

Deconstructing Student Motivations for Selecting a College Major: Strategies to Improve Recruitment in Construction Engineering

The growing population, an upturn in the economy, rapidly deteriorating infrastructure, and a high rate of retirement in construction workers will create substantial employment opportunities in construction-related occupations over the next decade. There are consistently more jobs for students that have graduated from a construction program compared to civil engineering. However, the majority of students who are interested in constructing the built environment major in civil engineering rather than enrolling in a construction focused program. The objective of this study was to understand how students decide between civil and construction engineering majors, and how construction engineering programs can increase their share from the body of students interested in the study of the built environment. Focus group discussions and statistical analysis of survey data collected from 102 construction and civil engineering students were analyzed to conclude three specific recommendations to increase the recruitment of students to a construction engineering program. It is recommended that marketing efforts for recruiting construction engineering students: (i) be focused on the bright career opportunities for construction engineering graduates; (ii) highlight some of the intellectually-intensive requirements of construction jobs and construction program; and (iii) target a wide range of candidates rather than solely focus on prospective students. The outcomes of this study will enable construction engineering programs to improve their marketing efforts for recruiting students and will help students to select a major that best matches with their interests.

Introduction

The growing population, an upturn in the economy, rapidly deteriorating infrastructure, and a high rate of retirement in construction workers will create substantial employment opportunities in construction-related occupations over the next decade (Burt and Tinker, 2017). The construction sector is projected to add more than half a million new jobs by 2026 which represents 11% growth in one decade. The median annual wage for construction occupations is about 20% higher than the median annual wage for all occupations (U.S. Bureau of Labor Statistics, 2018). In response to the clear need for skilled construction workers, many higher education institutions offer construction-related programs with names such as construction management, construction engineering, construction science, building science, or construction technology. However, despite the bright employment outlook for construction graduates, many of the construction programs do not meet their student enrollment targets. The unsuccessful recruitment of students to construction programs has been attributed to an unpopularity of Science, Technology, Engineering, and Mathematics (STEM) education in general, and a lack of interest in the traditional engineering programs (such as civil, mechanical, construction engineering) in particular (Gaedicke et al., 2016). Other factors, such as the perception or reality of hostility in the construction industry to female and minority workers, are known to hinder recruitment of specific demographic groups to construction programs (Menches and Abraham, 2007). While all these factors are real challenges faced by construction programs to recruit talented students, they are common challenges faced by both civil engineering and construction programs. On the other hand, an analysis of the Bureau of Labor Statistics' Occupational Outlook Handbook shows that career opportunities in construction field have been growing at a much higher rate than civil engineering (U.S. Bureau of Labor Statistics, 2018). However, the number of construction students is not following this trend. Despite the strong employment outlook for construction graduates, the majority of students who are interested in constructing the built environment are still going to civil engineering programs. The objective of the research presented in this paper is to illuminate how students decide between construction and civil engineering majors. By understanding students' motivations for selecting between Construction Engineering (ConE) and Civil Engineering (CE), we will be able to recommend targeted recruitment messages for students who are uncertain between civil and construction majors.

Method

To understand how students decide between civil and construction engineering as their field of study, this research aimed to determine: (i) students' motivations for pursuing higher education, and (ii) their perception of the

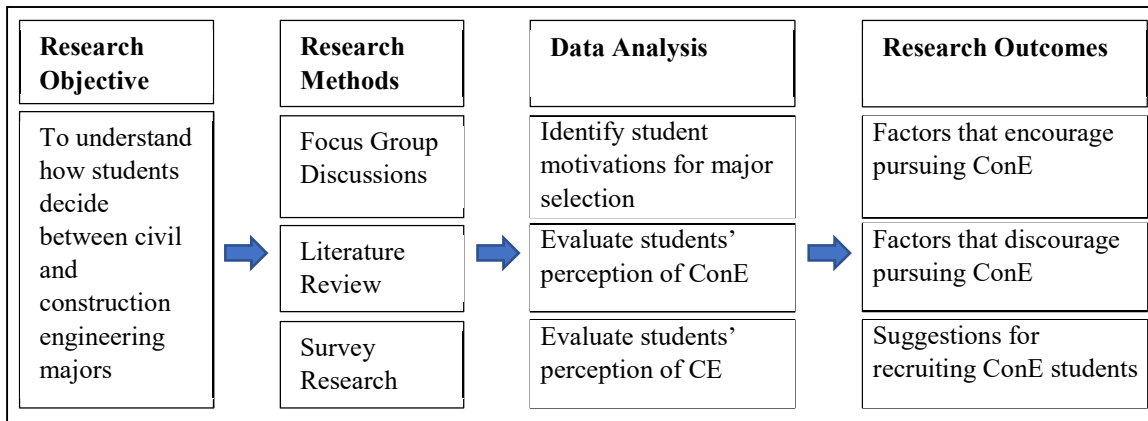


Figure 1. Research Framework

appropriateness of each major to their motives. In this study, a combination of focus group discussions, a literature review, and survey research was used to identify the factors that encourage or discourage students to select ConE over CE, and to make recommendations for targeted marketing messages for students who are uncertain between ConE and CE. Figure 1 shows the research framework used to achieve the objectives of this study. The remainder of this section will focus on the research methods, with the data analysis and research outcomes explained under the “Results” and “Discussion” sections.

Focus group discussions

The purpose of the focus group discussions was to determine the focus of the literature review which in turn was used to design the questionnaire. The Citadel has recently launched a construction engineering program within the Department of Civil and Environmental Engineering. The first two years of the curriculum is common between civil and construction engineering programs. The students have the opportunity to select between CE and ConE programs with little to no impact on their graduation date up until they begin their 3rd year. For this study, one focus group consists of 1st year students and one focus group consists of 3rd year students. The freshman and junior focus groups included 15 and 10 students, respectively. Each focus group met for a 50-minutes group discussion session. Within each session, a moderator posed a series of open-ended questions regarding students' motivations for selecting a college major, and their perceptions of civil and construction engineering as college majors. The participants were encouraged to share their thoughts and feelings freely. The moderator asked follow-up questions to clarify the participants' points of view without directing them to a desired response. For example, when a participant stated “I’m selecting my major based on the employment outlook”, the moderator asked “what aspect of your future employment is most important for you? Is it the salary, the type of work that you’ll be doing, or what?”. The moderator also encouraged other participants to share their thoughts about the same question. During this process, the researcher took notes of the vital points of the discussion as they relate to the research objective.

Literature Review

The literature review was intended to: (i) complement focus group discussions to identify factors that may affect students' motivations for major selection; (ii) identify what constitutes construction engineering both as an academic field and a professional discipline; and (iii) lay the groundwork to understand academic relevance of degree programs from the perspective of college students.

A review of the literature shows that interest in subject area; intellectual curiosity; prospect of a fulfilling and high paid job; prestige of the degree; encouragement by peers and support communities; perception of competence for the requirements of a major; gender, diversity and racial composition in a program; parental desires; and not being admitted to the first choice of major are among the main motivations of college students to select their major (Perez et al. 2014; Musu-Gillette et al. 2015; Bottia et al. 2018; Kim et al. 2018; Soria and Stebleton 2013).

The review of the literature also shows a high demand for construction graduates in all types of construction including residential, commercial, industrial, and heavy construction. In addition, construction jobs are among the top 5 well-paid occupations (Burt and Tinker, 2017; U.S. Bureau of Labor Statistics, 2018). The literature reveals five factors students perceive as crucial for a successful college major: (1) direct academic relevance, i.e. the program will eventually provide them with a degree; (2) direct occupational relevance, i.e. the students will directly apply what they have learned in their future careers; (3) direct personal relevance, i.e. the students will use what they learned in their day-to-day life; (4) indirect academic relevance, i.e. a program prepares them for graduate school; (5) indirect occupational relevance, i.e. critical thinking skills to help in their career but not a specific work task; and (6) indirect personal relevance, i.e. provide the student with general knowledge about the world they live in (Pisarik, and Whelchel 2018).

There are five categories of courses typical to construction engineering programs: math and basic science, engineering science, engineering design, humanities and social sciences, and business and management (Abudayyeh et al. 2000).

Survey

Focus group results and construction engineering education literature were used to prepare a survey containing six sections. The first section was demographic information, such as gender, ethnicity, and household income level. The second section focused on the respondents' personal information relating to their status in the college: class (freshman, sophomore, junior, senior), declared major or the major they are inclined to, SAT score and GPA, experience in civil engineering or construction work, and whether they have relatives who own or work for a construction or engineering firm. The third section questioned the students about their confidence in their declared major, and their inclination to change to a different major. The fourth section identified the factors, and their ranking, the respondents distinguish as having an impact on their major-selection decision. Sections five and six asked questions about respondents' perception of construction and civil engineering, respectively. A total of 102 surveys were collected from CE and ConE freshman and junior students in the Department of Civil and Environmental Engineering. Table 1 summarizes the demographics of the survey respondents.

Table 1: Frequency of Demographic Variables

Demographic Variable		n	%
Gender	Male	96	94%
	Female	6	6%
Status	Freshman	66	65%
	Sophomore	0	0%
	Junior	34	33%
	Senior	2	2%
Declared Major	Civil	72	71%
	Construction	23	23%
	Other	7	7%
Ethnicity	White	85	83%
	Hispanic or Latino	5	5%
	Black or African American	5	5%
	Native American or American Indian	1	1%
	Asian or Pacific Islander	3	3%

Other 3 3%

Results

Descriptive and inferential statistical analysis was conducted on the data obtained from survey to analyze the students' motivations for major selection and their perceptions of CE and ConE majors. The results are presented in this section.

Students' Motivations for Major Selection

Overall, "interest in subject area", "leading to a fulfilling career", and "prospect of getting a high paying job" are the main motivation for students selecting a major with 41%, 21%, and 18% of students, respectively, considering these factors as their top priority. However, there is significant difference between the top motivation of ConE and CE students. Figure 2 shows the priority motivation of students for selecting their college major. More than 75% of ConE students stated that "interest in subject area" was their main reason for selecting their major, while only 35% of CE students expressed the same feeling about this factor. On the other hand, 20% of CE students went into the civil engineering program for the prospect of getting a high paying job, only 5% of ConE students considered high paying job as their main motivation for major selection. About 24% and 14% of CE and ConE students, respectively, selected their major because they think it will lead to a fulfilling career. It is also notable that for all ConE respondents only four different factors were revealed as their main motivation for pursuing a ConE degree, while CE respondents report a wider range of motivations (11 different factors) to selecting their degree program.

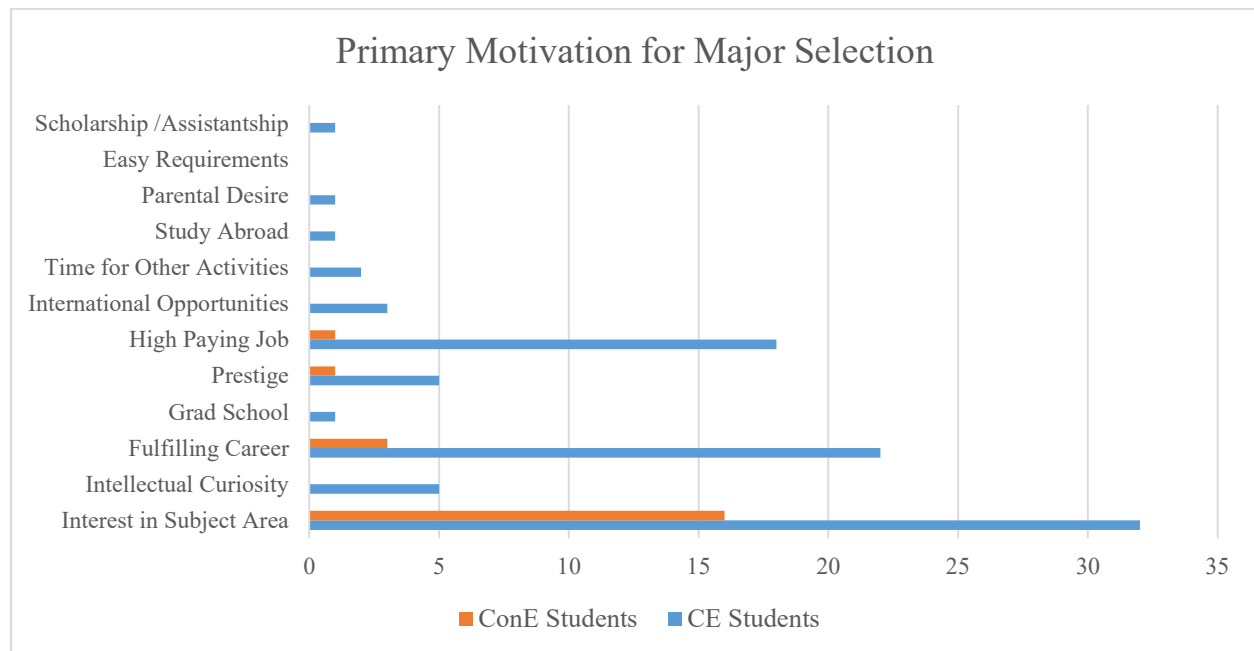


Figure 2: ConE and CE Students' Motivation for Selecting their Major

Students' Perceptions of ConE and CE

Students' perception of ConE and CE were evaluated with statements using a 5-point Likert scale. A response of 1 demonstrates the respondent strongly agrees with a given statement about the major and 5 corresponds to strong disagreement with the statement. Each question was asked once for ConE and once for CE majors. The Mann–Whitney U-test was used to test the null hypothesis that it is equally likely that a randomly selected value from students' perception of ConE will be less than or greater than a randomly selected value from the students' perception of CE. The following null hypotheses were tested:

Students believe:

- 1- ConE and CE are equally prestigious
- 2- There is no significant difference in ConE and CE graduate salaries
- 3- Family and friends encourage students to pursue ConE and CE equally
- 4- ConE and CE equally prepare students for graduate and professional schools
- 5- The requirements of ConE and CE degrees are equally academically challenging
- 6- The work environment is equally hostile to female graduates of ConE and CE
- 7- The work environment is equally hostile to minority graduates of ConE or CE
- 8- ConE and CE graduates will enjoy similar levels of international opportunities
- 9- Scholarships or assistantships are equally available for ConE and CE students

The results of the Mann-Whitney U-tests are shown in Table 2. Of the nine hypotheses tested, six were rejected at a 95% confidence level. Mann-Whitney U-test did not reject hypotheses 6, 7, and 8. This result shows that students perceive CE and ConE differently with regards to prestige, salary prospects, encouragement by family and friends for the degree program, preparing students for graduate and professional schools, academic difficulty, and availability of scholarships or assistantships. The six rejected hypotheses were tested with a one-tailed Mann-Whitney U-test and the following results were obtained:

Table 2: Mann-Whitney U-Test for Comparing Students' Perception of ConE and CE

Hypothesis Topic	U Value	Z-Score	p-value	result significant at $p < .05$?
Prestige	2706	5.60297	< .00001	Yes
Salary	3090	4.57777	< .00001	Yes
Family and Peers encouragement	2528	5.88361	< .00001	Yes
Preparing for graduate/professional schools	3738	3.08127	.00208	Yes
Difficulty of Requirements	3606.5	-3.5942	.00034	Yes
Hostility to Female Students/Graduates	4428	-1.39524	.16152	No
Hostility to Minorities	4990.5	-0.02077	.98404	No
International opportunities	4588	1.00428	.31732	No
Scholarship/Assistantship	3870	2.75872	.00578	Yes

- 1- Students perceive ConE to be less prestigious than CE.
- 2- Students think CE graduates will have greater salary potential.
- 3- Family and friends provide more encouragement for students to enter a CE program rather than ConE.
- 4- Students believe ConE degree requirements are easier than CE.
- 5- Students believe they will have fewer opportunities for continuing to graduate school if they graduate with a ConE degree.
- 6- Students believe fewer scholarship and assistantship opportunities exist for ConE students.

Discussion

There are more high-paying job opportunities for graduates of a construction program compared to civil engineering. Yet, a majority of students who are interested in “constructing” the built environment go to CE programs instead of ConE programs. This study attempted to find the root causes of this discrepancy. According to this study’s results, while 22% of total respondents selected ConE as their college major, only 5% of students who prioritize the prospect of a high salary for their major selection selected ConE as their major. Similarly, only 13% student who prioritize getting a fulfilling job for their major selection go into the ConE program. This result leads the authors to determine that an effective strategy for attracting more students to ConE programs should be focused on the bright career opportunities for ConE graduates.

Seven percent of the CE students selected their major based on intellectual curiosity, but the ConE program has not attracted any student whose primary reason for their major selection was intellectual curiosity. This finding is complimentary to an additional finding of this study that demonstrates, in general, students find the academic requirements of ConE easier to fulfill. Focus group discussions revealed students are very interested in the hands-on experience of the construction careers and are aware of the relatively lower mathematics and design requirements of ConE compared to CE, but are generally ill-informed about the challenging skills expected from ConE graduates; such as critical and analytical thinking, time management, people management, and strong communication skills. The students' perception that ConE is easier than CE and may not satisfy their intellectual curiosity may be attributed to the differing skills expected of construction engineers. To combat these misperceptions, it is recommended that marketing efforts for ConE programs highlight some of the intellectually-intensive requirements of construction jobs and the construction engineering degree program.

This study reveals students perceive ConE to be a less prestigious career than CE. Additionally, students are less likely to be encouraged by their family and friends to pursue a ConE degree. While "parental desire" is among the top five reasons for several students to pursue a civil engineering degree, only one student considered parental desire among the top 5 reasons they selected ConE. Parental desire was not the first reason for any student to pursue ConE. These results show the importance of targeting a wider range of audience for marketing the ConE program rather than just the prospective students, and should include parents and the general public.

Conclusion

This research identified and analyzed the factors that affect major selection of civil and construction engineering students. The objective of the research was to help construction programs increase their share from the body of students concentrated on the design and construction of the built environment. Using findings from focus group discussions and statistical analysis of survey data collected from 102 ConE and CE students, three specific recommendations are made to help ConE programs recruit more students. It was recommended that marketing efforts for recruiting ConE students: (i) be focused on the bright career opportunities for ConE graduates; (ii) highlight some of the intellectually-intensive requirements of construction engineering careers; and (iii) target a wide audience rather than being solely focused on prospective students.

While the sample size for this study was large enough to make inferences about the target population from the sample, it should be noted that all data was collected from one college and further research from other higher education institutions is required before the results could be generalized for construction engineering programs. Future work will assess the relation between demographic attributes of the respondents such as ethnicity, gender, and household income and their decision to pursue a construction engineering major. Future research will also identify the leading indicators of students' success in construction engineering programs.

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