



## Creating Better Science General Education Courses through a Comprehensive Curricular Redesign

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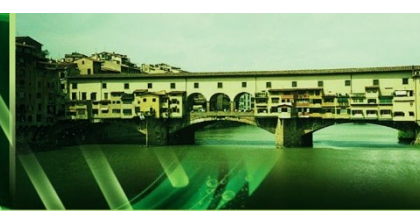
### Abstract

*The higher education landscape is changing rapidly in the United States, requiring educators to respond to external and internal pressures. This presentation documents the multi-year process of re-aligning curricula across the University to create a cohesive and coherent educational experience for students that is outcomes-based and measurable. The General Education (GE) curriculum was the perfect place to start the University's move towards effective and distinctive programming as it crosses all school and departmental barriers, is the foundation of all curricula, and allows for cross-disciplinary, collaborative efforts. In this university-wide realignment, all elements of existing curricula were examined and redesigned, foregoing isolated approaches in favor of integrating skills such as writing, quantitative reasoning, and oral communication holistically in a scaffolded manner. Through this process we redesigned the Science curriculum in the GE program; it now meaningfully aligns with the University's mission and institutional learning outcomes. The faculty considered recent trends in GE curricular design which included outcomes-based course design. This approach ensures that learning outcomes shape the course content and that competencies are taught through assignments aligned with the outcomes. The missions, values, and traditions of the University were used as a design framework for curricula that met the diverse needs of a 21st century demographic. This approach values preparation for both immediate career goals as well as lifelong learning and wellbeing. Thus, faculty adopted learning outcomes to expand the traditional scope of science GE courses; these now include the application of disciplines to illustrate connections among science, technology, and society. Furthermore, all aspects of the curricula were designed to address diversity in terms of issues related to difference (such as race, culture, gender, class, sexuality, etc.) and to ensure that course assignments and evaluative criteria are equity based, which had not previously been addressed in curricular expectations. As universities nationally and worldwide struggle to reinvent themselves in challenging political and economic times, the takeaways from our recent self-evaluation and subsequent redesigns are topical and timely.*

**Keywords:** *Curricular Redesign, General Education, Science and Society;*

The landscape of American higher education is experiencing internal and external pressures rooted in well-studied and documented factors, including demographic changes and shifts in the desired outcomes and concerns of students and parents affected by a recent recession. Institutions of higher education-- whether universities or colleges, public or private, open-access or selective-- are compelled to offer a curriculum that provides students with the job-focused skills and the intellectual tools that allow them to succeed both in their immediate future's career goals, as well as in rapidly changing professional landscapes in their more long-term future. This curriculum must be adaptive and forward-facing, while true to an institution's traditions and mission. The latter is of special significance as many small institutions strive to be distinctive in an increasingly competitive educational environment. As a response to these pressures and to ensure relevance and competitiveness, Dominican University of California (Dominican) decided to address the multitude of challenges through a comprehensive curricular redesign over the last two years, using the General Education (GE) program as the catalyst.

The GE program is the common curriculum that creates the focus of learning for all students in most U.S. American institutions grounded in the notion that higher education be broad enough to address the common good; at Dominican, it was the natural place to start such an effort as it is a distinctive aspect of the University's programming. All students entering the university as first-year



students are required to fully participate in it; thus, it has the ability to shape a university-wide educational experience while offering the opportunity to teach and reinforce skills and intellectual approaches throughout a student's years. Furthermore, all of the schools and departments participate in this curriculum, so the effort of redesigning this foundational programming has the added benefit of bringing all faculty together in a collaborative effort.

Dominican's curriculum redesign was a two-year process, initiated through a year-long self study process by faculty and direct assessment of student work in addition to surveys and focus groups concerning the existing GE curriculum. The process was then completed with an external review which included conducting on-campus conversations with administrators, faculty, and students. The results, documented in a report and shared with the entire campus community, indicated that the curriculum should focus on being more coherent and suggested two strategies for implementation: one option focused on using the integrative efforts already underway at Dominican; the other option suggested the creation of themed tracks. Ultimately, the Dominican faculty deemed the latter approach one more suited to a large institution and opted to proceed with the former strategy with its focus on creating a new curriculum that would be aligned with its Institutional Learning Outcomes (ILOs) and measurable.

The Institutional Learning Outcomes (ILOs) are intended to permeate all curricula have the four broad goals of:

1. The Exploration and Acquisition of Knowledge
2. The Development of Intellectual, Professional, and Artistic Skills
3. The Practice of Civic Skills and Social Responsibility; and
4. The Cultivation of Well-Being

To allow all four ILOs to be holistically woven into the entirety of the curricular experiences (though not all four components are required appear in each course or curricular activity) it was essential that all elements of the existing curricula be examined and redesigned simultaneously. One key advantage to undertaking a broad curricular redesign was the opportunity to meaningfully integrate skills such as written and oral communication, information literacy, quantitative reasoning, analytical thinking, and the exploration of relevance and meaning across the disciplines. The design approach shifted from a content-based distribution model to an outcomes-focused backward design process. Thus, the GE curriculum came to meaningfully align with the institutional learning outcomes and the University mission by ensuring that outcomes and competencies in each class are attained through the embedding of assignments aligned with the intended outcomes. It was re-visioned as a Core Curriculum.

This re-visioning of pedagogical goals addressed the concern of students (as determined by the self-study) that their GE classes be 'applicable' and 'relevant' to both their present lives and issues, as well as their future career paths. In particular, there was an emphasis on ensuring that students should be prepared to be active, thoughtful learners who have the background and tools to engage with a complex, ever-changing world. In the sciences, this meant pivoting to move courses away from the traditional approach that saw a GE offering as a mere introductory course to a major or discipline to one that is purposefully designed as an opportunity for students to apply their newly acquired knowledge and skills to relevant inquiries in their own intended career as well as to complex issues in the greater world. To foreground this important change, the title of this component of the GE program was changed from Natural Sciences to Science for Global Citizens.

To implement this new focus, an appointed small faculty group, the Science for Global Citizens GE Redesign Subgroup, articulated three specific outcomes to be met by prospective courses in order to be included in the GE curriculum. Two of the outcomes are typical of a science curriculum: the first focuses on laboratory and hands-on explorations of the science to observe and collect data, and the second focuses on the analysis, evaluation, manipulation and interpretation of data. However, the third outcome is indicative of the shift away from existing approaches. This outcome expands on the fundamental principles of the discipline by requiring that the course highlight and illustrate the discipline's approach to making connections between the science, its application to technology and technological advances, and its relevance and importance to society.

The original traditional outcomes had been designed to address two key ILOs: 1) The Exploration, and Acquisition of Knowledge; 2) The Development of Intellectual, Professional, and Artistic skills. The former had been met through the metric of increasing students' breadth of knowledge; the latter had been met by focusing on critical thinking, qualitative and quantitative reasoning and information literacy.



Now the understanding of both of those ILOs was expanded while the third and most unique ILO was addressed in the new Science for Global Citizens curriculum: The Practice of Civic Skills and Social Responsibility. This now encompasses a commitment to sustainability and social justice. Making sustainability and social justice a required focus of the program and its courses has required science faculty to redesign their classes to have these topics holistically embedded in their assignments and activities, which is a significant change from more traditional, introductory classes.

These new Core Curriculum courses were developed according to the principles of backward design in addition to being student-centered in their design. They began by identifying how they would address each of the ILOs as encapsulated in the new Program Learning Outcomes (PLOs). The new outcomes also daringly foregrounded the third ILOs and read:

Students will:

1. Examine and apply the fundamental principles of the scientific discipline (true for each course) in a manner that illustrates connections among science, technology, and society;
2. Engage in the scientific method through laboratory and fieldwork to examine key elements of the science and conduct independent exploration, using observational and direct measurement techniques for primary data collection;
3. Analyze, evaluate, manipulate, and interpret data to draw conclusions.

The expectation was that the learning outcome would shape course content and that assignments would be created to develop competencies in alignment with the outcomes and permeate the course. For each course, professors needed to indicate how the ILOs would be addressed using learning strategies (such as course themes, texts, and activities) and how graded assignments would be used to scaffold and assess learning as they related back to the ILOs.

As one of the motivating factors driving this university-wide curriculum change was an understanding that the demographics and needs of students in the United States is rapidly changing, it was essential that the new curricula directly address diversity and equity issues. As courses were proposed for inclusion in the newly designed Core Curriculum, professors were required to indicate how they would help students develop subject specific knowledge and skills about issues related to differences in race, culture, gender, and class, identifying instructional strategies for diversity and equity that would be implemented both in the classroom, and would be specifically integrated in assignments and evaluation to further support diversity and equity .

The end result of these changes is a university-wide science Core program that is more robust, inclusive, and relevant to the people it serves, which is the population of students who have chosen to not study science as their primary field. By putting all aspects of the curriculum on the table and adopting a larger, holistic redesign program rather than a piecemeal one, the resulting product has more cohesion, a shared vision and purpose, and is part of a strong, uniform backbone, i.e. Core Curriculum.that the other university programs and disciplines can rest on and use as support or foundation. By looking at the needs of the faculty and students and anticipating how those needs might change as the educational landscape changes, we have built a bold, innovative, comprehensive new science curriculum for a changing world.