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General Education 1.0
An Efficiency Overhaul for the Cold War Curriculum

Integrative learning is the new frontier for twenty-first-century liberal education, and it is the focal point for AAC&U’s work on the renewal of liberal learning as well as for Project Kaleidoscope’s rapidly expanding work on twenty-first-century designs for student achievement in science. The articles in this issue of Liberal Education emerge from these important efforts to develop a more purposeful and connective framework for college learning, a framework that emphasizes cross-disciplinary inquiry, big-picture thinking, and integrative applied work—from first to final year.

The vision that guides AAC&U in its commitment to integrative learning is summed up in the LEAP report, College Learning for the New Global Century, which calls for students to achieve, across general education and major fields, “wide-ranging knowledge of science, cultures, and society; high-level intellectual and practical skills; an active commitment to personal and social responsibility; and the demonstrated ability to apply learning to complex problems and challenges.” Integration and application are woven together in this vision, in the conviction that students must connect many strands of learning from different sources in order to tackle—whether through research or hands-on projects—the kinds of complex, unscripted questions they will face in work, civil society, and life.

But if this is to be the goal, proponents will need to face head-on the huge barriers blocking the way—the formidable elephants already in the room. One of these, of course, is the economic meltdown that has led to rash efforts to stuff increasing numbers of students into each course and has made hands-on and integrative learning less likely. A second, closely related elephant in the room is the enormous amount of federal and philanthropic energy now being invested in what can best be described as an efficiency plan for the Cold War curriculum. The Cold War curriculum? That, dear colleagues, is the third elephant in the room, a beast so familiar to all of us that many of us scarcely notice it at all.

Assumed rather than described in virtually all policy and philanthropic plans for systemic changes intended to increase graduation rates, the Cold War curriculum is not now and never has been a design for integrative learning across the curriculum. Both in its original twentieth-century architecture and in the new twenty-first-century plans for making it work more efficiently, this assumed curriculum will continue to impede rather than foster the kind of big-picture, integrative, hands-on learning that thoughtful educators value and employers warmly endorse (see employer research at www.aacu.org/leap).

The Cold War curriculum—invented in the first decades of the twentieth century, but consolidated and expanded after World War II—is the design for learning that is captured in the convenient shorthand of “breadth and depth.” Taken together, breadth and depth provide organizing principles for the content of the curriculum, but not for students’ ability to put knowledge to use. With admirable concision, “breadth and depth” signals the general idea that broad general education courses come first, followed later by concentrated study in a particular field or “major.”

In this now-standard model, breadth—to be attained in the first two years of college—is the glue that connects the so-called transfer curriculum in community colleges with the work of the four-year institutions. Depth, which is supposed to come later, is seen as the centerpiece of the advanced curriculum. With general education to be “gotten out of the way as soon as possible,” as students everywhere are still advised today, there is no intention of and certainly no game plan for helping students make their general studies serve as a context for their major studies. The entire design fosters specialization rather than integration, and critics have complained vehemently about exactly that design flaw ever since “breadth” began to gain steam.
This twentieth-century curriculum did not lack for high-minded exposition. The Harvard Redbook, in particular, shows what thoughtful people hoped it might achieve. But as “distribution requirements” across a range of general fields became the standard practice, concepts devolved into checklists. As a result, students everywhere are candidly mystified as to why they have to take so many courses in which they are not interested.

Critiqued by students, decried by thoughtful faculty and other academic leaders, and being redesigned by AAC&U member institutions across the country, this tattered old distribution system is currently receiving not a decent burial, but an efficiency overhaul led simultaneously by the federal government, state legislators, and some parts of the philanthropic community.

Beyond breadth and depth, consider the following systemic components of this fragmented industrial-age system: the notion that each course is a self-contained entity; the assignment of standardized credit hours for each of these self-contained courses; the development of “transfer packages”—organized by breadth or distribution categories (sciences, humanities, social sciences, the arts, writing, and math)—not to exceed a certain number of credits, which, if attained by the student, in fact facilitate transfer and, once complemented by the major and electives, are the basis—the primary basis, assuming decent grades—for the degree.

Today, each of these outmoded components is getting a design overhaul, with the express goals of ensuring quality and facilitating students’ passage through the (fragmented) system. Very soon, there will be a federal standard not (as many had feared) for students’ expected level of competence on core intellectual skills, but rather, a century too late, for the meaning of the credit hour! Similarly, many states and state systems are tidying up the transfer package not to ensure that students’ have achieved integrative learning at least within the zone of general education, but rather to make sure that courses carrying the same label and the same number will be more readily accepted wherever students may go. And the courses themselves? Work is underway to redesign “big gateway courses”—invariably general education courses—to make them more supportive of student completion and “success.” This is not a bad thing in itself, of course, but it does nothing to tackle the fragmentation and dis-integration that is the most chronic problem of the introductory college curriculum.

I watch all of this and shake my head that we have failed so utterly to engage policy makers and philanthropy with the really fine work now progressing on campuses that are seeking to break free of the Cold War curriculum and to create new designs for learning—designs that far more successfully prepare students for a world in which the ability to overcome the fragmentation of knowledge will be perhaps the only key to a sustainable, humanitarian future. The designs are out there. But with few exceptions, neither policy makers nor philanthropic leaders know anything about them. They are doing nothing at all to support the better designs that are already in place on many campuses. Instead, they are trying to fix the old design.

Distribution requirements organized around concepts of breadth and a major totally disconnected from broader studies have been, from the day they were invented, impediments to integrative learning across the curriculum. They will remain impediments once the current overhaul of the Cold War curriculum is complete. Tidying up the credit hour, fixing individual courses, and reifying transfer packages composed of disconnected courses may perhaps do something to facilitate students’ ease of passage across a complex educational system. But these reforms will not foster the learning outcomes students actually need for a fast-paced, chaotic, and fragmented world.—CAROL GEARY SCHNEIDER
The capacity for synthesis, or integration, has always been recognized as central to what it means to be liberally educated. This recognition is expressed, for instance, in Oliver Wendell Holmes’s observation that “the knowledge of a man, who confines himself to one object, bears the same relation to that of the liberal scholar that the red or violet ray of a prism does to the blended light of a sunbeam.” Yet, by the end of the last century, it had become clear that many structural impediments to this sort of blending had grown up within the academy, and that the practiced ability to make connections could no longer be taken for granted as an outcome of liberal education. Greater emphasis was needed on this aspect of liberal education, and greater intentionality in fostering it was needed on the part of colleges and universities.

As a result, integrative learning has very quickly become a watchword of liberal education in the twenty-first century. The prominence given to integrative learning in the listing of LEAP essential learning outcomes, for example, reflects widespread and growing acceptance of the notion that, in order to remedy the fragmentation and incoherence of the undergraduate experience as well as to anticipate the complex demands of life and work in this global century, colleges and universities must develop more effective ways of fostering students’ ability to make connections among ideas and experiences and to synthesize and apply their learning across a variety of fields and contexts. Already, the borders are becoming increasingly porous between academic departments, general education and the major, the curriculum and the cocurriculum.

To a certain extent, however, acceptance has so far outpaced understanding. In an article published in Peer Review a few years ago, Mary Taylor Huber, Pat Hutchings, and Richard Gale—leading experts on integrative learning—quoted a frustrated faculty member who observed that “we are very fond of talking about integrated multidisciplinary learning experiences,” and who asked through a professional development listserv for “some reflections on what this might actually mean in practice.” “This,” Huber, Hutchings, and Gale admit, “is the $64,000 question.”

The Featured Topic section offers some answers. In the lead article, Bill Newell, professor of interdisciplinary studies at Miami University and executive director of the Association for Integrative Studies, sketches a focused vision for integrative learning and, secondarily, interdisciplinary studies. The authors of the second article present a successful faculty development model from Roanoke College that addresses the challenges of preparing faculty to teach courses that incorporate broad skills and make connections across disciplinary boundaries. In the third article, a Fulbright Scholar in General Education reflects on his recent experience in Hong Kong, where educators are confronting many of the same challenges of integrative learning that face educators in the United States.

Fittingly, and perhaps inevitably, the topics of integrative learning and interdisciplinarity do not respect the regular division of Liberal Education into departments. As you will see, these topics surface throughout this issue.—DAVID TRITELLI
New Senior Director for Student Success
Tia Brown McNair, formerly assistant director of the National College Access Network, has been appointed as senior director for student success in the AAC&U Office of Engagement, Inclusion, and Success. In this newly created position, McNair will help lead AAC&U’s efforts to “make excellence inclusive” and to ensure that all students—including those from groups that have traditionally been underserved by higher education—gain the benefits of attaining the full spectrum of outcomes that result from an engaged liberal education.

McNair will collaborate with all AAC&U program offices and take a leading role in advancing AAC&U projects and meetings on student success. She will join ongoing work within the Liberal Education and America’s Promise (LEAP) initiative, including current sponsored projects with states and state systems as well as the new Developing a Community College Student Roadmap project. McNair will work with AAC&U Vice President Susan Albertine to provide leadership for the LEAP States Initiative, particularly focusing on the alignment and quality of learning from school through two-year and four-year undergraduate education.

AAC&U to Help Develop National Action Plan for Civic Learning
AAC&U has been named as subject expert to work with the Global Perspective Institute on a new civic initiative sponsored by the US Department of Education. Through a series of national dialogues, and with the guidance of a coordinating committee, AAC&U will help develop a set of recommendations for a national action plan to increase the visibility and impact of higher education’s efforts to advance students’ civic learning and democratic engagement. More information about this new project is available online at www.aacu.org.

Upcoming Meetings
- January 26–29, 2011
  Global Positioning: Essential Learning, Student Success, and the Currency of US Degrees, AAC&U Annual Meeting, San Francisco, California
- March 3–5, 2011
  General Education 3.0: Next-Level Practices Now, Chicago, Illinois
- March 24–26, 2011
  Engaged STEM Learning: From Promising to Pervasive Practices, Miami, Florida

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Within higher education, it is commonplace to observe that the world has become complex, and that our students will live out their lives in a world that is even more so. At a 2009 conference sponsored by the Association of American Colleges and Universities (AAC&U) in partnership with the Association for Integrative Studies—aptly titled “Integrative Learning: Addressing the Complexities”—the keynote speaker, Veronica Boix Mansilla, and a plenary speaker, Bruce Hutton, both identified globalization as a key driver of this increasing complexity. They argued for a redesign of higher education to prepare students to cope with the myriad complex situations they will face in a “globalized” world. Several years earlier, the Greater Expectations National Panel asserted that “the key to successful reform is a clear focus on the kinds of learning that students need for a complex world” (AAC&U 2002, x). I believe that a mixture of integrative learning and interdisciplinary studies, appropriately conceived and well grounded in academic disciplines, constitutes the most effective education for a complex world. But how exactly should interdisciplinary studies and integrative learning be conceived?

When I started teaching interdisciplinary courses in the late 1960s, interdisciplinary studies was a variously defined umbrella term for any curricular approach that was not narrowly disciplinary. Forty years later, the interdisciplinary studies profession had moved toward a more focused definition of interdisciplinary process, one ideally suited for understanding complex situations. Julie Thompson Klein and I set out the first version of that definition in the Handbook of the Undergraduate Curriculum: “interdisciplinary studies may be defined as a process of answering a question, solving a problem, or addressing a topic that is too broad or complex to be dealt with adequately by a single discipline or profession . . . [It] draws on disciplinary perspectives and integrates their insights through construction of a more comprehensive perspective” (1997, 393–4).

Similarly, integrative learning started out with an eclectic and varied definition. The broadest conception is contained in Lee Shulman’s observation that “there’s a sense in which all learning is integrative” (Huber, Hutchings, and Gale 2005, 7). Mary Huber and Pat Hutchings refer to fostering “students’ abilities to integrate their learning across contexts and over time” (2004, 1), to which “A Statement on Integrative Learning,” developed jointly by AAC&U and the Carnegie Foundation for the Advancement of Teaching, adds “and between campus and community life” (Huber and Hutchings 2004, 13). Julie Thompson Klein defines integrative learning as “an umbrella term for structures, strategies, and activities that bridge numerous divides, such as high school and college, general education and the major, introductory and advanced levels, experiences inside and outside the classroom, theory and practice, and disciplines and fields” (2005, 8).

WILLIAM H. NEWELL is professor of interdisciplinary studies at Miami University and executive director of the Association for Integrative Studies.
I propose a more focused way of thinking about integrative learning, one closer to the general cognitive approach underpinning the rubric for integrative learning developed by AAC&U’s Valid Assessment of Learning in Undergraduate Education project, which defines integrative learning as “an understanding and a disposition that a student builds across the curriculum and cocurriculum, from making simple connections among ideas and experiences to synthesizing and transferring learning to new, complex situations within and beyond the campus” (Rhodes 2010, 51). To prepare students to meet the challenges of a complex world, I believe we need to think of integrative learning as analogous to interdisciplinary studies. That is, we need to define integrative learning as outside-the-classroom activity (off as well as on campus) that provides students with certain types of experiences that facilitate the integrative process, experiences through which they are confronted with new perspectives and are challenged to integrate insights from divergent perspectives.

To appreciate the complementarity of integrative learning and interdisciplinary studies, so conceived, visualize several disciplinary groups each examining a complex situation from the vantage point of its own ivory tower (or silo). Because disciplines stand outside the complex situation and view it from different angles, they naturally see different aspects and arrive at different understandings of it. Meanwhile, interdisciplinarians visit each of the ivory towers to learn from the disciplines, and then step back to see the complex situation as a whole. Their goal is to integrate the insights of the disciplines into a more comprehensive understanding of the complex situation, one that best fits all available empirical evidence. This way of thinking about interdisciplinary studies has come to be widely, though by no means unanimously, accepted in the United States over the past decade. Yet few educators seem to have given much thought to the ways in which interdisciplinary studies and integrative learning can fruitfully be understood as complementary.

Integrative learning experiences bring students into contact with people who are inside the complex situation. Since these people are situated in different social locations, they look at the complex situation in which they find themselves from different angles, experience it differently, and come to different understandings of it. Study abroad experiences and multicultural education introduce students to people from foreign countries or cultures. Service learning, community service, practicums, and field work expose students to people from communities closer to home geographically, but who may be distant from them economically, socially, or racially. Learning communities, living-learning programs, and collaborative learning engage students with other students who may be of different races, classes, genders, sexual orientations, political persuasions, religious beliefs, and so forth. Talking to one or two people from another culture, community, or racial group may yield mostly idiosyncratic insights—after all, there is a lot of variation within cultures, communities, and groups—but if students get a chance to talk to enough individuals, the distinctive perspective of that culture, community, or group should start to become apparent. That’s why we set up whole programs like study abroad or service learning—so students get an entire semester of interactions with people with different perspectives.

Integrative learning is not just about making connections, however; in themselves, connections do not empower students. The challenge of integrative learning is to make sense of the contrasting or conflicting insights by integrating them into a more comprehensive understanding of the situation in its full complexity. In the course of their integrative learning activity, students may encounter many such complex situations. Any courses linked to those experiences offer students perspectives (disciplinary or interdisciplinary) from outside the complex situation. They confront students with the additional challenge of integrating disciplinary insights from outside as well as experiential insights from inside the complex situation.

**An interdisciplinary and integrative approach**

What complex situations require in order to be understood as fully as possible is an approach that is interdisciplinary and integrative. Grounded in the disciplines and in out-of-class experiences, such an approach exposes students to diverse perspectives and encourages them to integrate their insights. Integrative learning provides students with additional information about a complex situation beyond what the disciplines or even interdisciplinary studies can
offer. Setting up these approaches to maximize their effectiveness requires a rethinking of curriculum and pedagogy by faculty and administrators, as well as a rethinking of the cocurriculum and services by student affairs professionals.

Educators constructing integrative learning experiences face many challenges that are similar to those that confront faculty designing interdisciplinary courses. The educational experience needs to be designed so that it helps prepare students to address new complex problems after they graduate. Activities need to be organized that maximize the chances students will encounter other perspectives on relevant complex situations instead of leaving those encounters to serendipity. Students need to be encouraged to probe the assumptions and values underlying those perspectives. And students need occasions, and the means, to ponder how the insights from the diverse perspectives they encounter might appropriately be integrated into a more complete understanding of those complex situations.

If an educational institution offers several types of integrative learning experiences, each should be set up according to the same precepts in order to produce a synergistic effect. That is, they should reinforce the same set of skills, sensibilities, and habits of mind as are promoted by interdisciplinary studies. These include valuing diversity, “both/and” thinking, rejection of simplistic solutions, critical thinking, looking behind stated positions for underlying values and assumptions, and facility with techniques for creating common ground and best practices for constructing a more comprehensive understanding. The institution should provide opportunities for students who are engaged in an integrative learning experience (or who are veterans of such an experience) to interact with students who are or were engaged in other integrative learning activities. The idea is to ensure that as many aspects of the collegiate experience as possible promote a common set of learning outcomes—outcomes pertinent to a complex world. When that is achieved—as it has been at some experimental colleges (Newell 2001)—the impacts of integrative learning tend to be multiplicative, rather than additive, since interaction effects abound. The result can be a transformative educational experience.

**Integrative learning is not just about making connections**

The disciplines, which collectively follow a reductionist divide-and-conquer strategy using simplifying assumptions and “either/or” dualistic thinking, were not designed to address such complex situations, though the partial insights they provide are absolutely essential to understanding individual aspects of a complex situation. Each academic discipline studies a subset of the elements of a complex situation and the connections among them, producing valuable but partial insights into the complex situation as a whole. The tasks of identifying connections among subsets, creating common ground, and integrating disciplinary insights into an understanding of the complex situation as a whole, however, are left to interdisciplinary studies.

**An interdisciplinary and integrative process**

Thanks to growing consensus on a definition of interdisciplinary studies and agreement by almost all interdisciplinarians that interdisciplinary study is characterized by a process that includes integration, several variants of a theory of interdisciplinary studies have recently emerged that spell out the generic process of interdisciplinarity. The version of the theory proposed by Allen Repko (2008) has received the most attention. He identifies a ten-part interdisciplinary process that culminates in a deconstruction of interdisciplinary integration: identify conflicts between insights; create common ground; integrate insights; and produce and test an interdisciplinary understanding of Miami University

![Integrative Learning Image](image-url)
the problem. Thanks to this new focus on the details of interdisciplinary process, interdisciplinarians have now identified some useful techniques and best practices that demystify the process of interdisciplinary integration. I believe they can be readily adapted for use in integrative learning as well.

Interdisciplinarians are aware of at least four techniques for creating common ground: redefinition, extension, organization, and transformation. (Repko [2008] discusses them in detail and provides examples of their use in different fields, so I provide only a cursory review of them here.)

1. Redefinition. Disciplines are notorious for jargon, but even when they use the same term, it has a different penumbra of meaning because of the different intellectual contexts. We need to identify the kernel of meaning that two concepts have in common and their precise areas of overlap.

2. Extension. Common ground can be created by extending a concept from one discipline into the domain of another discipline. In recent years, for example, the concept of sustainability has been extended from the environment to include economic activity and indigenous cultures, creating common ground among advocates for the environment, economic development, and indigenous peoples.

3. Organization. Factors that are the focus of one discipline can be seen not as competing with the factors studied by another discipline to explain a situation, but as constraining, complementing, or reinforcing them. Or, they can be placed along a continuum, as when Boulding (1981) saw that benevolent behavior studied by sociologists and malevolent behavior studied by political scientists can be placed along a continuum of other-regarding behavior (positive and negative), with the self-regarding behavior studied by economists at the midpoint.

4. Transformation. Instead of treating diametrically opposed views as axiomatic assumptions (e.g., human behavior results from the exercise of free will versus it is determined internally by genes or externally by environment), treat them as endogenous continuous variables (e.g., ask how much freedom people have in a particular situation).

New from Jossey-Bass

Creating Interdisciplinary Campus Cultures: A Model for Strength and Sustainability

By Julie Thompson Klein

With increased interest in interdisciplinarity across the academy and funding agencies, the focus of this book is of heightened importance. Creating Interdisciplinary Campus Cultures provides a systematic approach grounded in a conceptual framework and a portfolio of pragmatic strategies. Chapter 1 maps developments across sciences, social sciences, and humanities. Chapter 2 describes patterns across campuses and variables of change. Chapter 3 addresses capacity building through mapping local interests, creating oversight and leadership, and building an endowed position. Chapter 4 defines elements of strength for critical mass, program review, and sustainability. Chapter 5 covers the career life cycle of hiring, tenure and promotion, and faculty development. The Resources section identifies key works and forums.

Interdisciplinarians have also identified a series of best practices related to the construction of a more comprehensive understanding:

- Assume every perspective that has stood the test of time has a kernel of truth to it.
- Find what is useful in each of the perspectives you dislike and what is problematic about each one you like.
- Create commonalties instead of making compromises.
- Find overlooked connections between ideas from different perspectives.
- Embrace contradiction, asking in what sense a situation can be “both.”
- Engage in shuttle diplomacy, going back and forth between theories, and between theory and empirical evidence.
- Seek an understanding that is responsive to each of the contributing perspectives but not dominated by any one of them.

**Conclusion**

The vision of integrative learning set out here has obvious implications for designing and implementing integrative learning experiences. For example, following up on the argument of Huber, Hutchings, and Gale (2005) that integration must be intentional, students need to be taught how to integrate. But their argument also offers a rationale for integrative learning that allows us to respond to critics who perceive such activities as nonacademic fluff and thus expendable. Similarly, a conception of interdisciplinary studies leading to courses that demonstrably prepare students for complex decision making is the best defense against critics who charge that interdisciplinary courses are not central to the mission of the institution. It also provides a response to those who ask why we should insist on a particular conception of interdisciplinarity when everyone is doing interdisciplinary studies these days. Such integrative and interdisciplinary activities have the additional benefit of motivating students by demonstrating the real-world relevance of their education.

I have long felt that the best undergraduate education asks students to go back and forth between disciplinary and interdisciplinary courses, since interdisciplinary courses need the disciplines for depth and disciplinary courses need interdisciplinarity for real-world applicability (Newell 1983). It is only recently, however, that I have come to realize that students also need to shuttle back and forth between the classroom and the outside world. This is not for financial reasons, as with the old co-op programs, but because integrative learning subjects theory to the reality check of human experience, while dispassionate theory is the best antidote for emotional and parochial bias. But interdisciplinary studies and integrative learning can achieve their full potential only if they are conceived in a way that values diversity of perspective, demands integration of insights, and embraces holistic as well as reductionist thinking. Only then are students prepared to meet the challenge of coping with complexity.

To respond to this article, e-mail liberaled@aacu.org, with the author’s name on the subject line.

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**REFERENCES**


How can we prepare faculty to teach courses that incorporate broad skills and make connections across disciplinary boundaries?

ADRIENNE BLOSS is associate dean for academic affairs and general education, PAUL HANSTEDT is professor of English, and SUSAN KIRBY is FIPSE project coordinator at Roanoke College. Some of the initiatives described in this article were supported by a grant from the US Department of Education. However, the contents of this article do not represent the views or policy of the US Department of Education, and you should not assume endorsement by the federal government.

Of course, everyone knew this curriculum would require extensive faculty development. It’s a sophisticated model, after all, asking faculty to approach the classroom in new and innovative ways—ways that graduate school didn’t prepare them for; ways that their previous teaching experiences didn’t encourage them to explore. And now it’s your job to make it happen.

Faculty development.
Yes. Of course.
You reach for a donut.

Jerry Gaff devotes the last eighth of his seminal article “Avoiding the Potholes: Strategies for Reforming General Education” to a discussion of implementation. Among other points he makes is a key one: “Courses that stress skills rather than content, that range beyond disciplinary boundaries, or that deal with value implications of knowledge pose challenges for any teacher, and such courses are especially difficult for teachers who are cut out of a traditional mold” (1980, 59). This is as true today as it was thirty years ago, and the current trend favoring highly integrative curricular models promotes courses with exactly these characteristics. In a professional setting where promotion requirements insist on the maintenance of the laser-like focus developed by graduate school training, how can we prepare faculty to teach courses that incorporate broad skills and make connections across disciplinary boundaries?

What follows is one liberal arts college’s answer to this question. While the solutions Roanoke College developed to address these...
issues are by no means perfect, they can, at the very least, provide a valuable framework for further discussion.

**Roanoke’s intellectual inquiry curriculum**

Integrated curricula come in many forms. The Roanoke College Intellectual Inquiry (INQ) curriculum draws integration from three areas. First, each INQ course is based on a focused topic. Whether a first-year seminar or an introduction to statistics, each course is taught in the context of a question or issue to which the skills of the course apply. Statistics are important because they help people analyze, among other things, gun control policies, health claims, weather forecasting, sports, and social justice issues—which is why each of these is a topic for one of our statistics courses. This contextualized focus also applies to INQ courses in the sciences, social sciences, and humanities: the common goals center on disciplinary skills and methodologies, while the topic of the course determines how those skills and methodologies are used.

Second, each disciplinary INQ course is taught from a global, natural world, or Western perspective. The perspective frames the way the topic is developed and explored. In some cases, the same topic could be taught from different perspectives—e.g., analyze US or global data in examining statistics on gun control—while in others the topic and perspective are inextricably linked. Third, all INQ courses incorporate writing and (with one exception) either oral communication or quantitative reasoning. This requirement applies to the disciplinary courses, so students have to write in their physics classes and may well use quantitative reasoning in their history classes.

Our work in preparing faculty to teach this curriculum has validated the assertion that “a sustained, connected set of faculty development experiences” is needed to “build the necessary level of skills, commitment, and community” for integrative teaching (Huber et al. 2007, 51). In the end, it’s our sense that two components, preferably in combination with one another, can help create an atmosphere of sustainable faculty development for an integrative curriculum. More specifically, we believe successful development models highlight the intellectual nature of course design and pedagogy while encouraging a creative, exploratory approach. We will discuss these two components in the context of three of our own faculty development efforts: the Writing Initiative Grant program, the Collaborative Teaching Grant program, and course design workshops.

**Writing initiative grants**

The Writing Initiative Grant program actually predates our new INQ curriculum. In fact, in many ways this program helped lay the foundation for a campuswide conversation about the need for curricular change. The structure of the program is fairly straightforward: faculty from outside the English department apply for grants to learn how to teach writing, and then they teach it. Pre-INQ, this meant teaching writing in a first-year writing course. Post-INQ, it means teaching writing in a non-English general education course. Imperative to the success of this program are three simple ideas: (1) faculty should receive a full year of training prior to implementing the writing aspect of their courses; (2) the training should be not only practical but also intellectual in nature; and (3) faculty should teach multiple iterations of their writing-intensive course.

In practical terms, this means that grant recipients begin the development process by reading several highly theoretical articles on the nature of composition studies in the United States—James Berlin’s “Rhetoric and Ideology in the Writing Class” (1988), for example, or David Bartholomae’s “Inventing the University” (1985). We take this approach in order to foreground the idea that teaching, like research and scholarship, should not begin at the level of tips and tricks. Rather, the
practices we use in the classroom should arise from careful consideration of the broader contexts: If I choose to respond to my students' essays using method X, what informs that choice? What are the consequences—academic, political, psychological, and so forth—of that choice? Additionally, as with scholarship, our teaching practices should demonstrate a willingness to attempt new methods, examine the results, and adjust as necessary.

We also find that a scholarly approach to faculty development appeals to the scholar in all of us. We got into this profession, after all, because we enjoy ideas, we enjoy testing our minds, we enjoy exploration and discussion. This last point implies that raising the intellectual level of development allows for scholarly “small talk.” Ten academics in a room debating an issue are also forming a community, a group with a common language and shared values forged around a discussion of the things we care about—our students, our work, the life of the mind. That the training goes on for a year (and indeed, because multiple iterations of the course are taught, for two to four years) only strengthens this sense of community.

Additionally, because of the length of the program, an exploratory atmosphere is created. A shorter development period can lead to an almost algorithmic approach: “I don’t have much time, so let me cut to the chase and just give you the formula for success.” But as we know all too well, no such formula exists. By contrast, faculty are more likely to develop individualized approaches that will be successful for them and will become integral to their teaching if they have time to explore pedagogical issues before they get into the classroom; if they can exchange ideas, both theoretical and practical, with colleagues; and if they have the opportunity to reconsider, rehypothesize, and reimplement based on the results of their first attempts.

Collaborative teaching grants
Our Collaborative Teaching Grant (CTG) program began as an imitation of the Writing Initiative Grant program. We wanted to encourage faculty in different disciplines to find connections between their fields and their courses, and to seek areas of integration that could be developed and highlighted for students. Why not, then, develop a program where faculty applied for a CTG, where they participated in not just practical but intellectual discussions, and where they were expected to teach the course not just once, but two or three times?

Fairly quickly, the CTG program evolved into its own animal. Partly as a result of a scarcity of intellectually engaging materials on collaborative teaching, the intellectual part of the question had to be addressed in a different way, namely, through increased dialogue among collaborating faculty. Sometimes this happened in the classroom; we had, for instance, an ethics course collaboratively taught by professors specializing in theology, Eastern religions and literature, and drama who relished the in-class debates created by their agreements and disagreements about the course material.

One of the most interesting elements of the CTG program was the range of ways in which faculty collaborated. We tend to think of collaboration in terms of traditional team-teaching—two professors in a single class—but doubling the resources for each class was not a model we could sustain, and team-teaching by simply dividing a course in half did not provide the integration we sought. So we encouraged faculty to envision other ways to collaborate, and their creativity flowed—from linking theory and application courses through joint assignments, to highlighting different faculty perspectives through plenary lectures in common courses, to using a single offering of team-teaching as a springboard to more integrative standalone courses down the road.

All these methods promote faculty conversations across disciplinary and departmental boundaries. They provide participating faculty with an expanded arsenal of ideas, knowledge, and ways of thinking that they carry with them back to their departmental, noncollaborative courses. And ultimately, they all help give students a more integrated experience.

Results from our assessment of the CTG-funded courses suggest that a majority of participating students found these experiences more integrative than traditional, single-discipline courses. The exposure to different faculty
perspectives within a course helped them make connections across the disciplines involved and improved integrative skills such as valuing, examining, and combining diverse viewpoints. Similarly, faculty learned from each other—both content and teaching methods—when co-planning (and sometimes co-implementing) a course. Faculty evaluations suggest that these collaborative projects often enhanced instructors’ sensitivity to integrative and inter-disciplinary possibilities in all their classes.

Course design workshops
Very early in our curriculum development process, we were fortunate to encounter the work of Barbara Tewksbury, a geoscientist from Hamilton College. Working with the support of a grant from the National Science Foundation, Tewksbury, together with Heather Macdonald from the College of William and Mary, developed a top-to-bottom approach to course design that is specifically structured to help faculty in the geosciences move beyond traditional coverage-based models and traditional instructor-centered classrooms. They eventually revised and expanded their no-nonsense, jargon-free approach into a flexible online tutorial and workshop approach that is appropriate for courses in any field, including general education.¹

There is nothing especially startling about Tewksbury’s model. It’s essentially a “backward” course design program, wherein faculty begin with a simple guiding question: what should students be able to do when they have completed the course? Tewksbury mercifully cuts through the usual load of eduspeak by simply calling the answers to this question...
“goals.” Once workshop participants have established baseline goals, they are asked to (re)consider course content and structure. Teaching chemistry in the context of a crime scene invites a different course organization from teaching chemistry in the context of the environment, for instance, and neither approach is likely to mirror the organization of a standard textbook. Identifying a structure that both supports the goals and draws effectively on available materials can be challenging, but the payoff is a framework for giving students meaningful, transferrable skills and knowledge. From here, Tewksbury (or whoever is leading the workshop, which is eminently portable) asks participants to think about how their course goals and structure might shape course assignments and assessments. And finally, faculty explore active-learning pedagogies that will help students practice the desired outcomes prior to final assessment.

Since discovering Tewksbury's holistic workshop, we have used tailored versions of it multiple times in multiple contexts, working with more than a third of our faculty to develop over sixty new courses from mathematics to music. One of our number has even taken the development model to Hong Kong, where he adapted it to the needs of his host institutions and used it many times with great success.

Our sense is that this particular version of the backward design model is so successful in part because it allows space for intellectual exploration and engagement. This is particularly true during two or more “gallery walks,” wherein faculty display and receive feedback on drafts of the various stages of their course design. For instance, once the concept of goals is introduced and some guidelines are given for designing effective goals (e.g., make them high order, make sure they are concrete and measurable), faculty are given markers and poster paper and are asked to draft a set of goals for their own courses. Once these are done, people circulate, reading quietly and leaving comments—praise, suggestions, concerns—via Post-it notes. A similar approach is taken in a culminating poster session during which polished drafts of goals, content organization, assessments, and day-to-day pedagogies are displayed and participants circulate, giving feedback. A larger conversation involving the entire group occurs after each “walk”: Which goals seemed particularly strong? What concerns did people have? How did or will they revise their own work, based upon what they’ve seen?

Beyond the obvious practical results of this strategy—ideas are first tossed up, critiqued, and then revised into more polished form—there are a few additional benefits. Pedagogical tips are sought and shared; broader intellectual discussions form around the ideas presented on posters; relationships between courses and fields are revealed; common interests are identified, from mountain biking to Vygotsky to chaos theory; and possible collaborations are explored. The informal exchanges build shared values and goals that engender respect among colleagues, inviting faculty to venture beyond disciplinary silos.

And that’s the point, because ultimately it’s about faculty development. And as Jerry Gaff (1980, 55) pointed out, citing the “iron law” declared by former University of Chicago dean Jonathan Smith, “students shall not be expected to integrate anything the faculty can’t or won’t.”

Yes. Of course.

Reach for a donut.

It’s time to get started.

To respond to this article, e-mail liberaled@aacu.org, with the authors’ name on the subject line.

REFERENCES

NOTE
1. See the Cutting Edge Course Design Tutorial developed by Barbara J. Tewksbury and R. Heather Macdonald, which is available online at http://serc.carleton.edu/NAGTWorkshops/coursedesign/tutorial/index.html.
EARLY IN THE START of the current decade, the Hong Kong Education Board reached a startling conclusion: the Hong Kong educational system was not working, and it needed to be changed. In part, the board’s decision was made in the name of equity: the current secondary system, based on England’s fifth-form and sixth-form exams, channeled roughly two-thirds of high school students into the workforce after only five years of post-primary education. In part, the decision was made for purely economic reasons: for a long time, the chatter in business circles had been that the graduates of Hong Kong’s eight public universities were very good at taking tests, but very bad at making thoughtful decisions in the workplace. When faced with the rapidly changing challenges of a newly digitized and globalized economy, Hong Kong graduates simply didn’t seem up to snuff.

The ensuing educational reforms were dramatic. Secondary education would be expanded to keep 100 percent of the population in school until the age of eighteen, and it would be shortened from seven to six years. Tertiary education, meanwhile, would be expanded from a three-year British model to a four-year American model. And the University Grants Council (UGC), the controlling organization for university funding, didn’t want that fourth year to be an “add on,” with students simply receiving additional education in a narrowly focused field. Rather, they sought a “common year” during which students would explore beyond their field and develop the cognitive flexibility and problem-solving skills the current graduates lacked. The thinking was that if Hong Kong university students were going to compete in a rapidly changing workplace—and if Hong Kong was going to continue to compete in the globalized economy—they would need to become comfortable with transferring knowledge from one field to another and with facing unanticipated challenges, and they would need to develop the ability to call upon previous, seemingly unrelated problem-solving experiences to address new situations.

Enter Po Chung, one of the founding directors of the international express mail and logistics company DHL. Educated in the United States, Chung knew what a good liberal education could do for students. And he was dedicated to making sure Hong Kong made the tertiary changes in the right way. His first idea was to fund an endowed chair of general education at one of the Hong Kong universities, but Glenn Shive, director of the Hong Kong America Center, proposed something more comprehensive: why not fund a series of special Fulbright scholars, knowledgeable in liberal learning, to come to Hong Kong over a period of several years, consulting with the various institutions as they work their way through the complicated process of developing comprehensive curricular revisions? Chung and Shive subsequently spent the next nine months selling the idea to Fulbright and top-level university administrators of Hong Kong’s eight UGC-funded universities. The ensuing program, the Fulbright Scholars in General Education, began in the fall of 2008, and will continue through the spring of 2012. Five scholars per year are sent to Hong Kong, each based at a different university but working in coordination across the system as well.

While it may be tempting to read this grand project as yet more evidence that the United States is going to fall behind in its own game—are we the home, after all, of liberal learning?—the reality is much more complex. The trends—both good and bad—that we’re seeing in the second year of the Fulbright program in

The trends that we’re seeing in the second year of the Fulbright program in Hong Kong often mirror the struggles and successes we’re seeing in stateside efforts, albeit with an Asian twist

PAUL HANSTEDT, professor of English at Roanoke College, served as a Fulbright Scholar in General Education at the Hong Kong Institute of Education from August 2009 to June 2010.
Hong Kong often mirror the struggles and successes we’re seeing in stateside efforts, albeit with an Asian twist.

**Trend 1: Culture change is never easy**

Liberal learning makes sense in the business world; people who work in the corporate and nongovernmental sectors understand that paradigms shift constantly and often very suddenly. Academics, on the other hand, are used to the idea that knowledge changes, but they experience this phenomenon largely within their own finite fields. Certainly there are exceptions—the emergence of cultural studies, for instance, or of specialized crossover fields like biochemistry—but for the most part academics are rewarded not for their willingness to transgress disciplinary boundaries, but for their ability to specialize successfully in increasingly narrow ways. As a result, academics are often slow to value integrative education—specific pedagogies that encourage students to make connections between fields and that research indicates help prepare them for a changing workplace. Often sheltered from the cross-disciplinary realities of the work world (an architect, after all, doesn’t separate her day into ENG, SOCI, and POLI rubrics), professors don’t see the necessity of asking students to think about why a biology major should care about political science, why a social work major should pay attention to chemistry, or why anybody in their right mind would want to study Victorian literature.

If anything, this phenomenon is even more pronounced in Hong Kong. For the most part, “publish or perish” didn’t exist here until the early 1990s, but when it came, it came with a vengeance. While teaching is always given lip service, and institutional service is recognized as a necessary evil, no one questions the idea that publication in peer-reviewed journals is for all practical purposes the only criterion by which faculty are promoted. That most of the Hong Kong universities lack a tenure system—operating instead on three-year, renewable contracts regardless of individual status—only exacerbates this emphasis on narrowly focused publication.
The result is that even though almost all the Hong Kong universities now have at least the outline of a general education program, many of them lack cohesion. There is a distribution of courses over the various disciplines, perhaps a core course or two, but very little to connect the dots—much the same as in many American schools.

**Trend 2: It’s a top-down world**

It might be different for the Fulbright Scholars in General Education coming from state universities, but for those who arrive from small or independent colleges in the United States, the level of control the University Grants Council has over the eight funded Hong Kong universities seems extraordinary. This centrally organized board determines exactly how many students go to which universities and what their majors will be—though this last part will change with the new curriculum, and only the disciplines will be determined.

Understandably, then, Hong Kong universities have something of a love-hate relationship with the council. On the one hand, this organization is the font of all resources, and can be incredibly generous (Hong Kong spends almost 25 percent of its budget on educating its citizens); on the other hand, this highly centralized decision-making system often leads to frustrating outcomes. Each year, for instance, the Hong Kong Institute of Education, Hong Kong’s flagship teacher-training university, is told exactly how many primary school teachers trained in the arts, the sciences, and the social sciences they are to produce. Sometimes the system clearly fails to make logistically reasonable decisions. Asked to develop a complicated, high-maintenance program to train teachers for Hong Kong’s new liberal studies requirement in secondary school, for instance, the Institute of Education was assigned only ten students per year, a barely sustainable number. With this in mind, it’s understandable that faculty at all the universities, and even the administrators, might view with skepticism the council’s decision mandating the common year.

Paradoxically, as a Confucian heritage culture, Hong Kong (and the rest of China, for that matter) tends to favor a top-down decision-making process even within a particular administrative structure. As Confucius himself put it, there is no harmony without hierarchy. In some cases, this has led to top-down implementation at the university level. Working on his or her own, a dean or provost may decide “this is how it should be,” and that is that. Even if an individual faculty member doubts the wisdom of the decision, he or she may be reluctant to question it openly. As Eugene Eoyang, professor emeritus of Lingnan University puts it, “no one in Hong Kong ever gets fired for following the rules.” And over time, these rules become set in stone. Hong Kong, known for its vitality and energy, can sometimes seem a rather algorithmic place: what is, is, and can’t be changed. A colleague tells a story, perhaps apocryphal, of a university where no one was allowed to ride bikes on campus. Then one day a professor was late for class, and, rather than dismounting at the gates and walking to his office, he pedaled across the campus. When confronted by guards outside his building, he asked that they point to the rulebook that forbade cycling on campus. They couldn’t, and neither could their superior. No such rule actually existed, but it was followed assiduously nonetheless.

**Trend 3: Discussions about pedagogy**

In many ways, assumptions about university teaching are no different in Hong Kong than in the United States. The vast majority of faculty members offer their students the same delivery approach they themselves experienced while in college, namely, the teacher at the front of the class talks while the students listen. “It worked for me,” these professors tend to think, “and it’ll work for my students, too.” If anything, though, this impulse toward top-down knowledge banking is perhaps even stronger in Hong Kong. To some degree this is due to the nature of the students—or at least instructors’ perception of students.

Every year, exactly 14,500 Hong Kong students are admitted to Hong Kong universities free of charge. This is approximately 18 percent of the age-eligible population. The other 82 percent are left to fend for themselves. Some head to colleges in Australia, the...
United States, or the United Kingdom; some receive associate’s degrees at one of the ever-growing number of two-year institutions; and the rest join the workforce. Understandably, this creates an atmosphere of intense competition among secondary students. Every other double-decker bus in Hong Kong is plastered with advertisements for “cram schools,” tutoring programs that charge huge fees, assuring parents and students that their program is, as one poster puts it, “the last chance to grasp success.” All of this results in a student population that perceives “education” to be the consumption of finite bytes of information in preparation for the exam. Accordingly, students’ expectation is that professors will lecture, providing them with as many facts as possible in a given period of time.

In this context, conversations about general education almost always evolve into conversations about teaching practices. This is often the result of the fact that in many general education courses content coverage is, if not exactly secondary, at least not preeminent. Therefore, there’s often more room in the courses for the kinds of active pedagogies that research indicates lead to deep learning. Similarly, the integrative nature of many general education programs can lead to a change in teaching practices. If, for example, a stated objective of the program is to provide students with the opportunity to draw connections between seemingly disparate courses or fields, it becomes awfully difficult for an instructor to assign the typical “choose a topic of your liking and research it” essay. What, though, to put in its place? Openings like this have led to invaluable conversations in Hong Kong, where instructors exchange ideas about nontraditional pedagogies that work, about unusual assignments they’ve used, and about their constructions of student expectations. More often than not, the belief that students will insist on passive learning is undermined, if not shattered.

**The current tertiary system in Hong Kong allows very little choice**

The current tertiary system in Hong Kong allows very little choice. The best students get to go to the best schools and, generally, can study whatever they choose, while the rest must sift through their options. One Hong Kong colleague in the field of art told me that it is not unusual for a new student to appear in his office who doesn’t know the first thing about art, never thought about art, doesn’t even particularly like art—and is now about to get a degree in art. The new four-year approach makes more room for student choice.
Instead of being assigned to a department, students will be assigned to a “faculty” (a “discipline” or “college” in American terms). They will then be free to choose which particular field within the broader area they will study.

Many of the conversations in Hong Kong are going even further, moving into the territory of “whole student” education. For example, a recent dialogue among faculty, administrators, and the Fulbright general education group at the Hong Kong Polytechnic, an institution that prides itself on the quality of its preprofessional programs, included discussion of student mental health issues like depression, alcoholism, and drug abuse. The challenge in Hong Kong—and elsewhere—is to avoid letting this discussion turn into a checklist of requirements. It’s not enough, as one (American) college president recently stated at a conference on the mainland, simply to create a checklist of the things that make us “whole”—mind, body, spirit, imagination, social self, and so forth. Rather, whole-person education needs to take a more heuristic approach, recognizing the often messy ways in which who we are out of class blurs with who we are in class, who we are emotionally influences how we think (and vice versa), and how learning is often a consequence of physical experience.

In short, conversations in Hong Kong are beginning (not for the first time, I’m sure) to shift to the “big” questions: How do we engage students in their own learning? How do we get them to think beyond the test? How can we move them into the communities outside the campuses? How can we inspire them in the life of the mind so that they begin to approach that near-mythical status of “lifelong learner”? Along the way, many professors are beginning to understand that whole-person education requires whole-person teaching—that, in other words, their engagement with their students must extend beyond the classroom and the PowerPoint presentation into those slightly fuzzier areas where we question our own ideas, take intellectual risks, and find the real joy of our work.

All of this, I understand, might sound just a bit condescending, placing not nearly enough emphasis on the “post” in postcolonial. It’s not, however, the presence of twenty American academics that is making these conversations possible. It’s the huge leap of faith the Hong Kong educational system is taking in tearing itself apart and putting itself back together again. This is an experiment to be applauded—and to be watched with great attention on both sides of the Pacific for what it can tell us about Asia as well as what it can tell us about ourselves.

To respond to this article, e-mail liberaled@aacu.org, with the author’s name on the subject line.
IT HAS BEEN over twenty years since the publication of reports calling for increased efforts to reform undergraduate STEM (science, technology, engineering, and mathematics) education. Since then, dozens of similarly themed reports have followed, and more still are currently being written. Three questions commonly recur in these reports: (1) What are the characteristics of effective teaching and learning in STEM fields? (2) How can we motivate more students to choose careers in STEM fields? (3) What should be done to ensure that all students are given the opportunities they need to be successful in STEM fields? Many have provided recommendations for improving STEM learning environments and ensuring broader success for all students. For example, in its 1989 report, the National Advisory Group of Sigma Xi, the Scientific Research Society, asserted that a quality undergraduate education provides students access to

- instruction that generates enthusiasm and fosters long-term learning;
- a curriculum that is relevant, flexible, and within their capabilities;
- a human environment that is intellectually stimulating and emotionally supportive;
- a physical environment that supports the other three dimensions.

Similarly, the Center for Science, Mathematics, and Engineering Education stated in its 1996 report that “all students should have access to supportive, excellent programs in STEM, and all students should acquire literacy in these subjects by direct experience with the methods and processes of inquiry” (4). Also in 1996, the National Science Foundation issued its seminal *Shaping the Future* report, whose sweeping recommendations to faculty, departments, and institutions still resonate today.

While significant progress has been made—especially with regard to our understanding of how students learn (Narum 2008)—the kinds of interactive, engaging, inclusive learning environments required for attracting, retaining, and graduating more students in STEM fields are not yet widespread. In a sense, much of the low-hanging fruit in advancing STEM education has been picked, and the really hard work of comprehensive institutional transformation is what lies ahead. The work ahead is less about what to do, and more about how to do it. More specifically, we need to concentrate on how to achieve transformation on a larger scale at more institutions of every type, in every state, in every classroom, and for every student in the nation. In order to move ahead in this way, we must understand what has happened (or not happened) to date, the forces at play in the institutional and national landscape, the currently dominant mental models, and the underlying assumptions that are driving or, in many cases, impeding progress.

We now have indisputable evidence that active and collaborative strategies that engage students in their own learning, and in relevant ways, are highly successful across all disciplines (not just STEM) and, importantly, for all students, including those from groups that have traditionally been underrepresented in higher education (Froyd 2007; Kuh 2008). And we know more about “what works” in translating this understanding to effective learning environments. As James Fairweather put it,

On balance the research suggests that the greatest gains in STEM education are likely to come from the development of strategies to encourage faculty and administrators to implement proven instructional strategies rather than to carry out additional research.
Leadership for Twenty-First-Century STEM Education
on these strategies. The largest gain in learning productivity in STEM will come from convincing the large majority of STEM faculty that currently teaches by lecturing to use any form of active or collaborative instruction. (2009, 26)

There are certainly more STEM classrooms today that utilize “pedagogies of engagement” than there were twenty years ago; however, these kinds of learning environments are still not as common as they should be given the overwhelming evidence of their positive outcomes. Our collective efforts must be more strategic, systemic, coordinated, and connected than they have been in the past. Project Kaleidoscope, because of its track record in highlighting and addressing issues in STEM higher education and its new partnership with the Association of American Colleges and Universities, is uniquely situated as a national, cross-disciplinary, undergraduate STEM education organization to address these challenges.

**Project Kaleidoscope 1.0**

Since its founding in 1989, Project Kaleidoscope (PKAL) has been pushing the frontiers of innovation in STEM pedagogy and faculty development, leadership capacity building, and network creation among its cross-disciplinary membership. In its first report, *What Works: Building Natural Science Communities* (1991), PKAL asserted that the most important attribute of strong undergraduate programs is a thriving “natural science” community, an environment where

- learning is experiential and steeped in investigation from the very first courses for all students through capstone courses for students majoring in science, technology, engineering, and mathematics;
- learning is personally meaningful for students and faculty, makes connections to other fields of inquiry, is embedded in the context of its own history and rationale, and suggests practical applications related to the experience of students;
- learning takes place in a community where faculty are committed equally to undergraduate teaching and to their own intellectual vitality, where faculty see students as partners in learning, where students collaborate with one another and gain confidence that they can succeed, and where institutions support such communities of learners.

These principles still guide PKAL’s work today. For the past two decades, PKAL has focused on engaging and cultivating a national cohort of faculty leaders who have the training and support to implement the kinds of educational changes required to advance “what works” in STEM education. The success of several signature programs has helped create what many now recognize as the PKAL “brand.”

PKAL’s approach to educational change is embodied in Faculty for the 21st Century (F21). Starting in 1994 with initial support from the ExxonMobil Foundation, early-career faculty members, supported by their deans, were purposefully woven together to form a national network. PKAL meetings and projects brought these F21 members together with other academic, scientific, and public leaders and facilitated the exchange of knowledge, experience, and expertise needed to transform the learning environment for undergraduate students in mathematics and the various fields of science. The PKAL F21 network today includes nearly 1,300 active leaders in undergraduate STEM at more than five hundred institutions across the country. Most of these institutions have two or more members; nearly eighty institutions have five or more, and twenty-four institutions have eight or more. As active scholars and practitioners of STEM teaching and learning, F21 members are among the nation’s pedagogical pioneers, leading change at the institutional and national levels. Through the F21 network and other national initiatives focused on introductory science courses, leadership, effective pedagogy, and interdisciplinary learning, PKAL has engaged thousands of faculty members and other leaders at hundreds of colleges and universities.

Over the years, PKAL has also engaged a broad cross-section of additional STEM faculty and administrators through national projects focused on transforming the teaching and learning enterprise of the STEM disciplines. A current project funded by the W. M. Keck Foundation, for example, is focused on discerning key recommendations for creating meaningful and sustainable interdisciplinary learning environments in STEM from nearly thirty campus-based projects around the country. A final report from this project, expected in early 2011, will describe recommendations and leadership strategies, and will set the foundation for future PKAL work in the interdisciplinary realm. One clear recommendation
from the project is that, in order for interdisciplinary programs to be both successful and sustained, grassroots faculty leaders must work together with the leadership at their institutions to advance agreed-upon goals for interdisciplinary learning that are established early in the process.

With funding from the National Science Foundation (NSF), PKAL has recently spurred the creation and evolution of regional networks focused on connecting STEM faculty members and leaders in local institutional consortia. Through biannual workshops and meetings, these networks are beginning to facilitate more extensive participation and engagement of STEM faculty and administrators in implementing more effective, learner-centered teaching strategies to improve student learning and success in STEM education. In addition to community building and sharing, the regional meetings have focused on effective pedagogy, twenty-first-century learning goals, the revision of introductory courses, calculus laboratories, STEM learning assessment, facilities planning, K-12 partnerships, community college articulation, and campus leadership development.

Some PKAL networks leverage other, already existing networks—formal associations or state college and university systems—while others have been formed wholly on their own by core groups of leaders whose local institutions and faculties have committed to participate. One such network has obtained NSF funding for its activities, and others have leveraged a variety of other funding sources to support their work. A wide range of institutional types are involved in these networks—from technical...
and community colleges to private liberal arts and public research institutions—and the number of institutions in each network ranges from ten to forty. The Science Education Resource Center at Carleton College is a key collaborating partner in PKAL’s regional network project, hosting PKAL’s pedagogic collection website and other resources (see http://serc.carleton.edu/sp/pkal/index.html).

The impact of this regional work is impressive: over the past two years, PKAL networks have held twenty-seven meetings that engaged over 1,750 faculty members and administrators. And four new networks are now emerging in Southern California, New York, North Carolina, and Virginia/Washington, DC, as PKAL continues to expand its distributed community with members drawn from institutions new to PKAL.
For the past fifteen years, PKAL has held summer leadership institutes, primarily for early and mid-career faculty—mostly those in the F21 network. Over 150 STEM faculty members have attended these weeklong retreats designed to help faculty members think more deeply about advancing a STEM education project on their campuses—from developmental math courses and undergraduate research programs to multi-section, learner-centered science courses. Participation in the institutes also helps emerging leaders better understand how to achieve the right focus and balance in their careers, how to function within their institutional contexts as well as the national system of STEM higher education, and how to lead institutional change projects. Participants leave with a new sense of their place in the institution, a plan for action to achieve their goals, new skills that will help them succeed, and a lasting connection to a larger network dedicated to a shared vision of effective STEM education. The PKAL summer leadership institutes will be expanded in the coming years to reach beyond the F21 network, and their scope will be widened to include department chairs and other formal campus leaders in STEM.

Finally, PKAL has over the years built close working relationships with several scientific professional societies and other educational associations. And PKAL has often acted as information broker, connector, and convenor for deep work in STEM education with additional stakeholders.

**Project Kaleidoscope 2.0**

In January 2010, PKAL formally joined forces with the Association of American Colleges and Universities (AAC&U) in an integrated partnership to advance and amplify the work of both organizations with respect to transforming undergraduate STEM learning, teaching, and leadership. As PKAL formulates its next-generation agenda within the context of its new partnership with AAC&U, we are consulting a wide range of constituent groups. This effort began at AAC&U’s annual meeting in January 2010 with an invitational forum during which over one hundred college and university presidents provided feedback regarding the current challenges that should drive the PKAL-AAC&U STEM partnership, including:

- how to assess STEM learning;
- how to help more students succeed in introductory science and mathematics courses;
- how to create more robust community college partnerships and articulation;
- how to scale up and sustain learner-centered pedagogical innovations;
- how to create more authentic research experiences throughout the curriculum;
- how to think more deeply about science in the context of civic responsibilities;
• how to enhance the recruitment and retention of traditionally underrepresented populations;
• how to build more interdisciplinary programs focused on real-world problems.

Ultimately, the big question is, how can we attain a critical mass of change agents and reform projects? In other words, how can we get to the tipping point? As Jay Labov of the National Research Council’s Center for Education has observed, we’re not there yet.

Are we close to the tipping point after all of this time and effort? Not yet. There are still too many faculty who continue to present science to today’s students in much the same way that it was presented decades ago. Science assessments still tend to emphasize (and thus reinforce) low levels of conceptual understanding by students. Equally importantly, too many current faculty continue to know little or nothing about the emerging evidence and consensus around effective practices in undergraduate science education. Too few future faculty (i.e., graduate students and postdocs) are being introduced to the literature on human learning and cognition or given meaningful experiences with what should be one of the most important components of their future scientific careers, so the cycle is perpetuated. At the institutional level, much remains to be done through policy levers to encourage high quality, effective teaching. (Labov 2009, 5)

It is clear that a strategic focus will be required if we are to make the necessary gains. Thus, in July 2010, PKAL’s new advisory board began work on a new strategic plan and reasserted the goal of focusing on both students and their learning environments.

PKAL’s primary influence over the past twenty years has been on STEM faculty members, and faculty will continue to be the central focus of PKAL activities. But an increasing emphasis will be placed on working with institutional leaders and external stakeholders in an attempt to achieve a more systemic and sustained impact on the transformation of STEM higher education. This new emphasis is depicted in figure 1, where the size of the circles indicates the potential influence of each group. PKAL will continue to be a distributed network, acting nationally as a connector within communities of faculty at the local level as well as extending across and into the other spheres.

The new partnership between PKAL and AAC&U will greatly benefit both communities that focus on the recruitment, retention, and success of STEM students from groups that have traditionally been underrepresented in higher education. PKAL’s programmatic work at the national level will also focus in the next few years on advancing interdisciplinary STEM learning and integrative learning environments that emphasize real-world issues within global contexts. PKAL will return to its early focus on introductory courses—for majors and nonmajors—with a renewed focus on systematic implementation of effective pedagogy as well as on the integration and assessment of student and program learning goals.

The new partnership between PKAL and AAC&U will greatly benefit both communities. Science and mathematics are central to liberal education in the twenty-first century. AAC&U’s Liberal Education and America’s Promise (LEAP) initiative emphasizes the importance of mathematics and the sciences, as well as their application through technology and engineering. Through the LEAP initiative, AAC&U has articulated essential learning outcomes that are focused on preparing all students for the future.

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Figure 1. PKAL’s Spheres of Engagement
students to engage competently and confidently with this century’s global challenges (see fig. 2). An understanding of science—including how the process of science works as well as the benefits and limitations of science—is central to knowledge of the physical and natural world, the first LEAP essential learning outcome. The complex challenges facing our society in this century—especially challenges related to energy, climate change, and global food and health—will require interdisciplinary, integrated solutions from a new generation of scientists, engineers, agriculturalists, nurses, teachers, and citizens equipped with the tools to grapple with the social, civic, political, and scientific facets of these problems. This is reflected in a recent survey sponsored by AAC&U, which demonstrated that employers want colleges to place more emphasis on learning in science and technology, ethical decision making, and applied knowledge in real-world settings (Hart Research Associates 2010).

With AAC&U as an active partner, PKAL now has even greater potential to expand the number of faculty, administrators, and institutions involved in its programs and networks. PKAL is committed to working within existing and new AAC&U programs on general education and assessment, global learning, public health, and inclusive excellence in order to deepen the attention paid to STEM learning. In addition to helping to shape AAC&U conferences and institutes with respect to STEM, PKAL will co-host with AAC&U a new annual conference series entitled “Engaged STEM Learning,” beginning in March 2011.

If we are successful, more college and university students will experience STEM learning environments where they are actively engaged in learning relevant content with their peers and faculty members as partners in learning. We’ll see more students from diverse backgrounds entering and succeeding in STEM courses and programs at all levels and types of institutions. Students will no longer view general education courses in science and mathematics with dread or as burdensome requirements to “get out of the way”; instead, students will anticipate these courses with interest because they are more engaging and relevant to their experience. Reaching this vision will require a coordinated, two-pronged approach involving (1) continued faculty development to promote student-centered,
interactive learning environments, and (2) focused, high-level leadership support to maintain, scale up, and sustain effective programmatic efforts at the departmental, institutional, and system levels. And institutional efforts must be aligned and connected to national efforts.

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REFERENCES:
How Teachers Need to Deal with the Seen, the Unseen, the Improbable,
MARSHALL GREGORY
The seen
In the teaching seminars and workshops I have been directing for more than twenty-five years, teachers consistently identify the following classroom issues as the most visible and vivid for them:

• Issues of authority: “Do my students grant me the authority that I deserve?”
• Issues of likability: “Do my students like me as a person—do they find me entertaining, funny, and charming?”
• Issues of coverage: “How am I going to cover all the material on the syllabus?”
• Issues of classroom participation: “Why aren’t more students eager to talk—why does this one student never shut up?”
• Issues of student resistance: “Why do so many students not like this wonderful material I’m presenting, and why do they not study harder to learn it?”
• Issues of competing demands: “If I spend as much time preparing for classes and grading papers as I think I should, how am I ever going to have time to do the scholarly work that I need for tenure or promotion?”

I would be the last to say that these “seen” issues are unimportant, but I am distressed by the extent to which many teachers seem to spend all their time obsessing over them as if they were the only compelling items on their teaching agenda. Classrooms’ visible variables are what philosophers would call a necessary part of all teaching, but they are far from being a sufficient ground of good teaching.

One consequence of failing to see the subtler classroom variables is that many teachers find themselves persistently frustrated in diagnosing the causes of classroom dysfunctions.

MARSHALL GREGORY is Harry Ice Professor of English, Liberal Education, and Pedagogy at Butler University. This article was adapted from a presentation at “Faculty Roles in High-Impact Practices,” an AAC&U Network for Academic Renewal conference held March 25–27, 2010, in Philadelphia. The original presentation is available as a podcast from the AAC&U website (www.aacu.org/podcast).
this state of affairs never improves, some will eventually lose heart and start just going through the motions. Another consequence is that a few teachers begin to blame their students, which is the first step toward becoming one of those teachers who spends an entire career becoming increasingly bitter and contemptuous about such heinous student crimes as “entitlement,” “laziness,” “poor spelling,” and “using Google for everything”—as if we faculty members never act entitled, feel lazy, make spelling errors, or use Google.

The unseen

Student passions, student fears, and student motives are among the many components of classroom dynamics that exist outside the range of the visible and that thus remain opaque to many teachers. Also invisible are the education narratives from movies and television that fill students’ heads with unrealistic expectations about both teachers and learning. The mostly unseen component that I want to focus on here, however, derives from the fact that teaching is always first and foremost a social relationship. Whatever social dynamics develop between students and teachers are more important than whatever happens between students and teachers on the academic front. This is true because teacher-student social relations act as a gateway that, when closed, makes students’ access to academic content seem unduly difficult if not fearsome, but that, when open, invites students to claim the academic content as their own.

Many teachers will immediately and urgently (if not defensively) reply that they are fully aware that the classroom is a site of ongoing social relationships: “I always take care to be respectful and pleasant to my students.” But this level of social awareness is little more than a matter of manners. While having good manners in classrooms is never a trivial matter, it is not a source of prolonged or analytical reflection about how social relations can and usually do dominate classroom interactions. The dynamics of social relationships can yield telling and rich insights about the dynamics that govern teacher-student relations and set students up for either engagement or nonengagement with academic and intellectual content. Taking this perspective, for example, suddenly makes visible the often unseen fact that students’ ethical judgments about teachers occupy the foreground of students’ thinking, even as teachers are concentrating on quite different matters such as their own authority, disciplinary coverage, academic standards, and student silences.

Less than five minutes after meeting a new teacher, students do what we all do less than five minutes after meeting any new person, namely, run rapidly through a checklist of ethical criteria as a way of assessing the new person and deciding whether we will want to spend time in his or her company. The items in our checklist tend to pop up in our minds as questions: Is this person honest—is he or she going to tell me the truth? Is this person fair—is he or she person going to treat me justly? Is this person generous—is he or she going to share materials, ideas, or companionship with me? Is this person compassionate and kind—is he or she going to help me if I am in trouble? Is this a person of self-control or self-indulgence—is he or she capable of keeping a focus on me and my interests alongside a focus on his or her own interests?

The fact that the ethical inferences we make about new people are sometimes wrong never leads us to stop making such judgments about the next new person we meet. We treat these ethical judgments as nondiscretionary; it is more important to us to make them than always to make them correctly. Nor does making ethical judgments mean that we will never change our minds. Because we run through our ethical checklist so rapidly, almost intuitively, we may seldom realize that we are always doing it. The fact that we do so unconsciously indicates how deeply programmed we are for this kind of cognition.

Whether our friends, lovers, spouses, and colleagues tell us the truth, show us compassion, and treat us with fairness has everything to do with how open we are to their influence. And if this is true about our relations with friends, lovers, spouses, and colleagues, it is also true about our relations with students. This is perhaps the biggest unseen elephant in the undergraduate classroom. Students are open to our influence and instruction precisely to the degree that they see us, their teachers, as trustworthy ethical agents: honest, compassionate, generous, civil, respectful, self-controlled, and fair. It’s not that students are always right in the judgments they make about us, and it’s not
that they don’t care whether we are professionally accomplished. Ethical evaluation is simply the foundation of all social relationships.

When first encountering a new class, many teachers are not worried about this reality (even though they should be) because they don’t see it. Instead, they ask themselves self-absorbed questions such as, do these students see me as the true expert that I aspire to be? Do they accept my authority? Do they recognize how smart I am? Are they going to work hard to learn the stuff I’m teaching? What many teachers see, in other words, is themselves as reflected in the mirror of their own concerns. They do not see that their students are busy making ethical evaluations. As a result, there is an immediate and potentially destructive disjunction between teachers’ and students’ concerns. If teachers and students are not forming their expectations of classroom dynamics on the same grounds, it follows that many misunderstandings, not to mention potential resentments and dismissals on both sides, will inevitably occur.
The improbable
While all of us would accept “educator” as an accurate descriptive term for what we do, few of us actually enter classrooms as educators. We enter instead as disciplinary specialists—biochemists, urban sociologists, Dickens scholars, evolutionary biologists, cognitive scientists, or whatever—and we fail to recognize that the structure of knowledge in our specialties is not the same thing and will never be the same thing as a philosophy of education. We commonly slide our disciplinary knowledge into the space that should be occupied by a philosophy of education and then barrel along, ignoring the fact that we have performed a dishonest sleight of hand on both ourselves and our students.

Instead of developing a philosophy of education, many faculty members rely on feeble clichés and well-worn bromides. If I ask any faculty member to tell me what’s important about his or her discipline, I get eight or nine coherent, well-developed paragraphs before they even take a breath. But if I ask what’s educational about education, I am lucky to get four lame sentences. The inability to answer this question in any developed, nuanced, or complex way points to a deep but mostly hidden spot of intellectual softness at the center of our profession.

When students ask their own version of my question, it comes out as two questions: Why do I have to take this course? And why will X—this disciplinary material that you, my teacher, are so lathered about—be valuable to me later on in life? Some teachers react resentfully because they hear these questions as disrespectful or hostile. When I ask faculty members what’s educational about education, I don’t get resentment, but I do get clichés. I have been told countless times, for example, that the goal of education is to make students “well-rounded” or to turn students into “critical thinkers.” If it is not a scandal it is certainly troubling, even dumbfounding, that educators cannot say what’s educational about education. If teachers and students walk into college classrooms possessing no developed theory of education, then no one can set things up from the beginning of a course in such a way that all the participants share some common notion of what’s educational about education and how the disciplinary specialty of this course fits into that educational agenda.

The nearly imponderable
In addition to dealing with the seen, the unseen, and the improbable, teachers also need to learn how to deal with the nearly imponderable, those issues about learning, identity, selfhood, and autonomy that are hugely difficult for all of us to think about. As agents in a pluralistic society and as teachers who say we value the life of the mind, we cannot simply put the terms of our interactions with other people—especially students—on autopilot. Most of us think that critical intelligence lies at the heart of our personal and professional integrity. Most of us think that we cannot be good persons unless we are actively considering how the choices we make turn us into the persons we become. And finally, most of think that we cannot be good teachers if we agree to think only what our powerful chiefs or our social traditions or our religious priests tell us to think.

As teachers, most of us share a deep intuition telling us that critical autonomy is a profoundly important goal of living, both for us and for our students. By critical autonomy I mean the cognitive and intellectual transcendence that allows us to inspect our entire existence in the same way that the power of introspection allows us to inspect our cognition: as if from above and with some degree of objectivity. The objectivity we can achieve by means of critical autonomy is never absolute, but, with practice and hard work, we can employ it well enough at least to avoid leading lives based merely on internal impulse or external programming. Critical autonomy is also our primary tool for avoiding lives dominated by fantasy, illusion, and rationalization.

Critical autonomy is a hugely difficult state of cognitive and intellectual maturity to achieve, much less maintain. We are never completely successful in deploying it against every temptation to indulge in self-deception, impulse, and social programming. Yet critical autonomy is perhaps the crucial feature of an educated mind because it allows us to critique the terms of our own existence. Exercising critical autonomy means that we do not accept the status quo at any level of life as natural, as inevitable, or as mere common sense exempt from interrogation and criticism. We do not exempt from
criticism our beliefs, our purchasing habits, our social attitudes, our current political order, the structure of our own desires, or anything else.

It is crucially important for us—as educators, not as disciplinary specialists—to help our students achieve some robust power of critical autonomy. Our students stand in a small existential space—as, indeed, do we all—that can, if properly cultivated, become a space of freedom and autonomy. The cultivation of this space, however, is always contested because the space itself is positioned between two huge walls that are always coming toward each other and threatening to squeeze out all freedom and autonomy.

Our students stand in radical vulnerability to these great walls of pressure unless we, their teachers, help them think about their position in life and give them the tools to resist.

One great wall pushing toward our students is composed of nature, our own human nature as shaped in large part by our evolutionary history, our brain structure, our perceptual
system, and our physiological configuration. To be thoroughly squeezed into this wall is to become an unreflective creature of impulses, appetites, needs, and desires. The other great wall is composed of culture, the entire range of cultural programming that begins shaping our perceptions and tweaking our desires almost from the moment we are born. To be thoroughly squeezed into this wall is to become an unreflective creature of whatever cultural forces get to us first or most vividly.

When and if these two great walls meet, the space for freedom and autonomy disappears. When this happens to teachers, we become soulless professionals—perhaps successful, but never questioning the terms by which we acquired our success. When this happens to students, they can go through an entire college experience without getting a genuine college education, for they will never realize what opportunities for freedom and autonomy they have missed. If, indeed, their noneducational college experience has primed them to do well in the corporate world, they may think that college has worked wonderfully well for them. After all, the only achievements that truly depend on critical autonomy are excellence and truth, and in the worlds of marketing, politics, and getting-and-spending, excellence and truth are viewed as discretionary commodities—if not as downright counterproductive for worldly success.

Are we sure that we want to saddle our students with a passion for excellence and a commitment to truth? It will be sure to cost them something socially and financially, and most of our students, not to mention their parents, think that college should produce a payoff, not a cost. When I say that critical autonomy costs, I mean that it forces us to live always with uncomfortable degrees of complexity, ambiguity, deferred gratification, more questions than answers, intellectual dissonance, moral humility, and tolerance for the ideas of people we dislike. If we teach students to view critical autonomy as just another casual skill in the pocket of the liberally educated graduate, then our students will never deploy critical autonomy when anything serious is at stake; they will only deploy it in social contexts where it will cost them nothing in the way of material rewards, social recognition, or professional reputation.

Teaching critical autonomy also costs. My deepest instincts as a teacher tell me that this is what I ought to be doing with my time and energy, that helping my students become critically autonomous agents is a job worth getting up for in the morning and staying up late for at night. Yet I cannot help but wonder by what right I as a teacher—or, for that matter, you as a teacher—insinuate myself into students’ lives and teach them to question the status quo, common sense, their values, their society’s values, their self-identity, the difference between
what people say is true and what the evidence says is true, and so on. If the main thing my students and their parents want from me is to teach how to “go along to get along,” who am I to say they are wrong? What do I think the contemporary emphasis on “accountability” is all about? And since when do I despise getting along? Since when am I unconcerned about my annual raise or my professional reputation or whether I drive a nice car? How do I configure a practically achievable, professionally responsible, and morally defensible set of teacherly practices when these two aims—the teaching of critical autonomy and the aim of going along to get along—exist at such odds with each other, and yet each appeals to me intensely for validation and implementation? These are not just problems of professional roles and personal integrity; they are existential problems of great complexity and great subtlety.

Perhaps the persistent wrestling with these problems is itself the point. Arguably, it helps prevent us from becoming ideological, hidebound, intolerant, glib thinkers. Persistent wrestling with nearly imponderable problems keeps us on the lookout for insights, not answers, and it increases our openness to other people’s views and ideas. It also confers two other, vastly valuable benefits. First, it simply makes us better wrestlers. The more we think about these problems, the better we get at holding their nuances and complexities in our minds all at once, balanced against each other although always in motion. Second—and here is where the metaphor begins to break down—if practiced as a mode of life instead of deployed as a utilitarian skill, the persistent wrestling can sometimes become a set of moves that possesses its own beauty and grace as the moves show themselves to be the material manifestation of the otherwise invisible life of the mind.

How, then, do I justify being more concerned about my students’ critical autonomy than their future income? The answer is that I don’t justify it—at least not in glib, self-satisfied terms. I am concerned about my future income, and my students are not contemptible moneygrubbers simply because they lack the ethical imagination and the social vision to become anything else.

In the end, I do not always know how to balance what we owe Caesar against what we owe our ideals and our future levels of development, especially our students’ future levels of development. But there are a few things I do know, and I try to use these as guides for where I invest my concern and for how I comport myself. First, I know the world can be better than it is. Much of the world’s terrible suffering, mayhem, and destruction could be alleviated overnight if only we cared enough. Second, I know the world will never become better if all of us sit around waiting for an anointed savior or the guy next door. Third, I know that people with educated minds who can endure ambiguity, tolerate differences, use evidence, make arguments, and analyze the subcomponent parts of complex structures offer the world its best resources for creating the modes and mechanisms of improvement. Fourth, I know that people who operate in the world as critically autonomous agents offer the world the irreplaceably important benefit of challenging the rest of us to think, feel, and judge in new ways. And, finally, I know that conscientious and dedicated teachers who spark their students’ minds, who call to their students’ most honorable and decent instincts, and who know how simultaneously to challenge and support their students can sometimes make all the difference.

To respond to this article, e-mail liberaled@aacu.org, with the author’s name on the subject line.
Perhaps it is my four years of high school Latin but I always associate the “liberal arts” or “liberal education” with “freedom.” Historically, of course, this was the direction of study pursued by those who were free to spend their time delving into such areas as logic, arithmetic, and rhetoric while the less privileged found themselves apprenticed to craftsmen in order to acquire a means of livelihood. While the first path would presumably prepare the student to pursue a wide variety of interests, the second would establish the apprentice on the road leading directly to a particular craft or trade. Today, we associate the liberal arts or liberal education with a course of general study that equips students with critical thinking skills, with the ability to communicate effectively both orally and in writing, and most importantly with the ability to continue learning in a world where swift change could make very narrow training rapidly obsolete. Preparing for a particular career is generally a far less important goal. Thus while the study of the liberal arts was often available only to those who were already free because of wealth or circumstance, today we like to view it as an opportunity for greater freedom in the choice of a future career or profession. Equipped with a broad knowledge of the arts and the natural and social sciences and with the skills to use that knowledge successfully for continued learning, reasoned and principled decision making, and effective communication, a liberally educated graduate (regardless of the kind of school he or she attended) should be poised to pursue a diversity of careers.

Unfortunately, while excelling at aspects of liberal education, liberal arts colleges, in particular, have been rather slow to recognize the opportunity that the study of computer science provides for achieving these ends. In fact, those who defend the appropriateness of computer science as a field of study in a liberal arts institution are frequently met with some skepticism from their colleagues. Furthermore, while most such institutions do offer the major or some sort of concentration, the impact on the general student body has not been very pervasive. Not long ago, a respected liberal arts college in Michigan announced its decision to drop the computer science major from its offerings. While this action was undoubtedly based on the small number of majors in the program, the need for this decision immediately raised the question of why there weren’t a great many students taking computer science courses. Twenty-first-century graduates will begin their careers in a world in which the computer is almost omnipresent, and yet they frequently will have only the most rudimentary knowledge of the important ideas and principles of computer science or the social and ethical implications of technology. Their ability to make contributions to the natural and social sciences will undoubtedly be limited by their capacity to make full use of the ideas arising in computer science, and their policy decisions and vision could very well be impoverished by a failure to address ethical issues related to technology.

After the precipitous drop in computer science enrollments during the first decade of this century, many small liberal arts colleges,
like their large university counterparts, found themselves with significantly diminished numbers of majors. While the most common explanation for these smaller populations probably included a reference to “outsourcing” or “off-shoring,” this is hardly an explanation in the context of a liberal arts institution. Most students who pursue majors in art history, the classics, or even psychology do not expect to find employment directly related to their major with only an undergraduate degree. Selecting such majors permits them to nurture their interest in a particular field while simultaneously developing competencies such as research and analytical skills and the ability to communicate effectively, which would make them valuable as future managers, leaders, and decision makers regardless of their major.

**What computer science can contribute to a liberal arts education**

From my perspective, the primary issue is that neither our students nor our colleagues really understand what computer science is. Consequently, they do not recognize the opportunities it provides for practicing precise logical and algorithmic thinking, for developing creative solutions to difficult problems, and perhaps most importantly, for encouraging interdisciplinary approaches. Computer science regularly employs ideas from subject areas as diverse as linguistics, physics, logic, mathematics, and psychology and then applies them across the spectrum of human endeavors.

Our homes are full of appliances and machines that do a single thing: toasters toast, washers wash, vacuums sweep. But such limited application is not true of a computer; a computer is a universal machine. Equipped with the appropriate software, this one device can be used to edit photographs, to send mail, to prepare income taxes, to play a game, to watch a movie, to solve a differential equation. The list goes on and on, limited only by the creativity of a programmer who can harness computing power to provide yet another solution to a waiting problem. The person who knows how to program can write his or her own applications. Think of the power and freedom available to those who know how to make this machine do their bidding! And even those who have no interest or need to program can enjoy a significantly enhanced worldview by appropriate exposure to both the possibilities and the limitations of that universal machine and the programs that drive it. Sometimes just knowing what can be done is very liberating!

Furthermore, an introduction to computer science has benefit far beyond the ability to write applications. Many of the advantages of a liberal arts education come from the ways one learns to think and solve problems, and from the methods one develops for analyzing and critiquing an argument. Computer science contributes to these skill sets with what is usually called algorithmic thinking; because a computer carries out the instructions exactly as given, programming requires clarity of thought and a strict logical correctness that is seldom demanded elsewhere.

In most programming situations there is an input, which determines the start state, and there is an expected output, which reflects the goal of the system. For example, the input might be a list of words that in the start state could be arranged in random order. The goal is to output that list in alphabetical order. In between lies the algorithm, which gives a precise list of steps that will transform the system from this start state to the desired goal state. Once that set of steps is encoded as a program and compiled, the machine will carry out those instructions precisely as stated. This may or may not do exactly what the author intended. Students can easily submit proofs or exercises

*Centre College*
in a mathematics course, hoping that they are correct or almost correct and, hence, deserving of at least partial credit. But while programs may contain some subtle errors that inadequate student testing may not reveal, most of the time aspiring programmers are acutely aware when their programs do not work correctly. Often a source of frustration, programming bugs openly manifest a failure in logic or an inadequate analysis of the problem. “Almost correct” will never satisfy the computer, which executes precisely what the programmer wrote as opposed to what he or she meant.

But beyond the ability to find a correct solution, computer science also cares about efficiency. Algorithms for solving a problem must be evaluated in the light of space and time requirements. This is based on careful mathematical analysis, which distinguishes the properties of one algorithm that will take hours to run from another that can solve the same problem in seconds. And in the face of unbounded expectation about what a computer can accomplish, computer science teaches that there are limits to computing. There are some problems that we know cannot be solved by any program, and others that cannot be solved in a reasonable amount of time. All of this takes detailed analysis and careful proof.

Far from being a course of study that prepares students for precisely one career path, a well-designed computer science program equips its graduates with knowledge of theory and principles, and compels them to think in a very careful and organized fashion to construct solutions to complex problems. Those problems can arise in almost any realm of human inquiry, from the analysis of environmental issues to the design of theatrical sets.

What the liberal arts can contribute to a computer science education

Finally, while computer science has a great deal to contribute to a liberal arts education, it is also true that the liberal arts have a great deal to contribute to a computer science education. Certainly the excellent communication skills, the emphasis on analysis and critical thinking, and the desire to look at a situation from multiple viewpoints—all of which are strongly supported by a liberal arts education—contribute to the development of an aspiring computer scientist. And many of the successes in computer science applications spring directly from applications of theoretical results in multiple disciplines. Compiler writers depend on the four classes of grammars developed by Chomsky. Random number generators quote theoretical results from abstract algebra. Robot designers employ logic for knowledge representation and reasoning, and they study learning theories from cognitive science. These contributions are just as important as the physics and statistical analysis one might more readily identify. The computer scientist who has been broadly exposed to a variety of disciplines has a greater arsenal of weapons at his or her disposal when it comes to solving a problem.

Computer science and the liberal arts have much to offer each other. Most graduates will find themselves empowered by a solid introduction to the many great ideas in computer science, and they will have much greater freedom because of their ability to understand and use them. Similarly, the computer scientist is liberated from a narrow focus by the breadth of ideas and skills that a solid liberal arts preparation ensures. It is time to embrace the possibilities much more broadly so that graduates will not only be able to use the machines of technology but also benefit from the ideas, algorithmic thinking, and rich interdisciplinary applications that a serious study of computer science can provide.

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What Students Say about
at Grand Valley State University

What are the odds of changing the culture of teaching and learning at a regional comprehensive university with twenty-three thousand students? Through the Claiming a Liberal Education (CLE) initiative, a group of faculty and administrators at Grand Valley State University sought to achieve this ambitious goal within the context of the university’s founding commitment to the principles of liberal education. Significantly, the CLE was a campuswide initiative that enjoyed broad institutional support. The faculty senate passed a formal resolution of support for the initiative, for example, and the university’s Pew Faculty Teaching and Learning Center provided support through its funding and programming priorities. In addition to funding research and structured discussion of liberal education, the provost modified the orientation for new faculty and students to include a stronger focus on liberal education and, later, strengthened the advising system, a key means of helping students understand the university’s liberal education values. The College of Liberal Arts and Sciences, by far the university’s largest college, included a statement about liberal education in its position descriptions. CLE leaders reached out to physical plant, public safety, and secretarial staff.

The CLE initiative also involved efforts to reach out directly to students, beginning with their earliest consideration of Grand Valley. After conducting focus groups with faculty and students, the Office of Institutional Marketing changed its messages to emphasize liberal education, rather than affordability and convenience. Even the university’s tagline was changed. The Division of Student Affairs responded by modifying welcome week activities to give them a stronger academic focus, by organizing themed academic learning communities, and, given the emphasis on diversity in the university’s definition of liberal education, by developing a diversity action plan. Most significantly, all student affairs programming now has learning goals that intentionally connect activities to the freshman course, Introduction to Liberal Education, and the number of sections was doubled to enable one-third of all freshmen to enroll in the course.

Focus group findings
The CLE initiative began in 2004 with a program of research that included a qualitative study of student perceptions of the learning climate at Grand Valley. Then, during the winter of 2009, CLE researchers replicated the qualitative study in order to gauge the effectiveness of these coordinated efforts to emphasize the value of liberal education and to align faculty and student expectations with the goals of liberal education. A total of ninety-five student volunteers participated in one-hour focus groups led by professional facilitators. Participants in 2004 and 2009 responded to the same series of questions relating to their learning experience at Grand Valley. The data from the focus groups were analyzed to determine how well students were able to define liberal education, and the following broad themes were identified.

Campus climate. In 2009, a larger number of students responded positively when asked about Grand Valley as a place where they could learn. Several students felt that the university is “open to student input,” and one said that the university “gives you the ‘oomph’ you need to keep going—makes you very competitive—especially in the sciences.” Many commented favorably on the broad and clear focus on liberal education and on the importance

DIANA PACE, CATHERINE FRERICHS, TAMARA ROSIER, AND KURT ELLENBERGER

PERSPECTIVES

Overall, the results indicate the effectiveness of a comprehensive, coordinated, institution-wide initiative designed to help students understand the meaning of liberal education.
of knowing what the term means—although one student said that “[liberal education is just] problem posing/solution finding. It is overrated here.” Many students said that college learning is “deeper” than high school learning, that it is not “rote learning.” Students said they prefer smaller classes that allow for more group projects and student presentations, which helped their learning, and appreciate the large selection of classes from which they can choose. In addition, the students recognized and appreciated the many opportunities for learning outside the classroom. More specifically, several mentioned the value of study abroad in “[breaking] down comfort barriers.”

Student development. In the 2004 focus groups, several students said they had not changed since coming to Grand Valley; in the 2009 groups, no student reported a lack of personal change. In fact, many of the 2009 participants commented on their own personal development since coming to Grand Valley. For example, one student said that she had changed 100 percent since arriving on campus. Commenting on their personal habits, students reported that they had become better organized, more motivated, and better able to manage their time. Several also said that being at Grand Valley had opened them up to what they are capable of and enabled them to know themselves better. Moreover, several students not originally from western Michigan commented that their experience at Grand Valley had encouraged them to be more open-minded and to examine their values.

Students taking responsibility for their learning. Although this theme emerged from the 2004 focus groups, where students mentioned their development of better study habits and better time management skills, it was more pronounced in the 2009 discussions of what it means to be a good student. Many participants in the 2009 groups agreed that taking responsibility for one’s own learning means putting in the time and effort needed to do well, even though this may entail sacrifices in one’s social life or elsewhere. Taking responsibility means knowing when to ask for help from a professor or from other students, seeking tutoring assistance, or just being willing to ask “dumb” questions. One student said, “I used to think being a good student meant getting good grades. Now, I think it’s being able to reflect and say what you’ve learned”; several students agreed with this comment. A few students argued for making the effort to relate all their classes to one another, commenting that this “pays off” in what they learn. Other students talked about the importance of applying what they learn—“even math”—to their real lives.

Faculty expectations of students. In the 2004 focus groups, some students said that professors should give students breaks, while others thought that professors were too lenient, and some were critical of students who disliked their classes or complained about professors. Participants in the 2009 groups did not express this type of negativity. Also, far fewer students identified themselves as consumers who are owed a degree by virtue of their payment of tuition. Further, several 2009 participants agreed that students should have a “willingness to learn, an open mind” and that faculty should hold students to high expectations. In the words of one student, “minimal expectations get minimal achievement.”

Student expectations of faculty. Students place a high value on “personal connection” with professors as a motivating factor. They are impressed when faculty members know their names and show an interest in them. They most like faculty members who create a comfortable atmosphere in the classroom, expect students to participate, and don’t have obvious favorites. One student summed up the expectations of faculty as “engage, relate, inspire.” In both 2004 and 2009, students commented that faculty members need to realize that students have more than one class. Several students in both groups tended to appreciate higher faculty expectations, but the 2009 students who were in professional colleges felt they would be overwhelmed by higher expectations.

Qualities of a good professor. The participants in both sets of focus groups agreed that good professors do not just lecture, expressed a preference for a more interactive classroom, and wanted professors to be accessible outside of class. Students in the 2004 groups wanted more handholding than those in the 2009 groups. In particular, they said that professors should cover in class anything that is important in
the textbook and go slowly so everyone can understand; none of the 2009 participants expressed this view. The 2004 groups emphasized concrete behaviors of professors, such as returning tests and papers in a timely fashion, being on time for classes, and being well organized. Both groups said that good professors adapt their teaching to the specific needs of the students in their classes and make sure everyone is “on the same page.” Several of the 2009 students talked about the value of relating course content to real life, a theme less evident in the 2004 groups.

Diversity and exposure to different views and attitudes. Student comments about diversity at Grand Valley were mixed. Some regarded the university as highly diverse; these students claimed to have learned new views and become more tolerant. Others, particularly students of color and students from outside western Michigan, believed that the campus needs to become more diverse. Students in both 2004 and 2009 expressed the view that their experience at Grand Valley had increased their appreciation of different cultures. The 2004 students reported having learned about diversity through their experiences and relationships on campus and, more generally, in western Michigan, whereas many of the 2009 students reported having learned about diversity through study abroad and other travel experiences.

The importance of being well educated. Students in both years indicated that it was important to be well educated, although there was more depth in the responses of the participants in the 2009 focus groups. Several equated being well educated with having a broad scope of knowledge: “It helps one to see the big picture and not have tunnel vision on just one thing.” They also said it means having a sense of how
things are interrelated and recognizing the value of different approaches to solving problems. Being well educated means being able to talk to anyone about anything. It means getting outside of oneself, recognizing, as one student said, “there’s more to the world besides the US.” Students implied that social intelligence is as important as formal education.

The value of an education. All students in both years believed that education is very important, although in 2009 they explained why in two different ways. The first is pragmatic: education is a necessity today if one wants to be successful. One student, who commented on how his father’s prospects were limited due to his own lack of education, said that he expects education “will open doors” for him. The second way relates to ethical relationships with others: education is not just about getting a job. “You have to be able to make good decisions,” one student said. “Otherwise, you’ll end up hurting people.” Another student said it would make a difference for children: “If I know more, I can give them more.” Finally, students appreciate the opportunity of getting an education: “It’s a privilege to come here to learn.”

Defining liberal education. At the end of both the 2004 and the 2009 focus groups, participants were asked to complete a questionnaire that included the following questions: “How would you define liberal education? What does it mean to you?” Some of the 2009 respondents defined liberal education in concrete ways, as a “broad selection of classes and requirements...
for a student.” A few went further, commenting on the integration in such an education: “If you imagine a knitted scarf and how each line connects—that is what liberal education is.” Many students agreed that a liberal education means more than comprehensive learning, however: “It involves being able to work in any environment under any situation.” Other students associated liberal education with being more open-minded, “not biased.” One student summarized, “A liberal education requires students to think critically and draw on information from not just the professor of a particular class, but all classes and life experiences.” None of the 2004 students completed this part of the questionnaire.

The questionnaire also presented a list of statements about liberal education, and participants were asked to choose the one that best described their own views. In selecting a statement, 46 percent of the 2009 respondents chose the response, “I think that liberal education should be a primary goal for all Grand Valley undergraduate students.” Forty-three percent chose the response, “I believe that liberal education is valuable, but not necessarily important for all undergraduate students.” The remainder said that liberal education was “somewhat important.” No student selected the other two possible responses—one indicating uncertainty about what liberal education is, and the other stating that it should not be a goal for Grand Valley.

Conclusion

Students absorb information about the purposes of education cumulatively from all their experiences at an institution. Marketing materials and student orientations typically make the first impressions, but on-campus residential living, participation in student activities, the structure of general education programs, graduation requirements, and course syllabi all convey important institutional messages. Overall, the results of the CLE replication study indicate the effectiveness of a comprehensive, coordinated, institution-wide initiative designed to help students understand the meaning of liberal education. By infusing a common definition of liberal education into all aspects of university life, institutions can ensure that students understand the meaning of liberal education. The study also demonstrates the value of institution-wide discussion of research findings. Too often faculty members are unaware of student characteristics, and students are unaware of faculty expectations. Sharing focus group results through various institutional venues can help develop a shared institutional vision and create support for institutional change. Finally, the study results point to the need for greater collaboration between the faculty and the student affairs division, which may otherwise convey very different messages to students. And by involving other offices—such as admissions and marketing—an institution can further strengthen its messaging.

Through campuswide initiatives that address students’ understanding of liberal education as well as faculty and student expectations, an institution can create a learning environment where students are more likely to take responsibility for their own education and their own achievement of essential learning outcomes.

To respond to this article, e-mail liberaled@aaau.org, with the authors’ name on the subject line.
As the leader of the nation’s only campus dedicated exclusively to early college, I head an institution that ensures students graduate sooner than the national average. As an academic who pursued my graduate work at Oxford University—an institution that confers most of its undergraduate degrees in three years—I have had direct observation of a successful model of a three-year degree program. Thus, I seem a likely candidate to embrace the recently touted argument for the three-year bachelor’s degree. And yet I have grave doubts about establishing the three-year college degree as the new American standard.

These doubts are based on three broad concerns: first, the argument for a three-year degree has, to date, been driven by financial but not by educational objectives; second, there is a very real danger that such proposals can undermine the already threatened core liberal arts; and third, such proposals circumscribe the breadth and depth of learning, as well as the intellectual and social development of students, that are central to a college education.

It is not hard to understand the attractiveness of an elusive silver bullet for college costs, however unlikely it is that such simple answers exist. Higher education can be costly, many states and campuses are in the midst of drastic budget shortfalls, and families hit hard by the recession are increasingly anxious about paying for college.

We need to remember that families are anxious about paying for college because it is a highly valued asset that they feel, rightly, is crucial to opportunity. In the process of addressing issues of cost, then, we must not erode the basis for the value of higher education; we must not only secure access, but also provide access to something of meaning.

This is not to dismiss concerns about the cost of higher education. Like most other colleges, my campus has wrestled with competing priorities and a genuine desire to provide both access and quality. And I have written extensively on the subject of finances in higher education. But it is important that educational mission and the question of quality be central to any discussion of cost reduction. To date, the three-year degree options do not address this issue.

Over the past decade, and particularly over the past few years, colleges and universities have used creative, albeit often painful, methods to maintain quality while reducing budgets. Most have made these changes while attempting to preserve the academic core. New methods of educational delivery are being explored, and they may open new avenues for student learning and possible savings, including options for different times to degree. And certainly access to courses in reasonable sequence and the ability to take classes required for degree attainment are efficiencies that we should rightly expect of our institutions.

But the reality is that the core work of higher education, the work of student learning, is not efficient. The process of discovery, reflection, integration, and intellectual growth are as complex as each individual who enrolls in college. They require not just access to knowledge, but the development of intellectual
An Idea Whose Time Will Pass
capacity and new habits of mind. They require time. Proposals for saving money do not need to preserve all extant systems, but they must honor the reality of the student learning process.

Which leads to my second concern about the three-year degree proposals, a concern for the place of the liberal arts in such a model. Liberal education is meant to be, quite simply, education that liberates—liberates us from the constraints of our own limited experience, liberates us from prejudice, liberates us from the folly of reactivity without analysis, and liberates us from the allure of hubris as a substitute for knowledge.

Liberal education is grounded in the idealistic but historically justified belief that through engaged learning, students can fully develop their own abilities and more completely contribute to society.

This is much more than education for gainful employment. Yet as Elaine Hansen, president of Bates College, has written, the skills acquired through a liberal education are necessary in the job market.

As we often say and can effectively demonstrate... any major in the liberal arts and sciences trains you for nothing and prepares you for everything. It is increasingly evident that the analytical, critical, and interpersonal skills fostered in the liberal arts college environment in general and in the humanities in particular are essential for people who will change jobs many times in their lives, pursuing careers and making contributions in fields and disciplines that at present we cannot even name. (Hansen 2006, 10)

While President Hansen was speaking particularly from the perspective of a liberal arts college, her point is relevant for the role of the liberal arts in all of higher education.

At its best, regardless of the type of institution, a bachelor’s degree should not only indicate a level of mastery in a specific discipline or field. The bachelor’s degree should also signal that students have developed skills of critical inquiry, writing and close reading, analysis and intellectual rigor. To be educated is to have the ability not only to do certain things, but also to think in creative ways, to understand the cultural, political, or historical context for major questions, to carry the skills of inquiry and analysis into the world.

If we believed the pursuit of specific, employable skills was the primary purpose of higher education, then the bachelor’s degree would cease to exist. We would not confer degrees; we would train for certificates, and students would return for more training each time they changed jobs or professions. A bachelor’s degree must signal the achievement of something beyond technical skills, or it ceases to have meaning.

Finally, I have concerns about three-year degree proposals because of the nature of contemporary education. The growth of technology, the reality of internationalization, and the breadth of information necessary for reasoned judgments in our society is expanding, not contracting. While it is specious to argue that higher education is capable of offering students all the information they will ultimately need, it is entirely reasonable to expect higher education to introduce students to a broad range of knowledge that captures the complexity and rapid evolution of information. It is reasonable to expect students to have a basic understanding not only of Western democracies but also of other forms of government, to speak more than one language, to appreciate different avenues of expression and different cultures, to have a core scientific literacy, and to have acquired a level of sophistication in at least one discipline. It is reasonable, but it is not efficient.

In addition to the time required for such learning, the social and emotional development of traditional-age students is a significant function of higher education. We know

**The reality is that the core work of higher education, the work of student learning, is not efficient.**

**AAC&U President’s Statement on the Three-Year Degree**

On June 3, 2010, Association of American Colleges and Universities President Carol Geary Schneider issued a public statement challenging proposals either to expand three-year degree options for a large number of students, or to reduce the number of credits required for a degree. The full statement, titled “The Three-Year Degree Is No Silver Bullet,” is available online at www.aacu.org/about/statements/2010/threeyears.cfm.
that students learn best when they discuss intellectual ideas outside as well as inside of class. We know that education is most effective when it involves active learning. And we know that involvement in activities beyond the academic develops skills not easily taught in the classroom. To focus on shortening the time to degree misses a core aspect of college education: the process of identity formation and learning to live and work effectively within a larger community.

A three-year option

But what of my own background? What about my experience leading an early college and attending graduate school at an institution that awards three-year degrees? Surprisingly, both of these experiences reinforce rather than negate my concerns about the three-year degree.

Few would argue that the value of an Oxford bachelor’s degree is less than that of a degree obtained in the United States because it is attained in three years instead of four. Yet Oxford benefits from crucial distinctions between the British and American models of precollegiate education, and its students arrive well prepared for college. And despite the overall shorter time to degree, Oxford is gloriously inefficient in its use of the tutorial system, college housing system, plethora of high-profile student activities, and extensive time between terms.

Similarly, the goal of early college as practiced at Bard College at Simon’s Rock is not to save money or to make education more efficient. It is to contribute to one of the great strengths of American higher education: diversity of opportunity. Early college is not an ideal option for all young people. But for those intellectually curious students who are motivated and who are not well served by their existing schooling, early college is a profoundly important educational avenue.

Similarly, there is nothing wrong with colleges and universities offering an option for a three-year degree. It can be a valuable alternative for some students. My concern is with the proposal to standardize this model. In fact, proponents of the three-year degree have specifically argued against introducing the three-year degree as one of many options, stating that this model would add, rather than reduce, costs.

If we are to take the three-year degree proposals at face value and consider this model as the new standard for obtaining bachelor’s degrees in the United States, then we must answer questions besides those of efficiency and cost. We must act as academic leaders and answer questions of educational merit. To date, the three-year degree proposals have failed to address these questions—questions that are at the core of the academic mission of colleges and universities.

To respond to this article, e-mail liberaled@aacu.org, with the author’s name on the subject line.

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AAC&U gratefully acknowledges the foundations, corporations, government agencies, other organizations, and individuals supporting its programs from July 1, 2009, to June 30, 2010.

Dear Friends and Colleagues,

I am very pleased to offer my sincere thanks, and that of AAC&U’s board and staff, to the generous institutions and individuals listed below. These donors have provided support for AAC&U’s educational work on behalf of liberal education through grants, sponsorships, and gifts, and have made it possible for us to accomplish much more for our members and for the field than would have been possible without them. Our donors help us work toward a shared goal of providing the best liberal education for all college students, not just some college students. I am extremely grateful to all of our contributors for their confidence, generosity, and support.—CAROL GEARY SCHNEIDER, PRESIDENT

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