Developing Student-centered Partnerships: Professional Socialization and the Transition to Industry

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Introduction

There is a persistent dialogue among academic and industrial stakeholders regarding the ability of students to transition into full-time engineering positions in industry [2, 3]. Engineering educators and professionals have contributed to the conversation by suggesting the need for broader collaborations between academia and industry[4, 5]. Academic-industry partnerships have resulted and have led to significant benefits for both academic and industry stakeholders. Academia cites gaining funds to support research, testing theory in empirical environments, exposure to industry problems and expertise, and establishing future employment connections for students as benefits[6-8]. Industry members cite access to new research techniques, development of new products and patents, generating knowledge and advancing technology by using faculty and student expertise, and engaging with potential employees [9-11]. Current literature offers evidence that partnerships generate benefits at both the macro level (organization) as well as at the micro level (individual student/employee).

Yet there appears to be some conflict with research and practice as evidenced by continued conversations about career readiness of graduates, debate about the skills required for early career success, and high attrition rates of early career engineers in the first five years in the engineering workforce [12-14]. We illuminate this contrast to suggest that academic and industry partners who benefit from establishing future employment connections for students can be more strategic in the design of partnerships to address these issues.

One way the skill gap can be narrowed is through designing partnerships in an intentional manner so that they support engineering students' professional socialization. Professional socialization refers to the process whereby a student acquires knowledge, gains experience to develop needed skills, and adopts professional values that lead to a successful start in an engineering focused industry career adapted from [15]. In this view, student career readiness and retention in full time roles are addressed by providing students with work experiences that include challenging technical assignments, engineering mentors, and responsibilities that mimic what one would expect in an engineering full-time position. Although some existing partnerships provide similar experiences, we offer professional socialization as a framework to consider the impact experiences have on career readiness and retention outcomes throughout a partnership's life cycle.

In this paper, we describe how an existing partnership model, the Academic to Industry Developmental Program (AIDP), informs professional socialization in the aerospace industry. We first expand our discussion of professional socialization as it relates to engineering students. Next, we describe the AIDP, with emphasis on the Academic Design Center level, and conclude by describing how the AIDP supports professional socialization of students using discussions with key informants.

Theoretical Framework-Professional Socialization

Professional socialization refers to an individual's identity development within a specific profession. In its most basic form, socialization relates to "the process by which persons acquire the knowledge, skills, and dispositions that make them more or less effective members of their society" [16]. Weidman, Twale, & Stein expand this definition by stating that professional socialization refers to the process whereby a student acquires knowledge, gains experience to develop needed skills, and adopts professional values that lead to a successful start in their career [15]. In essence, students should be able to answer three questions as they progress through the professional socialization process:

1) What do I do with the skills learned?
2) What am I supposed to look like, and how should I act in my professional field?
3) What do I, as a professional, look like to other professionals as I perform my new roles? [17].

Researchers have offered multiple and complex conclusions around professional socialization and its contribution to identity formation [18, 19]. Several studies have used the framework to explore undergraduate, graduate, and faculty member socialization in the academic environment [20-24]. Fewer researchers have utilized the framework in an industry environment or academic-industry partnership context. Although, few researchers have examined the engineering context directly, we highlight one example to illustrate the utility of the framework.

Cech et al. [25] used professional socialization to argue that experiences that occur during professional training, e.g. co-op or internship experiences, cause men and women to develop different confidence levels about participating in the engineering community. Authors analyzed survey responses from 288 students at four institutions to examine behavioral and intentional persistence among students who enter an engineering major in college. Findings identified differences in male and female students career fit confidence offering another reason why women were more likely to leave engineering after graduation [25]. Cech et al.'s findings suggest it is important to consider the impact of professional socialization when examining interactions engineering students have with industry. The authors illustrate how the framework can be used to explain gender representation differences in engineering.

Our intent for this paper is to use professional socialization as a lens to examine the value that an AIDP brings to a students' engineering identity formation, not to provide a full review on this topic. We focus on three outcomes of professional socialization to guide our discussion of how elements of an engineering academic-industry partnership support professional socialization. Figure 1 presents a summary of elements found in the literature to support professional socialization in various professions [15, 26].

Through this lens, stakeholders from other academic-industry partnerships can take a closer look at how designing experiences to support students to gain knowledge, skills, and values that can help narrow the skill gap and increase career readiness to support retention in full-time roles in engineering. Through this socialization, we propose that engineering students are able to make more informed decisions about finishing their respective engineering curriculum, entering into an engineering career field upon graduation, as well as how long they stay in that chosen career field. Industry and academic stakeholders can better understand student decisions to more purposefully direct and educate students for career roles prior to major selection and during major exploration.

Professional Socialization

Students acquire knowledge:	**Students gain and develop needed skills:**	**Students adopt engineering professional values:**
• Industry experiences must expand the university education • Opportunities for students to reflect on successes and failures during work experiences • Presence of qualified role models	• "Social learning"—individuals "learn- (ing) the ropes" from those around them through careful listening and observation [1]. • Learning the technology and language of the profession • High quality skill training, facilities, and equipment	• Adopting the profession's values and norms into one's belief system • Identifying with the profession • Incorporating one's professional role into other life roles • Adjusting to changes in personal and professional roles at the start of one's career

Figure 1. Components of Professional Socialization

Academic to Industry Developmental Program (AIDP) Description

Program History: The development of the AIDP began in 2001 while the developer, Mike Warburton, worked at a large aerospace company as the Chief Functional Leader for the Mechanical/Structural Engineering (MSE) team within the Defense and Space business unit. As the Functional Chief Engineer for the Philadelphia MSE team, Mike Warburton sought ways to “build” a strong technology focused team as well as retain the best engineering personnel over the upcoming years. Also serving as hiring leader, Mike Warburton began to seek out who were the most productive personnel. He quickly identified that the most productive and innovative personnel within his group of 700 engineers were actually the employees who had been within the large aerospace company the least amount of time; many of the high performers were either students on internship or co-op assignment or recently graduated engineers.

These findings led Mike Warburton to develop an opportunity to increase team performance by integrating student engineers into a focused business model and at the same time enhance students' visions of what it was like to work as an engineer within a large aerospace company. Mike Warburton identified approximately ten universities and focused certain technical skill sets to each –e.g., Drexel (Structures Design), Penn State University (Structures Analysis and VR), Stanford (Topological and Multi Disciplined Optimization), UCSD (Structures Testing).

The program was developed in phases with the goal of providing a better, more integrated “thread” between student employees and the needs of the large aerospace company’s program teams. In 2005, the AIDP as described here with four integrated “tenets” was developed (see Table 1). Many aerospace and defense companies have benefited from university relations and using internships as testing grounds for hiring. Additionally, most of these firms also have at least several overlapping corporate organizations focused solely on the integration with academia on research and development (R&D) as well as a provider of resource pools of talent. However, to date no single company or university (we have found) has a complete AIDP construct being executed. To that end, the AIDP construct is the actual threading together of all four tenets focused within company needs and university strategies.

Table 1. Academic to Industry Developmental Program

Tenets of “Academic Interaction”	**Description**
Core engineering classes	Provide a feedback loop into undergraduate and graduate coursework to more closely align with industry standard tools and practices.
Design Project Based Training	Identify and support relevant “Design/Analysis” projects that address real world problems of clients and the aerospace industry in general. The goal is to incorporate this early on in curriculum.
Academic Design Center	Utilize undergraduate engineering students to execute actual work packages, exposing them to real designs, technologies, and program pressures currently found on the industry partner’s platforms.
Core Technology Research	Both Basic and Applied –focused on strategic needs.

Paper Scope: For this paper we focus on the Academic Design Center level of academic interaction, which can be thought of as an engineering lab space fully equipped and managed to handle low and moderately complex work packages requested by the industry partner. Also, for this discussion, we focus on a single and ongoing AIDP partnership. Three strategic partners are engaged: 1) Academic Partner, 2) the Industry Partner, and 3) the Engineering Services Partner. Each partner's role is outlined in Table 2.

Within the Academic Design Center is the Co-op Development Program that aims to develop the next generation of the workforce through intentional personal interaction and formal and informal evaluations. The program provides professional guidance from an Engineering Services Partner to students via full time engineering mentors, skill recognition via IQ evaluations and strengths assessment, and personal goal setting through individuals goals assessments and entry and exit surveys. These program components allow students to identify and harness their abilities with the vision that students will leave the program as a more competent engineer and better equipped for the workforce at large.

Table 2. Academic Design Center Partner Descriptions

Academic Partner	• Private university with an ABET-accredited engineering program • Houses a comprehensive and world-renowned cooperative education program that provides for 18 months of co-op experience to students spread over three cycles of equal duration (six months each). • Supplies student candidates for co-op position
Industry partner	• Large engineering firm in the aerospace industry • Supplies work packages, software and hardware access, and technical expertise • Client to Engineering Services Partner to execute the AIDP
Engineering Services Partner	• Third party engineering services company contracted by Industry Partner to manage day-to day operations of AIDP • Responsible for the operation and performance of the project throughout the entire cycle from student recruitment and hiring, training, business development, work package execution, status reporting and student performance evaluations. • Support the Industry Partner's recruitment efforts of the top tier students upon graduation and also provide a secondary employment market for candidates who do not join Industry Partner's team • Employs students at an Academic Design Center that is offsite of the main industrial manufacturing site.

Program Status: A large aerospace company's Philadelphia Design Center has been executing the Academic to Industry Developmental Program (AIDP) concept, which increases the large aerospace company's involvement throughout the college experience, thereby helping develop the future workforce. At this level, engineering students work on site at the large aerospace company's facility or at the Academic Design Center office facility both located in Philadelphia, PA during cooperative education assignments. Now that co-authors Mike Warburton and Chris Ciechon have left the large aerospace company and the engineering service partner, respectively, to join engineering services companies, they now propose the AIDP to all of their strategic clients as a direct part of their engineering solutions business model and partnership construct.

AIDP and Student Professional Socialization

In this section, two co-authors serve as key informants to identify specific program elements that map to three outcome components of professional socialization. Key informants include Mike Warburton, AIDP Developer, Chief Operating Officer/Chief Engineer at Akka Technologies, US; Former MSE Chief Engineer at a large aerospace company and Chris Ciechon, Former General Manger of AIDP, Director of Business Development at Butler America; Former Engineering Manager at an engineering services firm. By mapping the AIDP to the professional socialization framework, we identify program elements that support how students acquire knowledge, gain and develop skills, and adopt professional values. We recommend existing programs examine their program offerings in light of the framework to identify opportunities to add or adjust elements to address student career readiness.

Student acquires knowledge. Students acquire knowledge through a combination of formal training in industry toolsets and direct application of those tools in an experienced based learning environment. Students are coached and mentored by industry veterans as they perform real world tasks that are part of the engineering product life cycle. A continuous feedback loop as part of the mentoring program reinforces positive behaviors and attributes and identifies areas for improvement.

In addition to technical knowledge, students also gain the supporting knowledge of how their direct engineering interests fit within a research and development setting in a large company. Since much of the R&D will be applied R&D within an industry specific focus area, students have some opportunity to target their experiences in actually performing engineering work within the company while still taking classes and perhaps working with professors and department heads on established research focus areas. Students might even generate new knowledge suggesting new areas of need and crossover for research.

Students gain and develop needed skills. The AIDP training program has been continuously evolving over the past three plus years, incorporating lessons learned and new tools and technologies. Engineering managers actively seek out documented feedback from the student workforce as they near completion of their co-op regarding the effectiveness of and value added by the training program. Particular emphasis is placed on relevance to their actual work experience, and content and duration of each topic. Additionally, managers continuously improve their training experience by varying the delivery method of the subject matter through the coursework (i.e., lecture, workshop, self-guided, web based as examples).

At least six weeks prior to the start of a training cycle, a team meets to review the effectiveness of the prior training round as well as its relevance to the work planned for the incoming students. This participative approach includes the best ideas from the entire staff, which also includes current students. As a baseline, training is on ENOVIA, CATIA, Patran, Nastran, MS Office, Siemens TeamCenter and client specific tools. The prior training agenda serves as a starting point and is modified as appropriate for ongoing and planned work.

Once the training agenda has been finalized, team members serve as the teacher for each subject area. The training team includes the program manager, project managers, lead engineers, designers, and co-op students. Also, current co-ops (as appropriate) serve as teachers to their student colleagues. This arrangement is an excellent means of knowledge transfer and serves to recognize top performers. Regardless of the level of the teacher, he or she is considered an expert in the area in which he or she will be training students. This decision was made to provide the dual benefit of having a subject matter expert give the lesson while spreading the teaching task across the whole team. In this way, current students may further develop their knowledge on the skill they are training, and new students gain skills from a relatable trainer.

Each designated trainer has responsibility for developing his or her course materials. A data store of all training materials is maintained and in many cases there is “prior art” available from which to base the teaching plan. Final training materials are compiled and approved by the program manager no later than one week prior to the start of training.

It is worth noting that the entire four plus month cooperative experience can be viewed as one long training session. Experience-based learning happens through the execution of work packages. The training program, therefore, provides the students with enough skills to start work. In the early stages of each co-op cycle, there is substantial Q&A between students and technical leads to foster additional skill development.

Students adopt engineering professional values. Students demonstrate that they are adopting engineering professional values that lead to a successful start in an engineering focused industry career through their increased participation in the AIDP both onsite at the Academic Design Center and offsite at their university.

At the university level, students may have the opportunity to participate in either setup or administration of new course material or lead course discussions. With industry experience, students return to campus with an applied engineering perspective that can foster more classroom engagement for the student. Students may also share their knowledge through formal presentation or informal conversations with classmates. These experiences continue to promote the development of engineering values because students discuss tools and processes which are established within industry as well as keep creative part of brain sharp by communicating technical expertise to varying types of audiences.

The true power of the AIDP to support students adopting professional values is realized when students participant in multiple co-op rotations. The more experiences students have with engineering professionals, technical projects, and supportive mentoring the more likely they are to understand what it means to thrive as an engineer within a large aerospace company. Through multiple rotations, students are able to participate in the engineering research to practice cycle by continually building on their engineering curriculum to understand the applied versus theoretical view of engineering. These experiences provide students with more understanding of their future role before actually being a “hired” engineer, reducing the probability of that student leaving either the company or the industry before five years.

AIDP and Addressing Career Readiness, Skill Gap, and Attrition

Career Readiness. The power of the AIDP becomes evident once a student graduates and enters the workforce. From the perspective of industry, the “newbie” learning curve is almost entirely absent. The AIDP graduate is fully versed in the tools and techniques required to perform tasks immediately as a productive member of their team if the student decides to pursue a similar full time role in the aerospace industry.

From a student perspective, there are likely few, if any, surprises with regards to the nature of the work environment, the expectations of management, the areas of specialization available within their chosen discipline, and the qualities and character traits necessary for a successful career.

Skill Gap. The direct application of skills and knowledge gained through performing real engineering work in an industry setting is the most powerful element of the program. Many schools attempt to simulate this experience through design projects and the like, yet the work performed in the AIDP is not, and cannot, be “graded on a curve.” At work, a project either succeeds or fails, and there is no partial credit. This higher standard of acceptance demands that the students develop the required skills rapidly in a fast paced environment.

Attrition. The AIDP is indeed a ‘try before you buy’ opportunity for all parties concerned. Industry has the opportunity to evaluate potential employees based on actual performance on real work. Correspondingly, students can evaluate potential employers and industry sectors through the same exposure and experience to ascertain whether their abilities, and most importantly their interests, align with the expectations and needs for success in a particular field.

As an example, in more than a few cases perceived ‘performance problems’ had as their root cause the student’s discovery that they have no interest whatsoever in the field in which they are performing their co-op. This ‘successful failure’ is precisely the point of the AIDP. All stakeholders benefit from this determination prior to career start. The results are that the students who are the most interested in the field to which they have had exposure pursue it upon graduation. These students also tend to be the highest performers during their co-op. As new hires, these candidates are much more likely to ‘stick’ over the long term.

Implementation Challenges

Although the AIDP model has proven to provide tremendous benefit to students, industry and academia, implementation has faced significant challenges. Several major challenges are discussed in the following sections.

"Not invented here" and "Too Many Masters" politics (Company and University). The largest hurdle faced with the implementation of the complete AIDP within an existing company has been the "not invented here and by me" syndrome. The scale of an AIDP effort within the Industry Partner was so large that it actually crossed into and threaded together three separate business units and teams:

1) Human Resources Department: University Relations and Staffing Organizations – who had responsibility, accountability, and authority for university campus plans, general hiring and recruiting, etc.

2) Commercial, Defense, or Space Business Units: Individual Programs who "owned" the actual day to day work packages, funding for work efforts, and applied research "needs" for their respective technology teams

3) Engineering, Operations, and Technology (EO&T): Skill-Based Functional Engineering Teams who served the specific career aspirations of the engineers as well as general applied R&D technology plans and roadmaps that tied with specific universities.

Because the initiative overlaps major business units within a large company, plenty of coordination is needed along each step of the way to be successful. For an AIDP to be implemented, such coordination would have to be established up front in the initial stages and constantly enhanced along the way so that ownership challenges could be overcome.

Cannot easily alter or modify course material (University). Many of the universities that were approached by the AIDP (over 20) have not taken kindly to potentially having their course material altered without direct financial support to do so. Requests have come in for cash (as part of The Industry Partner's Campus plan), additional research opportunities (from EO&T), or with in-kind payment (e.g. free teachers, free licenses, etc.). In one example, it took three years to introduce two courses in Design and Analysis. Even though a large aerospace company's technical fellows developed and taught the course (both virtual as well as onsite) and the university received more than 10,000 free licenses of CATIA V6, the university said that they needed to be paid for the "lease" of the classroom even though no time was expected from administrators or professors. Industry partners should expect some resistance when proposing curriculum alternations and work to understand curriculum modification process at individual universities.

Balancing work complexity and student interest (Student). Providing an engaging environment that facilitates the expansion of the students' minds and career horizons while executing low to moderately complex work packages requires as much art as technical and project discipline. Recognizing that the student is the key to the success of the effort both in a business sense as well as serving the broader strategic imperative of industry is a fundamental concept that must guide the operation and management of the AIDP.

Also, the training and early operational phase with a new group of students is a challenging time for everyone. Students want to do a good job and impress their potential employer, and the client expects a continuous stream of quality output. Team leads are taxed with the double duty of performing on task while dealing with the student learning curve.

Recommendations for Implementation

Noting the discussed challenges, there are several recommendations that can address both organizational and student level challenges.

At the organizational level, the following factors are critical: top-level buy-in, support, resources, strategic planning, and timeline placement. Specific recommendations at the organizational level are as follows:

- Plan a strategic AIDP 6 months in advance with 1 or 2 universities (if you are a Company) or with 1 or 2 companies (if you are a University).
- Company and University should tie the AIDP to their strategic research and development planning for the upcoming year
- Companies should utilize AIDP planning within their business model to reduce Non-recurring engineering labor hours by 25%.
- Utilize one strong “Champion” within each Company and University that has political “pull” and capital at the highest levels.

Specific recommendations at the student level are as follows:

- Student buy-in and participation is crucial, particularly for the success of the Academic Design Center Co-op Development Plan. Students must be made fully responsible for their success. Students must be surrounded with experienced staff that are passionate about people and have the skills and abilities to be coaches and mentors. “People Development” must take center stage while delicately balancing the business realities and near term objectives of stakeholders on all fronts. Enabling personal development of others and taking a small part in their success is a rewarding endeavor.

- Managers must be extremely careful about the level of complexity of the work accepted into the AIDP. The work must match the abilities of the student learner. An early mistake is to perform projects that are of such low complexity as to assure success (e.g., activities such as data entry). These projects typically fail because of lack of student interest in the work. On the other hand, work that is even marginally too complex will lead to frustrated students and clients. Finding the right balance is difficult and is more art than science.

Summary

Figure 2 summarizes specific elements of the AIDP that align with components of professional socialization. We offer this example as one framework to think through the design and contributions of academic-industry partnerships.

Professional Socialization		
Academic to Industry Developmental Program		
Partnership Members: Industry Partner + Engineering Services Partner + Academic Partner		
Students acquire knowledge:	**Students gain and develop needed skills:**	**Students adopt engineering professional values:**
•Formal training in industry toolsets •Direct application of those tools •Coaching and mentoring by industry veterans •Performing real world tasks •Student tailored experiences	• Robust training program ○ Continuous evaluation and improvement of student training ○ Participative and team based training approach ○ Student led training opportunities • Experience-based learning through the execution of work packages • Substantial Q&A in early stages between supervisor and student	• Participation in either setup or administration of new course material • Contributing to course discussions with an applied engineering perspective • Active participation in the research to practice cycle • Exposure to engineering professionals, technical projects, and supportive mentoring

Figure 2. Professional Socialization applied to AIDP

Conclusion

In this paper, we offered a framework for developing student-centered partnerships that support the school to workforce transition for engineering students. We used professional socialization as a theoretical framework to illustrate the value that academic-industry partnerships can bring to students' professional identity development. A three-entity partnership involving a large aerospace industry partner, engineering services partner, and an academic partner was used to describe how the Academic to Industry Developmental Program (AIDP) supports professional socialization within the aerospace industry. Students acquire knowledge through student tailored experiences, mentoring, and real world assignments. Students gain and develop needed skills through experience based learning and a robust training program. Students adopt professional values via exposure to engineering professionals and active participation in coursework, research, and technical projects.

Similar approaches in partnering may lead to increased career readiness, narrowing the skill gap for graduates seeking to enter engineering industry, and reducing attrition of engineers in the first five years on the engineering industry pathway. Academic stakeholders make advances through improved curriculum and tailored student experiences. While, in turn, industry stakeholders complete project deliverables and simultaneously train the future engineering workforce.

Next steps consist of exploring the impact of the AIDP from the student perspective. Former participants will be interviewed to explore what experiences students viewed to impact their career decision to pursue a full time role in engineering industry.

References

[1] A. S. Messersmith, "Becoming a nurse: The role of communication in professional socialization," PhD, Department of Communication Studies, University of Kansas, Kansas, 2008.

[2] American Society of Engineering Education (ASEE), "Transforming Undergraduate Education in Engineering," Washington, D.C.2013.

[3] National Academy of Engineering, "The engineer of 2020: Visions of engineering in the new century," Washington, DC2004.

[4] M. G. Angolia, J. L. Pickard, L. R. Pagliari, and C. J. Lesko, "Building sustainable industry partnerships that engage faculty and prepare job ready students," presented at the 2014 ASEE Annual Conference, , Indianapolis, Indiana, 2014.

[5] American Society of Engineering Education (ASEE), "Inovation with Impact: Creating a culture for scholarly and systematic innovation in engineering education," Washington, DC2012.

[6] G. W. Prigge, "University–industry partnerships: what do they mean to universities? A review of the literature," *Industry and Higher Education,* vol. 19, pp. 221-229, 2005.

[7] M. Perkmann and K. Walsh, "University–industry relationships and open innovation: Towards a research agenda," *International Journal of Management Reviews,* vol. 9, pp. 259-280, 2007.

[8] K. T. Marosi and B. Steinhurst, "Increasing the Retention of Under-Represented Students in Engineering Through Connections with An Industry Advisory Committee," in *2012 ASEE Annual Conference*, San Antonio, Texas, 2012.

[9] M. D. Santoro, "Success breeds success: The linkage between relationship intensity and tangible outcomes in industry–university collaborative ventures," *The Journal of High Technology Management Research,* vol. 11, pp. 255-273, 2000.

[10] National Science Foundation, "University-industry research relationships: myths, realities and potentials: fourteenth annual report of the National Science Board," National Science Foundation, Washington, D.C.1982.
[11] L. Morell, M. Y. Trucco, and F. E. A. Lopez, "An Industry-Government-Academia Partnership to Develop Talent and Technology," presented at the 2011 Annual Conference & Exposition, Vancouver, BC. , 2011.
[12] A. Duncan. (2012, Courage, commitment, and collaboration. *Help wanted 2012: addressing the skills gap,* 11-12. Available: http://www.innovate-educate.org/files/uploads/Help_Wanted_2012.pdf

[13] Gallup, "The 2014 insider higher ed survey of college & university chief academic officers," Washington, D.C.2014.
[14] J. H. McMasters and N. Komerath, "Boeing-University Relations–A Review and Prospects for the Future," presented at the ASEE Annual Conference & Exposition, Portland, Oregon, 2005.
[15] J. C. Weidman, D. J. Twale, and E. L. Stein, *Socialization of Graduate and Professional Students in Higher Education: A Perilous Passage? ASHE-ERIC Higher Education Report, Volume 28, Number 3. Jossey-Bass Higher and Adult Education Series*: ERIC, 2001.
[16] O. G. Brim, "Socialization through the life cycle," *Socialization after childhood: Two essays,* pp. 1-49, 1966.
[17] J. C. Daresh and M. A. Playko, "Alternative Career Formation Perspectives: Lessons for Educational Leadership from Law, Medicine, and Training for the Priesthood," presented at the Annual Meeting of the University Council for Educational Administration, Salt Lake City, UT, 1995.
[18] E. Howkins and A. Ewens, "How students experience professional socialisation," *International Journal of Nursing Studies,* vol. 36, pp. 41-49, 1999.
[19] A. Q. Staton, *Communication and student socialization*. Norwood, NJ: Ablex, 1990.
[20] J. C. Weidman and E. L. Stein, "Socialization of doctoral students to academic norms," *Research in higher education,* vol. 44, pp. 641-656, 2003.
[21] J. C. Weidman, "Undergraduate socialization: A conceptual approach," in *Higher education: Handbook of theory and research*, ed, 1989, pp. 289-322.
[22] V. T. Sule, "Black female faculty and professional socialization: Constraints, enablements and enactments," 3343225 Ph.D., University of Michigan, Ann Arbor, 2008.
[23] S. M. Clark and M. Corcoran, "Perspectives on the professional socialization of women faculty: A case of accumulative disadvantage?," *The Journal of Higher Education,* pp. 20-43, 1986.
[24] J. S. Antony, "Reexamining doctoral student socialization and professional development: Moving beyond the congruence and assimilation orientation," in *Higher education: Handbook of theory and research*, ed: Springer, 2002, pp. 349-380.
[25] E. Cech, B. Rubineau, S. Silbey, and C. Seron, "Professional Role Confidence and Gendered Persistence in Engineering," *American Sociological Review,* vol. 76, pp. 641-666, October 1, 2011 2011.
[26] M. Dinmohammadi, H. Peyrovi, and N. Mehrdad, "Concept analysis of professional socialization in nursing," in *Nursing forum*, 2013, pp. 26-34.