
Undergraduate Research: Approaches to Success

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Undergraduate research programs differ significantly from one university to the next. The programs reflect the student body, the faculty, and the institution. Success therefore needs to be determined by achievement of institutionally defined goals for undergraduate research. That being said, one can still identify consistent features of successful programs, regardless of institutional setting. These features include recognition of the value of undergraduate research to students, faculty, department/institution, and society; establishment of goals and objectives; effective use of available resources; celebration of undergraduate research; and development of a sustainable program.

An institution seeking to establish or improve its undergraduate research program should start by creating a taskforce on undergraduate research. The members should include faculty from all academic units and faculty who have engaged in research or scholarly activity with undergraduate students. Ideally, the taskforce would be chaired by a recognized campus leader among the faculty, and one or more administrators with budgetary authority would participate as members.

Reflection on the value and/or benefits of undergraduate research within the context of the institution is the taskforce's first consideration. Typical benefits to students include in-depth knowledge in a discipline, understanding of the ethical considerations inherent in research, improvement of oral and written communication skills, learning to cope with uncertainty, and teamwork. Faculty benefits include, among others, increased research or scholarship supporting promotion, tenure, and merit considerations; livelier and more up-to-date teaching content; opportunities for external support; and intellectual growth. Finally, potential benefits to depart-

ments and institutions include increased visibility in the local community, the region, the state, and to funding agencies; increased ability to attract students; and increased donations from alumni and other stakeholders. Once the values and benefits of undergraduate research are agreed upon, it is easier to establish specific goals and objectives.

As other successful programs have done, the taskforce should then set goals or overarching directions for the undergraduate research program. These are important in developing a plan to assess the impact and learning outcomes of the program, and they are critical in guiding the collection of data used to support, or justify, continuation or increases in funding for undergraduate research. In these days of budget cutbacks and demands for accountability by legislators, demonstration of wise stewardship of funding is mandatory. Objectives are specific activities intended to support achievement of institutional goals. To illustrate the difference between goals and objectives, it is useful to provide examples. Goals for undergraduate research programs might include an increase in student engagement in research, introducing students to, and use of, disciplinary methods for exploring or creating new knowledge and introducing students to the kinds of "explorable" questions asked in a discipline and development of research that contributes new knowledge in a discipline. How might these goals be achieved? Objectives set achievable targets such as increasing the number of students engaged in research by 3% in one year and 10% in five years, or increasing the number of faculty engaged in research with undergraduates from 20% to 50% in five years, or hosting a Scholars Day program at the end of two years with at least 15 students presenting their research and increasing student participa-

tion in the program by five students every year thereafter.

In setting goals and objectives, some attention should be devoted to the timeline and identifying those faculty members or committees responsible for achieving the goals. Are goals short term (less than one year), intermediate (one to five years), or long term (more than five years)? Goals of different timelines are needed to sustain the ongoing effort. Long-term goals are particularly important so as to avoid stalling the effort to establish a culture of undergraduate research. Short-term goals are needed to create a sense of accomplishment early in the process.

Successful undergraduate research programs effectively use all available resources. Undergraduate research is not free! Resources typically required include faculty and student time; financial support for equipment, supplies, and travel; support for library and computer needs; and physical space. The undergraduate research taskforce, in conjunction with the academic units, should seek to identify those resources that are currently available at the institution. It may be easier to divide resource consideration into those needed for undergraduates and those needed for their faculty research mentors.

For undergraduates, academic credit for undergraduate research or independent study that can be applied to graduation requirements in a discipline is an unambiguous means to show future employers or graduate institutions that undergraduates are engaged in research. Students will need research space to conduct their studies. This space can be in faculty research space or in an unused classroom or laboratory (more likely during the summer term) and could include designated research space such as a carrel in the library. Students and faculty mentors alike will benefit if the student has space that can be accessed at different times and where experiments or library research can be left undisturbed. Library facilities with access to hardbound or electronic journals are needed for both student and faculty researchers. One of the most important resource issues for students is financial support. Summer is a prime time for conducting research by both faculty and students, yet this is precisely the time when students may need to earn money to support tuition and other college-related expenses. If a stipend is offered, students will be more likely to devote weeks of full-time effort to research and will in turn have a greater chance for a productive experience. Stipends can be in the form of scholarship support or can be a salary paid to the student.

Other activities that support an enriching research experience include a weekly or biweekly meeting with other students engaged in research and the opportunity for attending professional meetings. The former need not require more than locating space for meetings and faculty mentors willing to host them; the latter will require financial support for travel and conference registration.

More often than not, when faculty are asked what they need more than anything else to conduct research, the answer is "time." Time is needed to write proposals for funding and manuscripts for publication. Time is also needed for careful planning of a program of research effort and for conducting the research itself. Reducing the amount of time spent on teaching-related activities is one way to support research. Faculty must prepare and deliver lectures, write exams, and hold office hours, but there are many time-consuming tasks that could be accomplished by others. For example, undergraduate students could be hired to grade homework assignments or to assist in grading exams. Adjunct faculty could be hired for laboratory or recitation/discussion sections. Use of upper-class (junior or senior) peer instructors will benefit faculty, students in the class, and the peer instructors themselves. If faculty members are responsible for laboratory preparation, institutions should consider whether students or non-faculty personnel could be hired to perform those tasks. The question that should be answered is where is faculty time best spent? Is it in guiding undergraduates in research or is it in performing tasks that could be done by others?

Finding time for research is so important that serious consideration should be given to non-standard course scheduling within a term and over the academic year. This does not mean that faculty would be teaching fewer courses, but it does mean that a standard two-, three-, or four-course teaching assignment might be altered each term. Departmental review of current teaching schedules within a term might reveal alternative times for courses and laboratories that would concentrate teaching to three days a week instead of five days, thus providing faculty two days per week to focus attention on their research programs. The number of different course preparations within a term should be limited. Every course a faculty member has to prepare, even if they have taught the course before, requires additional time. This is a particularly important consideration for new faculty who need to establish research programs and

can be important for senior faculty who frequently are expected to serve on more committees. Groups of faculty, with support from their departments, could devise teaching schedules that are heavier in one term and lighter in another term. This strategy enables faculty to more efficiently use time by providing uninterrupted time for research. When a “focused” research term is linked with summer, significant progress can be made on a research project. In this teaching-research scenario, faculty would still be teaching the same number of courses per academic year—they would simply be dividing the teaching expectations unequally per term.

Other support for faculty research includes “in-load” recognition for undergraduate research. Training and mentoring an undergraduate in advanced research techniques is an intensive form of teaching that should be recognized. One of our institutions tracks the number of credit hours of undergraduate research for each faculty member. Once the number of credits reaches a specific number, the faculty member is entitled to one released course to pursue research. The number of needed credits might be equivalent to the number generated by a three-credit course elected by 12 students.

If the institution does not have a grants/sponsored research office or an undergraduate research office, creation of such offices will provide support for faculty. To expect faculty to identify external sources of funding, to handle all the details of submitting proposals, and to oversee grant expenditures for funded proposals takes time away from the actual research. These tasks can be assumed by staff. Likewise, an institution should consider whether it is more important to have faculty mentoring research with undergraduates or to have them organizing events like Scholars Days or serving as production managers for an undergraduate research journal. In short, any task that can be handled by students or staff should not be assigned to faculty.

Despite wise use of all available resources, additional resources are likely to be needed. A timeline for acquiring these new resources should be drafted, and discussions with the institution’s grants officer or director of sponsored research should be initiated to match needs with potential external sources of funding. Examples of federal agencies that support research in the sciences include NSF (CCLI, REU, and other programmatic grants), the National Institutes of Health (Academic Research Enhancement Awards [AREA]) for predominantly undergraduate institutions and R1 awards

for all institutions), Department of Energy (selected areas), and the Environmental Protection Agency. These are just a few of the possible sources. Support from state agencies, local government, private foundations (both national and regional), and industries is also possible. Some institutes, such as the Howard Hughes Medical Institute, provide support for targeted institutions and programs. Faculty should be assigned responsibility for applying for external support, and the application should be considered as part of his or her service obligation. A coordinated approach is more likely to garner support than a random series of requests.

Finally, the institution can send a strong message about its support of faculty-undergraduate research by making institutional funds available to support undergraduate research. These funds should be awarded competitively and should be allocated by a committee of faculty members. Besides faculty stipend support, institutions can establish a grant-matching fund because some external funding agencies expect a measure of institutional support for funding requests. Summer support for students is important as noted previously. Undergraduate research does require access to supplies and equipment. Mini-grant programs that support faculty-mentored student research have been developed by a number of institutions. Developing a mini-grant program also provides an opportunity to introduce students to the process and art of writing proposals.

Celebration of undergraduate research is another common feature of successful programs. Student recognition can be achieved in a variety of ways beginning with informal recognition by faculty mentors such as invitations to lunch or dinner to formal recognition at departmental meetings to campus-wide recognition at Research Days or Honors Convocations. Outstanding Senior awards and notations on undergraduate transcripts are other means of recognizing student participation in research. Faculty participation in undergraduate research should be recognized as well. Some institutions have created distinguished faculty research awards that also carry a monetary stipend. An inexpensive form of recognition is to feature faculty research in campus publications such as newsletters and to highlight faculty publications and grant awards at faculty meetings. Some campuses also honor faculty who have been successful in garnering external support with public recognition at a formal dinner hosted by the campus president. Certainly, faculty mentoring of undergraduates in research should be

recognized in merit pay increases and in promotion and/or tenure decisions.

Sustaining an undergraduate research program, the final common characteristic of successful programs, requires much thought and attention. It will be important for the institution's administration to publicly encourage and support undergraduate research on a regular basis. Administrators should be frequently identified with research. Ways to do this include statements supportive of research in campus publications and in public statements before stakeholders such as boards of governors. The taskforce created to initiate or improve undergraduate research ought to be rolled over into a standing committee on research policy that can advocate for research needs of faculty and students to the campus community.

Throughout this chapter, no definition of undergraduate research has been provided. Each institution should develop its own definition that reflects the interests and needs of the students, the faculty, and the institution. Because the definition is institutionally determined, undergraduate research can be, and perhaps should be, defined in myriads of ways. We offer two definitions as a starting point for an institutional conversation. The first has been adopted by the Council on Undergraduate Research (CUR), a national organization supporting faculty development and research with undergraduate students:

Undergraduate research is an inquiry or investigation conducted by an undergraduate that makes an original intellectual or creative contribution to the discipline.

John Strassburger offers a broader and more inclusive definition:

Undergraduate research is students working in partnership with faculty in discipline-based inquiries (1).

There are resources available to institutions seeking to initiate or improve undergraduate research. CUR has a website (<http://www.cur.org>) with links to useful resources. CUR also publishes *CUR Quarterly*, which contains articles of interest to administrators and faculty. CUR hosts the annual institute "Institutionalizing Undergraduate Research" for teams of faculty and administrators. This institute provides information and time to plan activities to improve the climate for undergraduate research. The CUR institute on proposal writing is also offered annually. This institute is designed for faculty who would benefit from an intensive time devoted

to writing a proposal and to critical feedback at the institute from experienced proposal writers. Information on Scholars Days and other celebratory programs can be found at <http://campus.murraystate.edu/services/USRA>. White papers from the Undergraduate Research Summit (2–4 August 2003) provide additional information on many of the topics addressed in this chapter. These papers are available at <http://www.bates.edu/x50818.xml>.

REFERENCE

1. Strassburger, J. 1995. Embracing undergraduate research. *American Association for Higher Education Bulletin*, May, pp. 3–5.