## **Curricular Vision**

The Olin College Curricular Vision, which served as a guide for curricular development at Olin College, was written in the fall of 2001by David V. Kerns, who was provost of the college at the time.

#### I. Introduction:

This document serves as a summary and guidebook for curricular development at Olin College. The founding faculty have followed the strategic plan outlined in the separate document, Invention 2000, and have constructed a set of principles on which the future development and refinement of the Olin College curriculum will be based, consistent with the founding vision of the trustees. These concepts are summarized here. There are a number of supporting documents including reports from curricular retreats, faculty meetings, and faculty committees focused on various aspects of the curriculum development.

## II. The Amazing Vision

The founding vision of Olin College is expressed through early memoranda of the founding trustees and related conversations with the founding president and the leadership team during the first year of operation of the college (1999-2000). The arrival of the first faculty the following year (2000-2001) provided the opportunity for substantial dialogue including visits to existing schools, retreats, numerous faculty discussions and faculty white-paper reports. The arrival of the second group of faculty (Fall 2001) provided increased diversity of backgrounds and experience, and more detailed dialogue regarding optimum curricular approaches. Curriculum development was greatly enhanced by the arrival of the "Olin Partners" and the opportunity for faculty to evaluate various curricular approaches with students. This report contains information from a variety of these sources and credit must be given to all who participated in the Olin community.

Olin College was created to establish a model engineering program. Olin College was conceived to be a college that addresses many of the concerns identified by the NSF coalitions regarding engineering education as well as a variety of other issues systemic to most existing engineering programs. Olin College was intended to be agile, and responsive to change. The College seeks to institutionalize a culture of continuous improvement and set the highest bar for quality. The Olin culture is to be student centered with a passion for undergraduate education in an environment of personal attention and concern for each student. The College is not to be a copy of any other institution but seek new and innovative approaches to engineering education.

Olin College will not be just a teaching institution. Faculty cannot teach what they do not know, and engineering knowledge becomes outdated within a matter of only a few years. Consequently faculty and students will nurture a culture of innovation, inquiry, problem-solving, entrepreneurship, research, or other means of intellectual vitality to insure that faculty stay current with the latest developments in their field, that they are encourage to explore interdisciplinary areas, and that faculty transmit the results of this intellectual vitality to students

both in and outside of the classroom. The voice of industry is critical, and the Olin curriculum will include consideration of industry's needs.

Therefore, to implement this vision, Olin College recruits exceptional faculty with a passion for inspirational teaching, undergraduate education and for working closely with students inside and outside of the classroom. Olin College will nurture the needs of young students including intellectual growth and development, as well as social and personal development. The intellectual vitality, including research, entrepreneurship, inventions and other activities for keeping current in their field will be valued and supported by the College and faculty will seek to feed back to student this information to inform, enliven, and enrich each students learning.

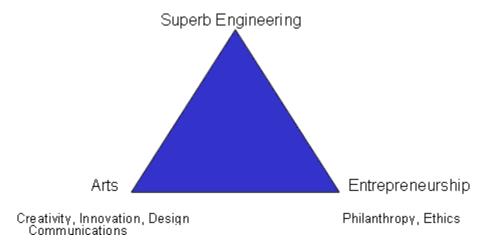
## III. The Vision of the Olin College Curriculum

The Olin College Curriculum will be structured to "open doors to student possibilities". This implies that the curriculum structure will not channel or focus students early into specific areas and limit their flexibility for future options to move into other related or even non-related fields. The early years of the Olin College curriculum will provide a strong solid foundation that will be an exceptional basis for all forms of engineering study, but also for other disciplines as well. There will be some student choices, and flexibility, even in the early years.

In addition, the Olin curriculum will seek to educate the whole person. This implies supporting not only the engineering, scientific and technical education of students, but also nurturing other non-technical aspects of health growth and maturing.

This vision for the Olin curriculum is illustrated graphically by what has come to be known as the "triangle model" illustrated in Figure 1. This concept was first introduced by Professor Dabby in a white-paper as "the Renaissance Engineer", and through months of discussion and development, adopted as a founding precept of the curriculum.

FIGURE 1. The Olin College Curriculum "Triangle Model"



This triangle shows a superb engineering education at the top. Olin graduates will receive an engineering education comparable to that of the best engineering schools in the country. This

implies Olin College students will acquire an in-depth working knowledge of science and mathematics core material and related engineering foundation knowledge. The manner in which this knowledge is acquired may be non-traditional, involving more projects, and close coordination of material, traditionally taught separately, such as physics and introductory engineering topics.

Another corner of the triangle indicates that Olin students will also experience a curriculum that provides elements of entrepreneurship and entrepreneurial thinking. This is broadly defined to include not only the fundamentals of business, enabling Olin students to understand the vocabulary of business and consider a future engineering career involving starting their own company, but also the broader aspects of entrepreneurship. These broader concepts include learning organizational and teaming skills, financial and marketing issues, and marshaling resources to accomplish a specific goal. Throughout the Olin curriculum, an effort will have been made to weave threads that emphasize the importance of a spirit of philanthropy and high principles, values, and ethics.

The final corner of the "triangle model" addresses the arts, and broadly encompasses creativity, innovation, and design. It is hoped that design will move toward the center of the Olin curriculum. One cannot design what one cannot imagine; therefore, enhancing creativity is an important precursor to effective design. Creativity and innovation expressed by activities such as student research provide strong educational value. Also imbedded in this dimension of the curriculum is the notion that the performing arts provide important life skills and capabilities. Vigorously preparing for a future moment in time when one must produce one's best work product is important to practice and to become comfortable in the process. Olin students typically have at least "one other passion" in addition to their engineering interests, and Olin will help nurture this intellectual diversity.

Creative and effective design when combined with entrepreneurial thinking and superb engineering comprise the ingredients for a superb education, educating multiple dimensions of student's lives and enabling Olin students to develop careers of leadership and positive contributions to society.

## IV. Specific Levels of the Olin Curriculum

It has been decided that the Olin curriculum will include three levels. These are:

## A. A Multidisciplinary Foundation

This is a broad-based preparation for many areas of engineering study and for other fields. It spans the first 1.5 to 2 years of undergraduate study and provides students with a superb foundation for engineering study including relevant mathematics, physics, biology, chemistry, engineering essentials, and also significant appreciation and opportunities in the humanities, social sciences, and the creative arts.

#### **B.** The Specialization Phase

This involves curricular content that provides in-depth student education in particular engineering specialties or disciplines. This phase of the Olin curriculum is where students

will select major fields of study, and choose learning experiences that support their intended major.

#### C. Realization

This is the final phase of the Olin undergraduate curriculum. It includes an authentic, ambitious capstone project. This typically completed at the senior level and is representative of a project experienced in professional engineering practice. It most often would be implemented in teams and involve multi-disciplinary components including at least elements of artistic/creative design and entrepreneurship.

#### V. Selected Curriculum Goals - the "Bold Goals"

The faculty unanimously agreed on a selection of goals for implementation of the Olin curriculum. These are:

## A. Hands-On Design Projects in Every Year

Problem based or project based learning will be an important element of the Olin curriculum. In each year students will have substantial component of their learning experiences based on projects, often open-ended projects. The project content may vary by year; it is expected that later years will have higher project content than early years.

## B. Authentic, Ambitious Capstone Senior/Advanced Student Project

The final phase of the Olin curriculum (the Realization Phase) will include an ambitious project undertaken by a team of students.

- C. The Olin Curriculum will include experiences for students to work independently, as members of teams, and as leaders of teams.
- D. The curriculum will include opportunities for students to perform before an audience that includes experts in the field of the presentation or performance.
- E. The Olin curriculum will contain an international or intercultural immersion experience. Olin College recognizes the globalization of engineering and the importance for future graduates to develop comfort in working in other cultures. To develop these skills, a component of the curriculum will involve engineering activities in a foreign culture and a requirement to relate those activities to the students' primary course of study and home culture. The Olin curriculum will seek to provide an option for some selected students to conduct a part of their specialization coursework outside Olin, if they have a strong international orientation. If this option incurs significant additional expense, the student may be required to help offset cost.

## F. Substantial Constructive Contribution to Society

The Olin Curriculum will seek throughout to develop a spirit of philanthropy and giving back to the community. As students mature and develop their own sense of social responsibility, faculty will assist in guiding their concurrent development of a spirit of

philanthropy so that they will seek means for voluntarily and graciously supporting the local and global community in ways in which they may best contribute. Developing a culture of philanthropy or "giving back" freely and without expectation of personal gain, will be a hallmark of the Olin experience.

# G. Ability to Communicate Logically and Persuasively in Spoken, Written, Graphical and Visual Forms

Communications in all its forms is vital to effective engineering practice and to leadership and success in all aspects of life. Olin College will strive to develop curricular opportunities for students to develop the ability to logically organize arguments and create persuasive vehicles of communication that convincingly communicate their vision.

H. Self-sufficient individual able to articulate and activate a vision and bring it to fruition. This goal captures the spirit of entrepreneurial thinking in its broader sense. The Olin curriculum will seek to develop an entrepreneurial spirit that will empower individuals to articulate, create and innovative a socially responsible vision, communicate it effectively and organize all needed resources to make it a reality.

## I. Other Curriculum Objectives Include:

- a. Demonstrated significant creative artistic expression.
- b. Significant work experience in a corporate culture.
- c. The ability to apply basic business practices necessary to bring a product to the marketplace.

All of the above would be realized within the Olin curriculum in a manner consistent with personal attention and concern for the welfare of each individual student.

#### VI. Specific Characteristics of the Olin Curriculum

In order to insure that each student's program is organized to empower their individual and unique goals, each student will design, propose and continually develop a plan to achieve personal and educational goals. This plan will be reviewed periodically with their faculty advisor and/or faculty committees and continuous improvement of this plan accomplished. The Olin educational experience will begin with some common "immigration experience" that initiates the multidisciplinary foundation and helps develop within the cohort a strong spirit of community.

Timely completion of the multidisciplinary foundation, and possibly earlier achievements, will be certified and assessed by one or more specific events, described as "gates". These gates will assure that each student has achieved a level of deficiency and fundamental knowledge in areas considered essential by the faculty.

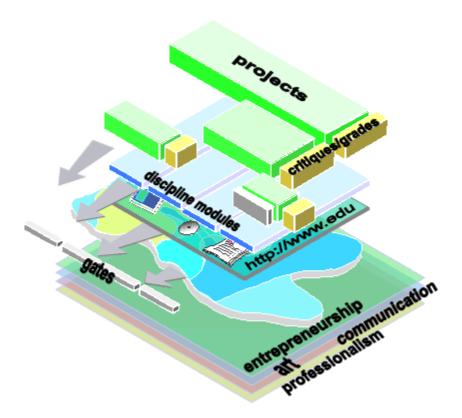
The Olin College calendar will utilize organizational units of time of approximately seven weeks (1/2 semester) in length, termed quamesters. There will be two quamesters in the fall and two in the spring.

#### VII. The Flowers Model

It has been often said that a single picture is worth a thousand words. Professor Woodie Flowers attempted to create a graphic to describe the elements of the Olin curriculum that have been generally accepted by the founding faculty. This model is shown in Figure 2.

At the base of this figure are planes representing entrepreneurship, art, and its related aspects of creativity innovation and design, communication and professionalism. These are often said to be "in the water". This means that these elements are woven through all aspects of the Olin curriculum – through virtually all coursework and curricular as well as co-curricular experiences. This does not exclude the strong possibility that there will also be explicit learning experiences in some of these topics.

FIGURE 2. The Flowers Model of the Curriculum



At the top of this picture one observes projects and project-based education as a significant ingredient in the Olin curriculum. It has been universally agreed that problem-based education expressed through the substantial use of design and other projects as learning experiences will occur in each year. It is also agreed that in general the proportion of project-based education will increase in time through the four-year curriculum and become more open-ended and authentic. Projects will typically be executed with teams of students and the projects will receive a substantive grading or evaluation. Students will quickly infer that the value we place on projects is related to the time spent in critique and evaluation of their project results. Consequently, the Olin curriculum will include extensive project support and evaluation including faculty and outside experts for evaluation.

Sandwiched in the middle of this picture there are three methods of curriculum delivery described. The lower level showing the fluid and somewhat random interface between student and faculty interactions represents something like the Oxford/Cambridge model. In this approach, student learning occurs more in a tutorial fashion and is guided by student inquiry. This model embraces the notion the fact that students are motivated and learning, and that is perhaps more important than specifically what they are learning. The level above represents the world-wide-web and the rich resources available via the web for student learning. Web-based and new media electronically enabled instruction is another rich resource for material for student education. Finally, the third level shows discipline specific modules more akin to traditional courses. In this level, material is presented in linear fashion following a program sequence similar to traditional courses.

In the Olin curriculum, students may gain knowledge from each of these knowledge resources, dependent upon the curricular design. There will likely be learning from all three delivery modes, with the foundation (particularly the first year more structured, and later years more flexible with more student choices, both in topics and modes of learning.

The students' acquisition of intended knowledge will be tested and certified by gates shown at the left of the picture which may be viewed as comprehensive examinations to assure that the curriculum process has been successful in transmitting required knowledge, capabilities, and defined competencies.

## VIII. The "Modes of Knowledge Delivery" Triangle

Another way to view the three primary modes of knowledge delivery is illustrated in Figure 3.

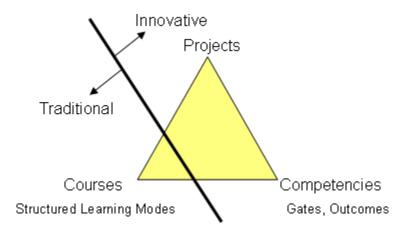


FIGURE 3. Modes of Knowledge Delivery

This figure shows another triangle representing various teaching modes or knowledge delivery methods. At the far left is "courses", the corner where most traditional engineering curricula are located.

The Olin curriculum will be innovative in that it will have a much higher component of both projects and competency based evaluation. It is likely that the Olin foundation will begin more at

the "upper left" of this triangle, with a strong mix of course-like material coordinated with projects, and move with time toward the center and right of the triangle to include more competency based methods.

#### IX. Other Curricular Issues

It has been decided that the foundation will take between 1.5 and 2 years. There will be student choices and some flexibility even in the foundation. This is of high priority to our students. This flexibility will include the opportunity to explore at least one other intellectual passion, other than engineering. It is likely that projects will be used to closely coordinate knowledge in two or more fundamental courses in the early part of the foundation, and become more loosely coupled to coursework later in the curriculum. The foundation will be structured so that not every student takes the same thing (there are student choices), but that any choices made during the first year will satisfy the foundation requirement for any of the Olin degrees. In order to make room for the diversity and multiple dimensions of this program, efficiencies will have to be created. There are such opportunities; for example teaching certain foundation material only once, in contrast to traditional curricula where some topics are taught in physics and then again in an engineering context.

## X. The Olin Curriculum Design

The notion of two "tracks" in the curriculum foundation, one with more emphasis on fundamentals, technical engineering and science learning, and the other with opportunities for exploring other dimensions, arts, humanities, entrepreneurship, and a wide range of practica has emerged as a strong model for the Olin curriculum. One version of this approach is illustrated in Figure 4. This model attempts to address many of the issues described earlier and provides a flexible and creative framework for innovative engineering education.

#### **XI.** Conclusion

The design of the Olin Curriculum must be innovative, flexible, and contain within it the evidence of a commitment to change and continuous improvement. It should not be rigid and inflexible but the opposite. The Olin experience should embrace a wide range of student talents, and open doors to a wide spectrum of student opportunities.

FIGURE 4. Possible Curriculum Model for the Olin Foundation (from Bourne Curriculum Z)

