

Entry of Undergraduate Engineering Students into Work-related Organizations and Occupational Roles through a Co-op Program

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ABSTRACT

The objectives of this study were to 1) develop a model or framework that described the organizational processes used to introduce engineering students into an organization and occupational roles through a cooperative education experience; and 2) determine activities and processes that better facilitate the student's movement from the education to the work environment.

Students were socialized to the workplace through a five-stage process. The third stage, entry to the co-op position, is the focus of this paper. Entry to the co-op position described the student's movement from outside to inside the workplace organization and engineering-related occupational roles.

Entry to the organization focused on teaching the student what employees need to know, regardless of what group the employee belongs to in the organization. Organization entry involved orientation processes and transfer of knowledge about organizational culture.

Entry to the occupational role consisted of the student learning what to do and how to behave and act within expectations of defined jobs and positions. Occupational role entry involved workgroup dynamics and interactions as well as work assignments. Occupational role entry consisted of an eight-phase role development process from an unsure student hire to a new or junior-level engineer.

Keywords: STEM, workforce transition, cooperative education

INTRODUCTION

As the demand for STEM talent continues to increase and outpace the supply of graduates (Education for Innovation Initiative, 2008), it becomes increasingly more important for an organization to be able to effectively recruit and retain STEM talent. Strategies for recruiting, orienting, and socializing STEM graduates to the workplace are varied, but one that has been shown to be particularly effective is internship or cooperative education (co-op) programs through a college or university (NACE Research Brief, 2011).

One of the critical factors that determine the effectiveness of the internship/co-op from both the student and the employer perspective can be the entry and socialization processes experienced by the student, whether planned/unplanned or intentional/unintentional. If the student does not effectively transition from the academic environment to the work environment, learning outcomes will not likely be accomplished (at least to the intended level going into the experiential education work event), satisfaction with the experience is unlikely, potential for dissatisfaction with the chosen academic program and career increases, and self-esteem and confidence in the ability to succeed may be negatively impacted (Chatman, 1991; Holland, 1985; Jurgenson, 1978; Rynes & Gerhart, 1990).

From the employer perspective, an ineffective pre-entry and/or socialization process can result in lower productivity from the student and negative morale, which could influence current full-time employees and other future students or new employees who may want to work for the employer organization (Bauer et al., 1998). This can greatly limit the potential for retention of the student, or new engineering employee, thereby minimizing the return on investment (Campion & Mitchell, 1983; Louis, 1980; Vandenberg & Scarpello, 1990).

METHODOLOGY

An investigation of the structure, processes, and relationships among people associated with the engineering co-op program, as defined by Collins (1971), at ‘the University’ was conducted. The engineering students at ‘the University’ and the employer representatives who hire, train and supervise the engineering students as part of a co-op program were the focus of the study. ‘The University’ is a mid-size (greater than 20,000 students), public university located in the upper-Midwest region of the United States. At the undergraduate level, a bachelor of science in engineering degree is offered with majors in computer, electrical, interdisciplinary, mechanical, and product design and manufacturing engineering.

Cooperative education at ‘the University’ is mandatory for engineering students and consists of each student working full-time for three separate four-month long semesters (total event equivalence of one year of work) in an alternating co-op sequence. The intention is that the student works with the same organization for each of the three semesters. The cooperative education event happens during the last two years of the academic program.

The graduates from the ‘the University’ engineering program who began the first co-op semester in the summer of 2001 were the target group for this study. Purposeful sampling was used to learn in-depth information about 22 representative individual cases through interviews and review of student journals and co-op semester evaluations completed by students and worksite supervisors.

Twenty-one of the students interviewed graduated with a degree in engineering – one graduated with a degree in business. Eight graduates hired on full-time with the same organization with which all three co-op assignments were completed. An additional two graduates hired on full-time with the company where the third co-op assignment was completed (these two students had moved companies from the original co-op assignment because of poor economic conditions at the company). Ten graduates went to work for a company other than the one where any of the co-op assignments were performed.

Representatives from employer organizations participating in the cooperative education program were sampled to learn about the work environment aspect. Purposeful sampling was used based on the information gathered in the student portion of the study. Sixteen company representatives were used for this part of the investigation. In total, nine different organizations were represented by the sixteen total company representatives that were interviewed. Twenty-four unique organizations were represented in the study, with a mix of sizes from large to small: 17 manufacturing- and product-based employers; 4 engineering design or engineering service-provider employers; 1 governmental entity; 1 higher education institution; and, 1 transportation company.

CO-OP EXPERIENCE SOCIALIZATION MODEL

Through review and reduction of the data, a five-stage socialization model was developed to explicate the movement of students from outside the engineering education program to inside an engineering organization and occupational roles. The five stages of the model are:

- Stage One: Pre-Entry
- Stage Two: Match-Making for the Co-op Position
- Stage Three: Entry for the Co-op Position
- Stage Four: Match-Making for the Post-graduation Position
- Stage Five: Accelerated Entry for the Post-graduation Position

This paper provides a brief summary of the stages of the five-stage socialization model (see Figure 1). For a detailed description of the study and model components, please contact the author or see the full study (Plouff, 2006). The five-stage socialization model is consistent

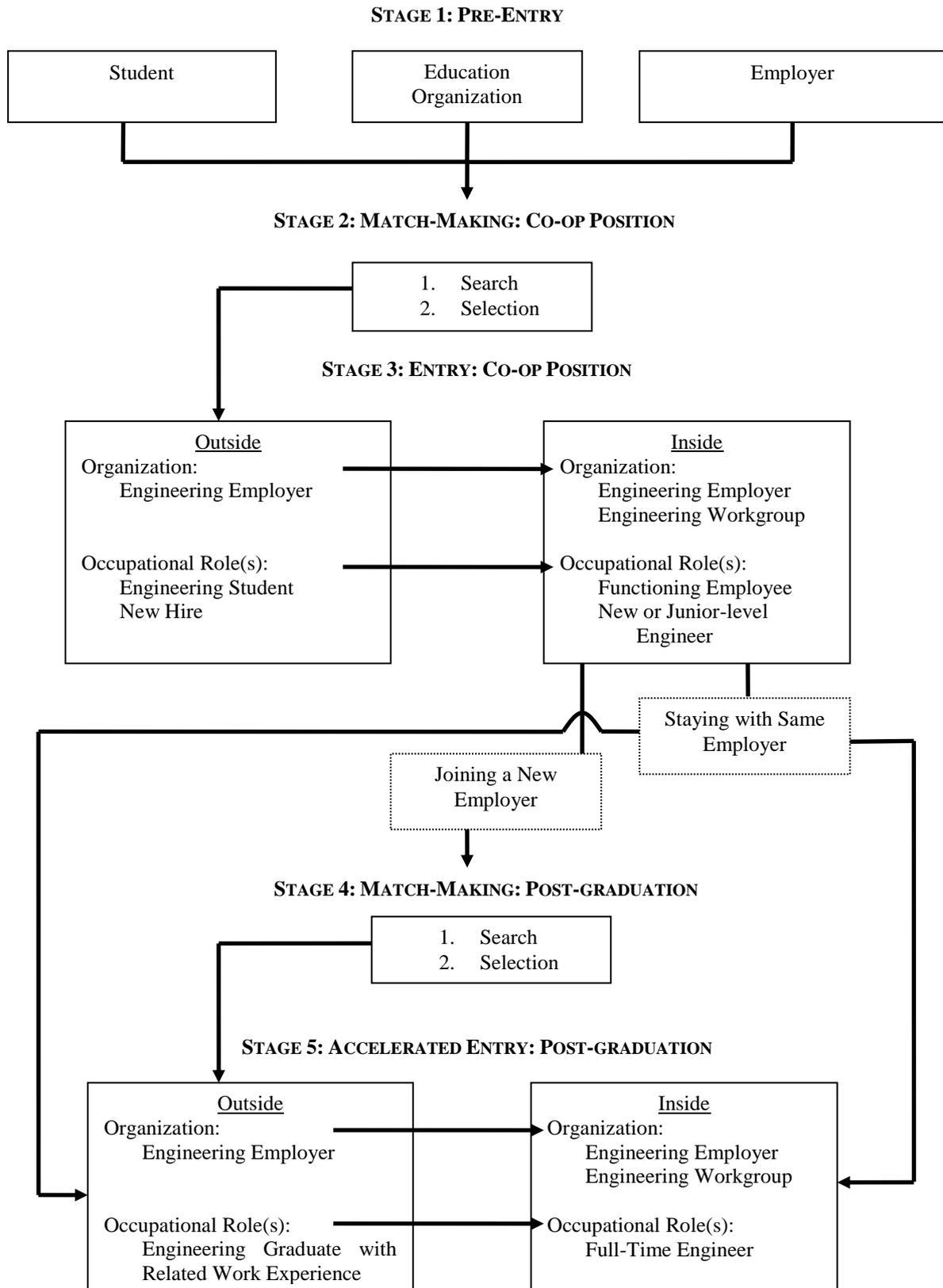


FIGURE 1: ORGANIZATIONAL OVERVIEW OF THE CO-OP PROCESS THROUGH POST-GRADUATION EMPLOYMENT

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with aspects of the first four stages of Schein's (1978) nine-stage model of the career cycle: (1) growth, fantasy, exploration; (2) entry into world of work; (3) basic training; and (4) full membership in early career.

The first stage was pre-entry and included student, education organization, and employer components. Influences for the student during pre-entry were the student's interest in the topic of engineering, where the student was from, prior work experiences, prior connections to the engineering field or profession, educational training, and expectations developed prior to beginning the co-op program.

The education organization acted as a training and screening agent of students prior to entry into an engineering-related organization and an engineering-related occupational role. The cooperative education program was the vehicle for moving a student inside the organization and occupational role, while the student was completing a degree.

Employers indicated five reasons for participation in a co-op program: to get work done at a reasonable cost, to hire new talent, to screen future full-time hires, to help students in the community, and to control the academic training. As with the student, the employer had expectations of the co-op experience, including skills and abilities the student should come to the organization already possessing and what the student should leave the experience with.

The second stage (match-making as part of the co-op program) and fourth stage (match-making post-graduation) consisted of two substages: search and selection. The outcome of the search and selection substages was an agreement between the student and employer to enter into an employment arrangement in a co-op or post-graduation full-time work capacity. The decision criteria for students typically included one or a combination of the following items: location, pay, company/work type, the people at the organization, or the number of employment offers. For the post-graduation match-making, most students were able to rely on network resources that were established through the co-op assignments or through classmates who also had completed co-op work assignments.

The third stage, and the focus of this paper, was entry to the co-op program. From an individual's point of view, entry into an organization "is the process of breaking in and joining up, or learning the ropes, or figuring out how to get along and how to make it" (Van Maanen, 1975). From the organization's point of view, this same process is marked by induction activities, basic training, and socialization of the individual to the norms and values of the organization (Schein, 1968). At the onset of the co-op program, the student began outside of the organization and occupational role and by the end of the program had gained some level of inclusion in each group or construct.

The fifth stage identified was accelerated entry for the post-graduation, full-time employment position, whether with the organization that hosted the co-op student during the co-op program or with a new organization. The socialization process happened at an accelerated rate because the student knew what to expect and had already experienced the activities and processes during the co-op program. Acceptance into the full-time engineering-related occupational role almost always happened more quickly than if a student had no prior engineering-related work experience.

ENTRY TO THE CO-OP POSITION (STAGE 3)

The third stage of the co-op experience socialization model was entry for the co-op position. There was a "feeling out" process between the student and the groups of people the student interacts with in the employer organization, with both student and employer groups trying to identify the fit both short-term and long-term with one another. Socialization is the process of the student breaking into the organization and an engineering-related occupational role. During the co-op experience the student moved from outside to inside the organization during the hiring process, during the orientation activities when the student began the co-op

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assignment, and by learning the company culture. The student moved from outside to inside an engineering-related occupational role through interactions with coworkers within the workgroup and through the work assignments.

The entry stage consisted of teaching the student what needed to be known in order to successfully enter the organization and occupational role. Students are expected to learn rules and regulations, norms and expectations, cognitive categories and scripts, and affective processes by means of tactics that are both employer-driven and student-driven. Expectations for what is learned is consistent with the elements of the three-pillar paradigm of Scott (2001) and the work of Greenspan and Shanker (2004) and Homans (1950) on affect. Regulative processes/activities rely on rules, laws, and power systems to coerce people into conforming. Normative processes/activities teach organization and group norms and help define roles and jobs. Cognitive categories and scripts rely on mimetic mechanisms and a person learning by copying and/or adopting the behaviors, actions, and beliefs of others. Affective processes refer to emotion, sentiment, and motive. The tactics can range from being formally to informally communicated or presented, and consciously enacted to taken-for-granted. The tactics define how the organization members display, project, communicate, and teach the student, and evaluate worthiness of the student for acceptance into the organization and occupational role(s).

Entry to the organization contained aspects of all four categories of “what was learned.” Rules and regulations were an important category, including many of the first tactics used by the organization upon entry after hiring the student. The number of tactics used to communicate norms and expectations and cognitive categories and scripts during entry to the organization was similar to the number of tactics used to teach rules and regulations. Affective processes were identified but were more generalized and symbolic than the impact affective processes have in the entry to occupational. All four categories were also identified for entry to the occupational role. However, there was a different composition of the “what was learned” as compared to entry to the organization. There were very few rules and regulations being taught for the entry to the occupational role(s). There were predominantly tactics used to teach norms and expectations and affective processes.

The two entry processes contained some common tactics, but were distinctly separate and identifiable, with different purposes and desired outcomes. Entry to the organization focused on teaching the student what all employees need to know, regardless of what group, or subgroup, the employee belonged to in the organization. Therefore more (but not only) formal tactics were used in order to ensure consistency organization-wide with certain elements important to the organization, most often in the forms of rules and regulations and cognitive categories and scripts. Entry to the occupational role was concerned with the student learning about what to do and how to behave and act (norms) within expectations of defined jobs and positions. It was a much more narrowly focused process and therefore relied on more individual and informal tactics enacted by a person (a mentor) or smaller group (subset) of the organization, most often in the forms of norms and expectations and affective processes.

Entry to the Organization

Figure 2 provides a detailed overview of a student’s entry to an organization through a co-op (or internship) program. Making it inside the organization included two general components: orientation tactics and other cultural/environmental tactics. Many of the organizations had some form of company-wide orientation program for new hires that was typically coordinated by the human resources office. This program often included an overview of company policies or procedures (such as filling out timecards), an overview of company systems (such as computer login and intranet usage), and training (such as safety in

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the facility). More elaborate orientation programs existed at some organizations and included facility tours, presentations by group and company leaders, and lunch gatherings. There was also evidence of orientation taking place within the workgroup or departments where the co-op student worked. However, these were more often unplanned and less formal and involved getting to know the people, places, and tools the student would be working with.

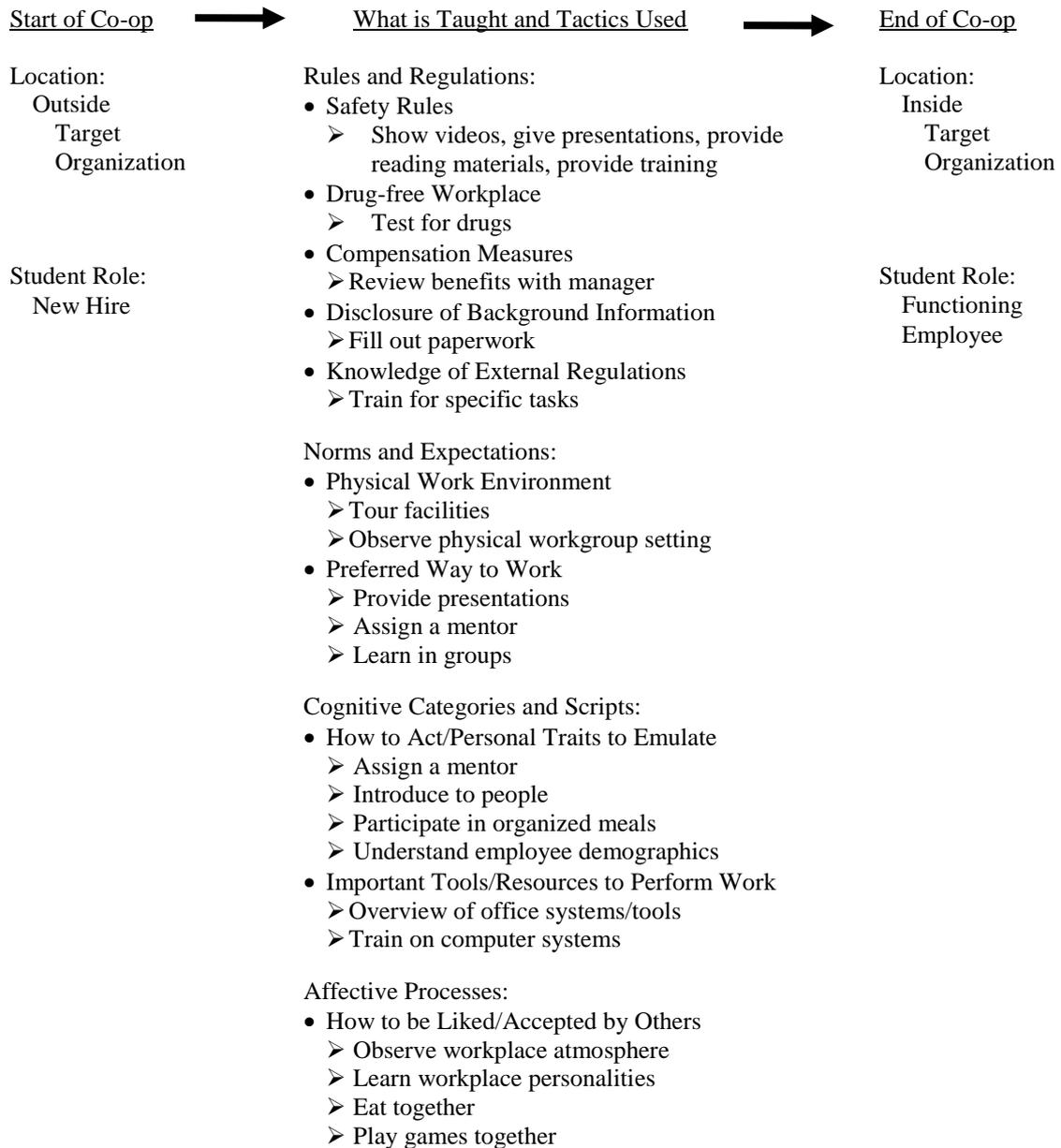


FIGURE 2: STAGE 3 – ENTRY TO THE ORGANIZATION THROUGH A CO-OP PROGRAM

Communication of rules and regulations by organization members was an important first step when students entered the organization. This process was often formal and planned and occurred within the first two weeks of starting work at the organization. Many of the rules and regulations were communicated by people in central management functions within the organization (human resources personnel, department managers, etc.). The purpose was for everyone in the organization to have the same set of rules and regulations by which to abide.

Norms and expectations and cognitive categories and scripts were also an integral part of the entry to organization process. The student was expected to learn how to act and what was

acceptable or unacceptable behavior within the organization. Affective processes that were identified tended to be fairly generalized and symbolic. The result was that the student experienced affect associated with the organization, but not as strong of an emotional connection when compared to the affective processes used in entry to the occupational role.

More often than not, students gathered information about company culture through observation and talking with their coworkers and/or mentors. Some organizations were very fast-paced and the people were driven by production goals, while others were “laid-back” environments and people were more easy-going. Getting to know and understand the employer organization culture involved environmental factors, peoples’ attitudes, and student-mentor and student-workgroup activities. The environment consisted of the type of atmosphere (easy-going, professional, etc.) and the physical setting (office layout, etc.).

Mentors were identified as important people within the entry to the organization process, as the mentor communicated various norms and expectations, types of information, and affective processes to the student. This finding is consistent with the findings of Louis (1980) and Reichers (1987), who found that mentors are an important agent of socialization. Ostroff and Kozlowski (1993) also found that newcomers learn more about an organization if they have mentors. Blau (1988) determined that an intern-manager relationship has a direct effect on socialization outcomes for a newcomer. The organization assigns the mentor as a person trusted to help the student learn and understand many of the various key aspects of the organization.

Entry to the Occupational Role

Figure 3 provides a detailed overview of a student’s entry to occupational roles through a co-op (or internship) program. The tactics used for movement of a student from outside to inside an engineering-related occupational role ranged from being either formally or informally and consciously or unconsciously (taken-for-granted) enacted. Different from the entry to the organization process, the predominant categories identified were norms and expectations and affective processes. There was very little indication of rules and regulations discussion for entry to the occupational role, although rules and regulations were an important aspect of the entry to the organization. Entry to the occupational roles was much more concerned with learning how things are done and how to act within the workgroup and gaining acceptance from the workgroup members.

The students learned about, and gained access to, various occupational roles within the engineering-related organization through interactions with members of the workgroups and through work assignments. Some workgroup interactions were employer-driven (originated from employer action or activities) and others were student-driven (proactive actions or activities by the student). Several of the students experienced forms of testing and challenging by their coworkers before they were allowed inside the workgroup or team. These activities included making fun of the new person because of the lack of knowledge of what was supposed to be done, and questioning the student’s understanding and ability. There also was evidence that many coworkers were friendly and helpful to the co-op students and were able to assist the students with understanding how to cope and manage in the new engineering-related occupational roles.

Students were expected to prove knowledge and ability to perform engineering-related work by first demonstrating the ability to learn and accomplish small tasks. Many of the students were simply given reading assignments or computer tutorials to complete during the first few days. The student was either encouraged, or expected, to ask questions in order to learn what to do. Eventually the student was given assignments to demonstrate the ability to handle more responsibility. More increasingly complex and meaningful assignments were given to the

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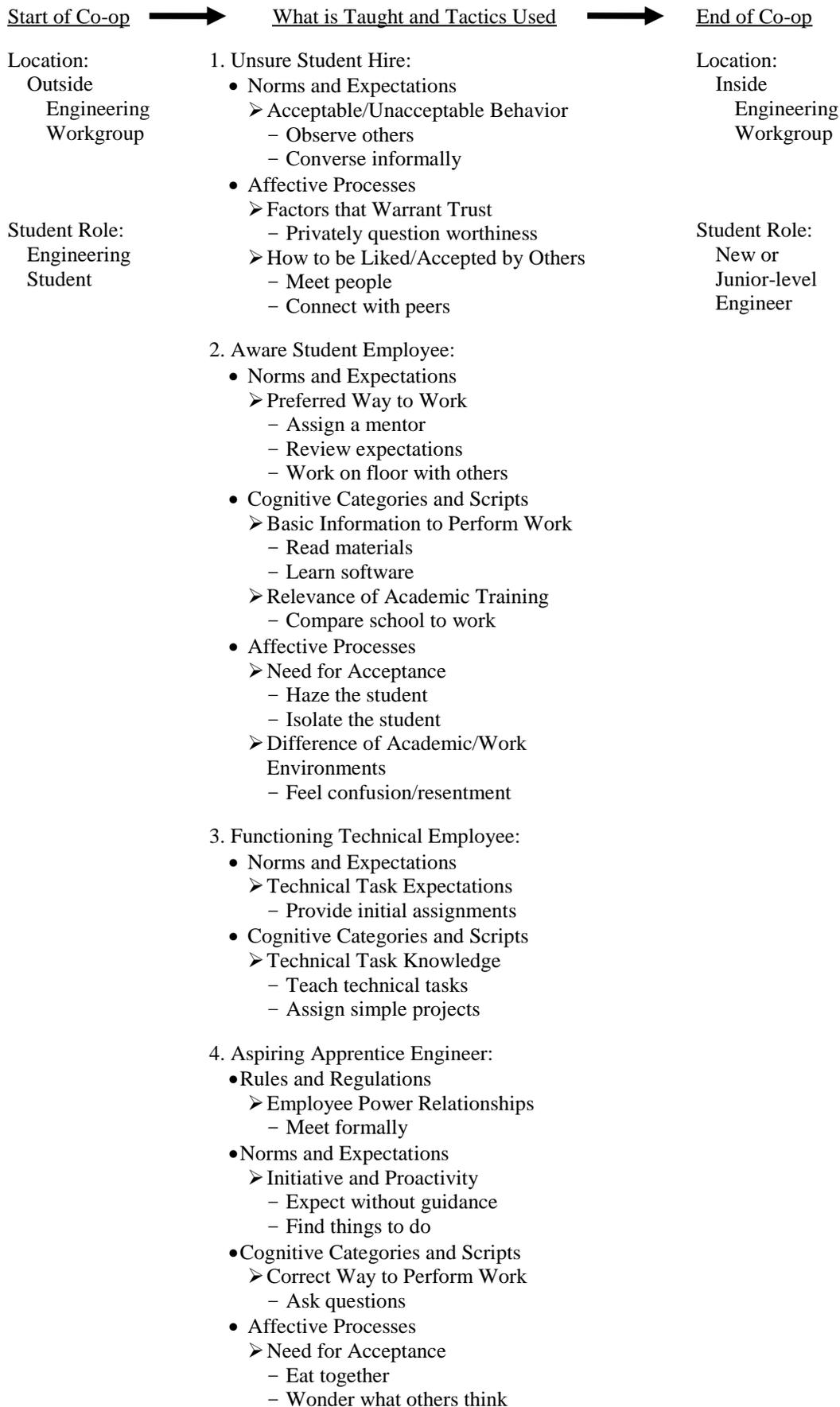


FIGURE 3: STAGE 3 – ENTRY TO THE OCCUPATIONAL ROLE THROUGH A CO-OP PROGRAM

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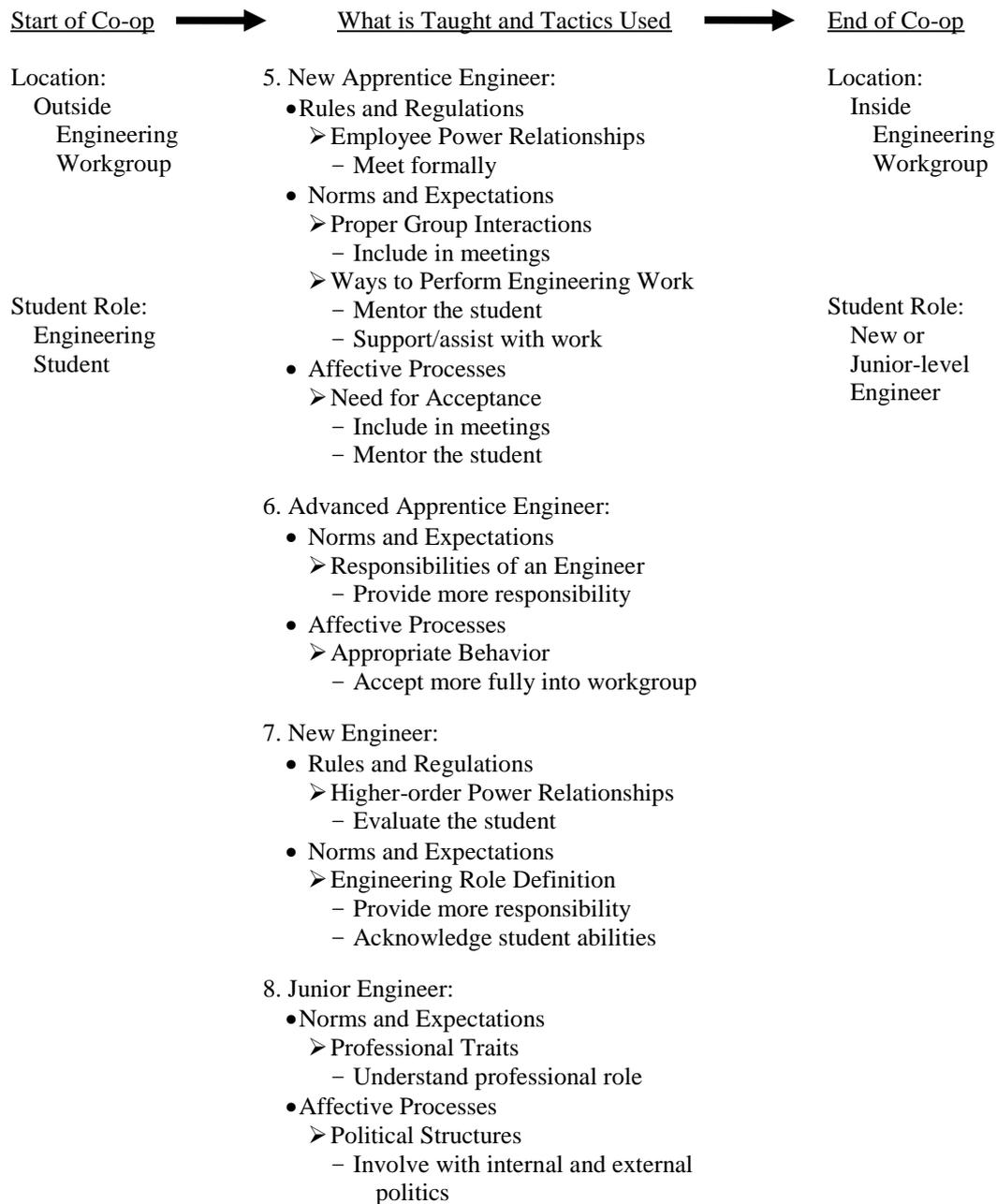


FIGURE 3: STAGE 3 – ENTRY TO THE OCCUPATIONAL ROLE THROUGH A CO-OP PROGRAM (CONTINUED)

student until the student was accepted as part of the work team and had regular responsibilities like other members of the workgroup.

There was an eight-phase process associated with entry to the occupational role consisting of the following student-centered role phases: unsure student hire, aware student employee, functioning technical employee, aspiring apprentice engineer, new apprentice engineer, advanced apprentice engineer, new engineer, and junior engineer. Not all students began at the same phase, nor did all students progress through each phase. Some students even moved forward and backward in the phases, particularly after starting the second or third co-op semester and having gone back to the university between co-op semesters. Finally, not all students progressed to the same final phase, although no students interviewed for this study progressed further than the eighth phase.

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Initially, most students moved from being a new hire (phase 1) to a functioning technical employee (phase 3), completing technical tasks such as CAD work, machine maintenance, and paperwork/documentation. In between, the student went through a phase named “aware student employee” that consisted of the student becoming aware of the difference between his/her academic training and the application in the work environment. This phase is consistent with the first stage of Wanous’ (1992) four-stage model of the socialization process, which consisted of confronting and accepting organizational reality, including confirmation/disconfirmation of expectations, conflicts between personal job wants and organizational climates, and determining which personal aspects are reinforced or punished by the organization.

At some point, the student desired to move beyond (or the employer pushes them to move beyond) the technician role and moved to an apprentice engineer role. If the student proactively sought this role, the student went through an “aspiring apprentice engineer” phase (phase 4) where engineering-related work was sought out. Once the engineering personnel in the employer organization were comfortable with the student and his/her abilities, the student moved into a “new apprentice engineer” role (phase 5) where he/she was mentored by the engineering staff and worked on engineering-related projects. Phase 6, the “advanced apprentice engineer” role, consisted of the student gaining more confidence from the engineers and therefore gaining more responsibility with less supervision. This included learning which modes of behavior were congruent with those of the organization, resolution of conflicts at work, commitment to work, and establishment of an altered self-image and adoption of new values.

After the student proved his/her ability to the engineers in the organization, the student was given his/her own projects. At this point, the student became a “new engineer” (phase 7). The final phases of this eight-phase process included detection of signposts of successful socialization, high satisfaction, feelings of mutual acceptance, job involvement, and achievement of organizational dependability. Many students reached the “new engineer” phase by the end of the three-semester co-op experience. Some students moved further and enter phase 8, which is named a “junior engineer” role. At this phase, the student functioned as an engineer in the organization and moved further inside the engineering profession, gaining responsibility for external correspondence with customers and becoming involved as a semi-equal in internal group politics.

Outcomes of Entry and Socialization

Thirteen employers were successful in retaining 18 unique students for all three co-op assignments. Ten students went to work full-time post-graduation with the employer where the last co-op semester was completed. All but one student were successfully socialized to an engineering-related occupational role by the end of the co-op program. Twenty-one of the 22 students interviewed were working in engineering-related positions five years after graduation, indicating that all but one student were successfully socialized to the engineering-related occupational roles after completion of the co-op program.

CONCLUSIONS

A five-stage socialization model was developed that explains the movement of students from outside the engineering education program to inside an engineering organization and occupational role. Specifically, the third-stage was detailed and explained which consisted of entry to the workplace organization and occupational roles. This stage is critical because it makes sense of the process of effectively moving from the educational environment to the practice-focused, professional environment. While there are examples where not all tactics explicated in the model are used, this model provides a comprehensive description of the

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tactics and processes used for successful transition into the workplace. Most importantly, the model can be generalized to describe entry processes to new work experiences for any STEM field.

Because the entry processes are predictable, participants can become better informed and trained prior to beginning, and during, the work experience. Understanding what to expect prior to beginning the experience will allow students to anticipate strategies and tactics, experience less anxiety associated with the unknown, and prepare to cope with the strategies and tactics. Instructors or advisors can better train students prior to the work experience. The depth of description and understanding of the entry process will help the education organization to more effectively evaluate potential employer sites and to develop better experiences for the student (in conjunction with the employer). The education organization will also be able to assist the employer in understanding how to effectively socialize the student, including training of employer members. Finally, employers will be able to plan more effective entry strategies and tactics and retain the students after the work experience.

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