Essay 5. Shaping Undergraduate Education via the Capstone Experience

Introduction

As part of our *Institutional Proposal*, UCLA selected "Shaping Undergraduate Education via the Capstone Experience" as one of three themes for the *Educational Effectiveness Review*, noting that faculty-mentored capstones provide students the opportunity to demonstrate mastery and integration of knowledge and learned abilities in an active context within a discipline. The Institutional Proposal Steering Committee saw capstones as the "bookend" to the general education curricular reform launched during UCLA's previous WASC review (see *Essay 4*), and hoped to engage the campus in examining its expectations for California's top students at the end of their undergraduate years.

In support of this theme, the committee cited *Reinventing Undergraduate Education: A Blueprint for America's Research Universities* (1998 Boyer Commission report[1]), which describes the capstone experience as marshaling all educational experience "in a project that demands the framing of a significant question or set of questions, the research or creative exploration to find answers, and the communication skills to convey the results."

The Commission, which advocated inquiry-based learning, set a national agenda that resonated with recent initiatives of the UC Office of the President and at UCLA to reexamine faculty roles in undergraduate education. In 2003, UCLA convened the Joint Administration-Senate Taskforce on Undergraduate Education in a Research Context, following a mandate[2] from UC President Richard Atkinson, who asked that campuses link undergraduate education more closely to the research mission of the university. The taskforce studied the ways in which UCLA delivers research-based education to advanced undergraduates in the form of individualized and small-group instruction, including research seminars, journal clubs, internships, apprenticeships, and one-on-one tutorials. In its 2003 report, *Undergraduate Education in a Research Context*[3], the taskforce recommended, among other things, the creation of a list of "reserved course numbers" to foster and track these types of courses across campus. Its most challenging recommendation was that departments "require a senior project or some type of capstone (design, research, seminar, or studio project)." In Spring 2003, the Undergraduate Council[4] endorsed these and other recommendations, and in Fall 2003, the recommendation regarding reserved course numbers was implemented through a comprehensive course-renumbering project[5].

To pursue the capstone theme, in Fall 2006 a faculty-student workgroup was appointed that encompassed diverse perspectives from across campus. The workgroup met five times during spring quarter 2007, surveying available capstone experiences at UCLA and confronting the obstacles that will challenge any effort to expand them significantly, especially in large departments with overtaxed faculty. Central among the group's goals were 1) to define the nature and function of capstones in a way that would be meaningful across campus, and 2) to understand better how curricula might be designed to support capstones. While embracing the project of improving the capstone opportunities at UCLA, the consensus of the group is that simply imposing a capstone requirement would fail. Instead, the group recommends that UCLA approach the problem so as to improve available capstones, to reshape major and minor curricula to better support the capstone, and to expand capstone opportunities wisely, according to a well-defined standard.

This reflective essay presents the workgroup's attempt to define capstone experiences for undergraduate students at UCLA and to propose a model that could be implemented by departments. The group will continue its efforts during 2008-09, and will prepare a longer paper on implementing capstone experiences and working with departments to establish clear criteria and student learning outcomes.

Definitions and Hallmarks of the UCLA Capstone

In considering how the capstone might best be conceived at UCLA, the workgroup stipulated that it should serve as a project-based culmination to a curriculum (a meaningful, shaped collection of courses typical of a major or minor), bringing together in a coherent way key elements of that curriculum, and also drawing, as appropriate, on other curricula and experiences such as general education, writing classes, lower-division seminars, and community-based projects. The capstone at UCLA should provide a focus for the broad basis of a program of undergraduate study. Thus, the acquisition of knowledge should lead to a specialized topic explored in a paper or project. Methodological training should be applied to a specific inquiry. Knowledge integrated across a range of topics and disciplines should provide broader contexts for a topic or project. And specific skills, such as research, discussion, teamwork, project design, performance, oral presentation, and writing, should be employed as appropriate to that inquiry. The workgroup offers the following as projected hallmarks of a UCLA capstone experience:

1. The project must require that the student engage in a creative, inquiry-based learning experience that deepens the student's knowledge and integration of the discipline.
2. The project may be completed individually or by a group of peers, provided each student is given agency; each student's contribution must be significant, identifiable, and graded.
3. The project must culminate in a tangible product that can be archived (including film, video, etc.) for at least three years by the responsible unit (department or program).
4. The project must be part of an upper-division course of at least four units, usually within the curriculum established for the student's major or minor.
5. Opportunities should be provided for capstones to be shared within a broader community, such as presenting a paper at a student or professional meeting.

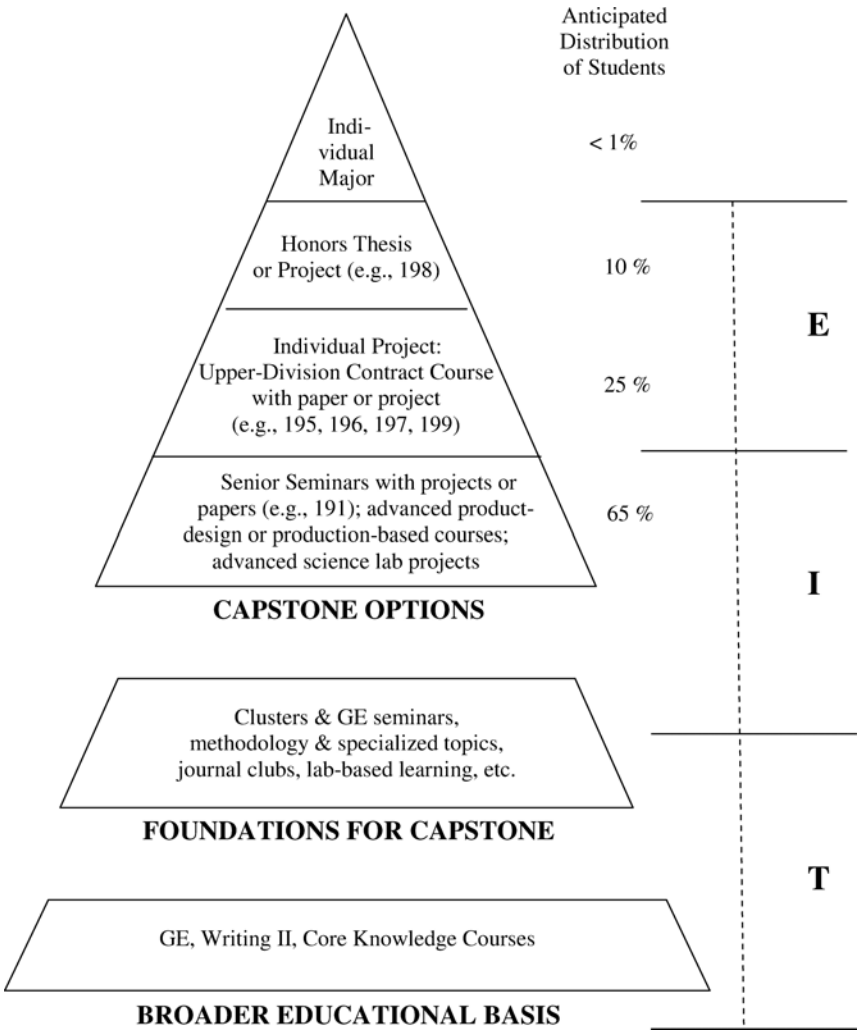
A Possible Capstone Model for UCLA

A statewide initiative begun in 2003 led to a taxonomy of UC instructional activity, called **T-I-E** (**T**otal **I**nstructional **E**ffort[6]), which delineates a comprehensive hierarchical structure for undergraduate curricula. **T-I-E**, which was fully implemented in 2005-06, created three broad categories: **T**ransmitting the knowledge base, **I**nitiating intellectual independence, and **E**mphasizing independent inquiry—and sought to give appropriate faculty workload credit especially for the last of those categories. **T-I-E** provides an appropriate structure for understanding the capstone, which may be seen to relate to its supporting curriculum as the upper tiers of a pyramid (see Figure 1). As shown, instructional activities progress from the "broader educational basis" of general education and preparation for the major, to "foundations for capstone" and "capstone options," the latter category encompassing possibilities ranging from upper-division seminars and project-related courses to honors theses and individual majors.

Within the **T-I-E** taxonomy, only the first level (**T**) is inappropriate to the capstone, because these courses are foundational. Some "**I**" courses also would not qualify. Some of these, such as Clusters Seminars and GE Seminar Sequences, serve as culmination for a part of the student's curriculum (see *Essay 4*), but they are unsuitable because they are lower-division. Upper-division journal clubs and methodology courses, while similarly offering important curricular foundation for the capstone, are also not suitable. Many courses from the "**I**" level could qualify, however, including senior seminars with projects or papers, upper-division product-design and production-based courses, and advanced science laboratory courses. The third level (**E**) is appropriate for capstones, since this category primarily includes upper-division "contract courses" with culminating papers or projects (courses 195, 196, 197, 198 and 199), some of which may qualify for departmental honors. At the top of the pyramid is the Individual Major[7], an option for College Honors students who have well-defined,

interdisciplinary interests for which no suitable major is offered. These students design their own course of study and are guided by a faculty committee responsible for grading the student's comprehensive thesis.

Figure 1. The Capstone Pyramid and its relationship to T-I-E



In surveying the existing capstone experiences at UCLA, the group found a broad spectrum, ranging from yearlong sequences of courses or tutorials to a single seminar and from honors theses to comprehensive seminar projects or internship papers. Capstones at UCLA may be based in tutorials, labs, advanced courses, or seminars, and may include either individual projects or team-based projects. They may be mentored by faculty or by advanced graduate students (with faculty oversight). They may culminate a major or a minor, or might build on other educational experiences unrelated to a specific curriculum, including yearlong projects such as UCLA's *Undergraduate Science Journal* [8].

The indication in Figure 1 of an "Anticipated Distribution of Students" is an estimate of the percent of graduating seniors who might complete a capstone experience at each of the four capstone levels, once the program is fully implemented. These figures are in line with the overall capacity of many but not all departments in the College and professional schools. It will also be possible for students to complete more than one level; for example, a student, having completed an advanced seminar, might decide to engage in an independent study.

Capacity Issues, Assessment, and Next Steps

Whenever the faculty considers the possibility of establishing a capstone program at UCLA, the question of feasibility invariably arises. The workgroup reviewed data on existing opportunities and curriculum-based, capstone-like requirements to gain a sense of current capacity and faculty commitment to such experiences. The data show that in the professional schools, capstones are often seen as crucial components of undergraduate curricula, especially in the creative and performing arts (School of Arts and Architecture and School of Theater, Film, and Television). In the Henry Samueli School of Engineering and Applied Science, capstones are a feature in all departments; they are typically team-based projects in advanced design courses and are an important element for ABET accreditation. In a few professional-school departments, however, resources and a concern for quality have led to some curtailment in these activities, in favor of honors programs that enroll fewer students.

In the College of Letters and Science, where the student-faculty ratios are often less favorable than in the professional schools, opportunities for students to enroll in senior seminars and independent studies courses are variable, and only 15% of current programs require students to complete capstone-like experiences. Department size does not always appear to be a limiting factor. For example, two of the College's largest and most popular departments, English and History, require all of their students to complete a senior-level seminar that would likely qualify as a capstone. Senior seminars appear to be more common in the Humanities and the Social Sciences Divisions, where about two-thirds of graduating seniors report enrolling in a "special topics seminar with a term paper" (2006 Senior Survey data[9]). In the Life and Physical Sciences Divisions, about one-third of the seniors report taking a senior seminar and about 45% report completing a research-based independent study course (198 or 199). In some science departments, advanced laboratory courses appear to serve the same function that advanced production and design courses play for arts and engineering students, respectively. Examples include the Marine Biology Quarter for the Marine Biology major and advanced laboratory courses for Cognitive Science majors. The workgroup believes that in many departments across the College, advanced graduate students will become key players in implementing capstones.

College seniors who completed an advanced seminar and/or a research project report high levels of satisfaction with the courses. Data[10] from the Senior Survey show that a majority of these students agree or strongly agree that "my research helped me better understand concepts presented in related classes" (89%) and "provided a strong intellectual challenge" (86%). Also, a majority of those who completed a seminar or research project agree or strongly agree that: "My research project contributed to the creation of new knowledge" (83%); "I made a meaningful contribution to the project" (87%); and "My faculty mentor challenged me to do my best" (82%). These data reinforce the workgroup's notions about the value of projects that encourage close partnerships between students and faculty.

In Fall 2007, the proposed capstone model was presented to the Academic Senate Undergraduate Council, who endorsed it unanimously and "with enthusiasm." The workgroup will next provide the WASC Capstone Essay to each department and interdepartmental program, asking them to respond to an online survey early in spring quarter 2008. The survey will focus on possible capstone experiences in the major and minor (if applicable). A key component of the survey will be a set of questions on educational expectations and learning outcomes for each proposed capstone experience.

The workgroup will use the online materials to begin crafting a proposal for a UCLA Capstone Program that will meet the expectations and capacities of each unit. The workgroup's proposal will be the basis of its *Educational Effectiveness Review* essay, since, as noted in recent studies, "capstone courses provide a venue for assessing how successful a curriculum is in achieving its learning objectives" (Berthelde 2007[11]) and "a culminating experience is the ultimate summative evaluation" (Teasdale 2007[12]). The workgroup anticipates that the nature of the experience will vary according to students' major or minor disciplines, but should be of comparable value to the "budding social scientist, bench scientist, artist, humanist, engineer, or history major" (Boyer 1998).