

## **A Preliminary Investigation: Student Summer Internship Activities**

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## **Abstract**

Workforce preparation is critical for college graduates to achieve their professional goals and therefore is an essential goal for colleges and universities. According to the Association for Career and Technical Education, career readiness involves having academic, employability, and technical skills. From literature, effective engineering education along with extra and co-curricular activities noticeably help students be ready for their future careers. Higher education institutions are making considerable efforts to encourage student workforce participation via summer internships. Every fall, sophomores, juniors, and seniors at The Citadel are surveyed regarding their summer internship activities. This paper analyzes the data collected over the last two years and examines correlations to student academic performance, via GPA. In addition, junior and senior summer activities are tracked over the past two years to examine if student preferences and choices altered between the sophomore and junior year.

## **Keywords**

internships, academic skills, employability, workforce preparation, career readiness

## **Introduction**

Career readiness and workforce preparation greatly help college graduates achieve their professional goals and employers find skilled individuals for their job vacancies. According to the Association for Career and Technical Education, career readiness involves having academic, employability, and technical skills [1]. Academic skills include foundational academic knowledge in the respective study field, in English and math, applying academics to context, and conducting some data analysis, reasoning, and mathematical problems solving [1]. Employability skills focus on, current, critical to workplace abilities such as critical thinking, problem solving, adaptability, ethics, communication in different forms, teamwork, professionalism, and technology use while technical skills comprise of level of job specific knowledge [1]. The National Association of Colleges and Employers has also identified some skills that students should demonstrate in order to be career ready, which include career/self-development, communication, critical thinking, equity and inclusion, leadership, professionalism, teamwork, use of technology, financial literacy, time and stress management, digital citizenship, and ability to acquire practical knowledge. [2], [3]. Effective engineering education along with extra-/co-curricular activities including but not limited to undergraduate research, professional organization, service and community based learning, study abroad programs, internships, and jobs noticeably help students be ready for their future careers since those enhance students' motivation and skills [4], [5]. Student participation in extra-/co-curricular has been associated with multiple benefits such as retention and graduation, leadership and professional development and engagement [6], [7].

Looking more in depth at the impacts that internships could have on students, literature suggests that internships can inform and influence college students' post-graduation plans and career

decisions and goals in a positive manner [8] as they give students the opportunity to apply engineering skills they have acquired through their studies. Internships also, usually, have high impact on students' innovation self-efficacy, engineering task self-efficacy [9], and innovation interests [10].

Preparing student populations with the essential career ready skills should be of utmost importance to higher education institutions. Students should be encouraged to participate in multifaceted activities such as internships, trainings, seminars and others during their college career to be best prepared for the workforce.

At The Citadel, summer extra-/co-curricular activities are highly encouraged via faculty involvement, career fairs, and projects. Every fall, sophomores, juniors, and seniors are surveyed regarding their summer activities. This paper analyzes the data collected the last two years and examines correlations to student academic performance, via GPA. In addition, junior and senior summer activities are tracked over the past two years to examine if student preferences and choices altered between the sophomore and junior year.

## **Methods**

This study collected data from students with a status of rising sophomore or higher enrolled in the Civil, Environmental, and Construction Engineering Department at The Citadel. The survey was conducted twice, in fall 2022 and fall 2023, to record and assess student activities in the preceding summer. Extra-/co-curricular activities explicitly included in the survey were internships, summer jobs, summer course enrollment, and military training exercises. While the survey consisted of questions beyond the scope of this paper, the questions this investigation aims to address include:

- 1) Does the ratio of students with summer internships change by student academic year or academic success [indicated by GPA]?
- 2) Are there any trends in the Civil Engineering subdiscipline of student internships?
- 3) How were students connected to internships?

As a Civil Engineering program, it is expected that a high ratio of students will participate in summer internships to acquire work experience prior to graduation. It was hypothesized that as students advance in their course work, a higher fraction will complete summer internships. Further, the course schedule of civil engineering students at The Citadel introduces the subdisciplines in different years (e.g. surveying in sophomore year versus transportation in junior year). Recent exposure to a subdiscipline was expected to increase the proportion of students interning in the subdiscipline. Data regarding how students connected to internships was collected to inform the Department and career center regarding future internship and job fair activities.

In order to clarify the data presented here, several groups were excluded. The survey was not administered to incoming freshmen due to not having started their college career the preceding summer. Data was collected from both traditional (entered college immediately after high school) and non-traditional college students, however the data presented here has been limited to the traditional student population due to the sample size. Further, the survey was administered to students of all majors within the Department, however, results here are for Civil Engineering

majors in order to better understand student internship selection for a major with multiple subdisciplines.

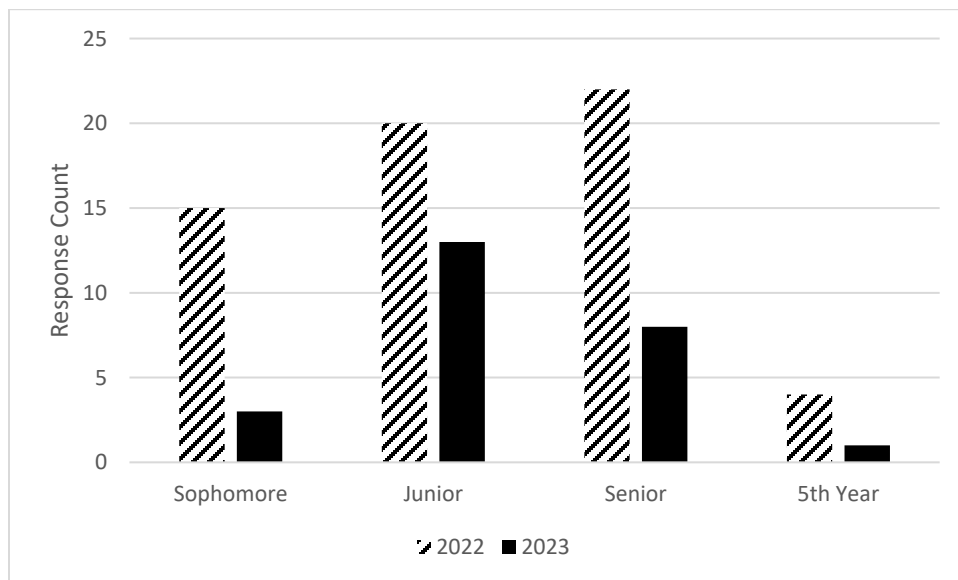
The survey was constructed to first collect identification data (name, major, academic year), and then had three branching questions:

- I worked during summer 20XX. Work includes full-time, part-time, and internships. [Yes, No]
- I took classes during Summer 20XX: [Yes, No]
- I completed military training requirements during Summer 20XX: [Yes, No]

When participants responded “Yes” to any of the branching questions, additional questions were used to gather more data about the activity. For summer work, additional questions clarified if the job was part-time or full-time, the subdiscipline of the work, the company and position name, if the position was paid or unpaid, how the student found the job opportunity, and when they were hired. For summer classes, students were asked about the school and the course type (math, science, engineering, etc.). Those completing military activities were asked to provide the branch of service responsible for the training. This paper is focused on the summer employment activities and thus the information from the branching questions for the other two activities (classes and military training) will not be presented.

### ***Survey Participation***

A total of 104 students responded to the 2022 survey and 42 in 2023. In 2022, the response rate was 67% and in 2023, 28% of the population of undergraduate students in the department with at least sophomore standing. When narrowed to full-time traditional students (entered college immediately after high school) majoring in Civil Engineering, the respondent sample is 61 and 25 respectively (Figure 1) or 56% and 28% response rates. The lower response rate in 2023 was found to be a consistent decrease across all student levels rather than just among one cohort thus maintaining sampling integrity even though the sample size was smaller.



**Figure 1. The count of Civil Engineering majors completing the survey by student status and survey year. Striped columns indicate 2022 data. Solid is 2023.**

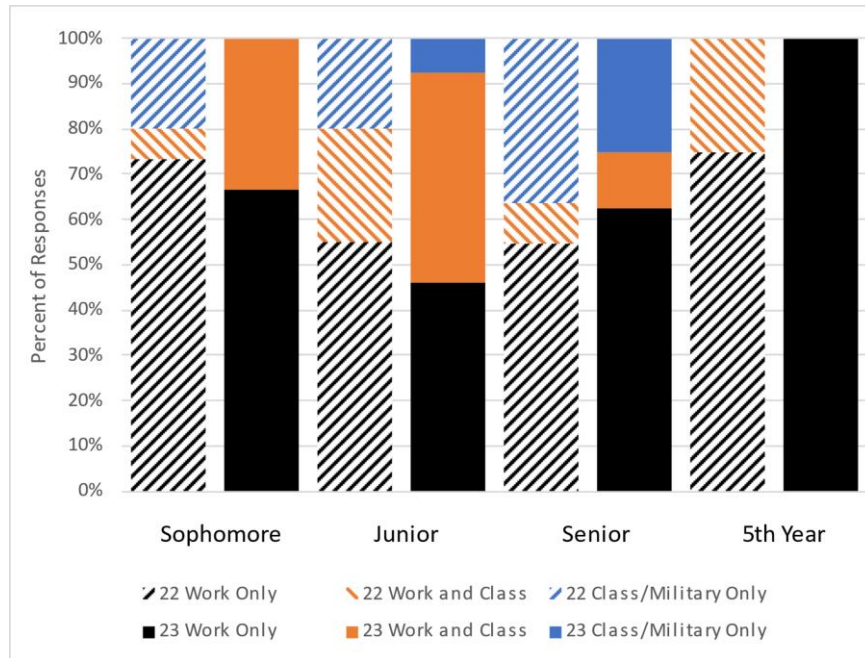
## **Results and Discussion**

The collected surveys were aggregated and analyzed. The student population was split into student status (sophomores, juniors, seniors, and 5<sup>th</sup> Year students) during each calendar year to examine any differences among cohorts. Tracking a single cohort's progress was also possible—e.g., the juniors in 2022 became the seniors in 2023.

### ***Internship Participation***

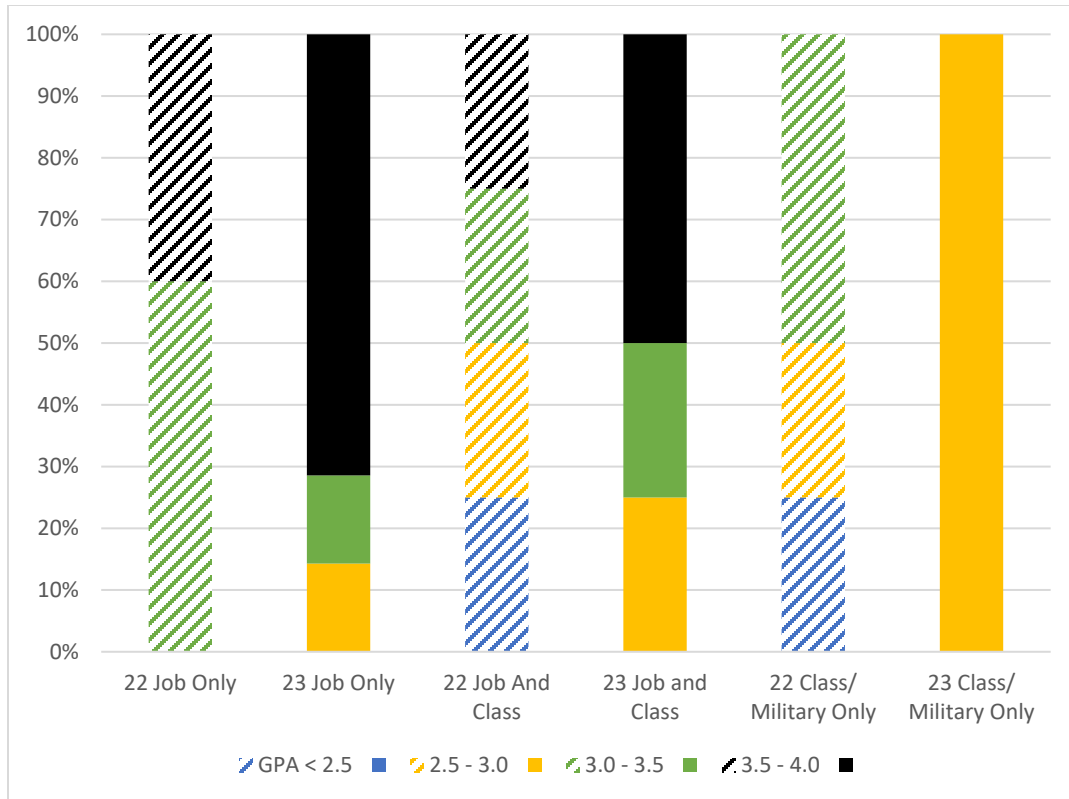
The first important finding of the survey was that all internship positions held by the Civil Engineering students were paid positions. This was the only consistent finding regardless of data collection year, student status, or major.

While there was a higher response rate among all student statuses in 2022 than 2023 (Figure 1), as seen in Figure 2, the proportion of respondents with summer work or internships remained consistently high (greater than 60%). This confirms the hypothesis that a high percentage of engineering students in this program complete internships during each available summer during college. These ratios are at or above those presented elsewhere in literature [11]. Among the smallest group, the 5<sup>th</sup> Year students, all reported completion of an internship in both years, but in 2022, one took class and held an internship. In 2022, nearly a quarter of sophomores did not work and participated in classes or military training instead, but this may be an artifact of the small sampling size of the cohort rather than a true reflection of student summer activity preference. The largest samples, juniors and seniors in both years, show an increasing number of students who report only completing military activities which corresponds with standard training timelines for ROTC students. These training camps take up a substantial portion of the summer, thus preventing students from participating in an engineering internship. Though one could state that military training is an internship for students who will pursue military careers after graduation. When looking at the same student level across two years (e.g. comparing 2022 juniors to 2023 juniors), we see inconsistent ratios of summer activities. However, when tracking a cohort between years there is more consistency in summer activities. For example, the 2022 juniors who became the 2023 seniors, approximately 55% only held an internship during the summer with an additional 20% taking classes while completing an internship. Those juniors became the 2023 senior class and maintained a nearly consistent ratio with 63% only working while an additional 13% both worked and completed a class.



**Figure 2. Count of Civil Engineering majors that did or did not work and/or take classes over the summer grouped by student status and survey completion year. 2022 collection is shown as striped columns while 2023 collection is solid columns.**

To further investigate the possible influence on summer activity selection, the cumulative GPA of incoming juniors in the 2022 and 2023 years were correlated with their summer activity preference. In the Civil Engineering curriculum at The Citadel, summer courses are not required, however they are encouraged for students who are behind, particularly in Calculus. Summer course offerings can also enable incoming juniors to “get ahead” by taking one or two junior-level courses early. Additionally, rising juniors rarely participate in military training exercises for the entire summer thus minimizing that effect on the data. As seen in Figure 3, rising juniors in the lowest GPA group (cumulative points less than 2.5) are more likely to take a class over the summer, either by itself or at the same time as an internship. This finding confirms expectations that students with low GPAs would be more likely to need to take classes over the summer which may limit their internship opportunities, though not entirely preventing this experience. Those in the highest GPA cluster (greater than 3.5) did not solely take a class over the summer. The highest GPA holders who took a class, presumably to “get ahead,” also did internships at the same time.

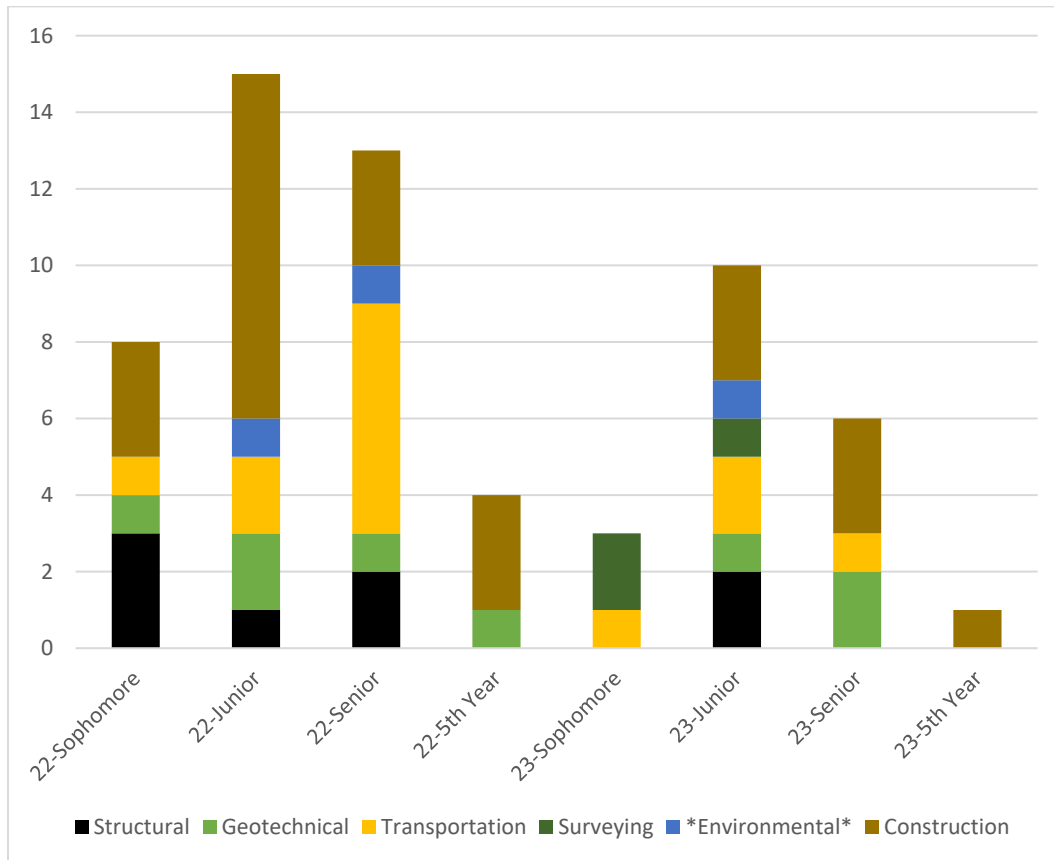


**Figure 3. GPA distribution of junior student cohorts in 2022 and 2023 grouped by summer activity. Color indicates GPA cluster. Striped bars show 2022 juniors and solid bars show 2023 juniors.**

### *Internship Subdiscipline Selection*

Civil Engineering consists of many complementary subdisciplines including structural, geotechnical, transportation, and environmental/water resources. Additionally, many trained civil engineers may work in the construction industry. These topics are not introduced at the same time in the 4-year program so course content exposure was hypothesized to influence the student's selection of internship field. Figure 4 shows the distribution of student internships across the subdisciplines. While students in the Civil Engineering program do not complete any construction management courses until their junior year and no geotechnical courses until senior year, the construction and geotechnical subdisciplines feature prominently in internships. When looking at these summary values, there is a relatively consistent proportion of the total students in each discipline: Structural (15% to 10%), Geotechnical (13% to 15%), Transportation (23% to 20%), Surveying (0 to 15%), Environmental (5% both years), and Construction (45% to 35%). However, when broken down by student status, there are larger fluctuations. For example, among the juniors in 2022, 60% were in Construction related internships, 13% were in Geotechnical and Transportation respectively, and 7% each were in Environmental and Structural. The following year, the junior students reported a much more equal distribution with 30% in Construction, 20% in Transportation and Structural, and 10% in each Geotechnical,

Environmental, and Surveying. However, as we track the junior cohort from 2022 into their senior year in 2023, there appears to be more consistent preferences with 50% in Construction, 33% in Geotechnical, and 17% in Transportation. This supports the hypothesis that each student cohort has somewhat unique preferences. However, the two-year sequential data may contradict the idea that student preferences change overtime as they complete additional course work. Additional investigation is required to definitively address the longitudinal preference hypothesis.



**Figure 4. Count of Civil Engineering majors by subspecialty of their summer job/ internship grouped by student status and survey completion year.**

Survey participants provided the name of the company that they worked with allowing further investigation into the disciplinary continuity from summer to summer. There were 19 students who had complete records from summer 2022 to 2023. Among those, 6 completed classes during the summer of 2022 and then held an internship in 2023, 3 worked for the same company for both summers, and the remaining 10 worked for two different companies in subsequent summers. While the authors are optimistic that this trend indicates students in Civil Engineering want to broaden their industry exposure or that preferences evolve as the complete further coursework but cannot be conclusively addressed with the current data. Such simplification of a



job selection to one or two criteria has been shown to vastly under represent actual influences on the participants’ selection of where to apply, if they are hired, and if they accept an offer [12]. Again, future work is required to identify the causes for students working for the same or differing companies in subsequent summers.

***Internship Opportunity Identification***

Internships are known to be an important co-curricular experience for engineers and thus connecting students to internships is an important role for an institution. As seen in Table 1, campus services such as career fairs and online services like Handshake play some role in connecting students to internships but among the student population surveyed here this was far smaller than the importance of family or friend connections to industry. The “Other” category allowed respondents to write in how they were connected to an internship if it did not fit into the previous categories. Examples of responses included “site visit for class” and “Civil Engineering club meeting guest speaker” indicating curricular and co-curricular activities during the academic year as organized by faculty may play an underrecognized role in connecting students to internships.

**Table 1: Self-reported student data on how they connected to and/or were hired by their summer internship opportunity.**

<b>Found Job Via:</b>	<b>2022</b>	<b>2023</b>
Campus Career Fair	16%	16%
Handshake	3%	0%
LinkedIn	2%	12%
Family/Friend Connection	18%	32%
Faculty Recommendation	3%	0%
Previous work/internship connection	3%	8%
Google Search	3%	4%
Other	15%	12%

**Summary and Conclusions**

It is vital that students perceive their undergraduate educational experience as one that successfully promotes their professional development. Graduates entering the engineering profession must be prepared to grapple with more complex issues than ever before. This study collected data regarding extra-/co-curriculum activities from rising sophomores, juniors and seniors in the Civil, Environmental, and Construction Engineering Department at The Citadel. The data analyzed are from fall 2022 and fall 2023. Extra-/co-curricular activities specifically included in the survey were internships, summer jobs, summer course enrollment, and military training exercises. However, this paper focused mostly on the internships.

Our findings demonstrate that all internship positions held by the Civil Engineering students were paid positions. More than half (greater than 60%) of respondents held summer work or internships. This confirms the hypothesis that a high percentage of engineering students in this program complete internships during each available summer during college. When looking at student performance through their cumulative GPA, rising juniors in the lowest GPA group (cumulative points less than 2.5) are more likely to take a class over the summer, either by itself or at the same time as an internship, because they, usually, need to catch up with their coursework. Those with GPA greater than 3.5 did not solely take a class over the summer. If they decided to take a course, presumably to “get ahead,” they also did internship at the same time.

Internships are held in several civil engineering subdisciplines but it seems that student preference towards internships at certain subdisciplines are not constant overtime. Also, even though campus services such as career fairs and online services play a role in connecting students to internships, most of the survey participants indicated that family or friend connections to industry helped them secure an internship.

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