AC 2009-1144: PREPARING STUDENTS FOR A SUCCESSFUL TRANSITION FROM ACADEMIA: AN INDUSTRY PERSPECTIVE

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Preparing Students for a Successful Transition from Academia: An Industry Perspective

Abstract

Universities have traditionally partnered with industry to identify emerging areas for research, emphasize key technology topics within curricula, and provide students with practical cooperative learning experiences. College students are typically presented with opportunities to cultivate their communication, problem solving, and teamwork skills as a standard part of their applied science, computing, engineering, or technology programs. In today's global economy, however, new employees must possess a broadly scoped professional repertoire that will differentiate them within an international talent pool. Companies are ideally looking for graduates who can make immediate contributions.

This paper will detail the types of skills and experiences that can best prepare engineering graduates for technical careers as identified through interviews with fifteen personnel managers from international technology companies. A taxonomy of behaviors to facilitate the move from academia to industry is subsequently described, and the activities that can support engineering students in their transition are discussed.

Introduction

The results-oriented culture of industry requires graduates to consistently demonstrate their value through the resolution of issues in support of business needs as well as client requirements. If new employees begin their careers with a fundamental understanding of the corporate landscape and the critical behaviors that enable achievement, they can focus on making a positive impact while simultaneously embracing the core values of an organization. Engineers must clearly possess the abilities to think critically, deliver creative solutions, and collaborate effectively. Technical employees will likewise be expected to drive innovation across multicultural environments and leverage international experience for the benefit of clients around the world[1,2]. As such, students must be capable of applying some of the more informal operational ideas that they encounter in the classroom to the world of work. Campus resources can certainly provide graduates with important information as they prepare to interview for jobs and review employment offers, but there are other key competencies that can position new employees for success in industry.

Industry practitioners can provide unique perspectives about the types of experiences that foster a successful transition to the workforce. Personnel managers, in particular, can identify the characteristics that enable newly hired employees in science, technology, engineering, and math (STEM) fields to thrive in the workplace. A series of interviews were conducted with fifteen personnel managers from international technology companies to assess the types of skills and experiences that can best prepare engineering graduates for technical careers. The interview candidates represented a broad cross section of technology domains (Information Technology and Consulting, Energy Management, Consumer Product Development), and all had experience with hiring and managing employees with 5 years of service or less.

As a group, the interview candidates had an average of 10.3 years of personnel management experience. The interviews utilized an open discussion format with comments recorded by a single interviewer during the dialogue. The sessions were conducted in person at the candidate's place of employment or via telephone and ranged in duration from fifteen minutes to forty-five minutes. During the interviews, the managers were asked a question about the types of skills and experiences that would best position new hires for success in the corporate environment. The interview candidates were additionally asked follow-up questions about specific personnel experiences to provide supporting examples for their responses as appropriate.

Results

The input collected from the interviewed managers was summarized as the behavioral taxonomy presented in Table 1. The responses were categorized as 'skills' or 'experiences' and subsequently separated into 7 behavior types. The term 'skills' refers to the development of a demonstrable aptitude in a specific domain. The term 'experiences' refers to an evolving mastery of specific knowledge over time. An analysis of the skill and experience data produced the following behavior categories: adaptation, collaboration, communication, competence, context, maturation, and socialization

Table 1: Behavioral Taxonomy based on industry input about skills and experiences

Behaviors	**Skills**	**Experiences**
Adaption: Adjustment to the organizational culture	- Strategic thinking - Goal setting	- Understanding the corporate landscape and organizational politics - Learning the 'unwritten' rules about organizational politics, advancement, and interaction - Embracing change and utilizing it as an opportunity
Collaboration: Effective partnership with others	- Team leadership and participation - Negotiation - Conflict resolution - Diversity training (cultural and generational)	- Working with diverse, multidisciplinary, cross-organizational, and global teams - Understanding defined authority vs. established authority - Dealing with difficult people - Expanding personal scope of influence within an organization
Communication: Clear expression of ideas, thoughts, and solutions	- Presentation skills (oral and written) - Attire and physical appearance appropriate for the environment - Business etiquette	- Leveraging technology to communicate effectively with peers and superiors - Framing messages for different audiences - Learning to articulate accomplishments

Behaviors	Skills	Experiences
Competence: Knowledge about the technical domain	- Cultivation of technical expertise - Logical thinking - Critical thinking - Analytical capability - Problem solving - Project management	- Learning about new and/or emerging technologies while managing routine job requirements - Understanding the business implications of technical decisions - Learning new processes, tools, and methodologies to support the organization's goals - Translating theory into practice
Context: Knowledge about the organization	- Clarity about the responsibilities associated with the job and expectations of the role	- Understanding the opportunity for impact - Learning about the client relationship to the organization - Understanding personal value to the department, organization, and company - Establishing realistic expectations about the norms and constraints of the work environment
Maturation: General professional capabilities	- Ability to multitask - Prioritization of work items - Time management - Straight talk - Ability to work autonomously	- Giving and receiving feedback - Proactively seeking resources and information to solve problems
Socialization: Connection with others for a purpose	- Networking	- Establishing and sustaining mentoring relationships - Building rapport with colleagues and co-workers - Exhibiting confidence and presence - Promoting a positive attitude - Developing interpersonal skills

Engineering students will have the chance to build most of the skills identified in the Collaboration, Communication, Competence, Maturation, and Socialization categories as a part of their standard curriculum. The 'project management' and 'straight talk' skills may not be as familiar to some students, depending on the nature of their assignments and team interactions. There may be also less of an opportunity to cultivate the skills in the Adaptation and Context categories in academia. In particular, 'strategic thinking' and 'clarity about the responsibilities associated with a job' may be skills that are more readily developed during an internship or co-op assignment than in the classroom per se. In general, the skills identified by the interviewed managers are relevant for new hires in a variety of STEM disciplines.

Overall, the experiences identified by the managers are less likely to be encountered in an academic environment. Students may be most familiar with some of the experiences in the Collaboration category, for example 'working with diverse, multidisciplinary, cross-organizational and global teams' or 'dealing with difficult people', given the diverse nature of the university environment as well as the emphasis on globalization and interdisciplinary teaming in engineering curricula. Students may additionally know about the experiences detailed in the Maturation and 'Socialization' categories, for example 'giving and receiving feedback' or 'developing interpersonal skills', as a function of their participation in structured team projects, course assignments, and campus activities. Several of the experiences in the Adaptation, Communication, Competence, and Context categories may not naturally occur in the engineering classroom. In particular, 'learning the corporate landscape and organizational politics', 'leveraging technology to communicate effectively with peers and superiors', 'learning to articulate accomplishments', 'understanding the business implications of technical decisions', 'understanding the opportunity for impact', and 'establishing realistic expectations about the norms and constraints of the environment' are experiences which are most meaningful in the context of the workplace. The most critical exception to note is the 'translating theory into practice' experience in the Competence category as that activity is a key part of engineering curricula.

Implications for Academia and Recommendations

Many of the skills identified during the management interviews are cultivated as a part of core Engineering content. The Accreditation Board for Engineering and Technology (ABET) specifically includes multidisciplinary teamwork, problem solving, effective communication, lifelong learning, and an ability to use the engineering practice as skills among the eleven required program outcomes for the accreditation of engineering programs[3]. Furthermore, employers also now expect engineering graduates to have a deep knowledge of team leadership, diversity, analysis, and decision-making[4,5]. A number of colleges and universities are exploring opportunities to pursue projects that require remote collaboration with teammates at an academic institution in another state or country. These types of project experiences can prepare students for the virtual project teams that they are likely to encounter in the workplace[6]. The university environment can additionally provide students with introductory training about diversity[7]. An exposure to cultural, generational, and intellectual diversity can provide students with an improved foundation for teamwork in the corporate setting.

Previous employer surveys of graduate transition from academia to industry have revealed communications skills as the most challenging area for new employees. Related surveys of graduates have shown that the most difficult aspects of the transition to the workplace include: understanding the business context for assignments, working with more experienced employees, and managing the work hours and deadlines[5]. This information underscores the need for even more focused preparation for students in the Communication, Context and Competence areas among the others.

The requisite skills provided by the managers interviewed for this study are more likely to be

covered in the academic environment than the experiences. Therefore, an early exposure to the experiences detailed, in addition to the development of the skills described, could provide a rich opportunity to enhance student preparedness for the corporate world. A number of suggested activities can be jointly pursued by academia and industry in support of the behaviors as listed in Table 2. There are clearly many colleges and universities that are already conducting efforts in these areas today, but other institutions may have room to take action.

Table 2: Suggested activities for incorporation in the academic environment

Suggested Activities
Update curricula to include content with a focus on global, multidisciplinary teamwork
Engage industry contacts to conduct lectures, seminars, panel sessions, and workshops about the importance of corporate culture, mentoring, organizational change, and personal value
Include real world case studies in traditionally theoretical courses to illustrate the financial investments and business decisions associated with product development in addition to the technical considerations
Promote internships and co-operative education as a mechanism to obtain firsthand experience and exposure to corporate environments in addition to technical skills
Encourage usage of campus career resources to drive fundamental knowledge about business etiquette, professional attire, and communication in the workplace
Provide students with additional opportunities to present to their peers, faculty members, and industry partners
Conduct panel discussions with alumni who can clearly articulate the challenges associated with their transition from academia to industry
Create opportunities, for example, shadowing assignments or roundtable discussions, that enable students to interact with people from industry before they graduate or prepare to interview for employment
Promote student involvement in professional societies or other organizations where industry members may also participate
Partner with industry to conduct long term projects that expose students to the pressures, dynamics, and realities of the workplace
Formalize campus opportunities for diversity training and discussion of diversity-related topics

The skills and experiences identified through the interviews cannot readily be provided by curricula alone. Academia and industry must continue to work together to prepare students for the workplace. Industry partners can engage with academic programs to educate students about the types of experiences that they may encounter as early career employees. Academic institutions can benefit from such partnerships by producing well-rounded graduates who can be even more competitive in a global marketplace where technical skills are necessary but not sufficient for success. Some colleges and universities are leveraging their Industrial Advisory Boards to refine skills requirements for graduates and obtain feedback about areas for improvement to better prepare students for industry[8]. Corporations will benefit by gaining talented new hires who can 'hit the ground running' to rapidly adapt to the environment and add value from the start.

Conclusions

Universities and the technology industries that they support can partner to introduce specific behaviors as an integral part of course content and early employment activities. Graduates with insight about the requisite competencies that can be coupled with their technical expertise may ultimately be better equipped to quickly adapt and perform in a corporate environment. New hires must clearly continue to grow their skills and master new topics after they enter the workplace, but there could be a benefit if graduates have some context for the outlined behaviors from the first day of employment.

Academic institutions have a responsibility to provide students with domain knowledge as well as communication, teamwork, and problem solving skills. Industry partners must, however, do their part to provide continuous input about the requisite skills that new hires need to thrive in the world of work. Ultimately, a balanced dialogue between academia and industry may be the most reasonable approach to address both learning and practice for the future engineer.

Further study is required to validate and assess the relative rankings of the identified skills and experiences from a broader group of industry managers. There could also be value in an assessment of the students' perception of their exposure to these identified skills and experiences upon completion of their engineering degree programs as well as after 2 to 3 years in the workplace. A final area for future research would be an evaluation of the suggested activities for academia and their impact on student preparedness for industry.

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