Nature and Human Values: Developing A Multidisciplinary Foundation Course

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Introduction

The Division of Liberal Arts and International Studies (LAIS) at the Colorado School of Mines (CSM) is in the pilot stage of inaugurating a new curriculum that will integrate aspects of liberal arts and engineering education concerning environmental and social implications of technology, with a strong emphasis on ethical considerations. So far, success seems in reach. A pilot version of the freshman course is up and running. This came about only because institutional conditions made such an undertaking feasible and cooperative institutional procedures enabled broad campus support. Such a change is not trivial. It involved transforming the fundamental nature of the LAIS Division.

Favorable Institutional Conditions

Recognizing an incipient crisis in the tension between environmental protection and the increasing demand for resources imposed by an industrial system aiming at unlimited growth, CSM has committed itself to educating engineers and scientists who understand the nature of that crisis and who can apply their technical knowledge in a way that contributes to its resolution. Therefore stewardship of the Earth is now an explicit part of CSM's mission, so much so that CSM has declared an intention to become "an academy for stewardship of the Earth." Because the roots of the crisis are first of all social and cultural, involving profound questions of ethics and values, CSM realized that its LAIS Division must have a crucial role in developing an appropriate curriculum.

Obviously, a coherent educational basis for understanding the issues implied by stewardship of the Earth requires an appropriate humanities and social sciences curriculum. The LAIS Division has entire responsiblity for humanities offerings at CSM and provides most of the offerings that count as social sciences electives, though certain offerings in the Division of Economics and Business augment the LAIS courses.

Transformation of the LAIS Division

Before CSM's commitment to stewardship of the Earth, the humanities and social sciences had been peripheral to the school's essential purpose. Although the minimal humanities and social sciences requirement had been generally acknowledged to be indispensable, neither CSM nor most of the LAIS faculty had any clear sense of how to integrate the humanities and social sciences with engineering education. The school generally saw the LAIS Division as simply providing a bit of educational breadth to an otherwise very narrowly focused engineering curriculum. There would be occasional suggestions that the LAIS curriculum ought to develop

some coherence and depth, but disciplinary fields among the LAIS faculty were too randomly assorted for consensus about the problem.

The school's commitment to stewardship of the Earth provided the basis for a strategic view of LAIS. Upon announcing the goal of making CSM "an academy for Stewardship of the Earth," Franklin D. Schowengerdt, then vice president for academic affairs, told the LAIS faculty that its leadership would be essential in the process of reaching that goal. LAIS responded with a new mission statement that, while for the present accommodating the random variety of disciplines represented by the existing faculty, set the stage for a new LAIS curriculum that would prepare engineers for professional leadership in making stewardship of the Earth an integral aspect of engineering design.

That mission statement begins with a general LAIS commitment to provide students "with an understanding of the cultural, philosophical, social, political, and economic contexts in which science and engineering function," thus enabling students "to learn how their responsibilities extend beyond the technical mastery of science and technology to the consequences for human society and the rest of life on Earth." It concludes by explicitly recognizing the pivotal LAIS role in enabling CSM to achieve its new aim, stating that "The LAIS mission is crucial to defining the implications of CSM's commitment to stewardship of the Earth and to the permanent sustainability of both social organization and environmental resources that such a commitment requires," finally emphasizing that an appropriate LAIS curriculum "is essential for graduating men and women who can provide the technical means for society's material needs in a manner that leaves posterity an undiminished level of both social and environmental quality."

This formulation establishes a recognition that sustainability is the key stewardship issue, that stewardship must focus on maximizing long-term well-being rather than short-term advantage, and that it must take into account social as well as environmental considerations. But how could a faculty with such disparate professional backgrounds devise a curriculum with adequate coherence? In the past, the makeup of a faculty chosen without any consistent rationale had determined the course offerings. The new strategic context required instead a rational faculty hiring plan based on curricular aims consonant with the new LAIS mission; the desired curriculum would have to determine eventual faculty makeup. This required new LAIS leadership, someone with an appropriate interdisciplinary background who could deal with the humanities, the social sciences, environmental issues, and international studies. CSM was fortunate enough to obtain in Dr. Arthur Sacks a new LAIS Division Director perfectly suited to this enormously complex and demanding task.

Outlining a New Curriculum

Actual work on a new curriculum could not begin without a fully elaborated plan, however provisional. Once LAIS had developed a credible plan to use as a springboard, a Humanities and Social Sciences Curriculum Reform Subcommittee (HSS Subcommittee) including representatives from various constituencies throughout the CSM community, was organized. Participation by engineering and science faculty was essential for success, and committee membership was entirely unrestricted--anyone in the CSM community could participate. After months of sometimes heated discussion, the subcommittee agreed on a three-course, ten-credit required core curriculum to be followed by three electives each student would choose from one of several "cluster" areas each dealing with a relevant general topic such as "Politics and

Society." The three core courses would be "Nature and Human Values" (NHV), a four-credit course in the freshman year, followed by "Human Systems" and "Principles of Economics," two three-credit courses in the sophomore year. Common focus on human-environment interactions and social effects would provide thematic coherence throughout the core. In the meantime, an LAIS Freshman Course Committee developed provisional suggestions for NHV that it submitted to the HSS Subcommittee.

The New Freshman Course: The General Conception Process

Time was growing short. One semester and a summer remained before inauguration of the freshman course in the Fall of 1997. Full development of the sophomore courses had to wait. At that point, only a few things were certain about NHV: it would strongly emphasize issues concerning human-environment interactions; in doing so it would provide some introduction to material representing the humanities, the social sciences, and international studies; it would deal with issues of values and ethics; it would be writing-intensive. How to make it writing-intensive was the most straightforward problem, so the subcommittee first addressed the LAIS Freshman Course Committee's suggestions regarding that.

A writing-intensive course is one that aims first of all at delivering knowledge of course content--for example history, literature, or political science--but also requires considerable writing about that content. Ideally, one instructor would deal with both content and writing, but effective writing instruction requires small classes of about 20 students. The LAIS faculty includes only a few individuals with experience as writing instructors, and not all of them have backgrounds suitable for the necessary content instruction. Current scheduling constraints required dealing with nearly four hundred students, two-thirds of the freshman class, in the first semester. The subcommittee agreed to recommend a basic format using large lectures for content delivery by regular LAIS faculty, plus small recitation sections taught by full-time writing instructors who would also attend the lectures. Lectures would be two hours a week, leaving two hours a week for recitation meetings that would not only deal with writing instruction but would provide opportunity for small-group discussion of lectures and readings, thus ameliorating the major pedagogical disadvantage of lectures.

Development of NHV fortuitously coincided with a campuswide commitment to developing a writing-across-the-curriculum program requiring every department to include writing in some of its courses, a commitment that meant an expanded role for the LAIS Writing Center, which had been operating on a minimal basis. The CSM administration approved hiring a writing programs administrator who would be responsible for developing the NHV writing component and teaching one recitation section, taking charge of an expanded Writing Center, and providing leadership in the writing-across-the-curriculum effort. Again, LAIS was fortunate. After an extensive search, Mr. Jon Leydens was hired and has proven ideal for this very demanding position. To assist him, two full-time writing instructors were hired to teach four recitation sections each as well as serve in the Writing Center.

This was not enough to keep the recitation sections down to 20 students each, but fortune continued to smile. The Colorado Commission on Higher Education (CCHE) had funded a cooperative effort between CSM faculty and the Jefferson County public school system to

address writing instruction strategies; this effort was underway concurrently with NHV development and led to a successful application for a CCHE grant to fund employment of several highly qualified Jefferson County high school teachers as adjunct recitation instructors who could meet recitation sections late in the day. These, plus several part-time adjuncts hired by LAIS, enabled the necessary limitation of recitation section enrollments. Two regular members of the LAIS faculty, myself included, agreed to take on the large lecture sections. In addition, three other regular faculty members each agreed to teach a small NHV class that combined content instruction with writing instruction, to determine whether results from an integrated small-class format would differ markedly from those achieved by the large-lecture/small-recitation format.

HSS Subcommittee representatives of the engineering faculty strongly favored the inclusion of a writing component, especially if it imparted technical writing capability. The LAIS Freshman Course Committee developed a list of desired writing outcomes emphasizing ability to produce good informational abstracts, familiarity with basic memorandum formats, documentation skills, expository skills, rhetorical skills, and ability to read and think critically, thus covering both technical writing fundamentals and general skills appropriate for dealing with HSS subject matter. The subcommittee accepted this list, and the Freshman Course Committee then turned its attention to the lecture subject matter, assuming--correctly as it turned out--that hiring a capable writing programs administrator would take care of further writing component development.

The Freshman Course Committee determined that NHV content emphasis would be key global issues for the 21st century: resources and population in terms of sociocultural interface. The course would have to advance the aims of the CSM Graduate Profile, such as fostering professional flexibility in addressing society's problems and ability to work effectively in an international setting. The course would have to introduce key issues pertaining to the several clusters of elective courses that would follow the required core courses. The course would have to provide an intellectual framework regarding ethical decisionmaking and would have to introduce a global perspective recognizing that ethical assumptions are different in different societies. One member of the Freshman Course Committee was particularly well qualified regarding ethical diversity. A retirement had allowed initiation of the new LAIS hiring plan the previous year, bringing on board Dr. David Frossard, an anthropologist specializing in Asian cultures. The committee was well suited to its task; its members represented a wide variety of disciplinary backgrounds in LAIS.

The Freshman Course Committee proposed organizing the course content in terms of present, past, and future. That is, the course would first cover present human interactions with nature and value systems that guide presently dominant human activities and survival modes. It would introduce concepts and implications of growth, population dynamics, resource limits, and sustainability. It would survey cultural, economic, social, geographical, and political forces.

Because the present is not intelligible without an understanding of the past, the course would review past modes of interaction with nature and provide historical perspective on how present conditions came about, with particular attention to modernization, the change to presently

dominant values and survival modes. The philosophical roots of the scientific revolution would be included, as well as an introduction to fundamental principles of ethics. A non-Western perspective would receive emphasis.

Finally, the course would go "back to the future," considering human prospects if present ways of interacting with nature continue to dominate, in particular asking whether present human interaction with nature is sustainable, and looking at possible alternatives, including the possibility of sustainable development.

Non-LAIS members of the HSS Subcommittee expressed concern that an emphasis on sustainable development would be make the course too one-sided. They were assured of a balanced approach to that issue, and to other issues. Also, some felt that the social sciences had ousted the humanities. Inclusion of historical and philosophical considerations was pointed out, along with the thoroughgoing emphasis on values. Assurance was given that cultural analysis would make use of a literary work. With that, the Subcommittee gave its blessing, and the proposal received approval by the requisite authorities governing curriculum development.

The New Freshman Course: The Design Process

The real work of course design then got under way, beginning with the problem of who would teach it. Dr. Frossard was the obvious choice for one of the large lecture sections. Since my American Studies doctorate is inherently interdisciplinary, combining both humanities and social sciences, and since a major emphasis of my teaching has been the problem of sustainable engineering, I was chosen for the other large lecture. Dr. Sacks agreed to teach one of the three small combined classes. Dr. Barabara Olds and Dr. Ronald Wiedenhoeft agreed to teach the other two small classes. Dr. Olds has a doctorate in literature, is the director of the interdisciplinary McBride Honors Program, teaches a course on the engineering relevance of the humanities, and has been director of a program combining engineering design and technical communications. Dr. Wiedenhoeft is an art historian with a bachelor's degree in civil engineering, and is an expert on transportation and urban planning issues. These five constituted the initial NHVCore group responsible for ultimate design and implementation of the course. The design phase lasted the entire Spring 1997 semester and required long meetings every week--often twice a week.

The Textbook Problem

NHVCore first had to deal with the fact that no existing textbook came anywhere near covering the desired course content, and any combination of textbooks that did so would be prohibitively expensive. Furthermore, text coverage of all the proposed subject matter would require the students to do too much reading. NHVCore settled on four texts, including one online text, covering certain essentials. Classroom presentation would have to cover everything else.

First of all, NHV needed a text dealing with the bedrock issue of environmental sustainability. NHVCore readily agreed that Our Ecological Footprint by Mathis Wackernagel

and William Rees is the best choice for that. This slender 160-page book, in arguing for sustainable limits to human activities, represents the limitationist viewpoint that perceives ineluctable limits to environmental capacity, limits that require humanity to stop the growth of its material resource consumption. Opposing that are selected chapters from the online version of Julian Simon's The Ultimate Resource 2 representing the expansionist viewpoint that perceives no resource limits and argues for unlimited growth.

NHVCore next settled on Environmental Ethics, edited by Louis P. Pojman, a collection of over seventy pieces on a variety of environmental issues. Its general bias is limitationist, but for the most part it includes opposing viewpoints evenhandendly. It has a very useful section on non-Western environmental views. The most difficult text selection problem was choosing a relevant literary work. Dr. Olds suggested Chinua Achebe's Things Fall Apart, which was adopted because it presents a non-Western worldview in a dramatically powerful way.

Things Fall Apart did not fit well into the basic scheme organizing the course in terms of present global modernization, past roots of modernization, and future alternatives. The answer was an additional category dealing with nonindustrial and non-Western perspectives. This meant having four instructional units.

Details of Course Organization

Unit topics in the following lists are roughly in the order of coverage, but the need to emphasize their interrelation requires considerable moving back and forth among them during a given unit, and even between units.

Unit I addresses the question: Where are we now? What seems to be happening to the human species and the Earth at the present time? Unit I topics include

--CSM commitment to Stewardship of the Earth

--Engineering ethics and the public welfare

--Global modernization

--Industrialization

--Urbanization

--Consumerization

--Population growth

--Expansionist assumptions

--Limitationist assumptions

--Stewardship of the Earth and sustainability

--Ethical implications

Unit II addresses the question: How did we get here? How did industrialization and modern science come about? Why did the scientific and industrial revolutions take place in Europe rather than elsewhere? What social and environmental changes did they cause? What changes in values and ethics were involved? Unit II topics include

--Preindustrial society

--The agricultural revolution

--The unique stimulus of ancient Greece: crucial features of ancient Greek scientific thought

--The medieval beginnings: crucial features of medieval thought and technology

--The scientific revolution

--The industrial revolution

--Rise of the modern corporation

--Environmental and social impacts

--Ethical implications

Unit III addresses the question: Other worldviews: Where have we been, and what are other worldviews like? Examination of nonindustrial and non-Western perspectives. Coverage of nonindustrial societies includes consideration of the medieval European worldview in response to the question "Where have we (Western people) been?" Unit III topics include

--What is a worldview?

--The medieval European worldview

--Worldview of the characters in Things Fall Apart, a novel about the Igbo people of Africa

--Ethnocentrism

--Anthropological basis for understanding various worldviews and cultures

--Evaluation of degree to which Igbo experience represents typical Third World-First World contact

--Comparison of themes in the world's major religious traditions

--Consideration of degree to which Western environmental views differ from environmental views typical in the rest of the world and environmental consequences of various traditional environmental views

--Value for the West of alternative religious/philosophical traditions and value of Western views for non-Western societies

Unit IV addresses the question: Where are we going? What are the likely outcomes of present trends? What are the alternatives? Unit IV topics include

--Globalization

--Carrying capacity

--Sustainability

--Population

--Biodiversity

--Equity (resource distribution)

--Urbanization (cities and megacities)

Settling on the defining questions and the general topics was relatively easy. Agreeing on readings in Environmental Ethics was more difficult. The problem was solved by limiting the common readings and allowing each instructor latitude in choosing ancillary readings.

Similarly, different approaches to subject matter in class presentations were accommodated by agreement that everyone would deal with all the topics listed in the common syllabus, but each instructor would have discretion regarding treatment and emphasis. Everyone readily agreed on the videos to be used, which were "The Population Bomb," "Race to Save the Planet, Part One," "Flames in the Forest," and "Race to Save the Planet, Part Ten."

Summer Countdown

By the end of the semester, NHVCore was benefitting from the membership of Jon Leydens, whose suggestions were a great help. At that point, everyone was faced with the most difficult task of all--preparing well-conceived class presentations for an entirely new course dealing with substantially new material. This would require a tremendous effort over the summer. Dr. John Trefny, CSM's vice president for academic affairs, was as eager as anyone to see the course succeed, and provided funds to cover a month of full-time summer effort for each NHV instructor. Also, Dr. Sacks gave each instructor a reduced teaching load for the Fall 1997 semester when the course would be introduced. NHVCore meetings continued during the first part of the summer to iron out details such as the nature of exams.

Requirements for Success

At this point I believe the LAIS experience shows it is possible successfully to introduce a course like "Nature and Human Values" at an engineering school, if the faculty involved keeps several crucial things in mind. First of all, the responsible department must comprise a considerable variety of disciplinary backgrounds. The general aim must be very clear from the outset, and the deparmental leadership must have an adequate grasp of the range of issues the course will address. There cannot be any significant resistance within the department, and the departmental leadership must be unwaveringly determined regarding the general aim, though flexible and open regarding practical specifics.

Course design must allow two full years from the time the course is proposed. The design process must have full institutional support and in its early stages must be open to all constituencies on campus. Adequate startup funding is a must; a course like this is a creation de novo, without examples to draw on or fully adequate texts available. The instructors cannot possibly get ready for it without ample release from ordinary demands. Given those conditions, the effort is well worth making. I believe that "Nature and Human Values" represents an extremely important step forward in engineering education.

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