

LEADERSHIP, TECHNOLOGY AND MANAGEMENT: AN UNDERGRADUATE APPROACH TO MEETING ORGANIZATIONAL NEEDS

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INTRODUCTION

Since the early 1980's, around the time when Peters and Waterman published the best seller, *In Search of Excellence*, business authors, practitioners and academicians have demonstrated a renewed interest in examining ways in which American organizations, both profit and not-for-profit, can improve their management practices. Clearly, the increasingly hostile business environment faced by many American industries with respect to global competition has been a key force causing this re-thinking of management systems. Manifestations of this can be seen across virtually all industries, and include: the movement towards Total Quality Management (TQM), the federal government's initiation of the Baldrige Award to recognize superior quality manufacturing in the US., and more sophisticated use of information processing and manufacturing technologies. In addition, organizations have placed increased importance on the role of marketing as they begin to focus on achieving higher levels of customer satisfaction. Many manufacturers are striving to remove the functional "silos" that have inhibited collaborative work relationships among design engineering, marketing, manufacturing engineering, and finance - creating cross-functional work teams instead, a

greater sense of commitment to responsible management as it affects the environment. Finally, there appears to be a conscious effort on the part of many corporate citizens to identify ethics as a core value within their respective organizations.

As organizations pursue many of these initiatives and restructure or reengineer their businesses to accommodate changes in their internal systems, their needs for and expectations of employees have also changed. Some business schools have responded with revised curricula that reflect greater emphases on quality, technology, understanding global competition, ethics, teamwork, and environmental management. Many of the curricular changes that have been made have been implemented at the graduate level, and indeed, new masters level programs have emerged in the areas of engineering management and the management of technology. Unfortunately, a number of business schools have taken a "mix and stir" approach to addressing prospective employers' changing needs, essentially adding or substituting specific courses (e.g., ethics, operations, international business, etc.) as degree requirements for business school students.

This paper presents information on the

design, development and implementation of a relatively new program that was introduced in 1993 at the undergraduate level. The institutional setting for the program is a small, highly selective, private university with strong programs in the liberal arts, business and engineering. The program, known as the *Institute for Leadership in Technology and Management* (ILTM), has adopted as its mission the challenge of preparing students for organizational leadership positions in the 21st century, a century that will place added demands on managers to be able to think holistically about problems that are becoming increasingly complex in terms of their technological, global, economic, human, and ethical dimensions.

BACKGROUND

It is important to note that ILTM is a market-driven program. The genesis of the idea actually came from outside the university, from a former student - now retired executive, who wished to provide funds to support a program or academic department that would integrate engineering and business disciplines. Rather than act hastily and simply start a new department (e.g., industrial engineering), an interdisciplinary task force of engineering and business faculty was formed to research the issue. The task force set out first to determine whether or not industry truly needed anything different than what was currently being offered by higher education in these areas, and secondly, if a need was identified, to consider the best educational delivery system to meet such a need, given financial and other institutional constraints.

In order to assess market needs, the task force spent a considerable portion of the summer of 1991 conducting thirty (30) in-depth interviews with executives and managers who represented a broad cross-section of technology organizations. All members of the interdisciplinary task force were present for all of the interviews so that a breadth of perspective on the issue was assured during these meetings. At the risk of oversimplifying a very rich database of qualitative information, the results of this field work can be summarized as follows: 1) that there is a need for more holistic approaches to problem solving on the part of engineers and business students, and

that part of this need relates to improved critical thinking skills; 2) that additional needs centered on abilities to work effectively as team members, improved communication and leadership skills, a greater sensitivity about ethics, and real world industry experience; and 3) that the current programs in engineering and business not be diluted in any way to accommodate these needs. Needless to say, these findings presented a daunting challenge to the task force, and one that ultimately led to ILTM's conception.

ILTM is a two-summer program for undergraduates who are majoring in one of the engineering or business disciplines. The first summer, following completion of the student's sophomore year, is spent studying on campus. The second summer, following completion of the student's junior year, consists of an internship with selected organizations. Stipends are paid to students during the first summer out of benefactor funds, and all interns in the second summer are paid by the sponsoring organizations. Interdisciplinary project work teams of undergraduates, engineering, business, social science, and humanities teaching faculty, active and collaborative pedagogies, visiting executives-in-residence, and internships are all key elements that combine to make ILTM a truly unique learning opportunity for students. The sections that follow present in greater detail the key features of the program, the "growing pains" that are being experienced, and critical feedback from employers and student participants that has been received to date.

SUMMER I: THE CURRICULUM

One of the curricular goals of the ILTM program from the very beginning has been to move beyond the traditional "mix and stir" approach of cross pollinating business and engineering majors with course content from their respective disciplines. Rather, ILTM was conceived around the notion that students need to enhance their critical thinking skills, and ultimately achieve a level of holistic problem solving. Viewing organizational problems not unidimensionally, as simply a marketing, engineering design, or finance issue, but as complex problems with multiple dimensions that need to be addressed in an

integrative way. Since students are entering their junior year in highly structured majors, they have had relatively little exposure to critical thinking and integrative problem solving techniques. Consequently, significant attention is devoted to these areas by teaching faculty from the humanities and social sciences disciplines during the first summer session.

Structurally, the first summer consists of three major settings: the classroom, field trips, and a case project that is researched by an interdisciplinary team of students. Each case project is designed by one of the corporate sponsors that is hosting a field trip that summer, and reflects a real world issue that currently faces the organization. Classroom time is devoted to case studies and other Socratic pedagogies, and classes typically are held mornings and afternoons. Each week focuses on a different perspective, beginning with macro issues during the first week, then specific micro level skills and tools relating to various functional areas (e.g., financial statement analysis, systems design, etc.), moving next into total quality management (TQM), world class manufacturing systems, and finally ethics and environmental considerations. The curricular centerpiece of this first summer is a two day presentation of the space shuttle *Challenger* disaster, presented by two visiting experts who developed the case one of whom was a central figure in the decision process who recommended not to launch *Challenger*. This case study is truly integrative in that the issues in the case include not only the engineering and management interface, but also the political and socio-cultural dimensions of the case as well. Finally, the sixth week of the program is devoted to final preparations for and presentation of the student teams' case projects.

The field trip component of the first summer is an important one and one that has been extremely successful. These trips last one full day and are specifically designed to reinforce and strengthen the concepts being taught in the classroom. Field trips are selected so as to represent a broad range of size and types of organizations, providing a rich blend of different technology and management environments, and have included Procter and Gamble's largest plant

in the world as well as a privately held precision steel manufacturer with fewer than 100 employees. Special attention is given by the host organizations to ILTM's mission and learning objectives, and in addition to tailored plant tours of the production and manufacturing end of the business, the field trips have included presentations to students by CEO's and other top management officials on themes such as leadership, working with cross-functional teams, and the engineering/management interface.

The case projects are intended to synthesize materials and concepts presented throughout the summer, and provide students with a unique learning opportunity to apply some of these skills, tools and concepts by working on an interdisciplinary team of student colleagues. Engineers and business students work together on these projects under the supervision of a faculty advisor. Each student team has access to a contact person from the respective project sponsoring organization, however the role of both the faculty advisor and company contact person is to direct students to various sources of information or alternative research methodologies, not to participate directly in the data analysis or problem solving process. While some case project work time is programmed into the daily schedule, most of the project work is conducted by student teams during late afternoons, evenings, and weekends. Student teams prepare a final written report of their findings on the case project and make a final oral presentation to faculty and company contact persons.

Students receive partial academic credit for successfully completing this first summer. As input into the determination of grades, faculty solicit peer evaluations in addition to using students' case project and classroom performance. Depending upon overall day-to-day classroom performance as judged by the faculty, a final exam may or may not be administered.

SUMMER II: THE INTERNSHIP PROGRAM

Consistent with one the primary findings of the initial field interviews with executives, that students need greater exposure to actual industry

practices vis-à-vis experiential learning, it was decided that a second summer in the program be devoted exclusively to an internship experience for students. Accordingly, each student who successfully completes the first summer session is placed in a 10-12 week internship following the junior year of undergraduate studies, and receives partial academic credit upon successful completion of the summer internship. These placements may be at a domestic or overseas site, and interns are paid by the host organization at prevailing market levels of compensation. It is important to note that, unlike traditional internship models where students might "shadow" a business person in routine tasks, or perform mundane work activities, the ILTM internship experience is designed to give the student exposure to the day-to-day planning and problem solving activities in the organization, and to the extent possible, to allow the intern to have direct personal access to several of the organization's leaders.

The actual matching process of students with host organizations varies in terms of screening and interviewing procedures. All students, of course, are required to prepare a resume, and faculty serve as intermediaries between prospective host organizations and student interns. Some hosts give full discretion to the faculty to make the appropriate placement, while other organizations review several resumes, conduct telephone and personal interviews, and finally select an intern. Within legitimate concerns for geographic limitations, students are expected to accept an approved internship that they are offered. With only two exceptions, this has not become problematic to the placement process.

Prior to their return to campus for their senior year of studies, the interns' supervisors at the host organizations are contacted by faculty and asked to submit a formal performance evaluation of the student interns on criteria which include technical competence, teamwork, and leadership skills. Once they have returned to school for the fall semester, student interns are required to submit a report to the faculty evaluating their internship experiences relative to ILTM learning objectives, reporting on each week's activities in a journal, and recommend whether that particular internship ought to be continued as part of the ILTM program. Having reviewed students' written

reports and journals, the faculty selects approximately 20 percent of the students to share their experiences in an informal oral presentation setting. Finally, student grades are assigned by the faculty using as input employer evaluations and written reports from the students.

To date, the types of host organizations providing internships fall into four broad categories: 1) traditional producers/manufacturers such as ARCO, Corning, General Electric, Johnson & Johnson, and Motorola; 2) newer high tech organizations such as Boston Scientific, Radius, and Energy Conversion Devices; 3) financial service firms such as Goldman Sachs, Dreyfus, and Price Waterhouse, and non-profit groups such as Geisinger Medical System and The Wilderness Society. Collectively, host organizations have provided an interesting blend of technology-related experiences for students in the areas of production, manufacturing, information systems and research & development.

SOME GROWING PAINS

Needless to say, like any entrepreneurial effort, ILTM has gone through a number of "growing pains" since its inception and will no doubt continue to do so as it evolves. Some of these are worth noting. First, and an irony to be sure, it became readily apparent to participating faculty during the design, development and implementation of ILTM that engineering, humanities, business, and social science faculty have very different work styles, thought processes, and perspectives when it comes to collaborating on a project such as this one. Suffice it to say that by the end of the planning period, and certainly after implementation, the respect for and tolerance of one another's strengths, weaknesses, and other differences had increased immeasurably.

The initial year of developing internship opportunities was extremely labor intensive. ILTM faculty needed to reach out to senior administrators, university trustees, and other key alumni during this process. There was some resistance to pay student interns during an economic climate of downsizing on the part of so many organizations, particularly given the novelty of an as yet "unproved" program. Fortunately, the

economic environment has improved some, ILTM is no longer an unproved concept, and a surplus of internship opportunities was realized for summer 1995 placements.

The recruitment, screening and selection processes of entering students has also undergone some changes. Students must now identify faculty references in addition to completing several essays as part of their application. Rather than requiring an arbitrary minimum grade point average, students who exhibit an otherwise strong application are interviewed by faculty to determine if the grade point average alone understates their true potential. Also, achieving an even balance of engineers and business majors by sub-discipline (e.g., civil, electrical, accounting, management, etc.) continues to present problems, however a revised marketing strategy to recruit a broader cross-section of students by major is currently underway.

Finally, an issue that the faculty continues to address is how best to teach basic engineering and business skills in a truly integrative way that minimizes redundancy with previous course work. Some thought is being given to splitting the group by major when specific topics are being covered in engineering and business, however this approach might be counter productive to the integrative theme that is central to the program. Other alternative pedagogies are also being considered.

PROGRAM FEEDBACK

The ILTM program has three principal stakeholders: university faculty; corporate partners who supply internship opportunities, field trips, and case projects; and student participants in the program. Both the core group of faculty, visiting "adjunct" faculty who participate in the program, and a sample of faculty from the broader community of teacher-scholars outside the university have all given high praise to the mission, learning objectives and design of ILTM. Whereas it was somewhat difficult to recruit specialized faculty to teach in the program during its first year, a number of these faculty and their counterparts now seek out opportunities to teach in the program. In fact, other universities with engineering and business programs have contacted ILTM core faculty to learn more about the design

and implementation of the program.

That corporate partners are excited about the program is clearly evidenced by the surplus of internship opportunities that was realized last summer. Moreover, a few companies want to involve themselves even more extensively as partners in the program, and one company in particular has been very proactive at identifying opportunities to provide executive guest speakers and internship opportunities abroad at one of its European manufacturing and R & D facilities. Additional evidence of the corporate stakeholder's response can be found in the internship evaluations. Most of the returning interns have all received superior reviews; none have been rated unsatisfactorily. More often than not interns have been offered permanent positions upon graduation (unless the organization was not hiring), and other non-participating organizations have been seeking out ILTM students to interview during their recruiting trips to campus..

Finally, the feedback from the most important stakeholder, participating students, has been overwhelmingly positive. ILTM is an intensive and demanding program with very high performance expectations placed upon its students by faculty. While students voice their concerns about time constraints for getting everything done and the overall pace of the program, particularly during the first summer, their (anonymous) written critiques of the program have been very favorable. In fact, much of the critical feedback from students has been so constructive that it has been used to make some curriculum adjustments during the first summer, not so much to lighten workload as to improve the scheduling of field trips, case project work time, and faculty participants.

SUMMARY

The past 10-15 years have seen radical changes in the way American organizations manage technology, systems and people. A new imperative has been placed on the leaders of these organizations to think more holistically about increasingly complex problems, to become more effective competitors in the global marketplace, and to be more responsible corporate citizens in terms of their environmental and societal

obligations. To help organizations meet these new demands, business schools of all types, graduate and undergraduate, must reflect thoughtfully on what they are delivering in the way of quality educational programs. One outcome of these reflections is bound to be the need for more integrated approaches to teaching students how to think more critically and holistically, to be able to synthesize information and knowledge from several different sources concurrently, and to make sound contributions as team members working towards their organizations' goals. Hopefully, the ILTM program that has been described throughout this paper will represent a useful model to examine as business school leaders plan for innovative ways to respond to the needs of their key constituents.

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