

The demonstration of quality is a fundamental responsibility of all colleges and universities, but both the kinds of quality and the methods used to measure it will differ depending on the mission of the institution.

—"Principles for Effective Assessment of Student Achievement,"
a joint statement issued July 19, 2013

Chapter 7: Assessment of Student Learning

Introduction

Penn believes strongly in assessing student learning and achievement. The School of Arts and Sciences, whose College of Arts and Sciences is central to undergraduate education at Penn, has pioneered assessments of student learning that can serve as a model for other undergraduate colleges. Our other three undergraduate schools also continue to lead the assessment of student learning in alignment with the expectations of their fields of study and the relevant external accrediting bodies.

In general, Penn locates the responsibility for the assessment of student learning with the faculty of the individual schools. This approach mirrors Penn's academic organization into twelve distinct schools, each with a specific educational mission and portfolio of degree programs, and reflects the strong belief that assessment practices are most meaningful when they are led by faculty with the requisite expertise, within the context of a school or discipline. Particularly useful are periodic assessments engaging peer review by distinguished faculty from schools and programs from other institutions. External peer review allows for deeper understanding of the problems and practices in a specific educational environment and encourages the sharing of new ideas across institutions.

Because Penn places academic authority in the faculty of each school, rather than any central office or single assessment process for the entire institution, the Assessment of Student Learning Working Group approached the issue of assessment of student learning by: 1) characterizing achievement of our students from a broad perspective; 2) studying the stated missions and assessment activities of each undergraduate school; and 3) identifying common educational activities across the schools and examining the means by which these are assessed. Taken together, these approaches provide an examination of assessment consistent with the "Principles for Effective Assessment of Student Achievement," which has been endorsed by the MSCHE, the six other regional accreditors, and major higher education associations including the American Association of Universities.

Working Group Charge and Process

The charge to the Assessment of Student Learning Working Group was to evaluate the overall assessment activities in our undergraduate education programs. The Group's work focused on the relationship between teaching and learning in each undergraduate school and the overall educational goals of the University, including the goal of having effective assessment processes for its core educational programs. The group was asked to use the framework of the MSCHE Standards of Excellence, especially Standards 7 and 14. This chapter provides an overview of how Penn meets Standard 14 and includes individual reports from each of the four undergraduate schools.

Student Achievement and Career-Related Outcomes

Penn prepares students for a broad and diverse array of careers and life plans. The University's size and range allow undergraduates to explore a wide variety of academic offerings and encourage our graduates to become well-rounded professionals, scholars, and intellectuals. We are proud of a strong record of post-graduate student placement: our most recent survey of undergraduate alumni in 2012 indicated that, five years after graduation, only two percent of respondents (n=1,465) were seeking employment at that time, with about one-fifth (22%) attending graduate school and virtually all of the remainder employed or self-employed.

This 2012 Alumni Survey (distributed to individuals who completed their bachelor's degree at Penn between 2001 and 2003) explored the relationship between students' primary educational discipline and the industry in which they work. Figure 7.1 shows the trajectory of discipline to job sector for Penn's graduates. Many of the trajectories are unsurprising: for example, Wharton graduates working in finance and biological science graduates working as physicians. Nursing graduates account for the large numbers of respondents in the "other" category entering the health care field. Humanities graduates are working in a broad array of professions, suggesting that their educations have prepared them to succeed in a variety of capacities.

In the 2012 Alumni Survey, alumni were asked how well they thought their undergraduate experiences prepared them to succeed in these same areas. In the 2012 Senior Survey, students were asked how much they believed their Penn undergraduate experience contributed to their knowledge, skills, and personal development in variety of areas. Although the responses are summarized for two distinct populations of graduates, the extent of agreement in mean response between the two groups is notable (Figure 7.2).

The top ranked items on both groups' lists include: ability to learn on your own, functioning independently without supervision, thinking analytically and logically, and thinking critically. Responses from both groups were overwhelmingly positive; both seniors and alumni credited Penn with contributing a great deal to their development. Alumni responded even more positively than seniors, a finding that may be interpreted in multiple ways. Alumni still engaged with the University are perhaps more likely to have a particularly positive view of the institution. The difference might also reflect heightened expectations of recent seniors, particularly as the University becomes more selective. Alternatively, it could also be that it takes several years for individuals to fully appreciate the skills and abilities gained in college. Planned consistency in survey instruments over time will allow us to use the data collected in these two surveys to conduct longitudinal analysis in future years.

Figure 7.1

Relationship between Penn Alumni's Undergraduate Disciplines (in colors, left side) and Job Sector (in grey, right side) 10-12 years after graduation

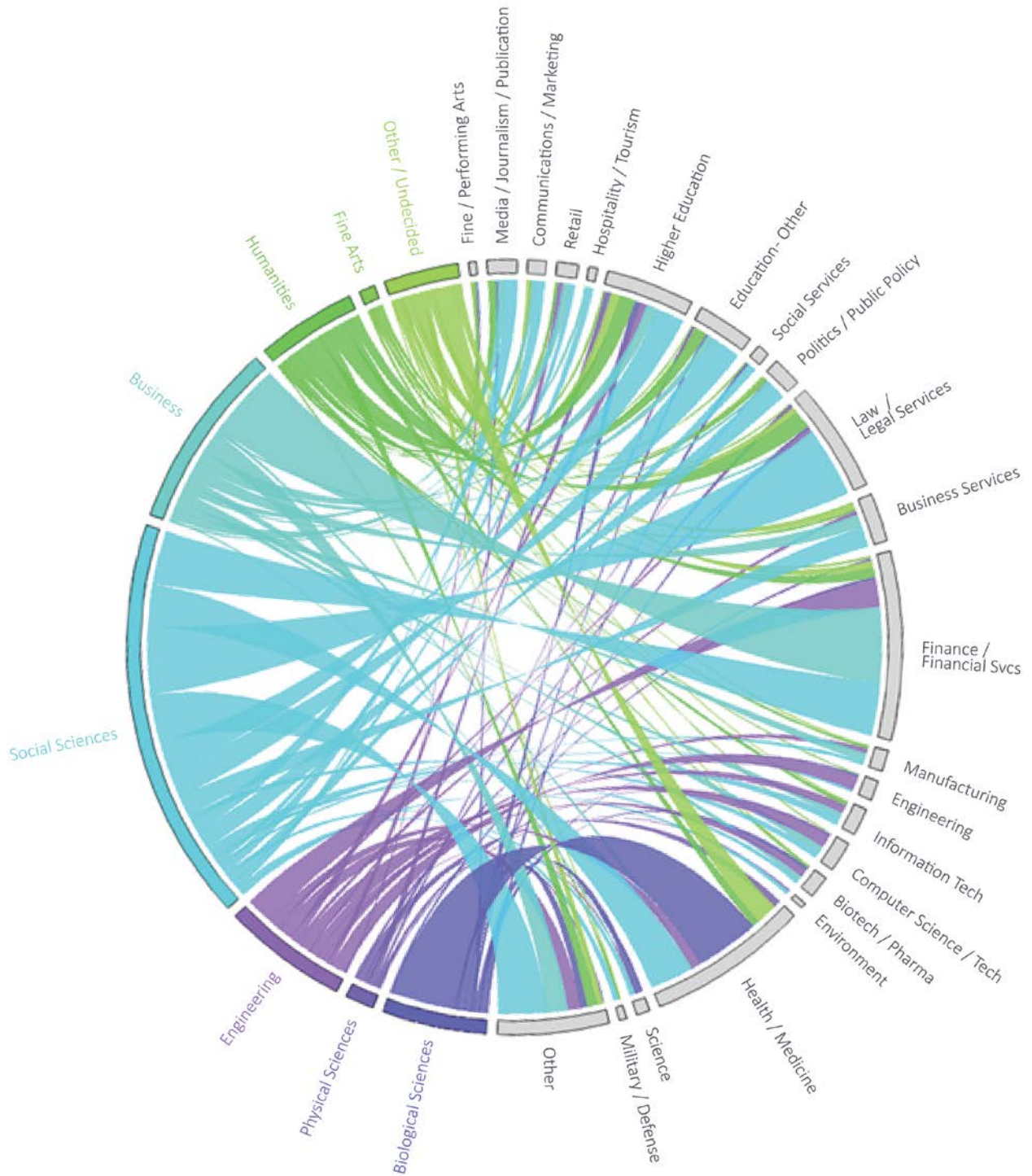
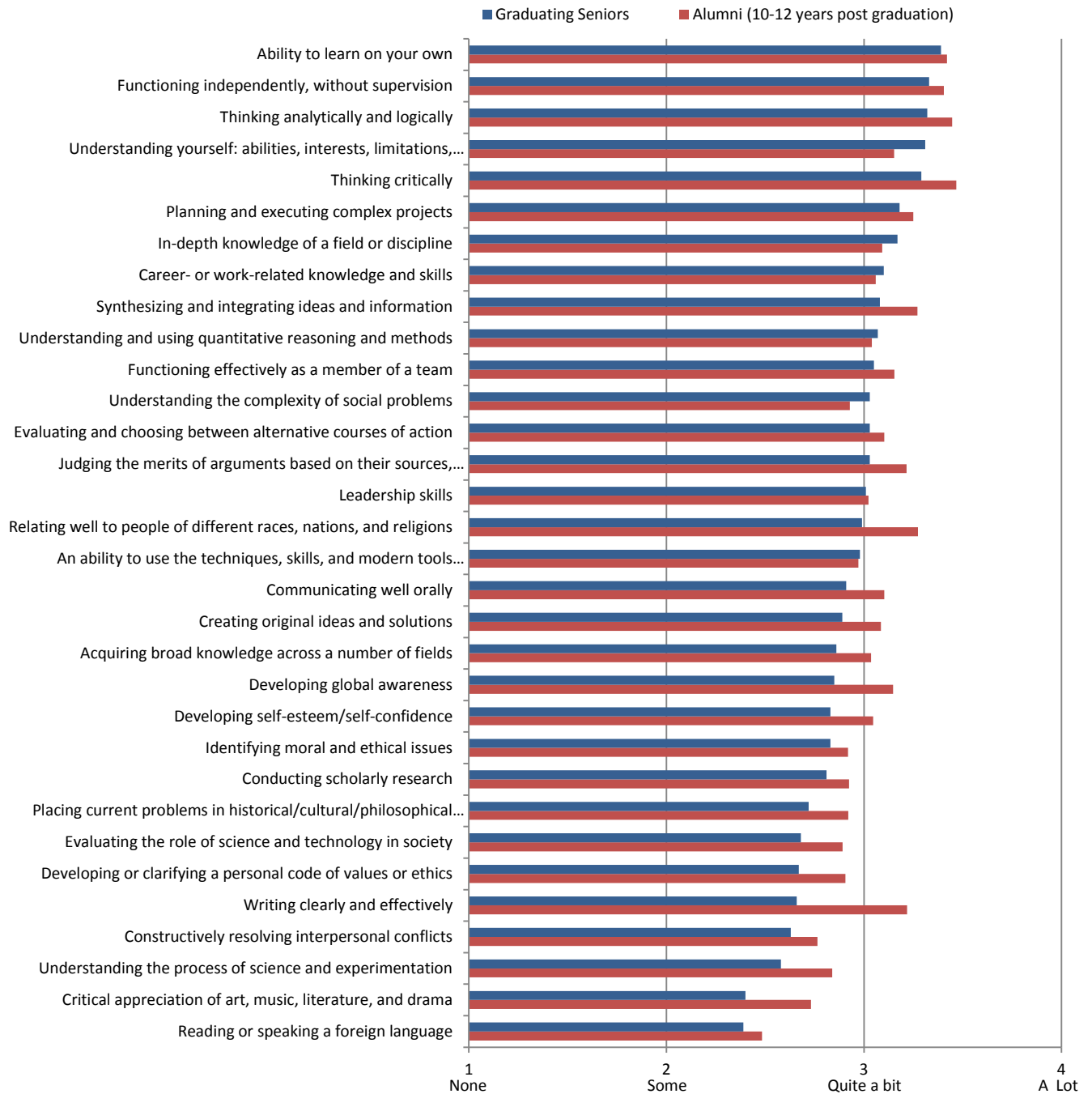


Figure 7.2
 Mean Perceived Gains in Knowledge, Skills, and Personal Development
 due to the Penn Experience, 2012 Senior Survey and 2012 Alumni Survey



Educational Mission and Assessment Activities

Penn aspires to expose undergraduates to a rich variety of academic offerings, enhance and deepen their understanding of the world and their place in society, and endow them with the gift of lifelong learning. While all four undergraduate schools are closely connected through the coordinating activities of the Council of Undergraduate Deans and other bodies, they retain specific missions and distinct approaches to education. This “flexible connectivity” is woven through the educational enterprise of the University and extends to areas noted in other chapters.

College of Arts and Sciences

The College of Arts and Sciences is committed to offering a broad education that will lay a durable foundation for critical and creative thinking. The College aims to help students become knowledgeable about the world and the complexities of today’s society; be sensitive to moral, ethical and social issues; prepared to exercise intellectual leadership; and enlivened by the use of their minds. Study of the arts and sciences provides a solid basis for advanced scientific and scholarly research, subsequent training in the professions, and the informed exercise of the rights and responsibilities of citizenship. In the tradition of its eighteenth-century founders, the College regards the enduring purpose of education as the liberation of the mind from ignorance, superstition and prejudice.

Assessment of educational programs and student learning outcomes in the College comes in two forms: regular departmental reviews and College-wide assessment activities emanating from the Office of the Dean of the College. The Working Group notes that, in response to Penn’s 2009 Periodic Review Report, the MSCHE requested “that the self-study conducted in preparation for the evaluation visit in 2013-2014 document that in the School of Arts and Sciences (1) assessment of student learning has been implemented in all departments and programs and (2) assessment results are used to improve teaching and learning (Standard 14).” The Assessment of Undergraduate Educational Programs in the School of Arts and Sciences is Appendix 7.1.

School of Engineering and Applied Science

The mission of Penn Engineering is to prepare its graduates for technological leadership roles in engineering and applied science, as well as in such other fields as medicine, business, and law in which creativity, critical quantitative thinking, effective communication skills, and a strong commitment to humane values are essential. Because the pace of technological development is so rapid, Penn Engineering emphasizes fundamentals and gives students extensive opportunities for hands-on engineering design experience addressing real-world problems coupled with hands-on research that delves deeply into their chosen field to generate new knowledge. Assessment of education programs in Penn Engineering is carried out through departmental reviews and the accreditation activities of the Accreditation Board of Science and Technology (ABET). The SEAS Learning Outcomes Summary of ABET Report is Appendix 7.2.

School of Nursing

Penn Nursing is committed to teaching the art and science of nursing, as well as creating opportunities for service, practice, leadership, and research. These goals are achieved through talented faculty,

internationally recognized scholarship, respect for the diversity of the Nursing community (of faculty, staff, and students), and a commitment to individualizing the pedagogical and material resources necessary for success. Assessment of education programs at Penn Nursing is coordinated by the accreditation activities of the Commission on Collegiate Nursing Education (CCNE). The 2013 CCNE Self-Study Report by Penn Nursing is Appendix 7.3.

Wharton School

The Wharton School seeks to cultivate a community of scholars who will transform the world as citizens and leaders of the global marketplace. It prepares leaders for business and public service, advances knowledge across disciplines and industries, and promotes economic progress throughout the world. Assessment of educational programs at Wharton occurs during quinquennial reviews and during the reaccreditation reviews by the Association to Advance Collegiate Schools of Business (AACSB). The most recent Self-Evaluation Report from the 2009 AACSB International Accreditation Maintenance Review is Appendix 7.4.

Definition and Assignment of Academic Credit

All of Penn's undergraduate programs use course units (CUs) as a general measure of academic work and progress toward a degree. The Assessment of Student Learning Working Group and the Finance and Administration Working Group examined how academic credit is assigned and how to define a CU. The descriptions below are endorsed by both Working Groups and the Steering Committee of the Self-Study.

Definition of a Credit Unit (CU)

A course unit (CU) is a general measure of academic work over a period of time, typically a term (semester or summer). A CU (or a fraction of a CU) represents different types of academic work across different types of academic programs and is the basic unit of progress toward a degree. One CU is usually converted to a four-semester-hour course. A degree from one of Penn's undergraduate programs requires the completion of 32 to 40 (or more) course units. Graduate and professional degrees vary in the number of years of study and the number of CUs required.

Assignment of Academic Credit

The CU value of a course determined by the faculty reflects their judgment regarding the expected work of a student completing that course. Factors that may be considered when assigning academic credit for a course include scheduled class time, expected time outside of class, the difficulty and range of materials covered, and the mastery of specific knowledge through written reports, exams, and other evaluations.

The assignment of academic credit for an undergraduate course is formally approved by the curriculum committee (or similar body) of the school when a course is first proposed. It is reviewed formally by the faculty of a program, department, or school through periodic program reviews or curriculum revisions. Additionally, it is reviewed by the faculty of a program, department, or school informally as part of ongoing assessments of curriculum and teaching effectiveness.

Curriculum Review and Course Approval

The faculty of each undergraduate school administers the school's degree programs, setting the degree requirements and the curriculum. Each faculty has its own process for approving its curriculum, including the assignment of credit values for courses.

College of Arts and Sciences

In the College, the Curriculum Committee reviews every new course to be added permanently to the curriculum. New courses are first approved by the department offering the course. Courses that are experimental in nature, topics courses, and graduate courses are reviewed only at the departmental level and are exempt from Curriculum Committee review. If the Committee approves a course, it recommends it for approval by the full faculty of the School of Arts and Sciences, which has developed an online tool, called [Curriculum Manager](#), to help manage the approval process for requirements, courses, and programs of study.

Most courses in the School of Arts and Sciences earn one CU per semester, even if they meet for more than three hours per week. Exceptions are made, however, for courses with significant laboratory components when those components are under the direct supervision of a faculty member, a member of the teaching staff, or a graduate teaching assistant. In these instances, students earn 1.5 CUs per semester. The Curriculum Committee has also approved a limited number of stand-alone 0.5 CU courses. These include courses such as certain honors seminars that extend across two semesters, where much of the work by students is done independently, and musical performance classes and language practice classes that span curricular and co-curricular endeavors. All courses in Arts and Sciences earning one course unit per semester meet for at least three hours per week over the course of the entire semester.

School of Engineering and Applied Science

Formal approval of engineering courses begins with a departmental faculty vote. If a new course is approved by the department, it is proposed to the Undergraduate Affairs Committee, which votes to approve a course. Courses in Penn Engineering are usually assigned 1 CU. Some courses are assigned 0.5 CU, as determined by the faculty member proposing the course in consultation with the department chair and, where appropriate, the school's central administration.

School of Nursing

The School of Nursing recently completed a major revision of its undergraduate curriculum designed to provide students with greater opportunities to develop the essential competencies required for professional nursing practice. This process was led by an Undergraduate Curriculum Committee, and the final curriculum was approved by the Nursing faculty as a whole. Key stakeholders approve new courses and minors through a new tracking process. The credit value of the courses in the new curriculum maintains the 40.5 CU total of the previous curriculum and meets all regulatory and professional standards.

Wharton School

The course approval process at Wharton begins with a proposal from a department to the Curriculum Committee. If the course is approved, it is then proposed to the school's faculty. All new courses are first approved as experimental. Once approved, an experimental course may be offered for no more than two consecutive years, beginning with the semester in which it is first offered. Departments may then propose that the course be made permanent if they wish to continue to offer it. Significant changes to existing courses and proposals to reinstate discontinued courses follow a similar process of approval by the Curriculum Committee and then the school's faculty (Appendix 7.5). Most courses are assigned 1 CU; however, Wharton has developed several 0.5 CU courses. The 0.5 CU classes allow the flexibility of "matching" two disparate classes in one semester and recognize the variance of depths of different topics.

Departmental Reviews in Penn's Undergraduate Schools

Consistent with Penn's academic organization, each undergraduate school follows its own process for regular reviews of its departments and programs. Most schools have regular departmental reviews that include self-study and external reviews, culminating in reports that are shared with the department, the school, and the Provost. Additionally, exit interviews with external review teams include school deans and the Office of the Provost, typically the Vice Provost for Education.

College of Arts and Sciences

The review protocol of the School of Arts and Sciences requires each department to be reviewed every five to seven years (Appendix 7.6). These reviews include a departmental self-study focused on the educational experiences of undergraduates, including teaching effectiveness, advising, and the scope and curriculum of the undergraduate program, including general education and the major. The Dean also appoints an external review committee, composed of three scholars from the discipline under review, which is responsible for producing a single report.

School of Engineering and Applied Science

The School of Engineering and Applied Science carries out comprehensive peer reviews of its academic departments and reports these as part of its reaccreditation process by the Accreditation Board of Science and Technology (Appendix 7.7).

School of Nursing

The regular reaccreditation review by the Commission on Collegiate Nursing Education (CCNE) functions as a peer review for School of Nursing programs (Appendix 7.3).

Wharton School

The Wharton School has a system of quinquennial departmental reviews that includes the collection of information about each department's undergraduate curriculum, as well as the MBA and PhD curricula (Appendix 7.8). The information collected includes courses offered, trends in enrollment per course, duration of each course, recent curricular changes, and students' evaluations of courses. Review committees, which are appointed by the Dean, are composed of four to five faculty members and three students (one undergraduate, one graduate, and one doctoral). Each review also includes three external consultants, who serve as an advisory group.

Common educational objectives

The Assessment of Student Learning Working Group, composed of faculty members from the four undergraduate schools (and supported by consultation with the broader faculty) examined the curricula from the four undergraduate schools and focused on the following questions: Are there common educational objectives that span the schools and, if so, how are they assessed? This inquiry revealed agreement about what can be considered the meta-goal of a Penn education: to enable our graduates make a difference in the world. The group then considered how the curricular offerings in the four undergraduate schools prepare our graduates to achieve this goal.

For our alumni to make a difference in the world, they should be problem-solvers, each in his or her own way. To become problem-solvers, students need to know how to work with problem-solvers in different fields. And finally, to have an impact on the world, they need to be good communicators. These objectives are common to all four of the undergraduate programs at Penn. Thus, the Working Group created four categories to describe a thought experiment in which institutional learning goals drawn from the curricular goals of the four undergraduate schools were explored, first by describing elements of each school's curriculum related to the goals, and then by describing the assessment of those elements. The result is a rough sketch of how Penn graduates could demonstrate proficiency across these four broad educational goals of a Penn education:

- 1) Problem-Solving
- 2) Understanding and Application of Connectivity
- 3) Global and Civic Literacy
- 4) Communication Skills

Problem-Solving

The ability of students to analyze and solve complex problems fundamentally shapes a Penn undergraduate education. Students need proficiency in the analytical tools employed in problem-solving, including quantitative/logical analysis, critical reasoning, research methods, ethical reasoning, and lifelong learning. This training helps Penn graduates approach problems that span disciplines and then successfully apply analyses and reasoning to solve those problems.

Every undergraduate school at Penn has a quantitative or formal reasoning requirement. Beyond that, the methods employed by each school to provide instruction that will lead to greater problem-solving ability vary according to each school's curriculum.

College of Arts and Sciences

Curricular design. Students in the College are exposed to various modes of problem-solving in several of the General Education Requirements, which all students must satisfy prior to graduation. Quantitative and logical problem-solving are fundamental components of two of the Requirements: *Foundational Approaches: Quantitative Data Analysis (QDA)* and *Formal Reasoning Analysis (FRA)*. Courses satisfying the QDA requirement use mathematical or statistical analysis of quantitative data as an important method of understanding a subject. More specifically, students are required to analyze actual data sets with the goal of evaluating hypotheses or interpreting results. Courses satisfying the QDA include such areas as science labs (e.g., Chemistry 053, Biology 121), economics (e.g., Economics 104), and sociology (e.g., Sociology 120), among others. Courses in the FRA requirement focus on deductive reasoning and the formal structure of human thought, including its linguistic, logical, and mathematical constituents. Illustrative courses include Mathematics 104, Philosophy 005, and Linguistics 105. Further emphasis is placed on problem-solving through the General Education sector requirements in the sciences, which require all students to take at least one approved course in each of these groups: *Living World, Physical World, and Natural Sciences and Mathematics*.

Assessment. There is no one-size-fits-all method of assessing student learning given these requirements. The process focuses on periodic assessments of the individual courses to ensure that they continue to include classwork, homework exercises, and exam questions that meet the minimum standards for a QDA or FRA course.

School of Engineering and Applied Science

Curricular design. Quantitative/logical analysis is essential to engineers and includes the ability to identify, formulate, and solve engineering problems. The solving of engineering problems includes the ability to design a system, component, or process to meet desired needs within economic, environmental, social, political, and ethical health and safety constraints, while also taking into account manufacturability and sustainability. Critical reasoning is also essential to engineering students. This includes an ability to design and conduct experiments, to analyze and interpret data, and to apply knowledge of mathematics, science, and engineering. As a baseline, all Engineering students are required to take Mathematics 104, 114, and 240, which take them through differential and integral calculus and differential equations with some exposure to linear algebra. Additionally, each engineering discipline requires discipline-specific math courses. Within each major, several courses include experimental design, analysis, and interpretation, with a large portion associated with hands-on lab courses.

Assessment. All courses in the Engineering BSE major are designed to meet ABET (Accreditation Board for Engineering and Technology) standards. As a result, courses are designed for and assessed by ABET-specified learning outcomes. Five of the ABET learning outcomes speak directly to the University's expected proficiency in problem-solving:

- (a) an ability to apply knowledge of mathematics, science, and engineering;
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data;
- (e) an ability to identify, formulate, and solve engineering problems;
- (f) an understanding of professional and ethical responsibility;
- (i) a recognition of the need for, and an ability to engage in, lifelong learning.

Each of the majors has different requirements and courses, but all are designed to guarantee coverage of these topics. The Learning Outcomes Summary of ABET Report (Appendix 7.2) demonstrates how Engineering meets these outcomes.

School of Nursing

Curricular design. To ensure that Nursing students graduate with strong problem-solving skills, each student is required to take a Reasoning Sector course. Courses in this sector must provide breadth in an area of study that addresses logical, mathematical, and quantifiable relationships among such entities as ideas, people, groups, systems, and other social or technological structures. Specialized research approaches—including field work, advanced statistics, and other methods—also fulfill this aim. Illustrative courses include Mathematics 101 (Algebra and Trigonometry) and 123 (Community Math Teaching Project) or courses in computer methodologies. Every student is also required to take Nursing 230: Statistics for Research and Measurement. In this course, students become literate in statistical terminology and symbols and knowledgeable about assumptions for statistical tests.

Problem-solving also demands clinical reasoning skills, which are developed through clinical experiences in courses such as Nursing of Women and Infants (Nursing 215); Mental Health (Nursing 235); Pediatrics (Nursing 225); Nursing Care of the Young and Middle Aged Adult (Nursing 245); Nursing Care of the Older Adult (Nursing 255); and Community Nursing (Nursing 380). These experiences present crucial opportunities for students to apply classroom learning and develop proficiency in caring for patients. Each student completes a total of 864 hours in the clinical setting. These clinical experiences are central to developing knowledge and skill. Clinical placements are varied, taking place in hospitals and in community settings. Clinical hours are obtained by working in some of the best hospitals in the country and by studying overseas, through experiences such as supporting safe births in a Honduran village or soothing sick children in an Israeli kibbutz.

All undergraduate students are required to take classes in research and ethical reasoning. In addition to taking Nursing 330 (Health Care Ethics), students take Nursing 547: Scientific Inquiry for Evidence-based Practice (beginning in 2014), which is designed to advance students' understanding of the research process, methods of scientific inquiry, and analytical techniques. They also take Nursing 389: Research/Inquiry-Based Service Residency. This course is designed to facilitate students' intellectual curiosity and independence through a structured and individualized faculty-mentored research experience based on specific learning objectives. All students rely on the Office of Nursing Research to help discover grant opportunities, find research partners, hone grant-writing skills, and connect with faculty mentors.

Assessment. For learning outcomes in quantitative/logical analysis, assessment measures include the evaluation of students' examinations of the statistical and clinical significance of research findings. Students in a variety of courses also evaluate tables and graphs to summarize research findings. Other outcomes are measured through objective tests, written papers, and oral presentations (position papers, clinical care plans), reflective journaling, group presentation of exemplar cases, and recordings of verbal and nonverbal interactions with patients. A significant assessment of learning for problem-solving comes with research projects, research papers, and posters presented in class and at national research conferences.

During clinical experiences, each student is evaluated based on written patient care plans, simulated laboratory experiences, and clinical practice tools. Clinical practice tools measure behavioral outcomes that students must obtain before progressing to other courses. Students also demonstrate knowledge in the clinical learning environment by performing safe calculations on dosages and solutions and teaching patients and families about safe dosages and calculations. The clinical evaluation tools have clear descriptions of competencies that students must meet in order to progress to the next course. Clinical reasoning that involves the acquisition of core knowledge and skills is also assessed through lab demonstrations and simulations. All students use low fidelity (standardized actors) and high fidelity (technological guided mannequins, etc.) simulations in the clinical nursing laboratory. They are measured by scores for crisis management skills (e.g., managing airway, breathing, circulation, and neurological problems), communication skills, and survival rates based on simulated (SIM) models, decision-making, and drawing conclusions. Students are also measured by live observation, performance checklists, video recordings, critical debriefing periods, and SIM device logs. The Commission on Collegiate Nursing Education (CCNE) Self-Study Report provides detailed outcomes assessment of these clinical experiences, including NCLEX-RN pass rates, certification examination pass rates, and employment rates (see pages 54-71 in Appendix 7.3).

Wharton School

Curricular design. Students in the Wharton School are expected to develop the capabilities required to solve business-related problems. Fundamental quantitative and logical analysis capabilities necessary to address a wide variety of business problems include the capability to: (1) frame problems in a manner that can be resolved mathematically; (2) develop, analyze and interpret business statistics; and (3) employ standard quantitative approaches used in business practice. These capabilities are introduced in required courses in micro- and macroeconomics, mathematics (College-level calculus, Mathematics 104), and business fundamentals (including two semesters of accounting and two semesters of statistics) and are further enhanced in subsequent elective courses requiring students to craft solutions to cases and hypotheticals linked to actual business experience. Problem-solving in the business environment demands critical reasoning skills, which are developed in many courses through class discussions of cases and problems, feedback on written projects, and project presentations followed by question and answer periods. Problem-solving in business often requires research involving multiple resources, such as library collections, regulatory filings, internet search engines, databases, archival empirical analysis, and surveys. Students are provided with opportunities to explore different research sources and methods through research papers required in some courses and independent study projects supervised by faculty.

Assessment. Students in the Wharton School receive a common foundation in problem-solving skills through selected required courses in business fundamentals that develop the students' capabilities to: (1) frame problems in a manner that can be resolved mathematically; (2) develop, analyze, and interpret business statistics; or (3) apply standard quantitative approaches employed in business practice. The required courses include: (1) Accounting 101 and 102: Financial and Managerial Accounting; (2) Business Economics and Public Policy 250: Managerial Economics; (3) Finance 100: Corporate Finance; (4) Operations and Information Management 101: Introduction to Operations and Information Management; and (5) Statistics 101 and 102: Introduction to Business Statistics. These courses focus on sources of data, solution techniques, and problem frameworks that are common to many business-related problem-solving exercises, and they are required of all students. Assessment is performed by the departments and instructors responsible for the courses, who rely on objective examinations to assess learning outcomes.

While the material conveyed in each of these courses is common across sections, the examinations used for assessment may or may not be the same. In some departments, instructors employ common examinations each semester and, in other departments, instructors prepare examinations unique to their course sections. The relevant department chair provides oversight for each course section, ensuring that each course and its assessment is rigorous. Finally, because the business curriculum is progressive, subsequent courses in the curriculum rely on students having learned material that gives them a common foundation. For example, Finance 203: Advanced Corporate Finance relies on students' understanding material covered in fundamental courses in financial accounting, finance, and statistics. If students are assessed to be deficient in their understanding of problem-solving material covered in the business fundamentals courses, the instructors in the higher-level courses provide informal feedback to the instructors of the fundamental courses. In fact, even courses that comprise the common foundation rely on material covered in other foundational courses. For example, Finance 100 assumes that students are familiar with and can effectively use the basic concepts taught in statistics, accounting, and economics.

Understanding & Application of Connectivity

The University places a strong emphasis on traversing disciplinary barriers and encourages students to work across academic disciplines and to work effectively in groups. As described and documented in Chapter 5, the University actively pursues multi-disciplinary dialogue through such avenues as dual degrees and multiple majors and minors (Appendix 5.2). As explored in Chapter 5: Integrating Knowledge, approximately 10 percent of Penn undergraduate students are enrolled in a formal integrated program of study and an additional nine percent are taking a self-constructed multiple major. The coordinated dual degree programs are monitored by the constituent schools. As further evidence of students' multidisciplinary education, there is a high level of cross-school student enrollment (Appendix 5.2). By building these bridges, Penn encourages students to venture out and discover points of connectivity, with the goal of applying those connections to create a richer intellectual experience. This journey in turn fosters collaborative learning, as students encounter classmates from across the Penn community, while also viewing their own educations through the lens of a distinct approach. The

sections below examine how each undergraduate school builds this kind of connectivity into its curriculum and assesses the success of those activities.

College of Arts and Sciences

Curricular design. Students in the College are required to complete seven sectors that cross disciplines. Courses in the five of the sectors—Society, History and Tradition, Arts and Letters, Living World, and Physical World—are generally grounded in the perspective of a specific discipline. The other two sectors engage students in interdisciplinary modes of inquiry. Sector IV: Humanities and Social Sciences (HSS) comprise courses that combine methods and approaches from at least two of the first three sectors. In Sector IV, students engage diverse approaches to society, history, tradition, and the arts more deeply than a single course from each domain can allow. Greater depth of experience is gained by bringing to bear several humanistic and social scientific perspectives on a single issue or topic or by engaging in academically based service or performance informed by these perspectives. In Sector IV courses, students broaden their perspectives by taking a course in the humanities or social sciences that has been approved as a General Education course but cuts across two or more of sectors I, II, and III. Some courses approved for this sector seek a more integrative approach by addressing a problem or topic from a variety of disciplinary perspectives. Others combine disciplinary study with community service or activism. Finally, some courses in the arts combine creative or performance experiences with reflection on and grounding in a specific discipline.

Another cross-disciplinary requirement is Sector VII: Natural Sciences and Mathematics (NSM). In fulfilling this requirement, students must engage with diverse approaches to the natural sciences and mathematics more deeply than a single course from the physical and life sciences would allow. Greater depth of experience can be accomplished by greater focus on one area; by study in a related area, bringing various scientific perspectives to bear on a single issue or topic; or by engaging directly in academically based activities informed by these perspectives. In this sector, students broaden their perspectives by taking a course in the natural sciences or mathematics that has been approved as a General Education course.

Assessment. Assessment of the Sector Requirement is carried out by two faculty panels: the HSS Panel (for Sectors I – IV) and the NSM Panel (for Sectors V – VII). The panels spent several semesters, following the inception of the current curriculum in 2006, discussing how best to define expected outcomes. They sharpened the definitions of the sectors for purposes of approving new courses and translated the general definition of each sector into statements of the expectations for student learning in that sector's courses. The results of this exercise can be seen in the [enumerated questions after each sector definition](#). The panels then reframed these definitions as learning goals for the sectors, which help determine how best to evaluate the success of the sector curriculum in ensuring that students have met those goals.

This past year, the HSS Panel undertook several initiatives to learn more about what College students may gain from the sector requirements. It aimed not only to develop a set of findings on how this component of the curriculum was functioning but also to demonstrate the value of this approach to assessing General Education that, if successful, could be used for assessment of the other sectors. The

panel composed and employed a set of supplemental questions appended to end-of-the-semester course evaluations that ask students to evaluate their learning in relation to the goals of the sector. These questions are listed in the appendix of the College Assessment Report. The panel pilot-tested the questions in the summer of 2012 and then added them to the standard questionnaire for all sector courses evaluated during academic year 2012-2013. Although students' own evaluations of what they learned are considered an indirect method of assessment, the panel thought that students' opinions provided important information about their views of their own learning. For more detail, see Assessment of Undergraduate Educational Programs in the School of Arts and Sciences (Appendix 7.1).

School of Engineering and Applied Science

Curricular design. Two of the School's ABET-specified outcomes align with the understanding and application of connectivity:

- an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
- an ability to function on multidisciplinary teams.

These outcomes are an integral part of each Engineering major, including the capstone Senior Design Project, a team project that integrates knowledge from all four years of study. Several courses in each major also include teamwork. Beyond ABET, all Engineering students are required to take seven social science and humanities courses outside the School. In addition to providing these students with a broad liberal arts education, this requirement guarantees a rich interaction with students and viewpoints outside the School. Between basic math and sciences and social science and humanities requirements, engineering students are required to take 17 of their 40 credit units in another school. Typically, students take more than half of their units outside Engineering. Finally, a number of Engineering students pursue dual degrees or minors in other schools. See Appendix 5.2 for details on cross-school programs.

Assessment. Assessment of learning outside the school is performed by the school that offers the courses. Within the school, outcomes are assessed by homework, exams, and projects in courses in each major. Most courses include a specific measurement for teamwork. The demonstrated attainment of ABET standards across the majors is provided in Appendix 7.2. As with other ABET outcomes, the goal is to exceed 85 percent achievement of the outcome, and this goal has been achieved.

School of Nursing

Curricular design. One of the School of Nursing's goals is to help students articulate a role that encompasses knowledge of systems thinking, inter-professional communication, organizational structure, and their influence on health care delivery. Students combine nursing studies with courses at other Penn undergraduate schools and may pursue minor, dual degree, and sub-matriculation options. Cross-disciplinary sectors are required of all nursing students: 1 CU each (outside the School of Nursing) in Societies and Social Structures, History and Traditions, Arts and Letters, and Global and Cultural Studies. All courses have

been approved by the School of Nursing. Nursing students take courses in the three other undergraduate programs, and students in other undergraduate schools take classes at the School of Nursing.

The knowledge that students gain from courses outside the School of Nursing enables them to have a strong voice at the bedside, in leadership and policy, in multidisciplinary research teams, and in the economic arena. Students are better prepared to care for individuals in groups, organizations, and a variety of institutions and, through courses in cultural studies and history, they have a greater understanding of historical traditions in cultures and societies as they care for diverse patient populations. Multidisciplinary work is also included in required courses for all students in the sciences, nutrition, and ethics.

Assessment. Understanding and application of connectivity involves teamwork. Special rubrics in clinical courses are designed to assess students' ability to work effectively as teams through high-fidelity scenario-based simulations. During these simulations, students are evaluated in decision-making as well as communication with physicians, respiratory therapists, and other health care workers. They may also be evaluated on working with engineers to design a more effective clinical workplace. One of the questions in the survey of all Nursing graduates measures the extent to which students feel prepared to work together as a team. An End-of-Course evaluation tool also assesses students' understanding of their roles in working with others as a team member. In the science and ethics courses, written examinations and papers are used to measure learning outcomes. Ethical reasoning is measured in competencies for clinical learning through clinical valuation tools and assignments in Nursing 330.

Wharton School

Curricular design. To ensure breadth of knowledge, Wharton students gain exposure to the arts and sciences through a General Education distribution requirement, which requires students to complete at least two CUs in social structures; at least two CUs in language, arts, and culture; and at least two CUs in science and technology. Wharton students are also required to take two additional non-business electives and a required course in mathematics. These broad educational requirements ensure that students receive sufficient intellectual breadth, which can be applied to their study of and careers in business. In addition to gaining the broader perspective offered by exposure to courses in other academic units, Wharton students are also required to develop breadth in the business domain through required courses in business fundamentals, societal environment, organizational environment, business breadth, and global environment. These course requirements ensure that students are exposed to the multiple perspectives of various business disciplines that can be applied as they pursue their specific business interests.

The ability to engage with a team is vital to the achievement of business objectives. Accordingly, Wharton offers many opportunities for students to engage with and lead groups of fellow students. All Wharton students must complete Management 100: Leadership and Communication in Groups, in which students study leadership and communication in teams. A critical teaching and assessment tool in that course is a required team field project in which a student team engages with a community service or small business organization. Many Wharton courses also require that students prepare cases and projects in teams. Some examples of courses requiring teamwork include: Accounting 297 and 242,

Finance 207, Legal Studies 210, Marketing 211 and 224, Management 230 and 291, and Operations and Information Management 290 and 314.

Wharton encourages and offers many avenues for students to pursue cross-disciplinary studies. Coordinated dual degree programs include the Huntsman Program in International Studies and Business, Vagelos Program in Life Sciences and Management, Fisher Program in Management & Technology, and Nursing and Health Care Management Program. Students are also encouraged to pursue dual degrees and minors outside of coordinated programs.

Assessment. Assessment of student learning in understanding and applying connectivity relies on several different metrics. Interdisciplinary learning achieved through breadth requirements—the general education distribution requirement, non-business elective requirement, and mathematics requirement—is assessed by the relevant school and department outside Wharton. Responsibility for ensuring that students successfully complete the requirements rests with Wharton. Interdisciplinary learning achieved through cross-disciplinary breadth requirements within Wharton—business fundamentals, societal environment, organizational environment, business breadth, and global environment—is assessed at the course level, with oversight provided by the relevant department chair.

Assessment of interdisciplinary learning in courses with cross-disciplinary content occurs indirectly through the assessment tools employed in those courses, which are typically examinations, projects, and cases. These assessments are indirect because they are specific to the material covered in those courses. The cross-disciplinary nature of that material, however, implies that the assessment must also reflect a student’s understanding of the links among disciplines. With regard to teamwork, all Wharton students complete project and teamwork assessments in Management 100: Leadership and Communication in Groups. Assessment of teamwork is accomplished indirectly in other courses through assessments of required group projects and presentations.

Global & Civic Literacy

To prepare for the increasingly international experiences today’s graduates encounter, Penn students ought to be able to cross cultural boundaries. While at Penn, students engaging in local and global civic dialogue and interactions increase their awareness and understanding of cultural contexts and experiences that are different from their own.

These activities include academic components grounded in the humanities and social sciences and various curricular requirements—for example, required course work in cross-cultural analysis in the College of Arts and Sciences or required courses in the global environment in the Wharton School. Yet they quite often extend beyond curricular requirements—and beyond the classroom itself—to engage with Philadelphia, the nation, and the world. Chapter 3: Local Engagement and Chapter 4: Global Engagement provide accounts of these activities across the schools and how they are assessed.

Communication Skills

The ability to convey knowledge, as well as receive it, is a fundamental part of the curriculum across Penn's undergraduate programs. Each school strengthens a student's ability to communicate in both oral and written modes. School communication requirements may also include such areas as foreign language proficiency and technological communication.

College of Arts and Sciences

Curricular design. The ability to communicate knowledge is emphasized in the College's General Education Requirements. The writing requirement recognizes that the ability to express oneself clearly and persuasively in writing is fundamental for success across all academic disciplines and throughout one's personal and professional life. All students must take a critical writing seminar and are advised to take this course during their first year of study. Students are also encouraged to develop their writing skills by participating in Penn's writing programs. The study of a foreign language is a second aspect of communication codified in the College's General Requirements. All College students must complete four semesters of study of a foreign language, or the equivalent based on departmental or standardized exams.

Although not a formal requirement, the development of public speaking and oral communication skills is strongly encouraged in many courses, and resources are available for students and instructors who wish to integrate an oral component into their courses. [Communication Within the Curriculum](#)-affiliated courses offer students the opportunity to improve their speaking abilities by meeting with a speaking advisor to rehearse at least one graded speaking assignment. They also include [critical speaking seminars](#), which are oral presentation-intensive courses.

Assessment. The [Critical Writing Program](#) engages in a range of assessments of learning outcomes, including diagnostic timed essays to assess students' command of basic writing skills, detailed rubrics for each writing assignment, and portfolio assessments scored by the instructor and at least one other member of the writing faculty. The same methods and criteria of assessment are used in all of the seminars, and all students must pass the coursework and final portfolio assessment to fulfill the writing requirement. The final portfolio assessment is performed by the student's writing instructor and one or more outside readers drawn from the writing faculty and administration. The coursework grade is based on a student's demonstrated knowledge of the fundamentals of writing and participation in a discourse community: knowledge of topic, rhetoric, genres, and writing process. The portfolio grade, in turn, depends on a student's demonstrated competence in cognition, invention, reasoning, and presentation, including grammar, mechanics, style, and adherence to genre and discourse conventions.

Instruction in foreign languages is another important way in which communication is taught in the College. For a description of the assessment of foreign language instruction, see Chapter 4: Global Engagement, and Appendix 7.1.

School of Engineering and Applied Science

Curricular design. Writing skills are developed through the fulfillment of the Writing Requirement; writing assignments in Engineering courses, particularly labs and the Engineering Senior Design Project required of all BSE students; writing in social science and humanities courses outside the School, seven of which are required of all engineering students; and elective courses in writing. The basic Engineering Writing Requirement is to take one of the College-administered Writing Seminars, typically during the freshman year.

Beginning in 2011, and intensively during the 2012-2013 academic year, Penn Engineering reviewed its writing program, the Technical Communications Program (TCP), which was created, in part, because high-quality writing assessment required expertise more readily available outside the school. The review included outcomes and assessments of students and employers of Engineering graduates that were part of ABET evaluations. After the review was complete, the program was eliminated for undergraduates, and writing programs for Engineering students are now provided in coordination with the Weingarten Learning Resource Center, including three courses in the fall of 2013 (Bioengineering 100, Engineering 299, and Electrical Systems Engineering Senior Design).

Oral presentation skills are required and assessed in various assignments in Engineering courses—particularly courses that involve projects, including the Engineering Senior Design Project course. In this year-long, required capstone course, students make multiple project presentations and progress reports, as well as a final presentation of the finished project. Opportunities for developing oral presentation skills also exist in courses taken outside the School.

Assessment. ABET explicitly includes “an ability to communicate effectively” as one of its required learning outcomes. Consequently, each required course includes communication elements and assesses student achievement in this area through assignments. The assessed communication assignments encompass both written and oral presentations, including project presentations and reports for the capstone Engineering Senior Design Project. As with other ABET outcomes, the goal is to exceed 85 percent achievement of the outcome, and this goal has been met. Penn Engineering relies on the College to assess and maintain achievement in its writing, social science, and humanities courses.

School of Nursing

Curricular design. The Nursing baccalaureate curriculum concentrates on four intersecting core themes that characterize the complex and contextual nature of nursing practice: engagement, inquiry, judgment, and voice. Each of these themes requires that students communicate in both written and oral formats. All Nursing students are required to pass four CUs of a foreign language and take a writing course. All Nursing students use technology such as iPads and advanced video technology in simulated situations, to enable them to make real-time decisions. Advanced video technology allows students to see a recording of their interaction with a simulated patient, which helps them to develop professional self-awareness and clinical reasoning. Students also manage patient information in the electronic medical record, which is becoming increasingly popular in health care organizations, and learn therapeutic communication in Nursing 103: Psychological and Cultural Diversity.

Assessment. A primary source of information is direct measures of success at achieving the desired goals of each course. All students are required to make oral presentations in different courses and make group presentations of exemplar cases. During class time, students are graded on oral participation as members of small groups. Students also advocate for scientific, social, and political action that advances quality nursing care for patients, families, and communities. For example, students observe and analyze advocacy in the hospital and an example of a nurse finding his/her voice and are graded on their analysis according to specific criteria. They also are graded on their participation in group work. All students also write papers (position papers and research studies) and clinical management plans and engage in reflective journaling. Finally, clinical evaluation tools evaluate students' abilities to talk with patients, families, and other health care workers.

Wharton School

Curricular design. Effective communication is essential to successfully contribute to business and public policy. Effective communication in these environments requires familiarity with the languages employed and the ability to present ideas and information in oral and written form. All Wharton students are required to develop their ability to communicate in writing, with a common foundation of instruction provided in the Writing Requirement, which can be satisfied in a number of courses in the College, and the writing requirements in the business fundamentals course Management 100: Leadership and Communication in Groups. Many subsequent courses taken in the business curriculum require case write-ups and other projects that further develop students' written communication skills.

The foundation for oral communication skills employed in business is established in Management 100: Leadership and Communication in Groups, which requires students to make a presentation as part of their field project. Many subsequent courses in the business curriculum require oral presentations in the form of project presentations (e.g., Management 104: Industrial Relations and Human Resource Management) or debates (e.g., Legal Studies 210: Corporate Responsibility and Ethics) that further develop oral communication skills.

In an increasingly global marketplace, facility with other languages is a valued skill. To ensure that Wharton students attain a minimal degree of competence in a language other than English, students are required to satisfy a foreign language competency requirement.

Assessment. Assessment of students' ability to communicate in writing is provided through the Critical Writing Program and the writing requirements in the business fundamentals course Management 100: Leadership and Communication in Groups. Many subsequent courses taken in the business curriculum require case write-ups and other projects that enhance and develop students' written communication skills. Assessment of foreign language proficiency occurs during language courses and through proficiency exams.

Strategic Considerations

The Assessment of Student Learning Working Group explored higher-level learning goals abstracted from the curricular goals of the four schools. It found some common ground in articulating the aspiration

that students demonstrate certain proficiencies. However, because these proficiencies cannot be directly connected to all fields of study in ways that would elicit meaningful learning outcomes across all programs, the University should avoid seeking to develop a general or overarching program of learning assessment spanning the four schools. For instance, although the group agreed that all Penn students ought to be proficient in problem-solving and communication, it found that these proficiencies were either too general to be meaningful (e.g., a basic math requirement satisfied by many students prior to matriculating says little about what is important about a program of study) or too specific (e.g., the expectation that students communicate effectively is deeply embedded in all fields of study but becomes meaningless when abstracted across many fields).

Shared values and goals, particularly those articulated by the Penn Compact, will continue to inform the careful work of teaching and learning across the University, and Penn will continue its established processes for institutional data gathering and analysis (as reflected throughout the other chapters of this Self-Study Report). At the same time, these shared aspirations should not be expected to lead to uniform, observable learning outcomes that credibly represent what Penn scholars believe is important about learning in a field of study. This lack of uniformity in learning outcomes is to be both desired and celebrated, as it reflects the rich diversity of educational opportunities at Penn. In the terms articulated in “Principles for Effective Assessment of Student Achievement,” Penn should expect schools and programs to provide evidence of successful student learning experiences that align with their particular curricular goals.

Recommendations

The descriptions above and the assessment reports of the four schools (Appendices 7.1, 7.2, 7.3, and 7.4) document Penn’s compliance with Standard 14. The University should remain committed to its durable and robust processes of curriculum review, course approval, and regular departmental review. At the same time, it should continue its work to improve coordination of these activities, including sharing best practices across schools and departments, through the Office of the Vice Provost for Education and the Council of Undergraduate Deans.

Assessment of student learning in three of Penn’s four undergraduate schools is guided by established professional school accrediting requirements, while the College of Arts and Sciences has been deeply engaged over the past several years in constructing and implementing its own program of learning assessment. The College’s thoughtful and systematic work in this area ought to continue, particularly aimed at sharpening evaluations of sector requirements and their effectiveness, informed by additional pilot-testing.