Journal of
INDUSTRIAL
TECHNOLOGY

Volume 19, Number 1 - November 2002 to January 2003

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KEYWORD SEARCH

Administration
Curriculum
Higher Education
Leadership
Research

Refereed Article

The Official Electronic Publication of the National Association of Industrial Technology • www.nait.org

The Status of Industrial Interaction/Outreach in Industrial Technology

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Introduction

In an effort to maximize the academic experience of Industrial Technology (IT) students, it is important that they participate in industrial activities or learn from faculty who have previous or ongoing industrial experience. In the following sections the researchers will provide background information regarding current (theoretical) industrial/academic interactions, National Association of Industrial Technology's (NAIT's) perspective on industrial interaction, and Southeast Missouri State's latest attempt to increase industrial interaction on its campus. Additionally, data will be presented from a survey of NAIT-accredited institutes to provide a snapshot of current industrial activities involving faculty and students.

To create an effective industrial outreach/interaction environment, the National Science Foundation (1998) suggested that, at minimum, institutions have the following structure/mechanisms in place:

- A modified culture that allows academe to better support industrial partnerships and better recognize the importance of industry's role in education and research
- Industry/academe partnerships that produce deliverables, not just financial support
- Strong college-level advisory boards that allow industrial input on professional practices to filter down to departments and into courses
- Involvement of alumni and regional industries in curriculum development and realistic project collaborations

Industrial outreach/interaction is vital to the maintenance and advancement of students and faculty involved in Industrial Technology programs. Whether the purpose is adjusting curricula around current competencies or providing faculty and students "hands-on" experiences, the partnerships are necessary. Striking a balance between academic and industrial demands is a fine line that must be walked with intentional and deliberate steps. However, if the partnership is developed correctly, the benefits are exponential for all involved parties, especially the students. A primary approach utilized by most academic institutions is the student internship. This method is very beneficial for students and the organization in which they intern. Another approach that is gaining popularity is the faculty internship (Beck, 2001). Therefore, it is imperative that faculty stay engaged in the constant changes of the technical workplace. Academic institutions cannot expect faculty who possess outdated skills and knowledge to maintain curriculum needed for today's students without some renewed experiences in their discipline. It is critical that faculty be given the resources and opportunities to stay abreast of the technological, business, and global practices. This engagement is typically obtained through consulting, internships and other industrial projects. Since there is no standard model for acquiring renewed or initial industrial experience, faculty should develop partnerships with agencies related to their area of interest or expertise. In doing so, relationships can foster a synergistic interaction for both parties. Some examples of these academic-industrial partnerships are listed in Table 1.

Background

Constant change has forced many universities to reevaluate the types of relationships they maintain with local/regional industries. The evaluation of these relationships has prompted many universities to develop more short-term projects rather than the traditional long-term ventures. The rationale behind this movement is supported by Anders (1992), in that "modern universities train[s] specialists and encourage applied research…" (p.76). To accomplish the latter half of Anders' statement, many universities have developed industrial relationships that produce "win-win" projects such as the creation of centers for excellence, rapid curriculum adjustments, faculty consulting and incubators for new commercial technology (Anders, 1992). Additionally, as stated in the Carnegie Mellon University Policy on Consulting by Faculty and echoed by other universities (2001), "The university believes that its educational program, and effective teaching in all its aspects, can flourish only when sustained by continuous, active participation of its faculty in research, enriched in many cases by interaction with industry, artistic organizations, business, government, and other activities and institutions of our society."

As technology continues to change, so should our curriculum and the qualifications of our faculty. The demands of industry require students to possess a blend of theoretical and practical experiences before completing their academic programs. However, in some cases, the latter component is lacking. In a related study polling technical employees, it was found that a significant number of those participating felt that faculty should have amassed at least three to five years of industrial experience prior to teaching (Downing, 1999). Additionally, the study found that faculty should provide curriculum and laboratory experiences that were similar to true industrial experiences. It was indicated that making these changes to curriculum could potentially increase the percentage of students that can effectively contribute to their organizations within a short period of time or without having to undergo extensive training.

Most industries are willing to involve themselves with local academic institutions when they can foresee a benefit unlike in the past, as Henry (2000) stated, "when companies threw money over the fence and nothing happened" (p. 63). These benefits are not single-sided. If carefully crafted, the industrial interaction/outreach can produce a "win-win-win" scenario. This means that local industry benefits from the faculty and student resources, students and faculty stay current, and the potential for financial contributions to the university or academic units increase. Henry (2000) says it best, "Everybody has something to gain from academic-industrial partnerships. Students get valuable work experience, corporations get needed research done, and professors get feedback on whether they are appropriately preparing students" (p. 63). Furthermore, the trend seems to be growing toward making more opportunities to involve faculty in higher levels of involvement for long-term company projects.

NAIT's Perspective and Requirements

In efforts to support and/or maintain quality instruction, accrediting bodies have incorporated standards that recognize the importance of industrial and business experience and interaction by faculty. This concept is especially true for the National Association of Industrial Technology (NAIT). NAIT's commitment to industrial integration is highly visible in the accreditation criteria.

No fewer than 13 of the 62 NAIT standards require faculty and/or student involvement with industry. The following is a list of relevant standards published by the NAIT accrediting office:

- 6.2.3 Program Acceptance requires that program is "understood and accepted" by internal and external groups including the "external business and industrial community"
- 6.3.4 Program Emphasis requires that each program "reflect the technology of contemporary industry"
- 6.3.10 Industrial Experience requires that "Each major program shall include appropriate industrial experiences . . . "
- 6.3.12 Competency Validation requires that the validation process include "an industrial advisory committee(s)"
- 6.3.13 Program Development, Revision, and Evaluation, requires involvement of "representative employers"

Table 1. Examples of Academic-Industrial Partnerships Projects

Institution	Organization	Project/Activity
Southeast Missouri State University	Systems Applications and Products (SAP)	Enterprise Resource Planning
Massachusetts Institute of Technology	NASA	3DP (3-D Printing)
Stanford University	IBM	Manufacturing Research
Georgia Institute of Technology	GE Aircraft Engines	Propulsion Technology
Virginia Tech and University of Wisconsin-Madison	Rockwell, Office of Naval Research	Electric Naval Ship
Cork Institute of Technology	Ericsson	RF Spread Spectrum, Advanced Digital Communications

- 4.4.4 Problem-Solving Activities requires that problem-solving instruction "reflect contemporary industrial situations"
- 6.5.1 Full-Time Faculty requires that program faculty qualifications include "industrial professional experience" and "applied industrial experience"
- 6.6.3 Placement of Graduates requires collecting placement data and documenting that "Industry's reaction to graduates as employees must be favorable"
- 6.8.3 Appropriateness of Equipment requires that equipment is "appropriate to reflect contemporary industry"
- 6.10.2 External Financial Support requires "evidence of external support for the program(s)"
- 6.13.2 Cooperative Education requires appropriate student support services "if cooperative education is either a required or an elective part of the program"
- 6.14.1 Program Advisory Committee(s) requires that "an industrial advisory committee shall assist in the validation of program content"
- 6.14.2 Advisory Committee Meetings requires that the "committee(s) meet at least once each year" and that documentation of meetings and recommendations be recorded.

Southeast Missouri State's Perspective

An example of a NAIT-accredited program with a long history of industrial interaction, by both faculty and students, is the Department of Industrial and Engineering Technology at Southeast Missouri State University. This interaction has led to outstanding external financial support, placement of graduates, and overall program reputation. Faculty are actively involved in industrial consulting and training. They work directly with area industry to insure curriculum and labs reflect industry of the region. The department's merit, tenure, and promotion guidelines reflect this interaction and recognize and reward faculty for this involvement. There is also a Service Award to annually recognize the faculty member who has been the most significantly involved.

Students are required to complete an industrial research project as a part of a senior seminar class. The students work in teams to identify solutions to a "real" industrial problem. Students must report their findings and solutions in both written and oral report form. Over one-half of the students also complete a paid internship experience.

The newest department industrial outreach initiative was the formation of the Technology Resource Center (TRC) in 1998 with assistance from Ameren, a regional utility company. The Center was created to become a more visible mechanism for outreach efforts in the region. The TRC mission was to introduce new manufacturing and energy-efficient technologies to students, area manufacturers, and the public through partnerships because continuous training and education are pillars of successful industry. The mission was to be accomplished by:

1. Assisting area industry to test new manufacturing technologies,
2. Conducting workshops, seminars, and lectures,
3. Assisting faculty and students with applied research projects,
4. Providing customized training to meet industrial needs,
5. Providing space for vendors to demonstrate new technologies, and
6. Building university-industry partnerships.

Beginning April 2000, the TRC entered into a partnership with Missouri Enterprise (ME). Missouri Enterprise is part of a nationwide network of 76 Manufacturing Extension Partnership Centers that work with manufacturers across the country to provide hands-on business and technical assistance to help manufacturers reach their performance and profitability goals. This merger makes available more coordination of resources to better serve the needs and interests of manufacturers in the region served by the Department of Industrial and Engineering Technology at Southeast Missouri State University.

To better facilitate the activities planned for the TRC, 5000 square feet of space is being provided for the TRC in the new Otto and Della Seabaugh Polytechnic Building completed in July 2001. The space is designed for maximum flexibility and has abundant utilities available to accommodate a wide variety of training, demonstrations, and research activities. Because of the diversity of activities (services) faculty can provide and industry desires, it was pertinent in the design of the TRC facility to capture multiple layout possibilities. With the additional space allocated to industrial outreach activities, it became apparent that the Department had to make sure the facilities would be utilized. Understanding that it was not realistic to stake all of the TRC justification in theory, a survey was sent out to poll other NAIT-accredited institutions to understand how their faculty interact with industry.

Although the researchers felt the role of industry is necessary (beneficial), it was important to validate researchers' thoughts and gather other ideas to enhance academic offerings at Southeast Missouri State University. It was the intent of this study to survey fellow NAIT-accredited institutions to understand how faculty and students interact with industry and determine if there is evidence of mutual benefits for involved parties. Additionally, researchers wanted to survey which types of activities were pursued by faculty and students. It was hoped that the study would indicate that the new TRC would provide added value for industrial outreach activities.

Purpose of the Study

The purpose of this study was to determine the importance, type, and extent of industrial interaction/outreach activities in NAIT-accredited programs and to collect data concerning the administration of the activities and rewards provided for faculty/student involvement. Since there is no standard practice across academe, it is important that administrators, faculty,

and students are participating in activities that are beneficial or productive for all involved parties.

Methodology

A survey instrument was developed with the help of a "jury of experts" made up of faculty and administrators who teach within or administer programs with extensive industrial interaction and outreach activities. A list of department chairs/heads of NAIT-accredited institutions (N = 48) was developed from the "2001 NAIT Baccalaureate Program Directory." The initial mailing resulted in 19 returned questionnaires. Follow-up e-mails and telephone calls resulted in the return of an additional eight questionnaires for a total of 27 usable questionnaires, or a 56% return rate.

Survey Findings

The first four questions on the survey concerned importance of faculty involvement and interaction with industry by NAIT-accredited institutions. The survey found that over 80% of the institutions responding expect faculty to interact with, and provide service to, area industry with nearly 75% of them considering it important or required for tenure, promotion, and salary decisions. For promotion, tenure, and salary decisions, industrial interaction is considered as only "Service" by 63% of the respondents, "Scholarship" by under 4% of the respondents, but over 33% said they considered it as both "Scholarship and Service." To ensure that faculty are comfortable working with industry, over 95% of responding department chairs/heads rated industrial experience important or required when selecting new faculty (see Table 2).

The next four questions requested information about administrative issues controlling faculty involvement with industry. Nearly 50% of the responding department chairs/heads had the responsibility of approving faculty industrial consulting and training activities, and 40% of them had limits on the total dollars faculty could earn doing these activities. However, only 11% had a standard pay/salary rate that faculty could charge. Data indicated that 44% of the faculty located and contracted their own consulting and training, 7.5% used only a "center or other entity on campus to assist them," and 45% used both (see Table 3).

The next six questions asked for information concerning departmental benefits from faculty involvement with industry. Only 40% of the respondents reported that the department receives a percentage of the faculty consulting and training revenues. Nearly 60% of reporting institutions solicit industrial donations directly and through the utilization of a foundation. Over 80% use industrial practitioners on curriculum committees with 44% using industrial advisory committees for each program option. Respondents reported that nearly 60% of advisory committee members provide co-ops, internships, or full-time employment opportunities for their students. Also, 80% of reporting institutions stated that the faculty are involved in either or both

Table 2. Faculty Involvement & Interaction

1. To what extent does your university/college/school administration expect department faculty to interact and provide outreach services to area industry?

Significant	Moderate	Very Little	None
7 (25.9%)	14 (51.9%)	6 (22.2%)	0 (0.0%)

2. How important is faculty interaction and outreach to industry for tenure, promotion, merit pay/salary decisions?

Required	Important	Not Required
3 (11.1%)	17 (63.0%)	7 (25.9%)

3. For tenure, promotion, merit pay/salary, is industrial interaction and outreach considered service or scholarship?

Service	Scholarship	Both	Other
17 (63.0%)	1 (3.7%)	9 (33.3%)	0 (0.0%)

4. How important is industrial experience when selecting new faculty?

Required	Important	Not Required
11 (40.7%)	15 (55.6%)	1 (3.7%)

Table 3. Administrative Issues

1. Do you, as department chair, have the responsibility of approving faculty consulting and training activities?

Yes	No
13 (48.1%)	14 (51.9%)

2. Is the total dollar amount faculty can earn each year from consulting and training work limited?

Yes	No
11 (40.7%)	16 (59.3%)

3. Is there a standard salary or approved pay rate for faculty consulting and training?

Yes	No
3 (11.1%)	24 (88.9%)

4. Do faculty locate and contract consulting and training themselves, or is there a center or other entity on campus to assist them?

Faculty	Center	Both	Other
12 (44.4%)	2 (7.5%)	13 (45.1%)	(0.0%)

student placement and follow-up activities (see Table 4).

The last two questions requested information about student interaction with industry. Nearly 45% reported that co-ops, internships, or research projects were required for graduation. Of these three experiences, the students were paid for 100% of the co-ops, 83% of the internships, and 50% of the research projects. The last question was concerned with the types of industrial involvement by students while in classes or student organization activities. Department chairs/heads reported the following: Tours – 96%, Speakers – 100%, Seminars – 67%, Workshops – 40%, Trade Shows – 82%, Conventions –63%, Conferences – 74%, and Career Fairs 93% (see Table 5).

Conclusions

As technologies and industries continue to change rapidly, it is increasingly difficult for faculty to stay abreast of the necessary skills, attitudes, and concepts students need to successfully enter and advance through the workplace. Therefore, maximizing students' educational experiences is a primary concern for most, if not all, Industrial Technology (IT) programs. More specifically, programs are continuously working to graduate students that possess a balanced combination of theoretical knowledge and industrial experience. This charge has many IT faculty reaching out to local/regional industry to find win-win opportunities to involve themselves and their students. This task is not small and the creation of industrial outreach/interactions activities must be properly integrated into our IT programs. It becomes even more difficult to prepare students for industry if faculty have never been or are not presently involved with the industrial community.

During this research the researchers found that were some mutual benefits for faculty and industries participating in outreach activities. From the faculty perspective their benefits include, but were not limited to, financial compensation, acknowledgement of activities when administrators review promotion and tenure documents, ability to maintain technical currency, and industrial contacts that can be beneficial to themselves and students. The industrial side of the equation is a bit more difficult to assess since members of industry were not directly polled. However, it can be inferred that organizations can receive both faculty (serving as experts) and students to

Table 4. Departmental Benefits

1. Does the department receive any part/percent of the consulting or training revenues?

Yes	No
11 (40.7%)	16 (59.3%)

2. Do faculty directly solicit industrial funding support/donations, or do they work through a Foundation?

Direct	Foundation	Both	Other
6 (22.2%)	5 (18.5%)	16 (59.3%)	(0.0%)

3. During your last program curriculum revision, did industrial people serve on the curriculum committee(s)?

Yes	No
22 (81.5%)	5 (18.5%)

4. Which type(s) of Industrial Advisory Committees do you utilize?

Overall Department	Each Option/Program	Both	Other
9 (33.3%)	12 (44.4%)	6 (22.2%)	(0.0%)

5. What percentage of your advisor committee provides employment opportunities (co-ops, internships, or fulltime employment) for your students?

Total Percentage
57.7%

6. Do individual faculty become actively involved in student placement and follow-up?

Placement	Follow-up	Both	Neither
5 (19.0%)	0 (0.0%)	17 (62.0%)	11 (19.0%)

Table 5. Student Interaction

1. Is a student industrial co-op, internship, or research project required for graduation?

Yes	No
12 (44.4%)	15 (55.6%)

If "Yes", which

Coop	Internship	Research Project	Other
7 (58.3%)	6 (50.0%)	4 (33.3%)	0 (0.0%)

If "Yes", are the students paid during the experience?

Coop Paid	Internship Paid	Research Paid
(100%)	(83.3%)	(50.0%)

2. Through classes and student organizations, which of the following types of industrial interaction do your students experience?

Tours	Speakers	Seminars	Workshops
26 (96.3%)	27 (100%)	18 (66.7%)	11 (40.7%)

Trade shows	Conventions	Conferences	Career Fairs
22 (81.5%)	17 (63.0%)	20 (74.1%)	25 (92.6%)

perform research or help solve problems related to their business or production goals, advice from faculty who specialize in areas in which industry needs assistance, and student labor that can be previewed for potential employment after graduation. The old adage states "experience is the best teacher," and the data found in this research project clearly supports it. Creating and maintaining relationships between academic and industrial organizations is a highly recognized mechanism to manage the changing demands of our industrial society. Additionally, these industrial experiences allow faculty to use first-hand knowledge to provide practical insight on theoretical concepts that may be presented in the classroom. This is especially true when it comes to the upper-level classes when students ask, "When will I ever use this concept?" After involving themselves in these industrial collaborations, faculty can renew their practical experience in their chosen field, which they then communicate back to their students.

Overall, the information obtained from this research shows that there is a need for faculty to participate in industrial outreach/interaction. When trying to facilitate these activities, it can be beneficial to have a facility such as the Technology Resource Center (TRC). Regardless of the desire, face-to-face training or designing a new manufacturing process cell, facilities are needed to accommodate industrial needs.

Implication for Further Research

The data found in Table 2 indicates that industrial interaction/outreach for existing faculty is important, but has not reached a level important enough to mandate industrial interaction/outreach as a standard function for faculty teaching in NAIT-accredited institutions. For example, only 25.9% of the participants indicated that institutional administration placed significant importance on faculty interaction with industry. Additionally, only 40.7% require industrial experience in hiring of new faculty. Since there are no standard practices exercised across NAIT-accredited institutions, it would be advantageous to determine the issues or concerns keeping institutions from requiring all faculty to engage in industrial interaction/outreach or requiring industrial experience when hiring new faculty. The benefits of such activities are widely documented in the literature, and gaining an understanding or reasons why some institutions participate, and others do not, would serve as a well-needed study for NAIT and its accredited institutions.

References

Anders, G. C. (Fall, 1992). The changing role of the public university in local economic development. Economic Development Review, 10(4), 76-80.

Beck, E. (August, 2001). Faculty interns: A bargain for business, a bonus for the classroom. Workforce, 80(8), 36-41.

Carnegie Mellon University. (2002, June 11). Retrieved June 11, 2002, from http://www.cmu.edu/policies/documents/FacConsult.html

Downing, C. (1999). An engineer's application of non-technical skills in team-based work environments. Unpublished doctoral dissertation, Southern Illinois University, Carbondale.

Department of Industrial Technology. (1999). Manufacturing Technology Resource Center (brochure). Cape Girardeau, MO: Southeast Missouri State University.

Henry, C. (May, 2000). Best of both worlds. Chemical & Engineering News, 78(18), 63-65.

MAMTC-Missouri. (1999). Business Survival Guide (brochure). Rolla, MO. Missouri Enterprise.

NAIT Board of Accreditation. (2000). Industrial Technology Accreditation Handbook. Ypsilanti, MI: National Association of Industrial Technology.

National Science Foundation. (1998). Building effective industry/academe partnerships for engineering education. Washington, DC: Author. Retrieved January 20, 2002, from http://www.nsf.give/pubs/1998/nsf9892/build.htm