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 102 students at Mississippi State University, freshmen to seniors, recently provided candid responses to a survey that asked them about teaching, learning, and careers. The objective of this preliminary study was to improve students' experiences and outcomes. The information collected here is likely applicable elsewhere.

Keywords

Civil Engineering, Temperaments, Teaching and Learning Styles, Professional Societies, Master's Degree

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)
- What civil engineering discipline interests you the most? Select one. (Construction, Environment, Geotechnical, Materials, Structures, Transportation, or Water Resources)
- According to the Keirsey test, what is your temperament? Select one. (Artisan, Guardian, Idealist, or Rational)
- 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 slides, Lectures on the board, 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)
- If you do participate on a team, why? 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)
- If you don't participate on a team, why not? 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 the fall term of 2015 to undergraduate civil engineering students at Mississippi State University. A total of 102 students in the Introduction to Civil Engineering course completed the survey. Most of the students were traditional college age between 18 and 22 years old. In this preliminary study, the survey was added to the course management software MyCourses in use at MSU that allows instructors to check which students have completed the work. In this case, those students who did so received a small amount of extra credit. But beyond this check, all responses remained anonymous. Subsequent editions of the survey will likely be run from Google Forms, and students will not be asked to identify themselves in any way.

The survey contained 17 questions and required about five minutes to complete. Most of the 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 MSU Office of Research Compliance.

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.

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.

Artisans are focused on the here and now. They are unconventional, bold, spontaneous, playful, excitable, and creative. Artisans trust their impulses. They want to make a splash, seek stimulation, and prize freedom. Artisans love to work with their hands and they seem right at home with tools. They are impulsive, adventurous, adaptable, competitive, and need to be free to do what they wish, when they wish.

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.

Survey Results and Analysis

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

The survey was given to students in the Introduction to Civil Engineering course, so most respondents, 79%, were freshmen or junior transfers.

Some 30% of students expressed the highest interest in structures, the most of all disciplines. Interest in structures was followed by construction and environment at 25% and 22%, respectively.

Survey responses of the Keirsey temperament test are displayed in Figure 1. Some 53% of the respondents were guardians, followed by idealists at 25%. 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, 45% of freshmen and sophomores were guardians, while 66% of juniors and seniors fit this temperament.

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

Some 76% of respondents reported high or moderately high enthusiasm about the program. Only 3% of students described their enthusiasm as moderately low or low.

Figure 1. Keirsey Temperament of Survey Respondents

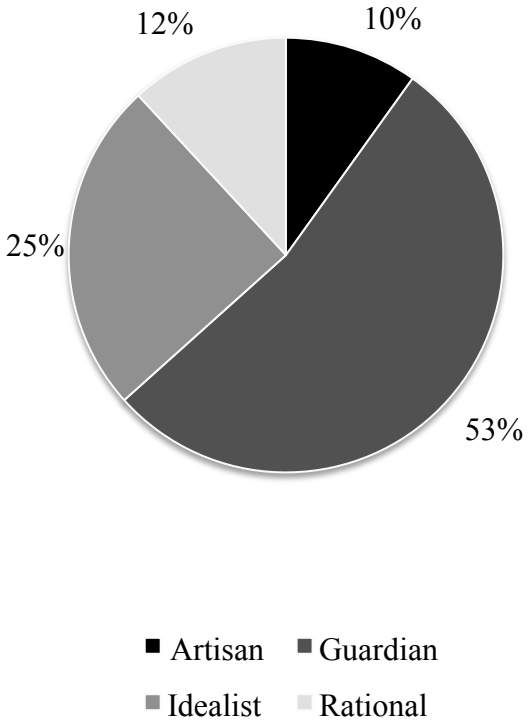
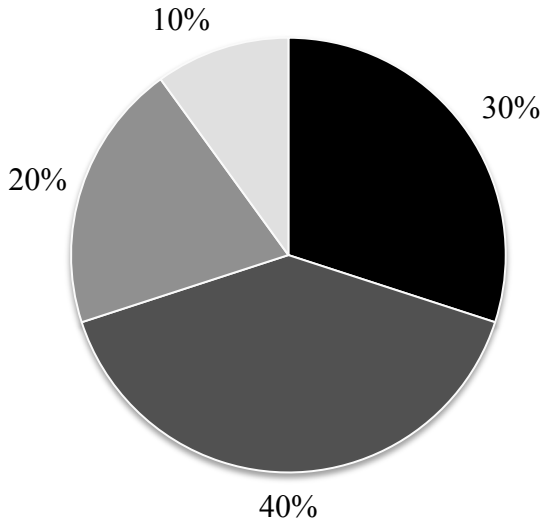


Figure 2. Keirsey Temperament in the General Population



Teaching and Learning

A majority of students said discussions are an effective teaching method, while lectures on the board 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 the use of 3D printers to make physical models.

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 the math 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 64% of respondents said textbook problem sets are more effective than projects. A majority of students, some 83%, typically study and work on assignments alone, while relatively few preferred to work in a group.

Professional Society Membership

Some 40% of students said they joined a professional society like ASCE, and 21% of students were members of the concrete canoe or steel bridge teams.

On an ASCE team, some 75% of respondents claimed teamwork and leadership skills are what they mostly acquire, while 25% see the experience as a way to improve technical skills.

Of those who did join an ASCE team, some 50% of respondents simply like the challenge, while 33% appreciate the chance to apply class concepts. Only 17% are attracted to teams because of the camaraderie. These results are displayed in Figure 3.

Of those who did not join an ASCE team, some 81% said a lack of time keeps the away. Some 15% did not know how they could contribute, while only 4% did not see the value of team participation. These results are displayed in Figure 4.

Careers

The attributes that students feel makes them most marketable to employers are displayed in Figure 5. A majority of respondents, 71%, said communication and interpersonal skills count the most. Previous work experience was considered by 24% of students to be most desirable to potential employers, while only 6% said high grades would most likely land them the job they want.

The attributes necessary to early job success are displayed in Figure 6. Communication and interpersonal skills are most important to early job success 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]

Figure 3.
Why ASCE Team Participation

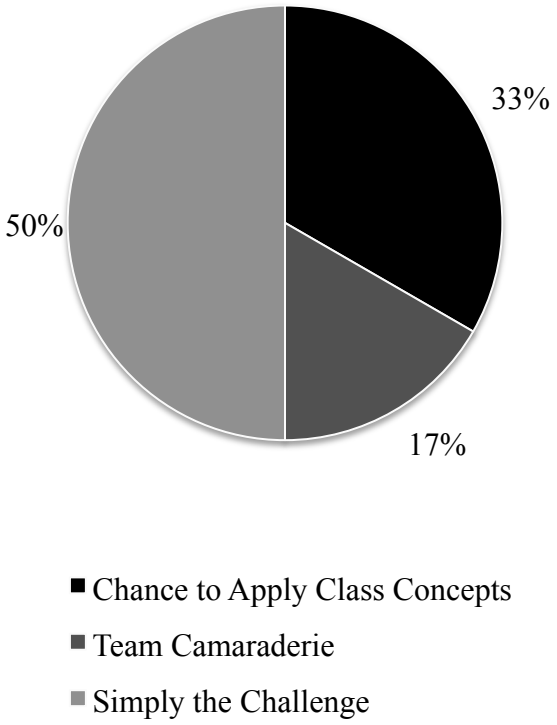


Figure 4.
Why Not ASCE Team Participation

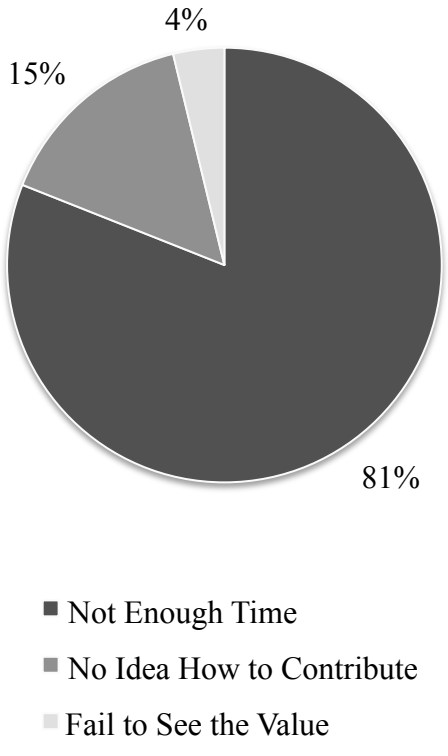


Figure 5.
Attribute Most Marketable to Employers

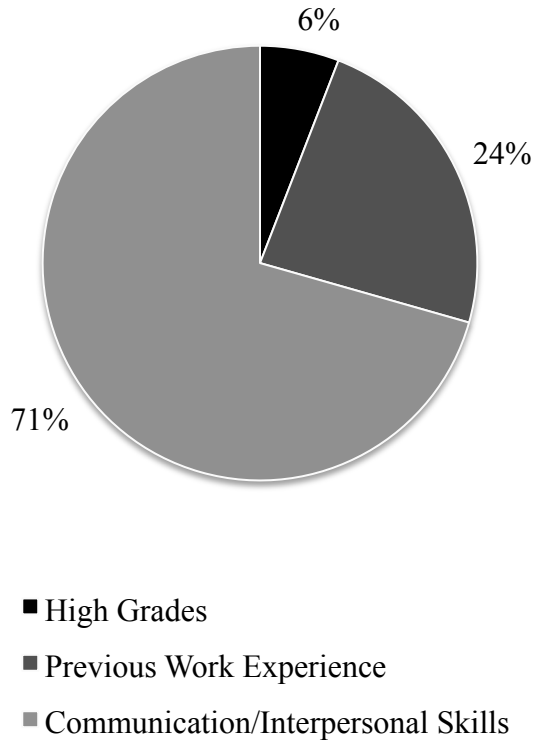
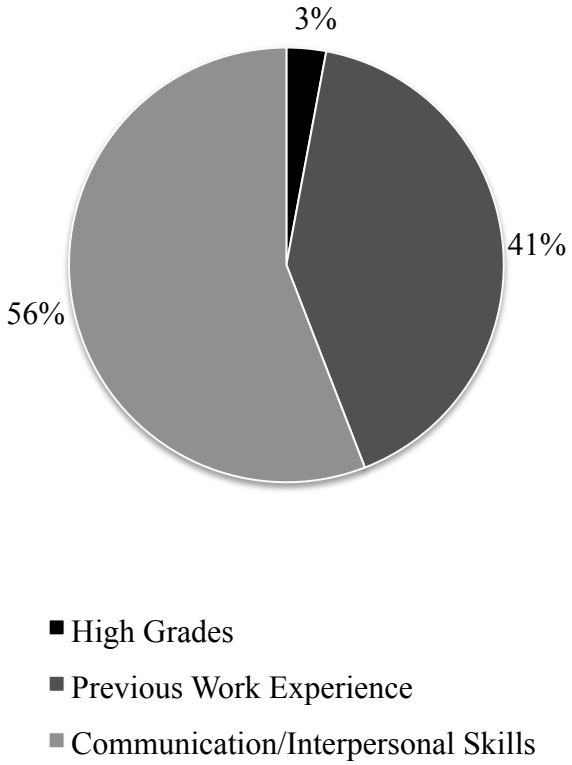


Figure 6.
Necessity of Early Job Success



Additional Education

Some 69% of respondents said a master's degree would help advance their careers, while 64% plan to pursue a master's degree. Some 66% of freshmen and sophomores plan to pursue a master's degree, while juniors and seniors were somewhat less fervent about the additional education. 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 in more courses 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.

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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