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From the Director

Renewed attention to the “teaching-research nexus” underlines the essential role of inquiry across the academic enterprise. In this issue of *Focus*, colleagues from diverse disciplines illustrate how they foster the development of their students’ research skills in contexts ranging from research experiences for individual students to learning experiences involving entire classes.



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Making Explicit the Implicit: Defining Undergraduate Research*

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The Carnegie Academy for the Scholarship of Teaching and Learning (CASTL) identified undergraduate research as one of the themes for its 2006-09 CASTL Leadership Program, and nine institutions in the United States, Canada, and the United Kingdom, as well as the Council on Undergraduate Research (CUR), were chosen to participate in the three-year project.

At the first meeting of the group, in October 2006, representatives from the participating institutions gathered in Washington, D.C., to discuss the definition, purpose, and benefits of undergraduate research. They also discussed ways in which the impact of undergraduate research on students could be assessed. Several of the participants agreed to return to their institutions and either review their current definition of undergraduate research or develop a definition.

In June 2007, the group met again at the University of Alberta, where the discussion began with consideration of the definitions of undergraduate research used

by the participating institutions. Because several institutions had begun formulation of their own definitions by referring to the definition developed by the Council on Undergraduate Research, participants first reviewed the CUR definition: “An inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline (www.cur.org).”

Our hope was to glean commonalities and then formulate our own working definition that could be used by the CASTL Undergraduate Research Team. After establishing a working definition, the team would be in a position to consider how one would be able to recognize high-quality research, which was the ultimate aim of the CASTL Team. Instead of moving quickly to common ground, however, discussion focused on tensions arising from aspects of the CUR definition and other colleges’ definitions of undergraduate research. These tensions regarding the various

components and practices of undergraduate research can be viewed on the following continua:

Student, process centered	↔	Outcome, product centered
Student initiated	↔	Faculty initiated
All students	↔	Honors students
Curriculum based	↔	Co-curricular fellowships
Collaborative	↔	Individual
Original to the student	↔	Original to the discipline
Multi-or interdisciplinary	↔	Discipline based
Campus/community audience	↔	Professional audience

In what follows, we will attempt to articulate some of the issues involved in each continuum, and also articulate the choices that must be made before useful definitions of undergraduate research can be formulated. The aim is to help those engaged in fostering and evaluating undergraduate research to become explicit about their values, so that research opportunities can be developed that most effectively reach their students.

Student Development versus Outcome Production

A key issue in defining undergraduate research is the purpose for which it is intended. Clearly, the majority of the participants at the 2007 CASTL gathering in Alberta felt that undergraduate research ought to foster student learning. However, there are some faculty members who do not want to label student learning as research until the product has reached a near-publishable state or a quality that might be presented at a conference or symposium. In this case, we might say that the product is valued over the learning process. Also, there are those who put major emphasis on undergraduate research as an important way for faculty members to maintain a research agenda while teaching primarily undergraduate students.

To the degree that the primary purpose of undergraduate research is to foster student learning, the emphasis might be on helping students to move along a developmental trajectory in the practice of research. The developmental process might begin in the first year of college and continue until the student is capable of doing independent research under the supervision of a faculty mentor. If, however, the primary understanding of undergraduate research is the production of a sophisticated product, or to provide competent students to assist in faculty research, then only the most promising students will be invited to participate in the research project.

A campus might define undergraduate research as student-centered in some departments and product-centered in other departments because research expectations will differ across disciplines. A school or department might locate itself toward the center of the continuum if its undergraduate research orientation involved efforts that were fairly well distributed toward both ends of the continuum. Alternatively, an institution or department might tend to identify its undergraduate research opportunities at one end of the continuum. It could also be the case that research for seniors would

be outcome-oriented in nature, with that for first-year students being process-oriented—on the other end of the spectrum.

Curriculum-based versus Co-curricular Fellowships

Some institutions or academic programs might embed research skills throughout the curriculum, developing a carefully articulated plan of courses wherein each nurtures one or more skills necessary toward becoming an independent researcher. This approach could be viewed as allied with student-centered research. It might suggest that all students across all disciplines would have some experience with undergraduate research prior to graduation. Brakke (2003) suggests that developmental experiences might begin with an investigative inquiry in introductory science laboratories and then move into more open-ended experiments. Disciplines other than science would have a variation on this developmental sequence. Toward the end of the college experience, students might be required to complete an independent research project or thesis in their senior year.

Other programs emphasize summer research fellowships or academic-year fellowships that are additions to the curriculum. These fellowships provide a concentrated period of time to work on a research project. It is likely that they would be reserved for students who are especially selected for participation. In most cases, these are students in honors programs or students who have demonstrated particular abilities in the area of study. Thus, this approach could be more compatible with an outcome focus, though that need not be the case. It is

possible that some departments would engage young students in co-curricular fellowships over an extended period of time, for the purpose of student development rather than publication per se. Also, an institution could apply its resources toward both kinds of approaches, thus itself falling somewhere toward the middle of the continuum when its overall research orientation is considered.

All Students versus Honor Students

Institutions must decide how to allocate scarce resources to competing enterprises. One institution might value assuring that all its students attain a certain level of research experience or expertise, and disburse its funds broadly. Another might choose to use its resources to take a small group of students to a very sophisticated level of scholarly development. If an institution prefers the latter, it may be more likely to define research as something that results in a publishable or near-publishable product, whether or not publication itself is actually an aim. Institutions that emphasize the former may not have the resources to bring all students up to that level of development; they then would be placing less value on student participation in knowledge creation within fields. If the institution chooses to place student development as the higher priority, then the institutional curriculum

could be research-rich, with investigative skills intertwined in all aspects of the curriculum. Such an approach might also suggest that professors begin with the student at whatever skill level he or she has, and then attempt to move the student as far along the continuum of research skills as possible given time and resources.

Furthermore, the purpose of engaging the student is also a factor. For example, one institution or department might argue that its purpose in teaching students to do research is to more effectively

“If the institution chooses to place student development as the higher priority, then the institutional curriculum could be research-rich, with investigative skills intertwined in all aspects of the curriculum.”

prepare students for graduate school. It then might focus more of its resources on helping a few students attain this stature, rather than spreading the resources out across the student body. Other institutions might prefer to emphasize the educating of citizens by providing all or

most students with the capacity to investigate pressing social problems, such as analyzing soil in low-income neighborhoods for lead content or studying child trauma in high-crime urban areas.

Student-Initiated versus Faculty-Initiated

Students may be encouraged to develop a passionate interest in a particular topic and then to design their own research projects, with the guidance of a faculty mentor. In other programs, students may be encouraged to work with a faculty mentor on a faculty-designed

research project. In the latter case, the student may take a small piece of the mentor’s large project so that the student has ownership of the research but has not developed the idea him/herself. Either approach can constitute legitimate research that might eventually lead to a publication or research poster and an original contribution to the discipline. And institutions might choose, as with each of the dimensions on the continua described here, to support a mix of student- and faculty-initiated efforts.

Originality: Original to the Student versus Original to the Discipline

A term used regularly when research is discussed is “original.” But what does “original” mean? Typically, the word is used to denote a new contribution to a field. It is possible, however, that a student taking an introductory methods course in psychology could produce something original, defined as a unique way of bringing information together. So we might view the latter as an “individual” form of originality, and the former as a “broad” form, with “broad” referring to originality as defined by a discipline and monitored through peer review.

It is also true that creation of an original product may not be essential to label work as research. For example, a sociologist might want to offer students basic methods courses in which projects called “research” are assigned, projects that give students practice in certain methods. These projects would not be expected to result in publishable outcomes or even to produce anything original, broadly defined. Other disciplines might be more interested in

naming as “research” only that work that resulted in what the discipline would view as worthy of submission to a journal.

Multi- or Interdisciplinary versus Discipline-Based

The extent and manner in which an institution engages its constituents in inter- or multi-disciplinary work could also be a factor in how it defines undergraduate research. Recent trends for U.S. funding of scientific research recognize the value of interdisciplinary approaches to answering complex/sophisticated questions (Committee on Facilitating Research, 2005). Nonetheless, many standard academic journals continue to emphasize work within disciplines and place relatively little value on interdisciplinary work. Those departments, programs, or universities most interested in interdisciplinary work might end up identifying research by a less-traditional type of outcome. For example, the outcome might be solving a problem, rather than a publishable paper. Community-based research takes on exactly this kind of problem-solving focus. There may be little interest in a publishable outcome; addressing a social challenge and the development of students’ skills to engage in this kind of work may be of greater concern.

Collaborative Research versus Individual Research

Research in the sciences tends to be more collaborative where students and faculty members work as a team. Indeed, high-level science research is often done by teams of professional researchers. Science professors at smaller liberal-arts campuses may

serve as mentors to their students. Professors may create teams for particular research projects that involve several students and then act as the team leaders/mentors. On larger campuses with graduate programs, a master’s or doctoral student or post-doctoral fellow may serve as the mentor and all levels of students may be part of the lead professor’s research team.

Undergraduate research in social science may be either collaborative or individual, while research in the humanities is most often individual. Collaborative research projects may be designed by the faculty

mentor, while individual projects are more likely to be student-designed. In all cases, however, the role of the mentor and advisor is critical to the students’ learning process so that they develop strong research skills and an understanding of ethics in research.

Campus / Community Audience versus Professional Audience for Student Research

Students who participate in undergraduate research often have the opportunity to develop oral and written communication skills through presentations and writing articles. Many campuses host research or celebration days when students can present the results of their work. Some campuses have a rigorous selection process for their research day, while other campuses may allow any student meeting

very basic eligibility guidelines to make a presentation. Students who participate in community-based research will have as a primary audience a non-profit organization, church, office of city government, or other non-campus entity. Regardless of the venue, students have an opportunity to share the results of their work with peers, faculty members, and others. They

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will receive feedback and be expected to answer questions about their project. The presentation process can be an invaluable part of their learning experience and prepare undergraduate

researchers for presentations to broader audiences.

Other students may have the opportunity to present their work at professional disciplinary meetings, either at special sessions for undergraduates or at regular sessions.

Campuses may publish journals of undergraduate research. These journals may be peer-reviewed and edited by students, faculty members at the institution, or faculty members external to the institution. Some student research is of sufficient quality that it may be publishable in professional journals. How a campus defines undergraduate research will determine the extent to which its emphasis is on campus-based or community audiences for student research or whether its target is professional audiences external to the campus.

More Contested Common Ground: Evaluation of Undergraduate Research

How does one evaluate the quality of the work that the student has done? If one's emphasis is on the product end of the spectrum above, and work is done in a single discipline, the standards for assessing student work should be fairly clear. The foundation for students' understanding of quality work begins early in the classroom when students are taught to look critically at a discipline's research and learn about the standards that such research is required to meet. One of the key tasks of research mentors/advisors is to build upon this foundation, to teach novice researchers how to fulfill such standards. Mentor/advisor assessments of a student's research would be based on these, probably longstanding, criteria of the discipline.

The student-development emphasis for undergraduate research can, in contrast, open up many ways of evaluating student work. At the most introductory level of education in doing research, a student's test results might suffice as an indicator of successful development. Tests of the student's knowledge of how to do regression analysis, for example, might suffice in an introductory economics-methods course. A formal research paper might not be required at this level of learning about research. Once one moves beyond a definition that is associated with a specific

discipline, criteria for evaluation may become contested, perhaps negotiated across disciplines or imposed by single disciplines. In community-based research, for example, a criterion might include the degree to which the student involved community partners in the research process—that is, the effectiveness of collaboration, of teasing out non-academic expertise needed in the project. Another criterion might be the usefulness of the information provided to the community organization for which the project was undertaken. Many in academia would not consider these valid criteria for whether a student has done research well or not. And yet, as problem solving becomes more interdisciplinary in nature, such criteria may become more salient.

Institutional Context

Definitional decisions may be more cultural or contextual than anything else. Some institutions, because of their history or culture, might simply be more inclined to name the earlier stages of student investigations as “research” than other institutions. Land-grant institutions might identify as research work that serves a community need, while others will only call work “research” if it has reached a stage that would allow it to be submitted to a scholarly journal. Institutional context matters.

Enhancing the Benefits of Undergraduate Research

It is clear that undergraduate research, by any definition, is

beneficial. For students, the opportunity to define a problem and work toward a solution that might have practical, real-life applications constitutes significant value. Students are more likely to engage actively in the total learning process when their curiosity is stimulated by the research question. Solving research problems can help students to organize their thinking, develop more creative thinking, and gain confidence in their own intellectual abilities. Undergraduate research can encourage students to continue their education beyond the baccalaureate degree, make them more competitive for graduate programs, and prepare them for success in graduate school. Opportunities for presenting the results of student research can lead to improvement in their oral and written communications skills. Undergraduate research can foster both collaborative and independent skills. Researchers learn to handle ambiguity, to accept the fact that the research project doesn't always work out as expected. And perhaps most importantly, undergraduates will develop the habit of asking “what if” and “why not” questions that can lead to new discoveries or new ways of improving the practice of their careers.

The benefits of undergraduate research extend beyond the student. Undergraduates can be valuable members of research teams. They can bring fresh perspectives, insights, and energy to investigations. Undergraduate research is important to a variety of disciplines because it helps to pass on the torch of investigative research to future generations; it ignites passions and quests for new knowledge within the college-age population.

“It is clear that undergraduate research, by any definition, is beneficial.”

Undergraduate research benefits students, faculty members, and institutions as a whole.

An aim of the Carnegie Academy for the Scholarship of Teaching and Learning's 2006-09 Leadership Program on undergraduate research is to understand what fosters high-quality undergraduate research education, so as to help guide our own institutions and others in better attaining its benefits.

We have found, perhaps not surprisingly, that definitions of undergraduate research vary widely, not just across institutions, but within institutions, and that definitions are often implicit. Thus, conversations among constituents of a college or university can be difficult, with each person thinking he or she is speaking the same language when, in fact, that is not what is occurring. We have attempted in this article to articulate the various points of potential incongruence between those hidden variations in meaning that can accompany the discussion of "undergraduate research" on a campus. These variations might be worth facing head-on if an institution wishes to bring the operative definitions of research at its institution to light, in the hope of making clearer choices about how best to teach undergraduate students to engage in scholarship.

Our conclusion: There is no one correct definition. One size does not fit all. An institution will best access the many benefits of undergraduate research by carefully formulating a definition or definitions that fit its campus culture and its unique institutional mission.

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