Integrating Research into Undergraduate Education: The Value Added
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Playfulness and Responsibility in Education and Research

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I'd like to begin today by sharing with you some on-the-ground views of undergraduate research. I'll begin with a moment in Africa that changed a student's way of seeing the world. Isla Casteneda, a Syracuse undergraduate who grew up in a family of migrant workers in the South, was one of 15 American students and 15 African students chosen to do research on an East African rift lake. During a three-day train ride to get to their field camp, she looked out the window and said, "Look—zebras! You don't see that every day." Her African colleagues smiled and said, "Well—actually—you do." Isla said the trip to Africa changed her life and helped her decide she wanted to become a research scientist working on global change.

Jeremy Gilbert, professor of biomedical and chemical engineering, a Syracuse department that requires all seniors to do a senior thesis, often finds that undergraduates will come to him and say "this is just not working" if they have followed a strict research protocol and get unexpected results. That's when he may remind them of Rob Gettens, a graduate student of his who, not long ago, was using an atomic force microscope to look at proteins attached to biomolecular surfaces. "Every time I do it," Gettens complained to Professor Gilbert, "a funny thing starts growing, like a contaminant." The "funny thing" was not a contaminant, however. Gettens had discovered that water can become solid at room temperature on mica, Professor Gilbert will say. "What he thought was a contamination and a failure turned out to be an exciting development."

Another view of discoveries that may come to light in research can be found in the undergraduate thesis, "An American Modernity," written for our Renee Crown Honors program last year by Assad Rajani. Rajani, who came from East Meadow, New York, graduated with majors in English and textual studies, history, religion, and political science. As that list alone indicates, his interests crossed the lines of many disciplines.

"As a Muslim-American student, a project that focuses on the fissures of ethnic identity is extremely relevant to me," he explains. "Especially in the post 9/11 era, it was important to elucidate the experiences of minority groups that are often considered outsiders to mainstream American culture."

In modernity, he writes, "I am describing something that changes as I struggle to study it. Like students of the subconscious, the galaxy or the atom, I can only relate modernity's significance through language—that is—through analogy. I cannot tell you what modernity *is*, only what modernity is like."

Not that he didn't try. One of this first questions to his faculty advisor, Professor Gregg Lambert, was: *When was modernity? Or when did it start*? He continues: "I wanted modernity to be located on a one-dimensional timeline." His professor "just smiled. I thought he evaded my question; I still do, actually. Gregg knew that my request was a form of control, a way for me to fold up modernity into a nice symmetrical package for me to get. The truth—or at least what I believe the truth to be—is that several modernities have existed." Rajani goes on to explain that his undergraduate thesis is "*an* American modernity, not *the* American modernity."

Rajani's thesis discusses insights from writers ranging from Sigmund Freud to the Native American author Sherman Alexie, from the Buddhist monk Buddhagosa to W.E. B. DuBois, who asked "*Why did God make me an outcast and a stranger in my own house?"* But some of the most poignant insights into his situation come when he interrogates his own experience with -- toilet paper.

"Bathroom etiquette was never a mystery for me," he writes. "My mother was quite candid about it. She used to tell me not to use American bathrooms. *All these people just use paper! Hold it in until you get home.* Home was transformed into a cultural fortress." Home, he adds, was the only place the topic ever seemed to come up. It was not until he was a sophomore at Syracuse, heading toward the floor bathroom with his jug of water, that his roommate had the courage to ask him outright:

> *"What's with the jug? Where are you going?"*
> *"To the bathroom."*
> *"What that? What for"?*
> *"To clean myself, man. I don't just use paper."*
> *"You're kidding me, right?"*
> *"No, I'm not."*
> *"Whoa, whoa, whoa. You mean you use your…your hand??"*
> *"I need to go."*

"The reaction was worse than I ever expected it to be," Rajani writes, explaining that water is a central symbol of spiritual and hygienic purity in Islam. 'For 19 years I had hidden this secret, and now not only was I being confronted with an image of my own body in such a brusque manner, I was being ridiculed by someone who perceived me to be unhygienic…My act of hygiene, my act of purification and bodily cleansing was considered *unclean.*"

The confrontation, he reports, ended in uneasy laughter, without answers.

As the Boyer Commission first recommended in 1988, research introduces undergraduates—sometimes in dramatic ways--to the processes of inquiry that are involved in the production of new knowledge. And although the commission reported three years later that the humanities and social sciences were lagging behind the laboratory sciences and engineering in hands-on research, we are now seeing compelling examples of how undergraduate research adds value to education in all fields.

What value does it add? There are, of course, many answers, some general and others quite specific, to this question, and I want to begin with a rather general framework about liberal education today. As we all have experienced, education can be transformational, especially when it simultaneously cultivates an attitude of *playfulness* (about ideas and truths and experiences) and of *responsibility* (to ground that playfulness in the world as it now seems and/or could become). In its most general sense, I believe that the value-added of a research experience is that it sharpens the educational process and turns it toward the kinds of creativity grounded in experience that is transformational. There are many such opportunities in college, but engaging in undergraduate research is more likely than not to lead in this direction.

The research/discovery process is one that provides a context of creativity, much akin, in my view, to the sharpness and intensity of artistic exchanges. Barbara White, a composer at Princeton, recently described the creative campus as one that encourages "experience-oriented imaginative space." That is what we are trying to do when we engage students directly in the discovery process. That is what happens when Professor Gilbert's students learn that what appears to be a failure may actually be a discovery. That is what happens when a student such as Isla Casteneda is plucked from her own familiar habitat and surprised into seeing the world from another's view. And that is the effect of Professor Lambert's refusal to place definite boundaries on *modernity*, inducing Rajani to explore between worlds, locating the sometimes painful distance between his own and others'. These experiences all occur in that "experience-oriented imaginative space" likely to engage our students in being both playful and responsible with ideas.

Cultivating the Creative Campus

If an important aspect of the value added by undergraduate research is that it embeds the student in the heart of the creative campus – a place where people and ideas mix both playfully and responsibly – how can we maximize that value? And where do we see it happening?

We think about our laboratories, of course, but we can also include more of our campuses and the wider community, as near as downtown, as far away as Africa, and anywhere in between, thanks to the internet and the technology that allows us to build networks in which we can collaborate and share knowledge. Just as we want to encourage creativity and innovation, we need to be very opportunistic and expansive about embedding research experiences directly into the "work" of our faculty and colleagues. Undergraduate research experiences can and should be found in a variety of settings and programs – from libraries and museums to homeless shelters and research vessels. The magic, in some sense, of a research university setting is that it is literally full of such opportunities if we can only harness them as such! And the experiences don't have to conform to the academic year, but rather can take advantage of faculty's propensity for doing major fieldwork in the summer. For example, at Syracuse, for two summers, the Earth Sciences Department Seismic Analysis Laboratory included undergraduates in its research cruises on Skaneateles Lake, one of the eastern Finger Lakes of Central New York.

These kinds of "off-shore" experiences speak directly to the central discovery mission of our universities and to our ability to prepare students for the world of innovation beyond the academy. For, as often as our students think of research as preparation only for graduate school, the reality is that this kind of experience will be preparation for life and for work in any number of sectors in this "knowledge economy."

Consideration of this aspect of our educational mission raises another question. What opportunities will these students find after graduation, and how can our undergraduate research experiences best simulate the creative process at the heart of our ever-changing global knowledge economy?

For the past six months, IBM has been brainstorming precisely this question, internally and with participants from many sectors around the world, in something they call a Global Innovation Outlook, an effort to understand the nature and practice of innovation, which they define as the intersection between invention and insight, when a new thought,

technology, business model or service actually effects change in society. Innovation, in this way of thinking, requires human interaction and broad-scale adoption, and "is always more about what we do with an idea than the idea itself."

Innovation, as they have found, is occurring more rapidly as barriers of geography and access come down. It requires wider collaboration across disciplines and specialties. It often involves human communication across generations and across cultures. To do this in the future, our students must begin now to learn to think quickly, to simulate possibilities, to test ideas, and to work in groups. They must learn to work with diverse others in interdisciplinary settings, on campus and at the interfaces of business, academia, and the wider community. They have to develop a tolerance for sharing and investing ideas in work groups that are less stable and hierarchical and more "horizontal" than ever before, with fewer experts and bosses and more colleagues and generalists. They have to care less about ownership over and credit for ideas and look instead for opportunities to pool knowledge and test ideas collectively. They also have to be comfortable in a world in which "learning" and "working" never stop, 24/7.

The dynamics of this global knowledge economy are double-edged, in my view, for research universities. On the positive side, if there is any sector in higher education that should be able to engage students in this kind of intensive, multi-disciplinary, collaborative learning experience, including partners from industry, government and community organizations, and reaching outside our country, it is our universities. Yet, we also know that our institutions are all struggling themselves with how to break down the almost feudal hold of departments and the rigidity of our tenure and promotion systems, not to mention our reluctance to share intellectual property or give due credit to collaborative work. Nonetheless, as we are all working on exactly these issues, we should all ensure a role for undergraduates right in the midst of the next generation of "work groups" in our institutions.

At my institution, for example, we are deeply involved in a new Center of Excellence on Environmental Systems and Energy that includes collaborations across 12 academic

institutions in Central New York and numerous business partners and a test-bed facility to share discovery work in downtown Syracuse. As we work out the intricacies of multi-site experiments, translations from discovery to marketplace, and collaborations with community partners to apply these new technologies to improve human health and sustain our urban environment, it is critical that we not forget to include our students, undergraduates as well as graduate students. While we might be tempted to postpone that part of the project until all else is running smoothly, we don't want to risk missing an opportunity to introduce students directly to the world into which they will graduate, a world that includes uncertainty, mistakes, and new starts. It is imperative that we stretch the boundaries of the creative campus right from the start.

Building Cultures of Innovation

Now, how realistic is this? Mary McCarthy once wrote: "If someone tells you he is going to make a "realistic decision," you immediately understand that he has resolved to do something bad." When we think about change, when we think about excellence, we have to be realistic—but in our case, that means we should plan to take advantage of what we have and to create new ways to use it. In the present context, I believe that we can use undergraduate research as a catalyst for institutional change, as well as for the transformation of undergraduates into creative thinkers.

In support of this effort, I thought I would list some of the assets that could be added to our campuses as we engage more thoroughly with undergraduates in research.

Cultures of collaboration. First, I suspect that as we work with students on research, we will be forced to consider how well we really do at collaborative work.

Interestingly, our students may well be better at collaborative work than we are – after all, many of them have grown up playing on teams or performing in theater groups; they have even had chat room experience; and their schooling is likely to have included a bit more of this joint work than ours did. Although they, too, will have to work at

collaboration--especially in diverse work groups--they still may have much to teach us along the way.

And we all have much to learn. Even our science and engineering faculties, those most likely to run collaborative laboratory groups, upon close examination often admit to adhering to rather rigid hierarchical structures without real sharing of ideas and pooling of knowledge and credit. Certainly our humanists, who count as collaborative research the prototypical faculty-student honors thesis (even as good as those experiences can be), can learn a great deal from their students about sharing knowledge in the process of innovation. By contrast, our performing arts faculty, who seem to create together, have a great deal of trouble assigning credit to this collaborative work. So there is much room for self-examination, and I believe that integrating collaborative undergraduate research into the heart of our most exciting scholarly projects might be a good catalyst for change.

Cultures of diversity. And speaking of institutional change, we certainly all want to encourage intellectual and social diversity as a core part of our community, not as some add-on on the margins. Again, I think that research experiences are fertile ground for this cultivation of diversity and excellence, hand in hand.

Moreover, this is work that takes energy and commitment. As we engage with our students in new ways, across generations and in new settings, we may well come to see how hard it is to get in the heads of those with different backgrounds from our own. Recall, for a moment, the interaction over toilet paper reported in Rajani's thesis on modernity or Isla's insights on Zebras in East Africa. These "research opportunities" can illuminate far more than the topic at hand. Just as the students stretch with that experience, so can we as faculty and as institutions.

Cultures of risk-taking and connection. In the process of stretching the creative campus, we also should be mindful of the occasional need to encourage some risk-taking on the part of our faculty. If we want to be seen as engaged institutions, contributing to

the social and economic health of our communities broadly defined, we must modify our views of what faculty members (and their students) should do with their time.

We should structure ourselves in ways that create vibrant exchanges of people and ideas. We want to create startling combinations with respect to *who we are* and bump minds with, and *how we work* within and across disciplines, technologies and methodologies. And, again, our students' interests in being engaged with the world can serve as good incentives for us in taking some risks to move beyond our campuses, libraries and laboratories.

That said, community-based research projects are extremely difficult to do well – they require building trust, ensuring reciprocal benefits to community as well as to campus, and maintaining partnerships over time. In this respect, all hands are needed, and the intergenerational, collaborative research model can be very useful. However, as with any large project, the same undergraduates who bring energy and a fresh look at the issues also require and deserve intense supervision. When collaborative projects are done right, everyone wins.

A recent project in Syracuse, for example, drew on the talents of faculty, graduates, and undergraduates to map hunger in our city under the guidance of the Samaritan Center, which had tried for some time without success to describe the changing needs for emergency food services and the resources available to fight hunger in the city.

As Syracuse Professor Don Mitchell, chair of Department of Geography in the Maxwell School of Citizenship and Public Affairs observed, the governmental social services offices and human service agencies and programs were fragmented and trying to deal with "a vastly uneven landscape where deep food insecurity can exist cheek by jowl with abundant wealth and comfort."

The hope at the beginning of this research project, in the fall of 2003, was that all the entities involved in the local fight against hunger could learn much more by collecting

and sharing information in a single local database. Dale Johnson, executive director of the Samaritan Center, hoped that the geography department could add technological sophistication and professional expertise in presenting and analyzing the information that was collected.

This extraordinarily labor-intensive and complex project has galvanized a great deal of Syracuse, and students have been at its heart from the beginning. Students in Professor Jane Read's undergraduate geographic information systems class in the Maxwell School used the latest Geographic Information System software to construct overlays incorporating information from more than a dozen social service agencies in the city, as well as from 10 city, county and state agencies. Other students, from Syracuse and also from neighboring institutions (LeMoyne College and Upstate Medical), worked with faculty mentors to scour the city, doing surveys of the availability of food in local pantries and of the shopping patterns of low income residents. In other words, the project mixed methods and contexts of data collection, and our students got a first-hand immersion in the alarming world of urban poverty and hunger. The project also represented a learning community that was thoroughly intergenerational, with graduate and professional school students' serving as the glue, translating between worlds in their dual roles as "experts" for the undergraduates and "novices" for the community partners.

As we all pursue a more community-engaged research agenda, we should not miss the opportunity to engage our undergraduates, as they will someday lead these communities. By stretching the boundaries of our own creative campuses, we will go some distance toward fulfilling our mandate to educate citizens ready to make a difference in the world. Student contributions to these efforts have been and can be substantial – making it feasible to collaborate on a relatively large scale, and, in the best of cases, build considerable public trust in the next generation of college-educated citizens. Listen to the words of the Syracuse community activist, Dale Johnson, Executive Director of the Samaritan Center, in his April 23, 2004 executive report:

> "One final note----a significant part of the work of the Syracuse Hunger Project was performed by students. The contributions of these students deserve this community's gratitude."

This reaction comes in the context of a very challenged community that is generally quite suspicious of the "folks on the hill."

Benefits and Hard Work for All

Throughout my comments today, I have emphasized the reciprocal benefits-- for faculty, students, and our institutions--of engaging undergraduates at the center of our creative campuses. Admittedly, this is not an easy undertaking at research universities, especially as resources shrink and the juggling act of our faculty members intensifies. Undergraduate research is time-consuming and resource-intensive, and many faculty members don't feel adequately rewarded or compensated for this kind of work. There are also some specialties that would find it very difficult to include undergraduates who know nothing at all about a scientific field—or nothing at all about talking with people who are not just like them. But there are faculty members have told me that they find undergraduate research to be intensely rewarding, even in fields in which undergraduates might seem difficult to incorporate.

To end on a positive note, I'd like to quote Professor Gilbert again, because I think his observations about the serendipitous nature of research apply across the board.

"I try to get students to understand that, as scientists, we design experiments and hope for an outcome, but we expect the unexpected. And I tell them, 'When you find something you don't understand, explore it—don't write it off. If we always knew that when we do A, B, and C, we'll get D, I'd look for something else to do. But if E, F, and G show up, that's wonderful. That's what gets me excited about science."

Let’s keep looking for ways to share the lessons, the adventures, and the excitement of research and discovery with our undergraduates.