Involvement in Out-of-Class Activities: A Mixed Research Synthesis Examining Outcomes with a Focus on Engineering Students

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Abstract

Co-curricular and extracurricular involvement both play important roles in students' cognitive and affective development, educational effectiveness and satisfaction, as well as a sense of belonging. Moreover, these practices can help equip a diverse population with the academic and professional skills that are necessary in order to succeed in the technological workforce. Unfortunately, undergraduate engineering students are consistently less likely than students in other majors to become involved in co-curricular and extracurricular activities. This study critically analyzes the body of literature focused on the extent to which involvement in out-of-class activities affects educational outcomes among both engineering and general undergraduate students. Employing a mixed research synthesis approach involving four steps, this study evaluates 50 qualitative, quantitative, and mixed methods studies published between January 2000 and December 2014. The findings suggest that out-of-class involvement supports undergraduate students' development of eight categories of outcomes and results in slight variations in outcome based on type of activity and major. This review synthesizes prior work, informs practice, and identifies opportunities for future research.

Keywords involvement; mixed research synthesis; co-curricular activities; extracurricular activities; engineering students

Introduction

Astin's (1984) seminal theory on student involvement suggests that all of the experiences of a college student are importantt and not just tet time spent in class. Students who engage in activities outside of the formal classroom setting are more likely than their disengaged peers to persist toward graduation (Pascarella & Terenzini, 2005; Tinto, 2000) and have been shown to develop transferrable cognitive and intellectual skills (Dalrymple & Evangelou, 2006). An increase in students' satisfaction with their college experience, academic success, lifelong learning, and persistence has been linked to student involvement in out-of-class activities, including student organizations (e.g., Pascarella & Terenzini, 2005), living-learning communities (e.g., Stassen, 2003), voluntary design teams (e.g., Khorbotly & Al-Olimat, 2010), undergraduate research (e.g., Hathaway, Nagda, & Gregerman, 2002), and community service (e.g., Coyle, Jamieson, & Oakes, 2005).

Activity Type	Description	Examples
Curricular	Associated with a course and connected to academic learning, but occurring outside of the classroom; tied to academic credit	Homework assignments, studying for an exam, group projects
Co-curricular	Complement what students are learning in a course and/or their major but are not connected directly to a particular course; may or may not be tied to academic credit	Engineering professional societies, undergraduate research, internships and co-ops
Extracurricular	Not explicitly linked to a course or major program of study; usually not tied to academic credit	Athletics (both intercollegiate and intramural), fraternities and sororities, student government, job (off-campus or on-campus)

Table 1. Categories of Out-of-class Activities

Out-of-class activities represent the way students choose to spend their time when not in a formal learning environment. These activities can be classified as curricular, co-curricular, and extra-curricular activities (see Table 1).

National Survey of Student Engagement (2013) data suggests differences in majors when looking at participation in various activities. In terms of enriching educational experiences, we know engineering majors are more likely than non-engineering majors to have a culminating senior experience (e.g., a capstone project) but less likely than other majors to study abroad or take foreign language coursework (Lichtenstein, McCormick, Sheppard, & Puma, 2010; Stevens, Amos, Jocuns, & Garrison, 2007). Much of the research examining engineering education and out-of-class activities centers on singular outcome measures such as student retention, grade point average, and student satisfaction (Allendoerfer & Yellin, 2011; Bergen-Cico & Viscomi, 2013; Micomonaco, 2011), or a single out-of-class activity, such as participation in student government or participation as an orientation peer advisor (Allendoerfer & Yellin, 2011; Pike, 2003). We are not aware of a review that synthesizes these findings.

The present study explored the various outcomes undergraduate students receive from participating in out-of-class activities and contributed to a larger study that developed a survey to investigate engineering student out-of-class experiences (Simmons, Tendhar, Yu, Vance, & Amelink, 2015). Initial investigation of the literature on out-of-class activities revealed a mix of research designs; thus, we conducted a mixed research synthesis to address the following research questions:

- What outcomes do undergraduate students receive from involvement in out-of-class activities?
- How do the outcomes from out-of-class involvement vary by type of activity (academic vs. non-academic)?
- How do outcomes from out-of-class involvement vary when comparing engineering undergraduates to general undergraduates?

Methods

Mixed Research Synthesis

Mixed research synthesis studies are "systematic reviews of empirical qualitative, quantitative, and mixed methods studies in shared domains of research aimed at aggregating, integrating, or otherwise assembling their findings via the use of qualitative and/or quantitative methods" (Sandelowski, Barroso, & Voils, 2007, p. 99). In a mixed research synthesis, the data are extrapolated from qualitative, quantitative, or mixed methods empirical studies. Analysis involves grouping, summarizing, and creating data in a way that calculates the equivalent of an effect size. The products can be qualitative or quantitative summaries of what is known about a target topic (Sandelowski et al., 2007).

Data Collection

The present study specifically focused on studies that examined the outcomes of undergraduate student out-of-class activities. We selected articles that met the following criteria:

(1) Investigated one or more out-of-class activities and reported the outcomes of student involvement.
(2) Included clear and detailed explanations of quantitative, qualitative, or mixed methods empirical research studies.
(3) Appeared as peer or non-peer reviewed primary studies in journals, conference proceedings, or other publications between January 2000 and December 2014.
(4) Focused on undergraduate students (either generally, or specifically engineering undergraduates) enrolled in a four-year post-secondary institution in the U.S.

We used four approaches to search for articles that met the above criteria. First, we conducted an electronic search using online databases and search engines (EBSCOhost, ERIC, Google, and Google Scholar), employing combinations of the following keywords: *co-curricular, extra-curricular, high impact activities, out-of-classroom activities, out-of-classroom experiences, outcomes, engineer*, and *undergraduate*. This first search identified 249 unique results. We examined the titles, abstracts, and full texts of each article to determine whether it met the established criteria described above (Petticrew & Roberts, 2006). Second, we used the same keywords and selection criteria to examine the table of contents of three journals *(Research in Higher Education, Journal of Higher Education*, and *Journal of College Student Development)* that were likely to include articles focused on undergraduate students from a wide range of majors. Third, we searched engineering journals and engineering conference proceedings likely to include empirical studies of undergraduate engineering students to delineate these student populations from general undergraduates. Last, we examined the reference lists of the articles collected from the previous three search approaches to identify listed references that also met our selection criteria.

We identified 50 articles that included 35 quantitative studies, 7 qualitative studies, and 8 mixed methods studies. The articles originated from 2 conference proceedings and 19 journals.

Data Analysis

Information extraction. We developed a coding scheme across three domains: sample composition, outcomes of student involvement, and types of out-of-class activities. We used a coding form to organize results.

Inductive analysis. We analyzed the outcomes of student involvement inductively using the extracted information. We conducted initial line-by-line coding to develop specific codes (e.g., GPA, analytical skills, confidence, etc.). We then sorted the 163 initial codes according to the positive, negative, and neutral influences that out-of-class involvement has on student development. Since only four articles referred to negative outcomes and two to a neutral influence of out-of-class involvement on students' development of outcomes, we focused the next step on positive outcomes. We organized initial codes into ten categories of outcomes using a higher level of abstraction. For example, we grouped the initial codes associated with academic performance, analytical skills, and critical thinking into the intellectual development category. This process required decisions about what categories made the most analytic sense to organize the initial codes inclusively and completely.

Cluster analysis. In order to generate the next abstraction of the outcomes, we used the cluster analysis function in NVivo 10 to group the categories into clusters by word similarity. Cluster analysis is an exploratory technique that helps visualize the patterns in the study by grouping nodes that share similar words using correlation coefficients; we asked the analysis software to visualize the similarity of words coded under each outcome node (Bazeley & Jackson, 2013; http://help-nv10.qsrinternational.com/desktop/concepts/about_cluster_analysis.htm). Cluster analysis is appropriate for qualitative coding because there is no assumption that the categories used are mutually exclusive or that they are normally distributed. The results of hierarchical cluster analysis are most frequently presented as a tree diagram called a dendrogram. In the dendrogram (see Figure 1), relationships among codes are presented visually with similar nodes being clustered together on the same branch.

Frequency calculation. We analyzed the frequency of the qualitatively derived outcomes by calculating the occurrence of articles that reported different categories of outcomes. We compared the outcomes by type of out-of-class activities: academic related activity, non-academic related activity, and out-of-class activities within and outside the major. Academic activities refer to the activities related to students' majors, including undergraduate research, service learning, and study abroad. Non-academic activities consist of clubs, student organizations, and voluntary service. We compared outcomes by groups of students: engineering students versus the general student population. We defined engineering students broadly to include traditional engineering majors (e.g., civil, mechanical, and chemical), pre-engineering (a common designation for first-year engineering undergraduates), and engineering-related fields such as computer science or other STEM (Science, Technology, Engineering, and Mathematics) majors.

Category	Description of Outcomes
Academic and Social Engagement	Refers to academic effort and engagement in educational activities while interacting with peers and faculty
Career and Professional Development	Refers to students' post-college plan, job preparation, and gains in professional skills
Communication Skills	Refers to the ability to convey information effectively and efficiently
Intellectual Development	Refers to students' gains in academic knowledge and skills
Intercultural Competence	Refers to the ability to understand the differences between people from diverse cultures and effectively communicate
Leadership Development	Refers to the process through which students gain the capacity to collaborate, delegate, and guide
Personal and Social Development	Refers to students' identity development, social development, self-esteem, and academic confidence
Persistence	Refers to students' tendency to stay in their majors or universities
Satisfaction with College	Refers to students' level of contentment with their college experience
College Belonging and Connectedness	Refers to the psychological perception of the extent to which students feel accepted and respected in a school setting

Table 2. Positive Student Involvement Outcomes

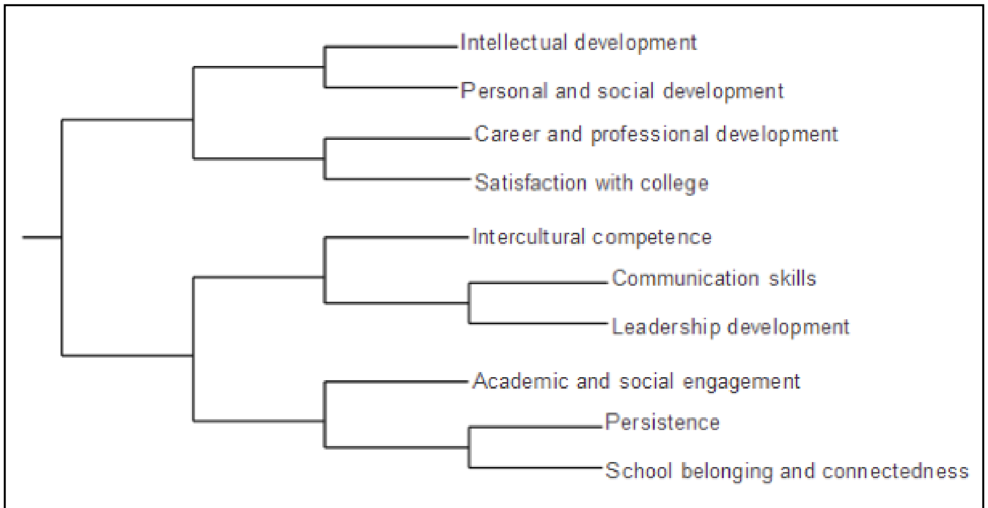

Figure 1. Dendrogram of out-of-class involvement outcomes clustered by word similarity

Results

Initial Categories of Student Involvement Outcomes

A review of the literature revealed that undergraduate students demonstrated positive gains in ten types of outcomes from involvement in out-of-class activities. Table 2 lists the outcomes and provides descriptions of each outcome.

Categories of Outcomes Supported by the Cluster Analysis

The dendrogram in Figure 1 provides a graphic representation of the ten outcomes to illustrate the similarities and differences among them (see discussion of cluster analysis in the Data Analysis section). In this dendrogram, we are interested only in which outcomes cluster together and are not concerned with the placement of the branches (such as, whether a branch is above or below another branch). Communication skills and leadership development were on the same branch, while persistence and college belonging and connectedness were on the same branch; this suggests that the coded words for the two categories were similar. These four outcomes were collapsed into two categories: communication and leadership and college belonging and persistence. The cluster analysis produced in NVIVO provided justification to reduce the initial outcomes from ten to eight categories. Table 3 shows the frequency, percentage, and rank of articles that reported the eight categories of positive outcomes, a reflection of a process called vote-counting.

Outcomes by Types of Out-of-class Activities

The greatest amount of attention in the literature about the outcomes of undergraduates' involvement in out-of-class activities has been given to, first, intellectual development and second, career and professional development. Among the 50 articles, 11 examined student involvement in academic activities, 25 investigated non-academic activities, and 14 studied student involvement in out-of-class experiences that were both within and outside of their majors. For details of the outcomes by types of out-of-class activities, see Table 4.

Comparing Outcomes For Engineering and General Undergraduates

Two of the three top outcomes were the same for the two engineering and general undergraduates: career professional development and intellectual development (see Table 5). The major difference between the groups was that college belonging and persistence was in the top three outcomes identified for engineering, but not for general undergraduates. Additionally, no engineering studies reported positive outcomes for personal and social development, whereas 36% (n=11) of studies involving general undergraduates reported this outcome.
les. Outcomes reflect those first identified in Table 3.

Outcomes	Frequency (%)	Rank: Overall	Rank: Engineering	Rank: General
Academic and social engagement	10 (20%)	5	5	4
Career and professional development	16 (32%)	2	1	3
Communication and leadership	11 (22%)	3	4	5
Intellectual development	25 (50%)	1	1	1
Intercultural competence	3 (6%)	8	N/K	7
Personal and social development	11 (22%)	3	6	2
Satisfaction with college experiences	4 (8%)	7	6	6
College belonging and persistence	8 (16%)	6	3	8

Note. N/K = not known because no studies found between 2000–2014 report outcome

Table 3. The Frequency of Articles that Report the Eight Categories of Outcomes (N=50)

Discussion

Outcomes Associated With Out-Of-Class Activities

The present study aimed to explore the outcomes of undergraduate students' out-of-class involvement by analyzing a body of research literature. A mixed research synthesis method was used to synthesize the findings from qualitative, quantitative, and mixed methods studies. A main finding is the eight outcome categories that emerged from the inductive analyses and cluster analysis of 50 empirical studies. When compared to Kuh's (1993) and Pascarella and Terenzini's (2005) studies of outcomes from out-of-class activities, the present study agrees on the following outcomes: career and professional development, communication and leadership development, intellectual development, and personal and social development. The present study developed four more categories: academic and social engagement, intercultural competence, satisfaction with college experiences, and college belonging and persistence in major and college.

Intellectual development was the number one positive outcome reported for all types of activities (academic, non-academic, and mixed)—an unexpected result. Beyond that, different types of out-of-class activities are associated with different categories of outcomes. Besides intellectual development, academic activities are more likely to promote student career and professional development whereas non-academic activities are more likely to promote students' academic and social engagement.

Compared to the general undergraduates, engineering students' out-of-class involvement is more associated with the outcomes of college belonging and persistence. Many out-of-class strategies have been applied to improve student retention by improving the culture of the current learning environment; for example, tutoring, peer mentoring, learning communities, learning centers, and peer learning groups (American Society for Engineering Education, 2012). Increase in these types of activities may help explain why college belonging and persistence were frequently reported in out-of-class involvement literature in engineering. Less clear is why outcomes associated with social and personal development were reported for general undergraduates but not engineering.

These findings strongly suggest new insights for additional research. A large number of existing research studies examined specific types of student experiences

Outcomes	Academic Activities (n=11)	Non-academic Activities (n=25)	Mixed Out-of-class activities (n=14)
Academic and social engagement	2 (18%)	8 (32%)	0 (0%)
Career and professional development	6 (55%)	4 (16%)	5(36%)
Communication and leadership	4 (36%)	1 (4%)	5(36%)
Intellectual development	8 (73%)	10 (40%)	7 (50%)
Intercultural competence	2 (18%)	1 (4%)	0 (0%)
Personal and social development	4 (36%)	6 (24%)	1 (7%)
Satisfaction with college experiences	0 (0%)	2 (8%)	2 (14%)
College belonging and persistence	3 (27%)	3 (12%)	2 (14%)

Table 4. The Outcomes by Types of Out-of-class Activities (N=50)

Outcomes	Engineering Students (n=19)	General Undergraduates (n=31)
Academic and social engagement	3 (16%)	7 (23%)
Career and professional development	8 (42%)	8 (26%)
Communication and leadership	5(26%)	6 (20%)
Intellectual development	8(42%)	17 (55%)
Intercultural competence	0 (0%)	3 (10%)
Personal and social development	0 (0%)	11(36%)
Satisfaction with college experiences	0 (0%)	4 (13%)
College belonging and persistence	6 (32%)	2 (7%)

Table 5. The Outcomes of Engineering and General Undergraduates (N=50)

or simple involvement in general, failing to capture the complex patterns of involvement that evolve across the collegiate experience. This gap contributed to difficulties in accurately assessing the relative impact of patterns of involvement on outcomes. Very few studies address multiple dependent variables tied to multiple independent variables, highlighting a need for research that examines the impact of different types of involvement on students. How students decide to participate or not participate in out-of-class activities, type of activity, and level of formality may differentially impact a range of academic, personal, and career outcomes. Current and future work by the first author includes pilot testing, psychometric validation, and nation-wide implementation of a survey exploring student engagement (PosSE Survey) with engineering undergraduates to do just that—explore the link between multiple independent variables (different activities) and dependent variables (different outcomes). The intended goal of this research is to gain new insights into engineering students' involvement in out-of-class activities, commitment to an engineering major, intention to pursue an engineering career, and propensity to become lifelong learners.

Conclusion

Given the educational, professional, and personal outcomes that students accrue from participation in out-of-class activities during college, it has become critical to have a clear understanding of how these experiences relate to both one another and specific outcomes. Our mixed methods research synthesis revealed complex relationships among the different types of activities, outcomes, and populations. The literature reviewed suggests eight categories of outcomes: academic and social engagement; career and professional development; communication skills and leadership development; intellectual development; intercultural competence; personal and social development; satisfaction with college; and college belonging, connectedness, and persistence. These categories often overlapped with previous categorizations reported in the literature but also suggest new areas for further exploration. Beyond intellectual development (the main outcome associated with all activity types and populations we examined), our findings indicate that both academic and non-academic activities contribute to a range of outcomes that extend beyond academics. Compared to general undergraduates, our results also reveal that college belonging and persistence outcomes were frequently reported in engineering, but outcomes of social and personal development were not. Finally, through our synthesis of the literature, three processes of student involvement in out-of-class activities emerge: accessing opportunities to interact with peers, faculty, and other people in academic and social settings; fulfilling relatedness, esteem, and safety needs; and learning about self and the profession. Out-of-class involvement has clear implications for student development and future research can help further elucidate the ways in which administrators and educators can use out-of-class activities to promote positive student development.

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An asterisk indicates inclusion in review (N=50).

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