



Work in Progress: Survey Development of the Influence of Engineering Students' Extracurricular Involvement on Career Aspirations and Professional Development

Beata Johnson, Purdue University-Main Campus, West Lafayette (College of Engineering)

Beata Johnson is an Engineering Education Ph.D. student at Purdue University and recipient of an NSF Graduate Research Fellowship. She received her BS in Chemical Engineering from Purdue University. Her research interests include extracurricular and experiential learning in engineering education, students' pathways through engineering education, and transition to the workforce.

Dr. Joyce B. Main, Purdue University at West Lafayette

Joyce B. Main is Associate Professor of Engineering Education at Purdue University. She received an Ed.M. in Administration, Planning, and Social Policy from the Harvard Graduate School of Education, and a Ph.D. degree in Learning, Teaching, and Social Policy from Cornell University. Dr. Main examines student academic pathways and transitions to the workforce in science and engineering. She was a recipient of the 2014 American Society for Engineering Education Educational Research and Methods Division Apprentice Faculty Award, the 2015 Frontiers in Education Faculty Fellow Award, and the 2019 Betty Vetter Award for Research from WEPAN. In 2017, Dr. Main received a National Science Foundation CAREER award to examine the longitudinal career pathways of engineering PhDs.

Work in Progress: The Influence of Engineering Students' Extracurricular Involvement on Career Aspirations and Professional Development

Abstract

This work in progress paper presents the design of a study developed to identify the influence of engineering students' extracurricular involvement on their career aspirations and professional development. This study investigates how students' extracurricular involvement influences their career certainty and confidence in job preparation, with emphasis on examining the types of involvement and specific aspects of involvement that lead to these outcomes. The study will be conducted longitudinally over three years with undergraduate engineering students at a single institution to examine the influence of extracurricular involvement over time and the pathways students pursue through undergraduate engineering in relation to their career goals. Research findings extend the literature by providing a longitudinal examination of how students' involvement and career aspirations evolve over their undergraduate years, providing opportunities to identify mechanisms of influence and potential causal effects. This research extends the literature by connecting student organization involvement to career aspirations and preparation, offering university stakeholders information to develop interventions to help students in their transition to the workforce.

Introduction

The transition from college to the workforce is a critical period for supporting the early career retention of a diverse workforce in the engineering field. Prior to students' transition to the workforce, their socialization into the engineering profession can be shaped by extracurricular involvement [1]. Extracurricular involvement informs students' early career experiences and socialization, which strongly influences retention in engineering careers [2], [3]. Extracurricular involvement comprises a large portion of undergraduate engineering students' time during college [4], and provides varied experiences for students to practice technical and leadership skills and to network with fellow students and potential employers. Students' involvement in extracurricular activities such as student organizations thus provides significant opportunity to influence their professional development and plans for post-graduation careers. By providing networks and experiences for early socialization into the engineering profession, student organizations may help students to formulate career plans and prepare for their transition from student to professional [1]. This work in progress paper presents the design of a study of engineering students' extracurricular involvement and its influence on their career aspirations and professional development.

Participation in student organizations has been associated with retention and graduation, leadership skill development, and intellectual and academic self-concept, among other positive outcomes [5]. Despite consensus on the benefits of involvement, the mechanisms of its influence are less clear, as well as what type and extent of involvement lead to such benefits [6]. Additionally, different students may benefit differently from a given experience or involvement [7]. For example, research has found that extracurricular involvement can provide communities of support for racially

minoritized students and introduce them to mentors [8], [9]. Furthermore, studies have correlated different types of extracurricular involvement (e.g., professional societies, student organizations, identity-based groups) with engineering students' employment pathways [10], highlighting the importance of understanding how different activities may differentially impact students in preparing for engineering careers.

Students face complex decisions in navigating potential career choices, and educational institutions can provide guidance for students to recognize and consider their options. This study will examine students' extracurricular experiences to inform university programming that supports students in their transition from college to career. Our research extends current work by connecting student organization involvement to career expectations and preparation, offering potential to develop interventions to support students in choosing extracurricular involvement and to retain graduates in their transition to the workforce through partnerships with student services, policymakers, and stakeholders.

Research Questions

This study will investigate the following research questions:

RQ1: How do undergraduate engineering students' extracurricular experiences influence their post-graduation career aspirations and preparation over time?

RQ2: Are there differences in pathways in the transition from education to work at the intersection of student background (first-generation or continuing-generation college student; non-traditional college student), race/ethnicity, and gender in engineering?

RQ3: Who/what influences students' choices about extracurricular involvement?

Conceptual Framework

Many studies of extracurricular involvement have drawn on Astin's theory of student involvement [11] to explain how extracurricular activities and programs lead to student development [12]. Astin defined involvement as "the amount of physical and psychological energy that the student devotes to the academic experience" [11, p. 297], suggesting that involvement could be considered as a behavioral manifestation of motivation. Astin's theory accounts for both the quality and quantity of involvement, which he posited as proportionally related to students' development with the caution that "there are probably limits beyond which increasing involvement ceases to produce desirable results and can even become counterproductive" [11, p. 528]. This study's conceptual framework builds on involvement theory both to examine aspects of students' involvement in student organizations that influence career aspirations and preparation and to investigate how extent of involvement corresponds to resulting gains. Figure 1 illustrates the proposed relation of the concepts in this framework.

To investigate potential mechanisms that explain the impact of involvement in student organizations on students' career certainty and confidence, this study will explore four constructs drawn from literature on student involvement in student organizations. The first construct pertains to how students' quantity and quality of involvement influence their personal development of

relevant skills (e.g., communication, leadership, technical) [7], [13], [14]. The second construct considers the influence of peer interactions through student organization involvement and the resulting networks formed with peers and potential employers [6], [15]–[18]. The third construct encompasses another aspect of these social interactions with respect to how students’ involvement in student organizations influences their socialization into the engineering profession, including their understanding of engineering as a profession, their sense of belonging in this profession, and their development of professional identities [19], [20]. Finally, the fourth construct relates to aspects of students’ career planning and how their involvement might influence or inform their active preparation for future career goals [18].

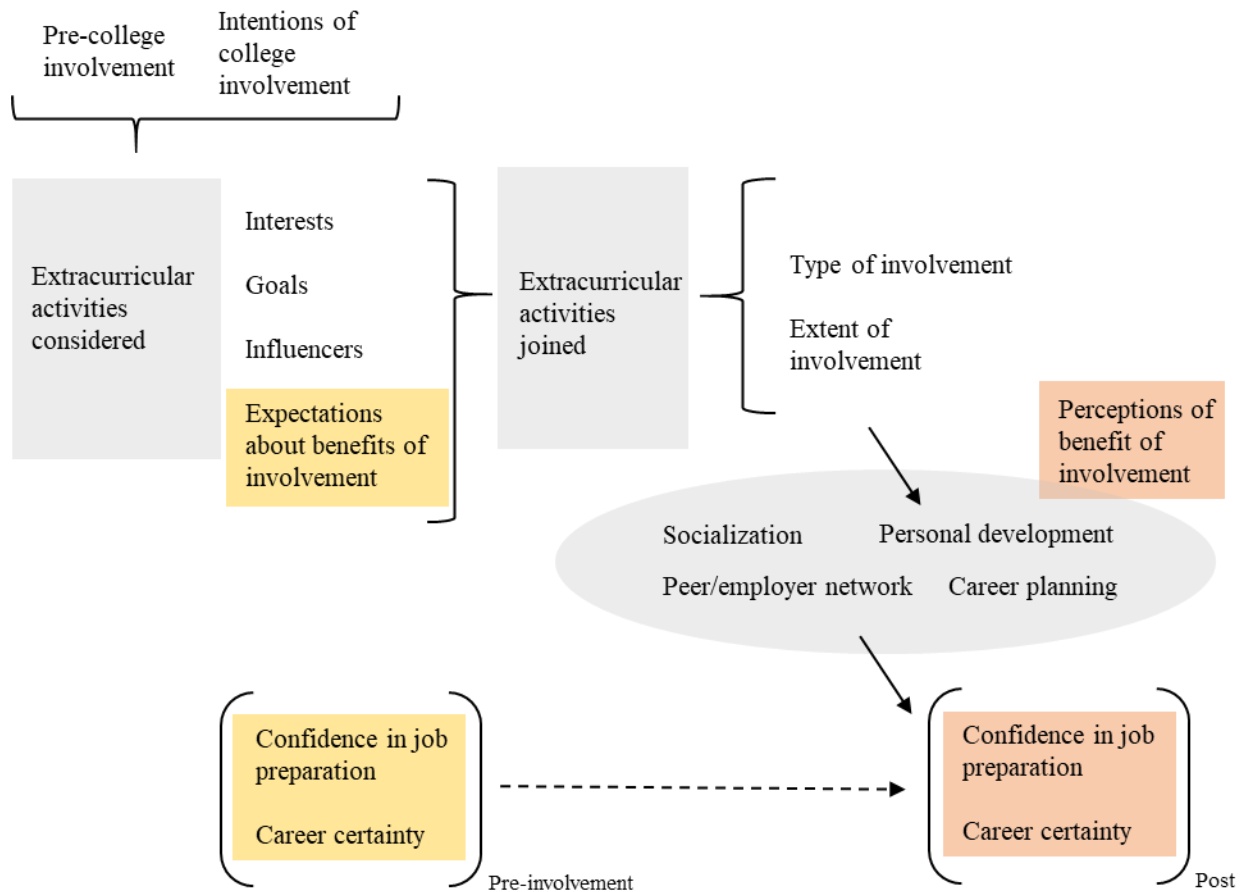


Figure 1. Conceptual framework of the influence of extracurricular involvement on career certainty and confidence in job preparation

The outcomes of interest in this study are students’ confidence in their job preparation and their career certainty. Students’ confidence in their job preparation captures students’ expectations about their ability to succeed in their chosen career path and their ability to prepare themselves for their career goals. Their career certainty captures their confidence in their career decision making process. These outcomes are considered as key indicators of students’ future persistence in the engineering profession or other profession of their interest [21]–[23]. Recognizing that not all students who study undergraduate engineering intend to pursue careers in engineering [10], this

study considers these outcomes broadly to capture students' certainty and confidence in preparing for the career that they desire to pursue.

Methods

This study follows a sequential explanatory mixed methods design [24] to explore students' experiences and perceptions of the influence of extracurricular experiences in preparation for their transition from university to career. The quantitative analysis will explore aspects and mechanisms of involvement in relation to how students prepare and plan for future career paths. The subsequent qualitative analysis will investigate the nuance of these findings, exploring how students choose and make meaning of their undergraduate extracurricular experiences and career plans.

The survey will be administered longitudinally for three consecutive years to capture the effects of extracurricular involvement on students' professional development and career aspirations over time. At each time point, students will respond to questions about the types of student organizations in which they are involved, the extent of their involvement, and activities in which they have participated through this involvement. They will then respond to a series of questions about their career certainty and confidence in their job preparation.

We will administer this survey to undergraduate engineering students at a Midwestern public research institution. The institution graduates 5% of engineers nationwide and has sizable engineering and non-engineering student populations as well as many technical and non-technical extracurricular opportunities. The survey will be sent to all undergraduate engineering students classified as sophomores or juniors in the semester of the initial survey administration. The survey was piloted with a group of undergraduate and graduate engineering students at this university in fall 2019 and early spring 2020. The initial survey administration was conducted in spring 2020.

Survey Measures. The survey will capture the types and extent of student involvement in various categories of extracurricular activities [25]–[27]. Students will select their involvements from a list of types of involvement (e.g., ambassador program, engineering/technical/design, professional society, identity-based organization). Examples of specific organizations on this campus within each category are provided for reference. Students will be asked to provide additional detail about two involvements that they consider to be “most significant” to them. Students will be asked about factors that influenced their choice of involvement, including both motivations for choosing their two most significant involvements and people/media/environmental factors that influenced their choice. Students who indicate that they are not involved in any extracurricular involvements will be asked a series of questions about why they chose not to be involved or were not able to be involved.

In the following section, students will be asked about their career plans post-graduation [28]–[30]. They will then respond to a series of items related to the four constructs described in conceptual framework (personal skill development, peer/employer networks, socialization, and career planning) leading to their career choice certainty and confidence in job preparation. Finally, the survey will collect demographic information, including a series of question identifying first-generation students and non-traditional students (part-time students, military veterans, primary caregivers of dependents, or students who are employed full-time). Non-traditional student status

will be considered in the analysis given unique barriers these students face in committing time to extracurricular involvements outside of class. We will merge university administrative records (registrar data, employment outcomes) with the survey responses for analysis.

Analysis. The data will be analyzed using cluster analysis and structural equation modeling. These analyses will identify profiles of student involvement and characterize the effects of different types of involvement on the specified educational and career outcomes. Initially, we will model the paths between measured student involvement variables, career certainty/confidence, and career expectations (RQ1). We will then use pathway analysis to compare students' pathways to engineering careers by student background, race/ethnicity, and gender (RQ2). Subsequent qualitative analysis of student interviews will provide additional detail about these students' lived experiences and how various experiences influenced their decisions and career expectations (RQ1/RQ3). Findings from the quantitative analysis will inform interview participant selection and the interview protocol development [24].

Expected Results and Study Implications

In examining the influence of student involvement on career certainty and confidence, we expect that the quality of involvement (types of activities/experiences students participate in through involvement) to more strongly influence the outcomes than quantity of involvement (number of involvements, amount of time invested in these) [6]. We expect that different types of activities and experiences in extracurricular involvement will be correlated with different mechanisms of influence (peer influence, socialization, etc.). We also expect that student motivation for participating in extracurricular involvements will influence the type of involvement chosen and resulting outcomes.

Research findings will help inform advising to students in choosing involvements, offering the potential to develop interventions to retain graduates in their transition to the workforce through partnerships with student services, policymakers, and stakeholders. Findings about pre-graduation influences on the transition from college to the workforce will additionally inform future investigation of students' experiences through this transition into engineering careers. Our research leverages existing registrar data to model the pathways of engineering students, such that our approach can be replicated in other fields and other student populations.

Acknowledgements

This material is based upon work supported by the National Science Foundation under Grants 1842166 and 1329283. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. We thank the SPHERE research group for their helpful feedback.

References

- [1] S. Kovalchuk, M. Ghali, M. Klassen, D. Reeve, and R. Sacks, "Transitioning from university to employment in engineering: The role of curricular and co-curricular activities," in *2017 ASEE Annual Conference & Exposition*, 2017.

- [2] R. Korte, S. Brunhaver, and S. Zehr, "The socialization of STEM professionals into STEM careers: A study of newly hired engineers," *Adv. Dev. Hum. Resour.*, vol. 21, no. 1, pp. 92–113, 2018.
- [3] C. Seron, S. S. Silbey, E. Cech, and B. Rubineau, "Persistence is cultural: Professional socialization and the reproduction of sex segregation," *Work Occup.*, vol. 43, no. 2, pp. 178–214, 2016.
- [4] "U.S. summary frequencies by related-major category," National Survey of Student Engagement, 2018.
- [5] M. J. Mayhew *et al.*, *How college affects students: 21st century evidence that higher education works*. San Francisco: Jossey-Bass, 2016.
- [6] M. K. Vetter, L. A. Schreiner, E. J. McIntosh, and J. P. Dugan, "Leveraging the quantity and quality of co-curricular involvement experiences to promote student thriving," *J. Campus Act. Pract. Scholarsh.*, vol. 1, no. 1, p. 39, 2019.
- [7] H. K. Ro and D. B. Knight, "Gender differences in learning outcomes from the college experiences of engineering students," *J. Eng. Educ.*, vol. 105, no. 3, pp. 478–507, Jul. 2016.
- [8] R. M. Banda and A. M. Flowers III, "Birds of a feather do not always flock together: A critical analysis of Latina engineers and their involvement in student organizations," *J. Hispanic High. Educ.*, vol. 16, no. 4, pp. 359–374, Oct. 2017.
- [9] R. A. Revelo and L. D. Baber, "Engineering resistors: Engineering Latina/o students and emerging resistant capital," *J. Hispanic High. Educ.*, vol. 17, no. 3, pp. 249–269, Jul. 2018.
- [10] S. D. Sheppard, A. L. Antonio, S. R. Brunhaver, and S. K. Gilmartin, "Studying the career pathways of engineers: An illustration with two data sets," in *Cambridge handbook of engineering education research*, A. Johri and B. M. Olds, Eds. Cambridge: Cambridge University Press, 2014, pp. 283–309.
- [11] A. W. Astin, "Student involvement: A developmental theory for higher education," *J. Coll. Stud. Dev.*, vol. 40, no. 5, pp. 518–529, 1984.
- [12] L. Wolf-Wendel, K. Ward, and J. Kinzie, "A tangled web of terms: The overlap and unique contribution of involvement, engagement, and integration to understanding college student success," *J. Coll. Stud. Dev.*, vol. 50, no. 4, pp. 407–428, 2009.
- [13] J. P. Dugan and S. R. Komives, "Influences on college students' capacities for socially responsible leadership," *J. Coll. Stud. Dev.*, vol. 51, no. 5, pp. 525–549, 2010.
- [14] D. R. Fisher, A. Bagiati, and S. Sarma, "Developing professional skills in undergraduate engineering students through cocurricular involvement," *J. Stud. Aff. Res. Pract.*, vol. 54, no. 3, pp. 286–302, Jul. 2017.
- [15] J. P. Dugan, "Patterns in group involvement experiences during college: Identifying a taxonomy," *J. Coll. Stud. Dev.*, vol. 54, no. 3, pp. 229–246, 2013.

- [16] M. Hudson-Flege and M. P. Thompson, "Empathy and extracurricular involvement in emerging adulthood: Findings from a longitudinal study of undergraduate college males," *J. Coll. Stud. Dev.*, vol. 58, no. 5, pp. 674–684, 2017.
- [17] S. C. Brown, "Where this path may lead: understanding career decision-making for postcollege life," *J. Coll. Stud. Dev.*, vol. 45, no. 4, pp. 375–390, 2004.
- [18] K. N. Smith and J. G. Gayles, "'Setting up for the next big thing': Undergraduate women engineering students' postbaccalaureate career decisions," *J. Coll. Stud. Dev.*, vol. 58, no. 8, pp. 1201–1217, 2017.
- [19] E. Brennan-Wydra, J. M. Millunchick, A. W. Johnson, C. J. Finelli, and T. S. Henderson, "The influence of background characteristics on socialization processes in engineering," in *ASEE 126th Annual Conference and Exposition*, 2019.
- [20] D. H. Jensen and J. Jetten, "The importance of developing students' academic and professional identities in higher education," *J. Coll. Stud. Dev.*, vol. 57, no. 8, p. 43, 2016.
- [21] T. S. Henderson, K. A. Shoemaker, and L. R. Lattuca, "Early-career plans in engineering : Insights from the theory of planned behavior," in *2018 ASEE Annual Conference & Exposition*, 2018.
- [22] B. D. Jones, M. C. Paretti, S. F. Hein, and T. W. Knott, "An analysis of motivation constructs with first-year engineering students: Relationships among expectancies, values, achievement, and career plans," *J. Eng. Educ.*, vol. 99, no. 4, pp. 319–336, 2010.
- [23] G. Lichtenstein, H. G. Loshbaugh, B. Claar, H. L. Chen, K. Jackson, and S. D. Sheppard, "An engineering major does not (necessarily) an engineer make : Career decision making," *J. Eng. Educ.*, no. July, pp. 227–234, 2009.
- [24] J. W. Creswell, "Mixed Methods Procedures," in *Research design: Qualitative, quantitative, and mixed methods approaches*, 4th ed., Thousand Oaks, CA: SAGE, 2014.
- [25] D. R. Simmons, Y. Ye, N. J. Hunsu, and O. O. Adesope, "Development of a survey to explore out-of-class engagement of engineering students," *Int. J. Eng. Educ.*, vol. 33, no. 4, pp. 1213–1221, 2017.
- [26] D. Wilson *et al.*, "The link between cocurricular activities and academic engagement in engineering education," *J. Eng. Educ.*, vol. 103, no. 4, pp. 625–651, Oct. 2014.
- [27] G. D. Kuh, "The national survey of student engagement: Conceptual framework and overview of psychometric properties," Indiana University Center for Postsecondary Research, Bloomington, IN, 2001.
- [28] E. Cady and P. P. Reid, "Understanding the educational and career pathways of engineers," in *2018 ASEE Annual Conference and Exposition*, 2018.
- [29] S. R. Brunhaver, H. M. Matusovich, R. A. Streveler, S. D. Sheppard, C. Carrico, and A. Harris, "Understanding engineering students' professional pathways : A longitudinal mixed-methods study," in *123rd ASEE Annual Conference and Exposition*, 2016.
- [30] S. R. Brunhaver, C. Carrico, H. Matusovich, R. Abhyankar, R. Streveler, and S. Sheppard,

“Measuring students’ subjective task values related to the post-undergraduate career search,” in *2017 ASEE Annual Conference & Exposition*, 2017.