

## **Information Sources Engineering Co-Op Students Use and the ABET Soft Skills They Gain**

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## **Abstract**

Engineering undergraduates at The University of Toledo need to complete three semester-long co-op experiences as a requirement of graduation. Co-ops allow students to experience first-hand what engineers do. This includes information seeking. As an engineering librarian, I was interested in which information sources students need to use during their co-ops and how comfortable they were in their information seeking.

An anonymous survey instrument was developed using Qualtrics. Surveys were sent electronically to all students who had completed at least one co-op experience. With a response rate of 21%, I found that while most respondents needed to locate and use at least one type of information while on their co-op. Most needed assistance from a co-worker or supervisor. These findings highlight a gap between students' self-perceived comfort and their independent information literacy skills.

Most respondents reported the need to locate and use information sources during their co-op. They will also need to do so after graduation; therefore, engineering students must acquire information literacy skills. Research has also shown that co-ops and internships contribute to the development of essential soft skills, including project management, communication, and teamwork. The paper will show the importance of these skills in employability and success in the engineering workplace. I will also show that enabling students to acquire these skills helps engineering programs meet three ABET standards.

## **Background**

Internships and co-op experiences have been part of undergraduate engineering programs in the United States since at least 1906 [1]. Today, these experiential learning activities are mandatory or elective for students, depending on the degree requirements at their institution. Internships are often unpaid, while co-ops are usually paid positions. Most research into these programs has focused on student retention, confidence, employment rates of graduates, and exposure to the workplace, some of which is summarized below. More recent research has begun to study the

acquisition of soft skills such as communication, teamwork, and information literacy. By participating in an internship or co-op, students gain work experience and higher retention rates, making classroom work more relevant and demonstrating the importance of lifelong learning skills, including information literacy. A review of the literature shows that these are essential skills for success in the engineering workplace.

## **Literature Review**

There is considerable literature on internships and co-ops in engineering undergraduate education. Much of this research focuses on the ability of students to apply technical knowledge gained in the classroom to the workplace. There is a growing body of research that looks at how internships and co-ops provide or enhance students' communication, teamwork, writing, and information seeking skills. These are soft skills that are critical in the workplace. ABET does not use the term soft skills, but the skills in Criterion 2, 3 and 5 are often referred to as such. Students need information literacy skills to fulfill those ABET requirements

In a review paper by researchers at the State University of Santa Catarina in Brazil looking at the importance of soft skills in engineering disciplines, the authors state, "...engineers should be responsible for appropriating new knowledge, expressing their ideas proactively, critically, and independently." The authors also assert, "The ability to correctly search for data and to interpret information, avoiding bias is also interrelated to...critical thinking, and... problem-solving" [2].

Students from England and Wales who had completed internships in the information and communication technology sector were sent an online survey instrument about their experience. Follow-up interviews were conducted. Interviews were also conducted with employers and faculty supervisors. Soft skills were cited as important factors in students' ability to get an internship, receive more training, work on higher-level projects, and gain employment after graduating. It was also noted that employers gave students real-life projects to work on, which required the "...sourcing of appropriate information to complete the project" [3].

Twenty-four engineering undergraduates at the University of Illinois at Urbana-Champaign and 10 internship supervisors were recruited for a study of "...internships as a complex social phenomenon..." [4]. The authors emphasize the "social and relational interactions" students are exposed to during internships as important aspects of their formation into working engineers.

The importance of networking, collegial relationships with co-workers and supervisors, and general workplace culture can be learned through experiential learning, such as internships. The authors also state, "A critical goal of higher education and employers is to develop and support life-long learners..." a critical component of which is information literacy.

An undergraduate student and a mechanical engineering faculty member from York University in Toronto, Canada, conducted interviews with faculty and students from Mechanical Engineering, Civil Engineering, Electrical Engineering, and Computer Science about the acquisition of "employability skills" through co-ops [5]. Mechanical Engineering faculty indicated "knowledge acquisition" as an underdeveloped skill in their students. "Knowledge acquisition" is described as lifelong learning later in the paper. Teamwork and organization were both described as skills that were not lacking among students having completed a co-op. Initiative was listed as underdeveloped by all three departments.

Researchers from McMaster University and MacEwan University in Canada surveyed undergraduate students from McMaster University who participated in a program that included 12 months of co-op placements about their experiences [6]. The authors reported that employers found the most important "soft skills" for entry-level hires to be collaboration, teamwork, interpersonal, and relationship-building skills. Their survey revealed that students learned those skills through group work in courses, which translated to better co-op experiences.

The skills referred to in the papers outlined above are also referred to by three ABET criteria, while not using the term "soft skills" [7]. ABET Criterion 2 requires "An ability to communicate effectively with a range of audiences. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives"

ABET Criterion 3 requires students to be able to "apply knowledge, techniques, skills, and modern tools of mathematics, science, engineering, and technology to solve well-defined engineering problems appropriate to the discipline, communicate effectively orally and in writing, and work as part of a team. These are all skills that can either be learned or enhanced through an internship or co-op experiential learning placement.

ABET Criterion 5 lists skills such as using standards and codes, and the skills for "lifelong professional development." This is a skill where information literacy is an essential component.

## **Methodology**

I was curious about how engineering students used information on their co-ops and which information sources they needed to access. I wanted to ask students about their information seeking on co-ops. The office of Engineering Career Development was able to provide a list with email addresses of current students who had completed at least one co-op experience. I developed a survey instrument using Qualtrics and submitted a research protocol, which was approved by the IRB in October 2023. To increase the likelihood that students would complete the survey, I limited the questions to six (see Appendix). Respondents were allowed to skip any question they did not wish to answer.

The University of Toledo is a comprehensive metropolitan university with an enrollment of 15,013 students for the fall semester 2023, comprising 11,454 undergraduate students and 3,559 graduate students. The College of Engineering is the largest college at The University of Toledo, with an enrollment of approximately 2,000 students. The College of Engineering is one of eight engineering programs in the United States to require students to complete three semester-long, paid co-ops. Students graduate with one year of work experience. Students secure placements with assistance from the co-op directors in every department of the College.

During the Fall 2023 semester, I sent emails to 838 students each with a unique link to the Qualtrics survey. Twelve days later, I sent a reminder to potential subjects who had not completed the survey. Qualtrics facilitated the sending of surveys and reminders. The response rate was 21% with 179 surveys completed.

## **Results**

The two demographic questions showed that 50% of respondents were 20-21 years old, while 38% were 22-23 years old. Fifty-nine percent were seniors, 33% were juniors, and 7% were sophomores, as shown in Figure 1.

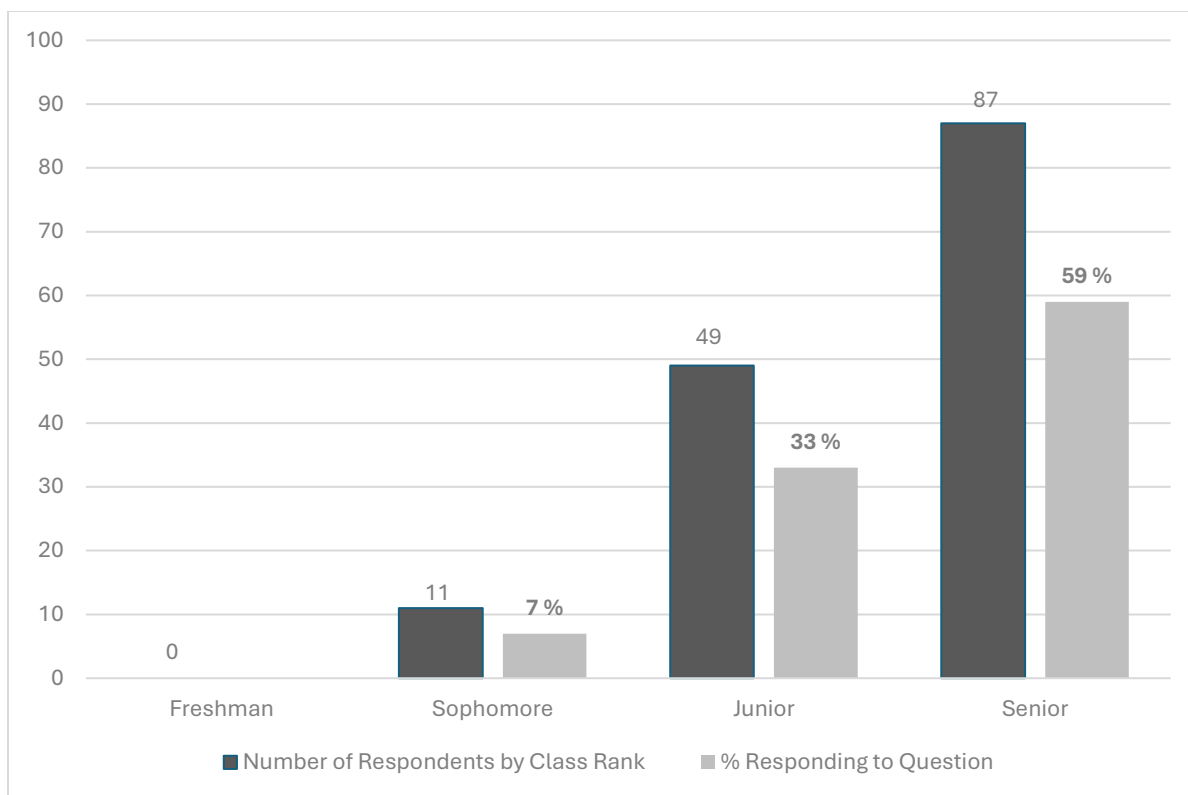


Figure 1. Respondents by class rank and percentage of total responding to question

Students were asked how many co-op experiences they completed. Forty-nine percent of respondents (n=147) reported having completed three, 26% reported having completed two, and 25% reported having completed only one. Note that respondents were allowed to skip any question.

When asked which information sources they needed to locate during their co-op experience, 75% of those responding (n=132) indicated they needed to locate and use at least one information source, while 96% (n=128) reported using more than one information type.

Respondents were given a list of information sources and asked to select all the types they used. The most sought information sources were standards, manufacturer specifications or prices. Sixty-four percent of respondents reported needing manufacturer specifications, while 62% reported needing standards. Patents were selected by 10%, and bulk chemical prices were selected by 7%, as shown in Figure 2.

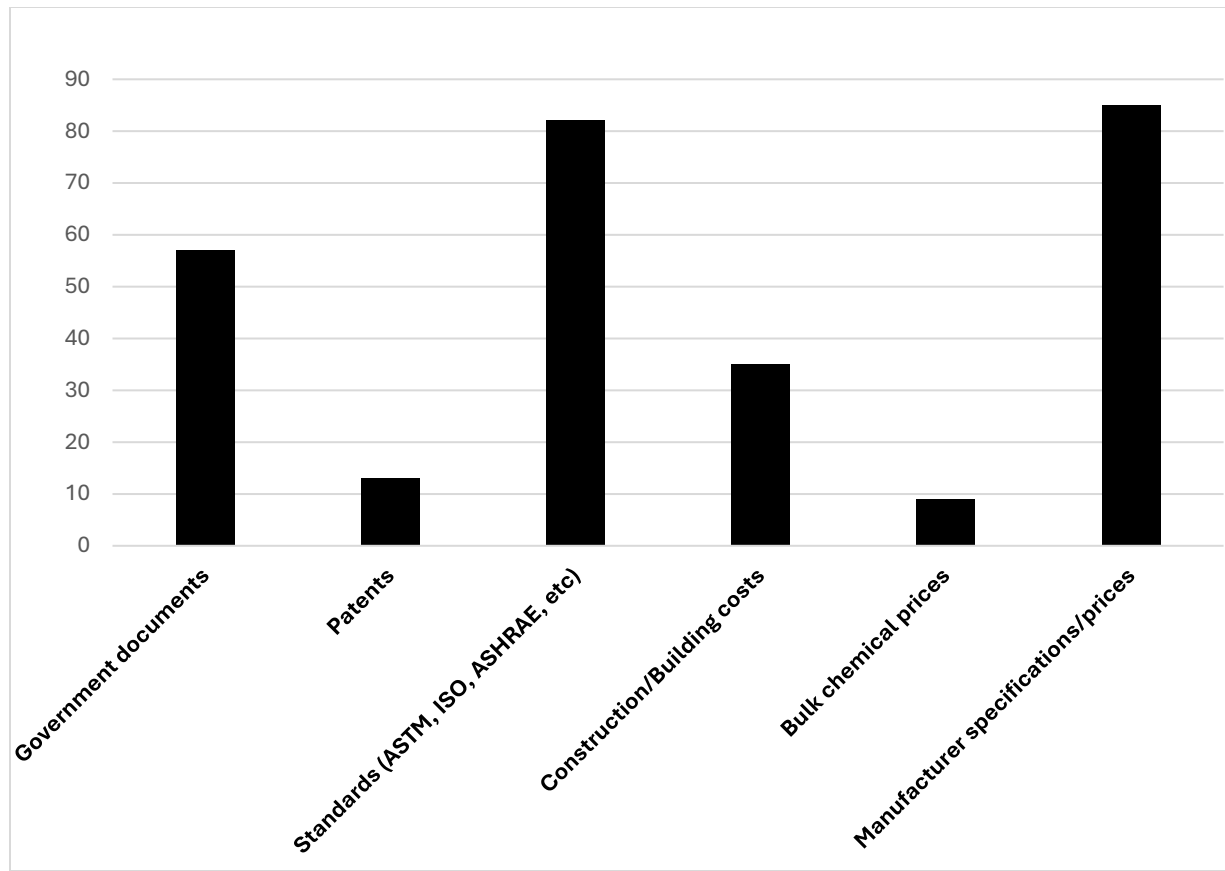
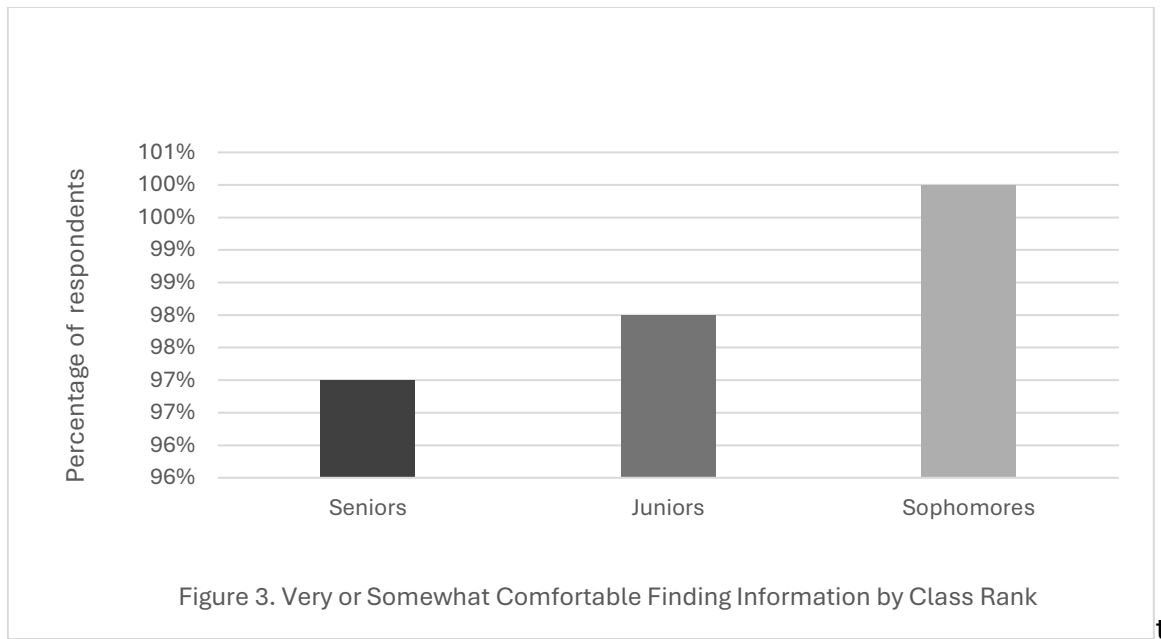


Figure 2. Information sources needed during co-op

When respondents were asked if anyone assisted them in finding needed information while on co-op, 83% (n=104) selected the box for “Supervisor”, while 79% (n=99) selected the box “Co-worker”. Sixty-one percent (n=77) selected both.

A related question asked about their comfort with locating information. A Likert Scale of “not at all comfortable, somewhat comfortable, very comfortable” was provided. Fifty-three percent of respondents selected “somewhat comfortable”, while 45% of respondents reported being “very comfortable”, and 2% selected “Not at all comfortable.” The results as shown in Figure 3 show percentages, by class rank, of respondents to this question describing their comfort as “very” or “somewhat comfortable.”



## Conclusions

While it was good to see that most students felt comfortable seeking information, the findings that 83% received assistance from a supervisor, and 79% received assistance from a co-worker, and 61% received help from both indicate that students are not going into their co-op experiences as well-prepared for information seeking as they could be.

Engineering students need information literacy skills for co-op experiences as well as for the jobs after graduation. It is also clear that experiential learning, such as co-ops or internships, in addition to providing work experience, also provides the soft skills that are essential for engineering career success.

For engineering librarians, this study underscores the value of integrating problem-based assignments, targeted workshops, and workplace-relevant resources into information literacy instruction. Such approaches can prepare students for more successful co-op experiences and, ultimately, for the information demands of engineering practice. This paper will report on the survey of co-op students as well as on how active learning experiences such as co-ops and internships foster learning beyond technical engineering skills.



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## Appendix - Survey Instrument

1. What is your age?
  - 18-19
  - 20-21
  - 22-23
  - 24 or older
2. What is your class rank?
  - Freshman
  - Sophomore
  - Junior
  - Senior
3. How many co-ops have you completed while at UToledo?
  - 1
  - 2
  - 3
4. What type of information have you needed while on co-op?
  - Governmental documents
  - Patents
  - Standards
  - Construction/Building costs
  - Bulk chemical prices
  - Manufacturer specifications/prices
5. Did you get help from anyone with finding needed information?
  - Co-worker
  - Supervisor
  - Librarian
6. How comfortable were you with locating needed information during your co-op?
  - 1-5 Likert scale