

ASHLEY BEAR AND DAVID SKORTON

Students at Syracuse University are developing a deep understanding of neurobiology through the process of writing haiku. At DePauw University, students are learning about biochemistry by creating sculptures based on protein-folding research. Harvard Medical School students are improving their communication, visual literacy, critical thinking, and empathy through art observation. Olin College of Engineering students are learning about alloys in the context of the life of the American patriot Paul Revere, best known for his “midnight ride,” but also a skilled silversmith. LaGuardia Community College students are writing essays on mathematics as it relates to the origin of Western thought.

These educational approaches reflect a growing sentiment that standard curricula have become too segregated or siloed along disciplinary lines, and that in an increasingly complicated world, students are having difficulty understanding the connections between diverse forms of knowledge and inquiry. This movement in higher education goes beyond the general education curriculum found at almost every institution of higher learning in the United States, in which students take several disconnected courses in different disciplines outside their major. In this integrative model, the knowledge, modes of inquiry, and pedagogies from multiple disciplines are brought together within the context of single courses or entire programs of study. In such a model, professors help students make the connections between these disciplines in an effort to enrich and improve learning. This model is both new and old. It is new in that society is witnessing a recent surge of interest and enthusiasm for more holistic and integrative approaches in higher education, and it is old in that it is rooted in the longstanding tradition

# The World Needs Students with Interdisciplinary Education

When students can understand and make connections across a diverse array of knowledge and skills, they embark on a path to more rewarding lives and employment opportunities. Higher education can and must do a better job of leading the way out of disciplinary silos.

of a liberal education that dates as far back as Socrates and Aristotle. Today it goes by many names, such as “STEAM” (with an “A” for “arts” added to the standard STEM acronym for science, technology, engineering, and mathematics), “convergence,” “transdisciplinary,” or even “SciArt.”

Over the past two years, we had the opportunity to examine this trend in higher education in the context of a National Academies consensus report, *Branches from the Same Tree: The Integration of the Humanities and Arts with Sciences, Engineering, and Medicine in Higher Education*, that explored how approaches to teaching and learning that integrate across disciplines might better prepare students for work, life, and citizenship. While working on this report, we spoke with many faculty and administrators who voiced concern that college graduates today are leaving higher education having taken an array of seemingly disconnected courses, with those courses outside their declared major seeming irrelevant to their interests and unrelated to the world beyond campus. We heard that many students are asking themselves: If I am a science or engineering major, why do I need to know about ethics, history, writing, and design? Shouldn't I just focus on the classes that will prepare me to get a job after graduation and to succeed at that job? What we learned is that a holistic education that integrates the arts, humanities, sciences, and engineering will make students more attractive candidates for employers and more successful in their future career—or, more likely, careers. The challenge for higher education will be to teach students in a way that helps them understand the connections between diverse forms of human knowledge so they can appreciate, for example, the ethical dimensions of writing software that collects people's personal data without their knowledge or the importance of intuitive and aesthetic design in the engineering of a profitable smartphone.

Indeed, some of the learning outcomes associated with integrative approaches—including improved written and oral communication skills, teamwork skills, ethical decision making, critical thinking, and the ability to apply knowledge in real-world settings—are the very same outcomes that employers and university administrators alike agree that all students should possess upon graduation. Recent surveys reveal that employers see talent as more than deep technical expertise or familiarity with a particular technology. Employers are also looking for well-rounded individuals with a holistic education who can comprehend and solve complex problems that transcend disciplines. An online survey conducted by Hart Research Associates found that the majority of employers say that both field-specific knowledge and a broad range of other kinds of knowledge and skills are important for recent college graduates to achieve long-term career success. Very few employers indicated that acquiring the knowledge and skills needed primarily for a specific field or position is the best path to long-term success. Employers reported that when hiring, they place the greatest value on demonstrated proficiency in skills and knowledge that cut across all college

majors. The skills they rated most important include the ability to communicate clearly, both in writing and orally, teamwork, ethical decision making, critical thinking, and the ability to apply knowledge in complex, multidimensional, and multidisciplinary settings. According to employers, this combination of cross-cutting skills is more important to an individual's success at a company than the major she or he pursued while in college.

A study by Burning Glass, a job market analysis company, reported similar results. Its textual analysis of 25 million job postings aimed at understanding “the essential or baseline skills that employers are demanding across a wide range of jobs” revealed that oral communication, writing, customer service, organizational skills, and problem solving were among the most prized skills across a wide range of occupation and career types. The study also categorized the importance of what were termed “baseline skills” and “technical skills” by occupation groups. The results of this analysis speak to the importance of both job-specific technical and baseline skills and the relative importance of these skills by occupation type. Predictably, jobs categorized as being within the domains of information technology, engineering, health care, the physical and life sciences, mathematics, and manufacturing require more technical skills than categories such as sales, marketing, or human resources. But even among the highly technical fields, a quarter to a third of the required skills deemed essential by employers fall within the baseline skills. The results suggest that higher education should equip *all* students with the baseline skills needed for success in a wide range of occupations.

This conclusion is all the more important because, as shown by US Census Bureau data, students who major in the standard liberal arts disciplines—in STEM as well as arts, humanities, and social sciences—often end up in professions that are not directly aligned with their major, just as specific occupations attract students with multiple kinds of academic preparation. These data raise questions about how well a college or university curriculum focused on a specific, disciplinary major will serve students after graduation.

Moreover, graduates should be prepared not only to take a job that does not directly relate to their college major but also to change jobs and careers often throughout their working years, particularly in the years just after graduation. According to a 2016 Bureau of Labor Statistics report, younger workers (ages 25-34 years) stay in a single job for an average of 4.2 years. These data suggest that graduates will be well served by skills and competencies that are transferrable from one job to another, as well as by the ability to be adaptable, lifelong learners who can pick up the new knowledge they may need for success and fulfillment in each new job.

Why does all this matter? Because employers also report that many recent college graduates have not achieved the kinds of learning outcomes that they view as important. Employers want to hire people who can apply knowledge and skills in real-world settings, think critically, and communicate

clearly and effectively in both writing and speaking. And in these areas, fewer than 30% of employers think that students are well prepared. More than 80% of employers feel that colleges and universities need to do a better job helping graduates gain cross-cutting skills and knowledge.

Yet institutions of higher education largely agree on the importance of this same set of competencies. Although higher education in the United States is an incredibly diverse enterprise, comprising a vast array of different types of institutions that serve a variety of student goals and educational purposes, research has demonstrated that there is broad agreement across this diverse landscape of institutions on the importance of student learning outcomes. A survey released in 2016 found that nearly all members of the Association of American Colleges and Universities—which constitute a majority of the nation’s four-year colleges and universities—have adopted a common set of learning outcomes for all their undergraduate students. Shared learning outcomes include writing and oral communication skills, critical thinking and analytical reasoning skills, ethical reasoning skills, knowledge of global world cultures, and “integration of learning across disciplines.” The survey also found that general education is growing as a priority and that administrators are more likely than they were in 2008 to report an emphasis on the integration of knowledge, skills, and applications. This integrative turn of higher education signals a shift to intentional and purposeful learning across knowledge, skills, and personal and social responsibility.

Given the high level of employer dissatisfaction with the core competencies of college graduates, the movement toward a more integrative approach in higher education couldn’t be more timely—for students, for communities, for employers, and for the nation. Today the value proposition of US higher education has become less apparent to a large percentage of the population. Many people are struggling to understand the return on investment in a college education as they weigh rising costs that far outpace inflation, even as more and more employers are requiring a postsecondary degree for jobs that did not previously require one. Indeed, surveys have demonstrated that most US residents today view higher education as a path to a good job. As many people have come to see higher education more as a private commodity than a public good, states have invested less money in higher education and have increasingly linked resources to demonstrated employability of graduates. Disinvestment has created pressure at many institutions to promote skills and training that are considered more likely to lead to immediate job placement, which has led to a perceived need for greater specialization. This trend has in turn reinforced the view of higher education as largely a path for workforce preparation best pursued through a narrowing curriculum, contrary to the historical mission of institutions of higher learning, which embraced a more expansive view of education as helping to prepare students for life and productive citizenship.

Yet, as we have discussed, the notion that disciplinary

specialization and technical depth are the only important prerequisites for employment turns out to be false. Institutions of higher education and employers turn out to be generally aligned in their view of the kinds of cross-cutting skills and knowledge students should possess upon graduation. Such student learning outcomes can be achieved when professors help students make the connections between disciplines and appreciate that, in the words of Albert Einstein, “all religions, arts, and sciences are branches from the same tree.”

But to realize a vision of higher education that emphasizes the importance of a holistic, integrative education, institutions must first ensure that effective teaching practices are a priority for faculty and administrators. This may mean reexamining incentive structures such as tenure and promotion criteria, which, as everyone knows, too often emphasize and reward publication and grant funding over teaching practices, integrative or otherwise. But now society is also beginning to understand that the lack of emphasis on integrative teaching practices may actually serve students poorly in the job market. Although the evidence in support of an integrative approach is promising, it is certainly the case that more research is needed to understand the impact of individual courses and programs on students’ lives. Thus, along with developing stronger incentives for quality teaching, universities also need to evaluate the impact of different teaching practices in higher education.

The good news is that we see higher education moving in this direction. We catalogued over 200 programs and courses across the broad spectrum of US higher education—community colleges, research universities, technical colleges, and liberal arts colleges—that are taking innovative new approaches that better integrate knowledge and pedagogies from the arts, humanities, sciences, engineering, and medicine. These courses and programs (which are surely a subset of the total number of integrative efforts in higher education) exist despite the many institutional barriers to integration. Their existence demonstrates that it is possible to bridge between entrenched disciplinary silos. Many of these courses and programs are framed around the global and local challenges that many students are passionate about addressing: climate change, obesity, poverty, to name a few. If this movement toward greater integration in higher education persists, perhaps in the future students will no longer major in a specific science, engineering, art, or humanities discipline, but rather will focus their studies on addressing the many real-world challenges they are likely to encounter in the context of their careers, lives, and civic engagement.

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