THE BEST OF BOTH WORLDS: A NEW LOOK AT COOPERATIVE EDUCATION

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Introduction

> "Probably no social partnership holds more potential for both immediate and long-term impact on America's future . . . than the budding cooperation between schools and some businesses . . ."[1]

> "Norman Augustine, Chairman and CEO of Martin Marietta Corporation, 'suggested that with the end of the Cold War, engineering education needed a new set of guiding principles' and that 'engineers now faced a world of intense international competition.' To confront this challenge, there needs to be a focus on partnerships."[2]

> "Partnerships must build closer ties to industry."[3]

The many advantages of cooperative education are well established. It provides not only an almost essential link between theory and real-world application, but also it offers an income opportunity to assist the student in funding his or her education. For the traditional student co-op is a program of either alternating terms of course work and professional experience or part-time of both. For the non-traditional student it is typically a repeatable course with specific objectives, frequently tailored to the needs of both employer and student. Nevertheless there remain shortcomings in cooperative education for both the traditional and non-traditional student. A co-op program is envisioned that combines the advantages of the traditional program with those of the non-traditional course while addressing many of the shortcomings of both.

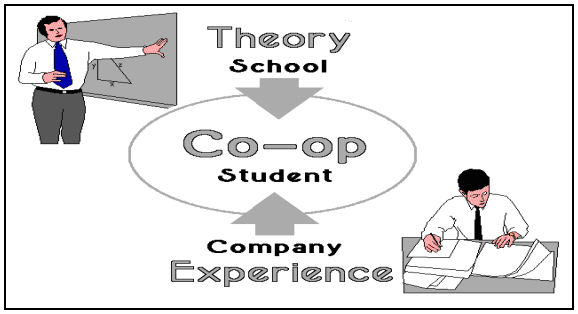
Analysis

To design such an "ideal" co-op program, one must take a critical look at the shortcomings and needs of both the traditional and non-traditional approaches.

Shortcomings of the Traditional Program

The traditional co-op program is well-suited for the full-time or part-time student who does not need to work full time. Consequently, it cannot be taken by the working (full-time) student who cannot afford to go to school full time. This is the non-traditional student who has family obligations and works forty hours a week pursuing a career. Obviously, this person's co-op aspirations are met by the co-op course, provided that such a course is offered at his or her school. In short, the traditional co-op program

cannot be for everyone by its very design. Eligibility for many co-op programs begins in the third academic year (after three semesters for some). Unfortunately the money available for college education is often spent in two years; so the opportunity to earn the money needed to finance the balance of one's education is gone. (Such was the case with author Wojtecki, who enlisted in the U.S. Air Force when his education fund was depleted.) Entry into a co-op program may not be possible for some in an era of the military draft.

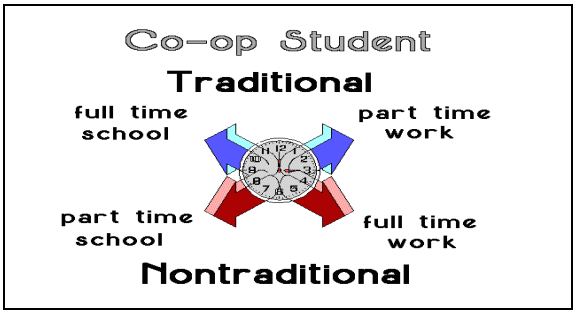


A third shortcoming of the traditional program is that typically it extends a person 's academic program by a year. This extension results in additional subsistence expenses. Although this extended time and expense may be well worth it, perhaps there is a way to incorporate the co-op opportunity into an all-inclusive four-year academic program (e.g., co-op opportunities or a greater number of course offerings in the summer).

Many school administrators do not fully understand the academic value of co-op programs. "Many institutional administrators don't seem to understand the role of co-op ..., or else they choose to ignore it."[4] Fortunately visionary administrators, including the authors', realize the need for and value of co-op and support the efforts for co-op growth and change. Because co-op is a program of growth and change, it needs dedicated administrators as well as faculty to build and maintain its quality and to coordinate program details.

Shortcomings of the Non-Traditional Program

As previously stated, the co-op "program" for the non-traditional student (available to the traditional student as well) is typically a single repeatable course (more than one at some institutions). Course repetition is restricted, frequently totaling six semester hours or equivalent with a limit of two credits in a semester.



A major shortcoming with the non-traditional program, particularly for graduate students, is its lack of the means of providing the opportunity for viable, leading-edge job research to be associated with any academic program. If this problem could be resolved, enrollments across the country would likely increase. This shortcoming is manifested in many ways; for example:

1. The research is conducted at a test facility far from the location of the university or college attended by the researcher-student. Travel by the potential overseeing

professor- principal investigator (PI) either is not paid by the sponsoring organization or is impractical for the professor due to the required time away from his or her other duties and responsibilities. The sponsoring organization may have no academic interest in the research—it is often developmental—and so is unwilling to incur travel expenses other than for its own employee. The potential PI must remain available for teaching duties, other research, oversight, etc.

2. There is no expert in the independently sponsored research area located at the school attended by the employee. Therefore, the school is unable to accommodate the dissertation opportunity.

3. The PI, employed by the sponsoring organization, is not associated with a university.

4. An expert in the field of sponsored research is associated with a university and is hired by the sponsoring organization as a consultant, and this expert 's expenses are paid. However, this professor's university is too distant for the employee to attend.

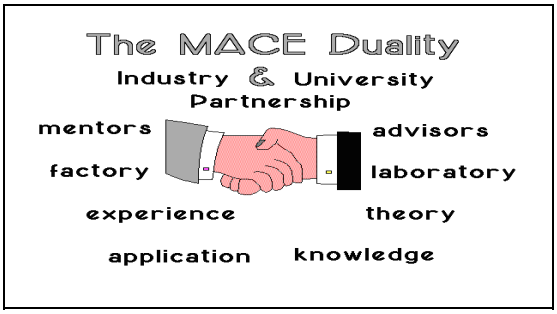
5. The expert's university does not have a graduate-level co-op program; so the employee (a part-time student) is unable to apply the research to his or her academic program. (What an unfortunate missed opportunity!)

6. The decision by the sponsoring organization to conduct the research is made in an untimely manner from the student's standpoint, precluding the opportunity to take the appropriate courses prior to conduct the research.

7. The research is government-classified or employer-proprietary. For classified research the professor-consultant must have both an appropriate security clearance and a "need to know." Satisfying this condition is not so difficult as it may first seem. A hired consultant in government-sponsored, developmental research frequently has a security clearance; justifying the "need to know" is then a straightforward result of the consultant's contract. However, if the proposed research is the consultant's first working experience with a classified program obtaining the security clearance could be time-consuming. For proprietary work the employer must be willing to share its secrets with an outsider—a problem which may be more difficult to overcome than that of obtaining a security clearance. However, companies write their own confidentiality agreements to protect their proprietary information—agreements that must be signed by consultants and employees alike as a condition of employment. So a means of satisfying a company's concerns does exist.

8. In government-sponsored research, even if all the other issues of geographic location, personnel and security are satisfied, there always remains the risk of funding (contract) cancellation. There is nothing that can be done in this case, unless the research is awarded to another contractor with whom personnel

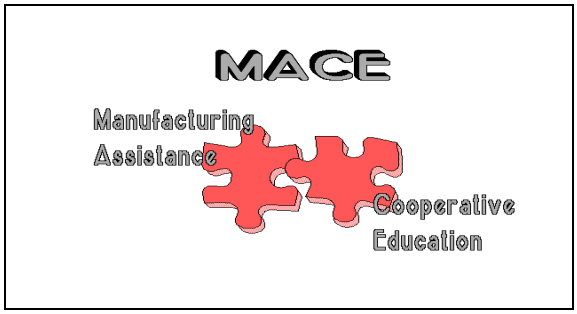
(student-employee and professor-consultant) re-affiliate. After all, life is not risk-free.



Another shortcoming of some non-traditional co-op programs is lack of academic support. Required support includes dedicated faculty, load relief for professor's time expended on the program, and continuity of structure. "Most academics knowledgeable about co-op recognize it as an academic program. "[5] Some faculty may support traditional co-op programs, but not the non-traditional ones because of additional work including travel to the student 's work place. Lack of load relief often accompanies the non-traditional co-op course; i.e., the professor does not get paid for his additional effort. This is frequently the case when the course is offered as an individual investigation, yet the student pays tuition for these credits, which are over and above the professor's normal course-credit load. Finally, in terms of structure, faculty approach to the non-traditional co-op differs. Two faculty members from the same academic department may manage co-op projects in stark contrast to each other. The significance of the student's experience can differ to an unacceptable degree.

Many working engineers miss potential opportunities to have their work-related research apply towards advanced degrees. An engineer may either conduct or be responsible for developmental research that is government-funded but not associated with a university. Thus there is no opportunity for this work to be applied to any academic program, even though it may be "leading-edge" research. (Both authors encountered this problem during their industrial careers.)

Needs of Co-op Programs



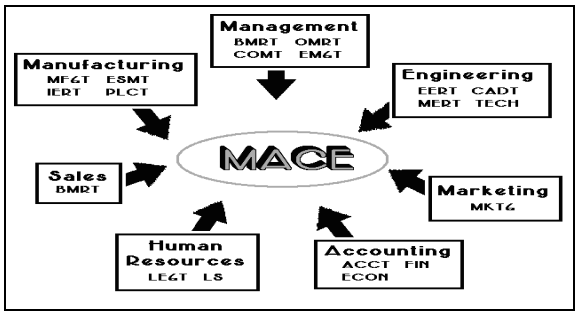
Stemming directly from the shortcomings discussed is a need for improving the mechanics of co-op programs. The first shortcoming of the traditional co-op is satisfied by the non-traditional program. The second may be satisfied if the income opportunity of the co-op is sufficient to defray enough of the costs incurred while going to school. The third shortcoming (lengthening one's academic program) can be circumvented if the co-op program is more closely integrated with the academic program. With respect to the fourth, greater visibility of the benefits of co-op programs is needed with those administrators who may not understand the academic value of a co-op. Finally, for quality improvement of the traditional co-op, there needs to be a renewed emphasis on the depth and appropriateness of the content of co-op programs. Additionally, as with student group projects in the classroom, "cooperative learning promotes a significantly higher level of individual achievement than either competitive or individualistic learning."[6]

Most of the shortcomings of non-traditional co-op programs can be eliminated by widening their scope. This simple statement has significant implications that are not insurmountable if a new approach is taken which addresses the problem areas above.

Cooperative Education: A New Approach

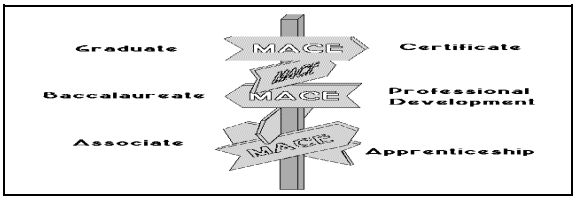
As beneficial as co-op programs are, there remain definite areas for improvement. A model that addresses the shortcomings of both the traditional and non-traditional programs is proposed and is under consideration for implementation at Kent State University Trumbull Campus. This new approach has been named Manufacturing Assistance for Cooperative Education (MACE). Its objective is a challenging one: to provide *appropriate* work experiences to integrate and apply knowledge accumulated during the student's educational program. The work experience must be at an appropriate level of technological intensity with a focus on problem solving in an industrial environment. Problem solving requires innovation. "The design principle for innovation is the team, set up outside of existing structures, that is, as an 'autonomous unit.'"[7] This implies change. "There is broad recognition that [U.S. engineering education] must change to meet new challenges. . . . colleges must educate their students to work as part of teams, communicate well, and understand the economic, social, environmental and international context of their professional activities. These changes are vital to the nation's industrial strength and to the ability of engineers to serve as technology and policy decision makers."[8] Furthermore, beliefs that challenge traditional academic culture include: Integration of work and education enhance learning; and leadership and team management skills are best learned through team project experience.[9]

There are many benefits to MACE. "It has been found that substantial benefits are derived by all three partners, employer, employee, and college from WBL [work-based learning] programmes."[10] First, MACE will develop a cooperative union of professionals from industry in partnership with faculty members. This union can enrich both industrial and university partners by providing an environment of mutual interest and concern. "Time spent by engineering faculty and graduate students in industry can enhance transfer of new technologies to industry, as well as provide practical experience and an understanding of business policies. Time spent by industry experts in engineering colleges can help make engineering coursework and research more relevant to actual practice."[11] A synergy of understanding is expected, and the experience will create a team effort (a duality) between industry and the university. This duality includes: industrial mentors and faculty members; laboratory experiences with a factory atmosphere; and classroom theory coupled with real-world experiences. "Through co-op programs educators can keep abreast of industry trends, students can enhance their understanding of key engineering concepts and processes, and corporate managers can tap a valuable source of part-time and potentially full-time employees."[12]



MACE can combine and unify several academic programs, such as engineering technologies, business, marketing, and computer science; "many modern engineering projects require a combination of several disciplines . . . engineering education programs have much to gain from other disciplines. New insights can be provided . . ."[13] A goal of MACE is to thrust students from different disciplines together in a laboratory environment to solve real-world problems. The synergy of experiences created by mingling of disciplines (a real-world situation) will develop a variety of skills from leadership to problem-solving as well as provide opportunity for the application of technical knowledge. "And just as important as their specific technical skills, engineers receive valuable preparation for a host of other careers in such areas as finance, medicine, law and management. These professions require analytical, integrative and problem-solving abilities, all of which are part of an engineering education. Thus, engineering is an [*sic*] technologically-dependent society of the twenty-first century. "[14] "If US products are to be preeminent in global markets, companies must excel *not only in* engineering and management, *but in the integration of these functions* ."[15]

MACE can provide opportunities in research and development. It can be a vehicle for grant funding. A "pay-to-play" scheme can provide student income. This scheme will require a company to pay a fee to participate with the university in joint projects which result in direct benefits to the company.



The MACE approach will allow controlled work experience at the student 's level of need. The laboratory atmosphere will allow the student to develop creative approaches to problems while being guided by mentor and faculty advisor experience. It will also allow for the objective evaluation of the student 's progress and will focus on remedial effort where needed.

MACE will allow program continuity since program completion by one student will not necessarily terminate a project, or completion of a project will not necessarily terminate the program. A continual influx of projects is planned which will keep the program going and growing. As any program requires, success of MACE will depend on continual and controlled growth in the number of projects as well as the number of participating students. A one-term student employment arrangement should be avoided.[16]

As manufacturing assistance, MACE will provide a community service by allowing small- and medium-size companies to participate in a forum of research and development not affordable to them independently.

Finally, MACE will create some university positions by requiring an operational staff; however, this staff should resemble a corporate staff to effectively provide a real world hands-on environment.

What distinguishes MACE from conventional co-op programs is its control. Conventional co-op programs are controlled by industry. The student works in the plant on specific projects needed by the employer; the student may have a casual interest in the project but a stronger interest in the income. In contrast, MACE is a joint industry and university effort, conducted at the university 's manufacturing assistance facility. Therefore, a definite tie is maintained with the school, and the company 's project becomes the manufacturing assistance. The company 's professional and the university 's faculty work on cite. The student clearly benefits from working with both sides of the theoretical and real-world issues. The student continues to go to classes, thus maintaining academic progress, while getting paid if the project is funded by the participating company or by a grant. To be most effective, project work must be seen by the students to be relevant to the employer. [17]

MACE also offers the opportunity for interdisciplinary interactions among students. Only fairly recently have interdisciplinary approaches been emphasized among scholars, and the importance of these approaches can thus be emphasized at the outset of the students' careers.

"The American university has outgrown the structure its founders built a century ago. It needs now new thinking about its mission and function, its objective and governance, its priorities and the criteria by which it should measure its accomplishments and results." [18] "As noted by Richard Morrow, past chairman of the National Academy of Engineering, 'the nation with the best engineering talent is in possession of the core ingredient of comparative economic and industrial advantage.'" [19]

". . .the application and learning of knowledge are fundamentally no different than any other work. . . the product is entirely different and so are the materials and tools. But the process is basically the same." [20]

"Successful alumni claim that cooperative education programs helped accelerate their careers. Thousands of companies and government agencies are employing co-op graduates and looking to hire more." [21]

Table 1– Program Abbreviations Used in Figure 5

Abbreviation	Program Description	Abbreviation	Program Description
ACTT	Accounting	LEGT	Legal Assisting
BMRT	Business Management	LS	Labor Studies
CADT	Computer Aided Design	MERT	Mechanical Engineering
COMT	Computer Technology	MFGT	Manufacturing Engineering
EERT	Electrical/Electronic Tech	OMRT	Office Management
ESMT	Environmental Safety	PLCT	Plastics Manufacturing
IERT	Industrial Engineering		

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14. *Ibid.*
15. Chelst *et al.*, 289.
16. Sovilla, 23.
17. Edward.
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19. http://www.asee.org/pubs2/html/greenworld.htm
20. Drucker, 229.
21. Sovilla, 21.

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