in Science and Mathematics Education. She has experience in curricular reform, assessment and program evaluation, faculty development, accreditation, and strategic planning. She has led a wide array of STEM education initiatives on a range of topics in higher education, such as PKAL’s national initiatives on interdisciplinary program development, STEM transfer student success, sustainability in the undergraduate curriculum, and leadership development. She has experience leading programs in science teacher education and serves as a consultant regarding best practices for effective undergraduate STEM learning and student success. In 2006–07, she completed an American Council on Education Fellowship at the Colorado College where she studied leadership issues regarding interdisciplinary models of undergraduate learning. Elrod is also a PKAL Faculty for the 21st Century member.

MARY ROTH is associate provost and the Simon Cameron Long Professor of Civil and Environmental Engineering at Lafayette College in Easton, Pennsylvania. She received her degrees in civil engineering from Lafayette College (BS), Cornell University (MS), and University of Maine (PhD). She has authored or coauthored over fifty publications and has served as principal or co-principal investigator on seven grants from the National Science Foundation. At Lafayette College she has served as department head of Civil and Environmental Engineering and as director of Engineering, in addition to multiple faculty committee assignments. She has led campus-wide accreditation and assessment initiatives, implemented new faculty orientation programs, directed the development of multiple proposals to private foundations, and coordinated interdisciplinary academic programs. She has received a number of awards in recognition of her scholarship and teaching including a Fulbright Scholarship, an American Council of Education Fellowship, and multiple teaching awards. Roth is a member of American Society of Civil Engineers, American Society of Foundation Engineers, and American Society of Engineering Education and she serves on multiple advisory committees. She is also a member of Phi Beta Kappa and Tau Beta Pi and is a licensed engineer in the states of Maine and Pennsylvania.
Since its founding in 1989, Project Kaleidoscope (PKAL) has been one of the leading advocates in the United States for building and sustaining strong undergraduate programs in the fields of science, technology, engineering, and mathematics (STEM). With an extensive network of nearly 7,000 faculty members and administrators at over 1,000 colleges, universities, and organizations, PKAL has developed far-reaching influence in shaping undergraduate STEM learning environments that attract and retain undergraduate students. PKAL accomplishes its work by engaging campus faculty and leaders in funded projects, national and regional meetings, community-building activities, leadership development programs, and publications that are focused on advancing what works in STEM education. PKAL is now in partnership with AAC&U, building on a shared vision of shaping undergraduate learning environments that prepare all undergraduates to address the challenges they will face as leaders in the new global century.

The Association of American Colleges and Universities (AAC&U) is the leading national association concerned with the quality, vitality, and public standing of undergraduate liberal education. Its members are committed to extending the advantages of a liberal education to all students, regardless of academic specialization or intended career. Founded in 1915, AAC&U now comprises more than 1,250 member institutions—including accredited public and private colleges, community colleges and universities of every type and size.

AAC&U functions as a catalyst and facilitator, forging links among presidents, administrators, and faculty members who are engaged in institutional and curricular planning. Its mission is to reinforce the collective commitment to liberal education at both the national and local levels and to help individual institutions keep the quality of student learning at the core of their work as they evolve to meet new economic and social challenges.

Information about AAC&U membership, programs, and publications can be found at www.aacu.org.