

Civil Engineering Students' Viewpoints on Teaching, Learning, and Careers

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Abstract

What do civil engineering students think about the undergraduate program, both in and out of class, and the job prospects ahead? Some 161 students at Mississippi State University, freshmen to seniors, recently provided candid responses to a survey that asked them about teaching, learning, and careers.

It was discovered that some 63% of the respondents are guardians, which is one of the four temperament types according to the Keirsey test, which students were asked take before this survey. Only 40% of the general population are considered guardians.

Some 54% of students said they joined a professional society like ASCE, and 20% of those active in ASCE were members of the concrete canoe or steel bridge teams.

Surprisingly few students said high grades were more important than communication and interpersonal skills and previous work experience when it comes to the job search and early job success.

Some 65% of respondents said a master's degree would help advance their careers, while 58% plan to pursue a master's degree at some point.

The objective of this preliminary study was to improve students' experiences and outcomes. The information collected here is likely applicable elsewhere.

Introduction

A survey was directed at undergraduate civil engineering students at Mississippi State University. The purpose of this survey was to assess what students think about teaching, learning, and the job search ahead. The survey began with basic questions about students' status and temperament. Students previously took the Keirsey temperament test.

The questions on the survey were as follows.

- What is your class status? Select one. (Freshman, Sophomore, Junior, or Senior)
- I am a...(Male or Female)
- According to the Keirsey test, what is your temperament? Select one. (Artisan, Guardian, Idealist, or Rational)
- What civil engineering discipline interests you the most? Select one. (Construction, Environment, Geotechnical, Materials, Structures, Transportation, or Water Resources)
- How would you describe your enthusiasm about pursuing a civil engineering degree? Select one. (High, Moderately High, Moderate, Moderately Low, and Low)

- What teaching method(s) do you feel is (are) effective? Check as many as you wish. (Lectures on the board, Lectures on slides, Discussions, and Group work)
- What modern educational tool or teaching innovation would you like to see introduced into the civil engineering program?
- What activity best allows you to learn the material out of class? Select one. (Textbook problem sets or Projects)
- How do you study and work on assignments most of the time? Select one. (Individually or In a group)
- Do you have membership and attend chapter meetings of any professional society such as the American Society of Civil Engineers (ASCE)? Select one. (Yes or No)
- Do you participate on the ASCE concrete canoe or steel bridge team? Select one. (Yes or No)
- What is the best explanation of why you choose to participate on a team? Select one. (It is a chance to apply what I learned in class, I enjoy the team camaraderie, or I simply like the challenge)
- If you do participate on a team, what attributes do you most acquire? Select one. (Teamwork/leadership skills or Technical skills)
- What is the best explanation of why you choose to not participate on a team? Select one. (I don't have enough time, I don't know how I could contribute, or I don't see the value)
- What do you feel makes you most marketable to employers? Select one. (High grades, Previous work experience, or Communication/interpersonal skills)
- What do you feel makes you most ready to quickly succeed on the job? Select one. (High grades, Previous work experience, or Communication/interpersonal skills)
- Do you think a master's degree would substantially help advance your career? Select one. (Yes or No)
- Do you plan to pursue a master's degree at some point? Select one. (Yes or No)

Methodology

The survey was given in both fall and spring terms of 2015/16 to undergraduate civil engineering students at MSU. A total of 161 students in several courses completed the survey, generally in class, and these students received a small amount of extra credit. Most of the students were traditional college age between 18 and 22 years old. The survey was made in Google Forms. All responses remained anonymous and students were not asked to identify themselves.

The survey contained approximately 16 questions, and the exact count depended on the responses. Most of the survey questions had multiple choices and respondents could mark only one. Immediately before the survey was given to students, the instructors intentionally did not comment on the issues to avoid any undue influence and bias. The survey received consent from the Office of Research Compliance at MSU.

The Keirsey temperament test is online and free. The students generally took the Keirsey temperament test immediately before the survey, and they needed about twenty minutes to complete both.

Temperament Types

The Keirsey test, a powerful 70 question personality instrument, identifies four distinct temperaments.¹

Guardians are dependable, loyal, responsible, dutiful, and cautious. They trust authority. Guardians are quiet and serious about their duties and responsibilities, and work steadily within the system. They are meticulous about schedules. Jimmy Carter is an example of a guardian.

Idealists love to work with people and give themselves to help others. Like coaches, they inspire others to grow as individuals and to fulfill their potentials. Idealists make enthusiastic and inspirational leaders. To them, what exists in the world now is only a place to start. Idealists seize the possibilities of life and push others to high accomplishments too. Oprah Winfrey and John Wooden are examples of idealists.

Artisans are focused on the here and now. They are unconventional, bold, spontaneous, playful, excitable, and creative. Artisans seek stimulation and want to make a splash. Artisans are right at home with tools. They are impulsive, adventurous, adaptable, competitive, and need to be free to do what they wish, when they wish. Bill Clinton and Tiger Woods are examples of artisans.

Rationals are rigorously logical, ingenious, and fiercely independent. They prize technology and efficient solutions, and they disregard any authority or customary procedure that wastes time and resources. Rationals are often seen as cold and distant, absorbed in a drive to unlock the secrets of nature and develop new technologies. Bill Gates and Steve Jobs are examples of rationals.

Survey Results and Analysis

Class Rank, Discipline of Interest, Temperament, and Level of Enthusiasm

The survey was given to students in several courses to capture all class levels. Of the respondents, 29% were freshmen, 10% were sophomores, 25% were juniors, and 36% were seniors. Approximately 20% of civil engineering students at MSU are female.

Some 29% of students expressed the highest interest in structures, the most of all disciplines. Interest in structures was followed by construction and environment at 24% and 20%, respectively. Few students, only 1%, had the highest interest in materials.

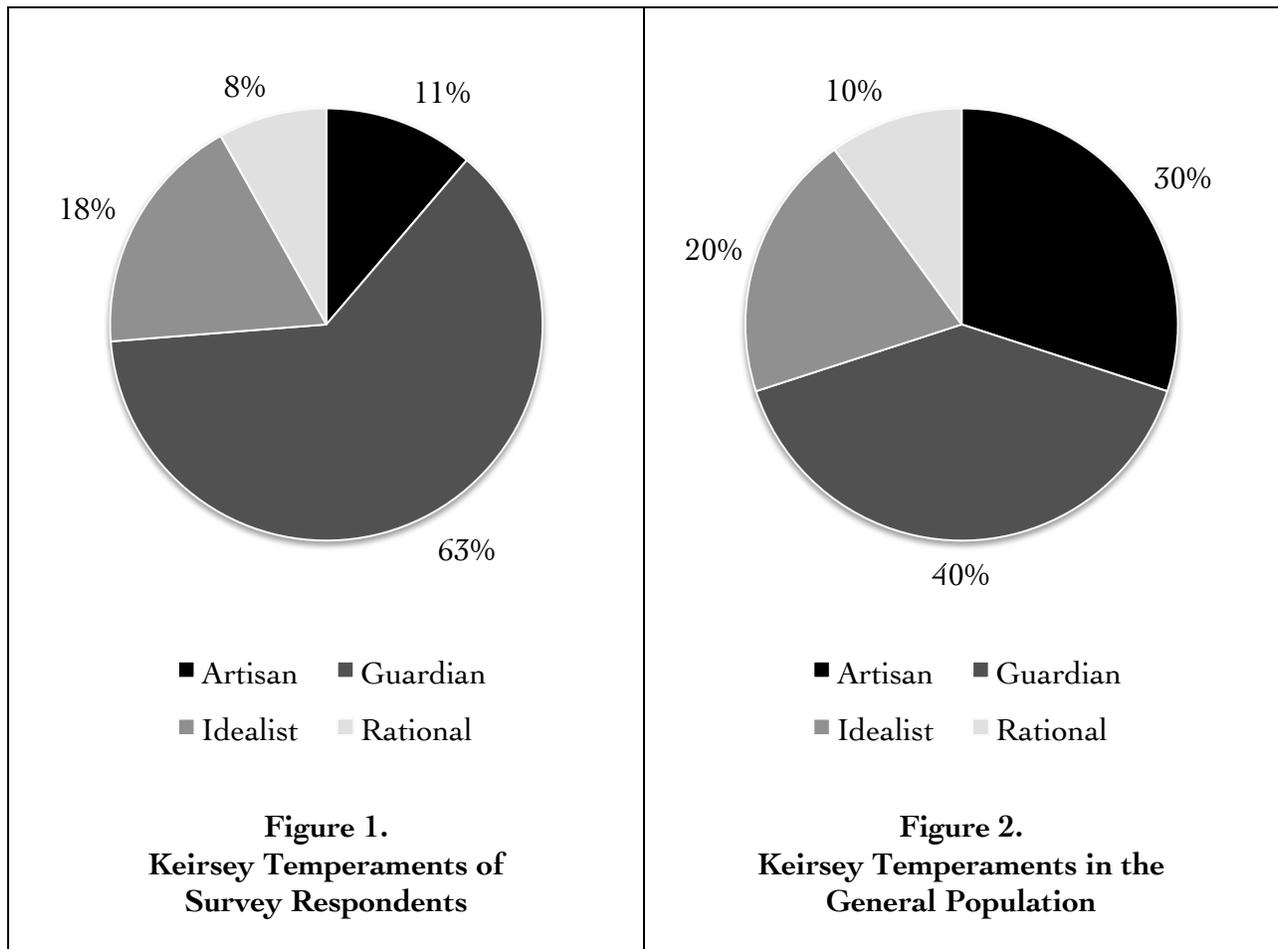
Survey responses of the Keirsey temperament test are displayed in Figure 1. Some 63% of the respondents were guardians, followed by idealists at 18%. Rationals and artisans were the

least common temperament types found in the survey. Figure 2 shows the Keirsey temperaments of the general population in this country.

The freshman class was reasonably representative of the temperament types found in the general population. But previous experience at MSU shows that many idealists, artisans, and rationals eventually leave the civil engineering program before graduation, and the share of guardians consequently increases. The way courses are taught and the temperaments of the faculty could explain why guardians are more likely to persist and flourish while others choose different paths. In this study, share of juniors and seniors who are guardians clearly exceeds the share freshmen and sophomores who fit this temperament.

A trend was not observed between temperament and discipline choice, as most disciplines attracted a representative share of temperament types.

Some 83% of respondents reported high or moderately high enthusiasm about the program. Only 2% of students described their enthusiasm as moderately low or low.



Teaching and Learning

A majority of students said discussions are an effective teaching method, while group work received the least support.

When students were asked about educational tools or teaching innovations they would like to see brought into the civil engineering program, there were many and diverse responses.

One respondent recommended more use of physical models to help students visualize the designs.

Several others thought MSU should introduce new software to keep up with what industry uses, as many workplaces have now largely replaced CAD software with BIM. One student wondered if Microsoft Excel was still useful.

One idea was to put the lectures on YouTube so students can watch at home, and then use class time to work on problems. The traditional lectures can be effective, but today's students generally like more active methods.

A comment was made that very few if any lectures are dedicated to historical civil engineering accomplishments and remarkable feats.

Several students demanded to have instructors who can actually teach. Others were simply content and like college the way it is, but they wanted to be asked again in a few semesters once they have had a few more key core courses.

One respondent thought faculty should help more with students' placement in summer internships so they can experience a specialty of choice.

Several respondents wanted more opportunities to practice communication skills.

There is too much to do in college, said one respondent, who requested a time management coach.

On this survey, students were also asked about the activities that help them learn best, and how they want to do the work. Some 61% of respondents said textbook problem sets are more effective than projects. A majority of students, some 73%, typically study and work on assignments alone, while relatively few preferred to work in a group. Seniors were much more likely to appreciate group work than freshmen.

Professional Society Membership

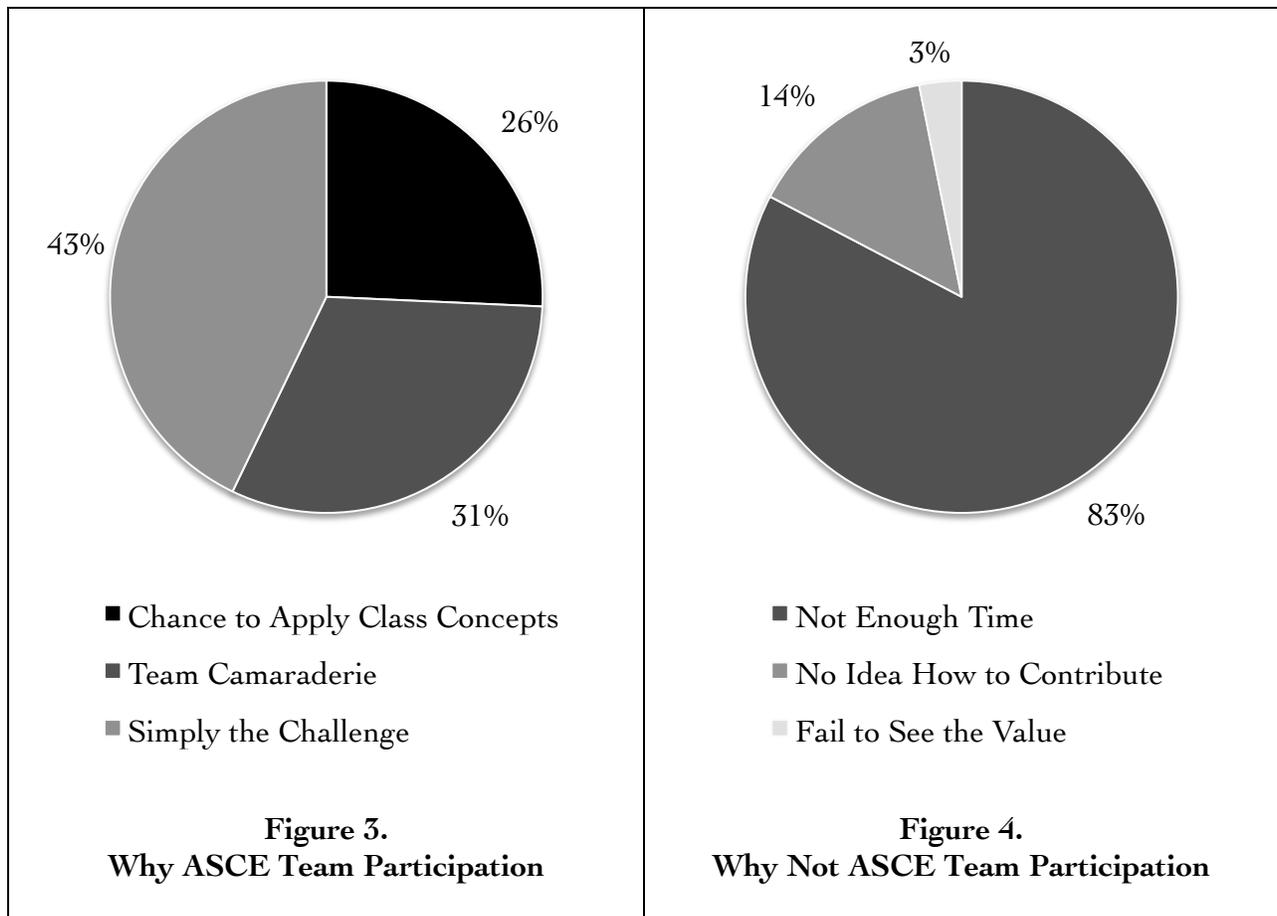
Some 54% of students said they joined a professional society like ASCE, and 20% of those active in ASCE were members of the concrete canoe or steel bridge teams.

On an ASCE team, some 77% of respondents claimed teamwork and leadership skills are what they mostly acquire, while 23% see the experience as a way to improve technical skills.

Of those who did join an ASCE team, some 43% of respondents simply like the challenge, while 31% are attracted to teams because of the camaraderie and 26% most appreciate the chance to apply class concepts. These results are displayed in Figure 3.

Of those who did not join an ASCE team, some 83% said a lack of time keeps the away. Some 14% did not know how they could contribute, while only 3% did not see the value of team participation. These results are displayed in Figure 4.

A new course at MSU will start in 2016/17 to give students one credit when they join an ASCE team. The course will not count toward degrees but awards students with recognition on their transcripts. Students can take the course more than once. Faculty advisors will supervise the activities, and students will likely be asked to keep a work journal.

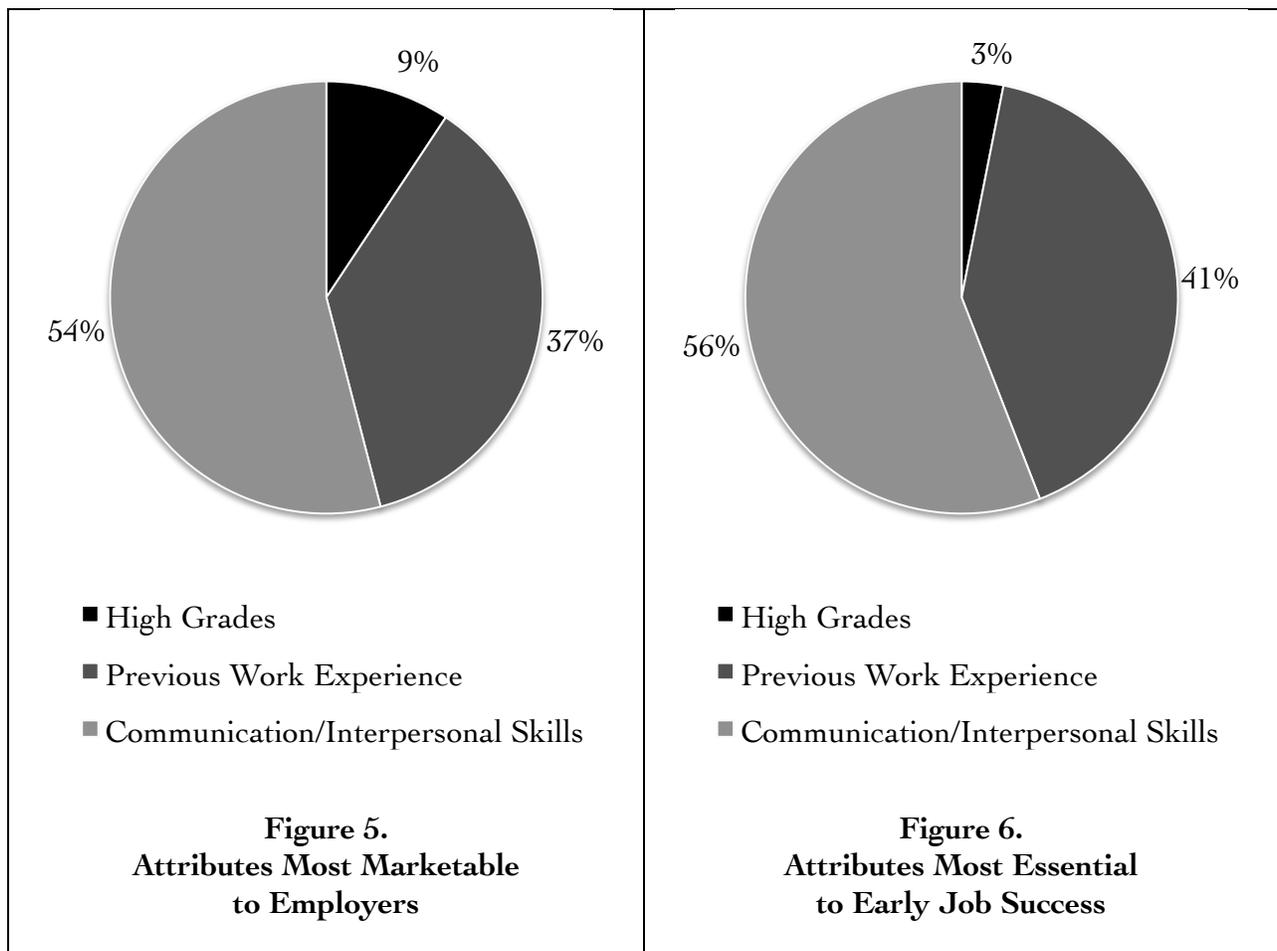


Careers

The attributes that students feel makes them most marketable to employers are displayed in Figure 5. A majority of respondents, 54%, said communication and interpersonal skills count the most. Previous work experience was considered by 37% of students to be most desirable to potential employers, while only 9% said high grades would most likely land them the job they want.

The attributes most essential to early job success are displayed in Figure 6. Communication and interpersonal skills are most important according to 56% of respondents. Some 41% of respondents said previous work experience helps secure early job success. Perhaps the most surprising mark in the survey, only 3% of respondents believed high grades are the key attribute of early job success.

The civil engineering industry wants technically competent employees, and also those with communication skills, business acumen, social aptitude, and ethics.² Many civil engineering students lack the communication skills they will need to succeed professionally.³



Additional Education

Some 65% of respondents said a master's degree would help advance their careers, while 58% plan to pursue a master's degree at some point. Freshmen and sophomores were somewhat more fervent about the additional education than juniors and seniors, who are ready to taste life beyond classes. All respondents who said high grades were most important to the job search and early job success plan to pursue a master's degree.

A majority of survey respondents were in tune with ASCE, which believes a master's degree should be necessary before entry into professional practice. The challenges that civil engineers face are increasingly complex, and a bachelor's degree can hardly contain the broad body of knowledge.⁴ New educational requirements could more solidly prepare future civil engineers to safeguard the health and safety of the public.⁵ Charles Thornton, who founded the venerable structures firm Thornton Tomasetti, considers a master's degree essential in the structures field.⁶ Education beyond the bachelor's degree could also raise the stature of civil engineering.

Opponents argue that additional education requirements could turn some students away from civil engineering and negatively impact businesses. They want the market to determine the minimum educational level.⁷

Conclusions and Future Goals of the Study

The goal of this study was to understand students' experiences in the civil engineering program at MSU. Often students' opinions are neglected or afforded little importance. Here the authors made an effort to understand students' personalities, interests, and aspirations.

The authors plan to give the survey to more students at MSU in the semesters ahead. The more extensive knowledge of students' viewpoints will allow them and others to continuously improve the civil engineering program. And the results here can be used to shape civil engineering programs elsewhere.

It would be of interest to ask civil engineering employers and also students of other majors and those employers what they feel are the attributes most marketable and essential to early job success.

Of special concern is the departure of all temperament types except guardians. Certainly all temperaments are needed in the field of civil engineering. What is the cause of this exodus and what can be done to change the tide?

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