

Undergraduate Research as a Deep Learning Experience

Undergraduate Research Advisory Committee

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As Winthrop University contemplates how “deep learning” can be better integrated and encouraged across the curriculum, we, the Undergraduate Research Advisory Committee in the College of Arts and Sciences submit this document to explain how undergraduate research is an important deep learning experience. Furthermore, we identify the barriers to undergraduate research on our campus and make recommendations about how Winthrop can expand the research opportunities for our undergraduates.

Undergraduate Research Is A Valuable Learning Experience

The definition of undergraduate research can differ among and within colleges and universities. In the College of Arts and Sciences we recognize undergraduate research as student research, scholarship, and/or creative activities where students and faculty mentors collaborate in the design and implementation of projects and the dissemination of results. This is in the spirit of the broad definition adopted by the Council on Undergraduate Research: “an inquiry or investigation conducted by an undergraduate student that makes an original, intellectual, or creative contribution to the discipline” (Wenzel, 1997; 2000), which is applicable to all disciplines and implies a high standard specified by each discipline.

Undergraduate research usually entails a student working independently or in a small group under the guidance of a faculty mentor. The student may explore entirely new areas of study as commonly occurs in the humanities or directly collaborate on an established team-oriented project, which is usually the case in science laboratories. In any event the student engages in a discipline-specific activity beyond the normal classroom setting and range of assignments. Undergraduate researchers often disseminate their work at regional and national meetings or submit the scholarship for publication in academic journals. These experiences expose the students to the rigors of the peer-review process, which help to ensure the validity, significance, and originality of scholarship (Brown, 2005). As a result, students have a greater understanding of the value of reviewed work and perhaps learn to look more critically at their own work.

Although mentored research is conducted within a specific discipline, the process of research has broad applicability. Research is the personal experience of posing relevant questions, critically examining available information, seeking new levels of understanding, and clearly communicating conclusions. Student transformation comes from both participation in the research process and from the knowledge acquired.

A study by the American Association of American Universities found the undergraduate research experience “helps them (students) develop critical thinking skills, the ability to work with ambiguity of open-ended questions, an ability to apply skepticism to the daily flow of information and an appreciation of what it takes to create new knowledge” (Merkel, 2001). Moreover, recent surveys show students engaged in undergraduate research report they are better able to think analytically and logically (Ishiyama, 2002;

Lopatto, 2004; Seymour et al., 2004) and are able to make better use of the primary literature, formulate research hypotheses, interpret data, and communicate the results of research (Kardash, 2000). Another survey revealed alumni perceive an increased skills development resulting from their research experiences including acquiring information and speaking effectively (Bauer and Bennett, 2003).

A joint statement by the governing boards of the National Conference on Undergraduate Research and the Council on Undergraduate Research (2005) describes how the student-faculty mentor relationship promotes learning:

“This collaboration triggers a four-step learning process critical to the inquiry-based model and, congruently, several of its prime benefits-

- 1) the identification of and acquisition of a disciplinary or interdisciplinary methodology
- 2) the setting out of a concrete investigative problem
- 3) the carrying out of the actual project
- 4) finally, the dispersing/sharing a new scholar's discoveries with his or her peers-a specific step traditionally missing in most undergraduate educational programs.”

Several studies indicate there is a correlation between the participation in research and the likelihood of student success. For example, students who engage in research projects as undergraduates continue working toward their undergraduate degree to a greater extent than comparison groups (Nagda, et al., 1998) and they display increased levels of independence and self-confidence (Seymour, et al., 2004). The experience helps students to clarify and or confirm career intentions (Lopatto, 2003; Seymour, et al. 2004), and these students are more likely to pursue a graduate education than students who did not have a research experience (Hathaway, et al., 2002; Bauer and Bennett, 2003).

Undergraduate Research Fosters Deep Learning

Undergraduate research both involves and promotes deep learning in two key ways: first, because of the particular relationship that exists between the student and the professor as they engage collaboratively to create and then to solve a research problem, and second, in the ways in which knowledge and inquiry are viewed.

The key word here for understanding the relationship between the faculty member and the student who are engaged in research is of course “collaboration.” In the traditional classroom, it is difficult for a faculty member to collaborate with students: collaboration implies a peer relationship, and the faculty member in his or her classroom is rarely seen by students as a “peer.” He or she is an authority figure, not only in terms of “control over the classroom,” but also in terms of the authority he or she has developed as a result of years of inquiry, research, and study of the content area. In the best classrooms, the faculty member uses both kinds of authority to challenge students intellectually, urging them to engage in “deep learning” as a result of tough questions and projects that demand research. But it is very possible that some students see even the best classrooms as places in which they passively acquire knowledge from the authority figure.

When students are engaged in research, however, authority and thus the relationship between faculty member and student changes. The undergraduate student becomes more aware of the faculty member as someone who is also seeking answers or perhaps more complex understandings of a problem. As Donald Schön asserts in his two books on reflective practice, the student who works with a professional sees the “reflective practitioner” deal with the messy reality of his or her field, how the practitioner “sets” problems out of that reality, and ultimately how he or she solves them (Schön, 1983; 1987). While our students cannot see everything we are doing as we analyze a poem, decipher a gene’s function, or design a computer program, their working with us as we do these things enables them to learn *actively* from our behaviors—not just passively as a result of what we say in a lecture or other straightforward delivery of information. The student is more able to watch us thinking in action—how we adjust what we are doing based on the complex information we are absorbing from the messy reality around the problem we have set ourselves.

The second way in which undergraduate research promotes deep learning is in the ways in which knowledge and inquiry are viewed. Because students are only beginning to understand the complexities and demands of their chosen fields, they tend to simplify the problems we set for them in order to deal with them: for example, students who are asked to interpret or analyze a sonnet may simply summarize it. They revise the professor’s assignment in order to set themselves a problem that they are able to solve. When working with a professor one-on-one, however, students are able to learn from the ways in which the professor sets the problem—what is important and what can be ignored—and this makes them more able to set ever more complex and challenging problems.

The one-to-one aspect of undergraduate research also demands that students engage in deep learning, in part because the student is the only one responsible for answering the professor’s questions. There are no classmates to help carry the discussion forward. The student, therefore, must view “content” and “knowledge” more actively because he or she is experiencing it more actively. The research project also breaks down the structures of the classroom that can sometimes protect students from the hardest work of learning—the times when their own beliefs are challenged, when things they thought they knew are found to be wrong.

Finally, knowledge and inquiry can also take on other forms as students and faculty collaborate. A professor may see the potential in a student’s work—perhaps a research paper—and suggests further research or new methodologies to pursue. The professor may then take on a different “role” in reading the work: the perspective of the conference chair or perhaps the editor of a journal, acting as these people would in reviewing the student’s text. The student then “practices” the demands of his or her profession, moving into the discipline not simply as a student-learner but as someone engaged in the actual practice of the profession. Collaboration in this sense may not deal with the student’s content so much as with helping the student to achieve greater understanding of the profession’s academic discourse—the vocabulary, stance, evidence, and format that are expected in the field.

Undergraduate Research Builds on the Foundation of General Education

In many college programs undergraduate research becomes a type of capstone experience that is undertaken by juniors and seniors during the school year or the intervening summer. However, the tenets of research should be introduced early and reinforced throughout the curriculum. In this way students will be better prepared to take on the challenges of research and may begin independent research projects earlier in their college careers. There appears to be a strong correlation between the length of time students are engaged in research and the quality of their experience. Indeed, in alumni responses the “highest ratings were given by those who had devoted the greatest amount of time to research and had completed a senior thesis through the URP (undergraduate research program)” (Bauer and Bennett, 2003).

The use of undergraduate research to promote deep learning should be preceded by courses that provide a strong and well-structured knowledge base. As part of that base knowledge and in order to use undergraduate research as a deep learning tool, students should have a research methods course that emphasizes inquiry-based assignments and the development of analytical skills. After acquiring the foundation needed for the research process, upper level courses could provide other opportunities for students to engage in research. Ultimately every student should have the opportunity to learn through the direct involvement in research with a faculty member.

Undergraduate research benefits all students. Unlike many traditional classroom methods, undergraduate research has the unique ability to enhance deep learning in both low and high performing students. High performing students are typically capable of going beyond the classroom material. Independent research can offer a needed challenge for these students, allowing them to demonstrate their special strengths and ability.

Although high performing students are often targeted for research opportunities, we believe that research can be a valuable tool for low performing students as well. For example, low performing students may lack motivation in the classroom but exhibit high levels of motivation and ability if supported in an individually directed project of their own choosing. Similarly, low performance may reflect a mismatch between teaching and learning styles. During the intense and individualized mentoring process of conducting research, these students may exhibit higher performance than they do in the traditional classroom. In both of these situations, research experience may unmask low performers who have had the potential to be high performers all along.

In addition, both low and high performers benefit from the development of research skills, because these skills are transferable to many domains. High performing students may use research to prove their preparedness for graduate training. They may also use their undergraduate research experience as a litmus test to refine career and educational goals. Low performing students who will not attend graduate school can develop professional skills through research. Students learn to ask relevant questions and seek answers in an ethical and competent manner, critically analyze information and sources of information, and communicate information in verbal and written formats.

Presenting research at conferences provides additional skill building opportunities. Students are required to present themselves in a professional manner through their attire and communication. They are exposed to a range of individuals in varied stages of their own career development. This exposure, in a sense, broadens the boundaries of the university by supplementing our own faculty's expertise. Students have the chance to make connections with and receive feedback from a broader audience than they may have encountered on campus. These experiences have value as students leave the university and enter today's workforce, where presentation, communication, and relationship skills are vital for success.

Undergraduate research can be a critical component of an international experience. Involvement in undergraduate research and participation in a study abroad program were identified by alumni to be two of the most beneficial experiences of their college careers (Bauer and Bennett, 2003). Combining them could be a powerful way to enhance the development of students as they become scholars and citizens of world.

“Preparing students for a globally interconnected world involves empowering them with the capacity to work in diverse groups and communicate in more than one language; informing them with knowledge of the world's cultures; and developing responsibility for others through sensitivity to cultural difference.”
(From To-morrow Professors listserve by Andrea Leskes)

In study abroad programs students are led into an unfamiliar linguistic and cultural environment so as to learn a foreign language. This is necessarily the beginning of a process of deep learning because students cannot avoid the challenge of adopting new ways of expressing themselves and of accepting different cultural values and customs if they want to acquire a foreign language. By letting this new acquisition inform their intellect, students experience their own language and culture in a different way. This complex learning process at different levels is enhanced when they are given the occasion to spend time in the country of the foreign language they are acquiring. Consequently, the expanding Winthrop Study Abroad Programs provide a unique opportunity for students to further their reflection on a given foreign culture while improving their skills in the target language. This reflection could constitute the basis of undergraduate research in the field of cultural studies. Instructors in charge of Study Abroad Programs could expand the requirements encouraging research projects on the foreign culture students are experiencing first hand.

Promoting Undergraduate Research as a Deep Learning Experience

There are a number of barriers to establishing undergraduate research as an institution-wide deep learning tool. Three significant areas we need to address, which are common to most academic institutions (Merkel, 2001) are 1) expanding undergraduate research opportunities to most students, 2) faculty reward systems, and 3) assessment. However, the way each institution resolves those issues depends upon many factors including their overall mission, size, governance structure, faculty, and students. Below are suggestions for each of these areas.

Expanding undergraduate research opportunities to most students

- 1) Because undergraduate research has the potential to facilitate deep learning in all levels of students, this experience should be available to all levels of students. In order to accomplish this goal, we need to see an increase in funds available to conduct such research and to support a greater amount of student travel.
- 2) Incorporate undergraduate research throughout the curriculum. Have each department identify introductory courses where assignments in basic skill courses could include concepts of academic inquiry. Develop discipline-specific methods courses that can be offered early in a student's academic career. Some of these already exist and can be used as examples for other departments (e.g. BIOL 300, PSYC 302, SOCL 316/516). Encourage instructors of upper-level courses to use inquiry-based assignments in class. Create research courses to allow students to conduct independent research with faculty. Because several majors have little room in their degree programs to create research courses, Arts and Sciences should consider a special research designator, i.e., RSCH. This is especially important for BA programs.
- 3) Encourage more students to do senior projects or honors theses.
- 4) Create and financially support more summer research experiences. The summer offers both the students and the faculty more time to devote to research.

Faculty Rewards

- 1) We recognize that it requires time for faculty to maintain their own research program, and that effort should be rewarded by the university. However, it is critical that the university simultaneously acknowledge that involving students in research expands the time and energy commitment on the part of the faculty. Faculty who are highly engaged with students may appear to have an overall lower level of productivity, but may have a higher contribution to deep learning in students. This factor should be taken into account when rewards and compensation are determined.
- 2) Presently, research in some departments focus on graduate students. Some faculty members already carry a heavy load with their work with graduate students; for them to work with undergraduate students on research as well would be unrealistic given a full teaching load in addition to the research mentoring. Therefore, in these departments the lack of time is perceived to be a major barrier to using undergraduate research to promote deep learning. Reduced course loads could be a reward for faculty who use undergraduate research to foster deep learning.
- 3) The College of Arts and Sciences should encourage the departments to develop mechanisms to create reassignment time for faculty who mentor individual student researchers. Although one college-wide policy may be unrealistic, a general framework should be developed to help the departments use undergraduate research as deep learning experiences throughout the curriculum. For example, it should be clear to the faculty and department heads that specific policy options are available including 1) a banked hours system for those mentoring research students so that faculty have a realistic chance of cashing in those hours, 2) teaching credit for research/independent study courses, and 3) reassignment time can be generated from grants to work with students.

- 4) The College of Arts and Sciences should recognize the mentoring of undergraduate research as an integrated effort of teaching, scholarship, and service that can provide a critical deep learning experience for our students. Furthermore the contributions made by faculty who provide such opportunities to the students should be considered in tenure and promotion decisions. This should be explicitly stated in the College's tenure and promotion documents.
- 5) The College of Arts and Sciences should establish an annual award, similar to the one granted each year to an outstanding advisor, for an outstanding mentor of undergraduate research in order to make visible the College's commitment to undergraduate research.

Assessment

- 1) We need to assess a student's level of involvement in research beyond looking at the credit hours received. A student working as a research assistant to lessen the workload of a faculty member is a very different experience than a student who conducts an independent research project under the guidance of a faculty member.
- 2) We need to develop ways to assess the level of a faculty's involvement with students. Faculty compensation needs to be discriminating, not just reflect an assumption that all research training is equivalent.
- 3) We need to develop ways to assess the outcomes of student participation in research and use that information to continually improve the undergraduate research experience. Part of that measurement should be the effects of an undergraduate research experience on student learning and skills development.

Conclusions

Undergraduate research helps to build a community of scholars. As Winthrop incorporates deep learning into the curriculum, undergraduate research can help tremendously in creating a culture of scholarship that reflects the deep learning and personal growth we expect from our students, and a campus infused with undergraduate scholars helps to create communities of learners both on and off campus. However, to reach these goals there needs to be a firm commitment by the administration, faculty, and students. Merkel (2001) describes the commitment needed to create a cultural of research:

“An institution that has developed a culture of undergraduate research exhibits certain characteristics. Within the administration, these elements include some of the following: undergraduate research as a component of the university's strategic plan or central mission for undergraduate education; an articulation of an overarching vision for undergraduate education and the role of undergraduate research within it; and allocation of resources to encourage the activity...

Faculty are able to articulate the institution's commitment to undergraduate research. They understand what undergraduate research means to their university. Faculty within the university use common language to talk about mentoring students. They share expectations about what students can and should do. They identify benefits to themselves, to the students, and to the institution. The faculty know what programs are in place and how to get involved...It is clear that there

has been an institutional conversation about where undergraduate research fits in the teaching-research continuum, usually on the teaching side...

..students know that opportunities are available and they are encouraged to get involved. They know how to find out about such opportunities, whether or not they choose to avail themselves of the chance to do research. They know why they want to have an undergraduate research experience and have expectations of what they will derive from it...

Universities can take steps to create a culture supportive and encouraging of undergraduate research. It requires a commitment to develop the components of undergraduate research culture over the long term. It requires promotion of the enterprise, a regular communication of the importance and value of the activity, and a celebration of success and achievement. Creation of culture is a long process that requires sustained effort. It might employ marketing (a disagreeable word, but a good concept) techniques such as identification of the strengths, weaknesses, opportunities, and threats or barriers to the organization, and targeting efforts and communications toward those elements.

Developing an undergraduate research culture also requires human and monetary resources. It may demand line-item budget funding to establish infrastructure. An institution committed to undergraduate research has addressed these resource issues and has taken steps to assure that necessary funding is available.”

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