

Understanding student personality trends for curriculum development

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Abstract

Keirse's personality test was administered to our students in introductory civil engineering course to help students realize their personalities over the past six years. A similar evaluation was performed for those approaching graduation. In addition, data collected from our senior civil and environmental engineering students was evaluated to understand the trends of different personalities in our student population and the student involvement through our civil engineering curricula. We examine the impact of student personality on overall activities and effectiveness of the program and student performance and development through their graduation. Further, the authors examine if changes in program structure will impact the diversity of students, as defined by their temperament, who graduate from that program. This article presents the outcomes/observations and learning lessons from data evaluation and correlates with potential modifications to the overall curriculum to enhance student learning experiences and career development and preparedness to the professional careers.

Keywords

Engineering education, student personalities, Keirse Temperament Sorter, engineering design, and student learning

Introduction

Success of an academic program can depend largely on the characteristics and personalities of both students and instructors. The personalities of students play a critical role as this has substantial impact on their learning. Understanding students' personality traits and learning styles will help instructors better understand the students, create a more conducive learning environment, and help students be more successful in the courses.

Students have different learning styles in that they prefer to focus on different types of information, tend to operate on perceived information in different ways, and achieve understanding at different rates. The match or mismatch between the instructional method and learning style may have significant impact for levels of student satisfaction in any program. Students whose learning styles are compatible with the teaching styles of a course instructor tend to retain information longer, apply it more effectively, learn more, and have a more positive attitude toward the course and the program in general.^{1,2}

Students also identify with careers for different reasons and with different goals. For each, success is defined by achieving different things in different way.³ While one person may be looking for the security of employment, another is looking for a way to impact the world. Some students want to work in a tactile way to create solutions, other prefer the detachment that come with working in an office. There are students who seek opportunities to create grandly unique things that solve great problems, and others wish to solve problems using tried-and-true solution methodologies. If engineering programs don't recognize this difference, derived largely from temperament, ability, and interest, then segments of the potential engineering pool will become disenfranchised from our profession and seek career alternative which align with their personal definition of success.

Some desirable traits such as critical thinking, and decision making skills can make students successful professional engineers⁴⁻⁶. These desired traits can be evaluated first through personality tests such that an instructional pedagogical innovation can be identified to meet the needs of the most students in the course. Similarly by comparing these personality trends across the sub disciplines, it may be possible to correlate the student personalities with their area of interest and determine if they provide a rationale for such correlation.¹⁻³

Methods

There are different ways of understanding the student personalities in an academic program. The tools often used for this purpose include Myers-Briggs' Personality Types (myersbriggs.org) and Keirsey's Temperament Sorter (<http://www.keirsey.com>)^{1,2}. The goal of these evaluations is to define students' personalities in our civil engineering introductory course over the six years and relate the temperament change patterns with student learning and area of interests. We have also collected the results from students enrolled in senior design elective courses who completed the Keirsey evaluation during their final year in the program. These courses were CE 4703 Construction Engineering Management, CE 4883 Engineered Environmental Systems, and CE 4963 Steel Structures.

Keirsey's test helps identify the personality temperament as one of the four types namely "Artisans", "Guardians", "Idealists", and "Rationals". Descriptions of these temperament types are provided below³.

- "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.
- "Guardians" are dependable, loyal, responsible, dutiful, and cautious. They trust authority and are quiet and serious about their duties and responsibilities, and work steadily within the system keeping schedules.
- "Idealists" are people-oriented meaning that they like to work with people and to help others. 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.

- “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.

The following sections describe the trends in students’ personalities and the relationships with their areas of interest, i.e. civil and environmental engineering concentration areas such as construction, environment, geotechnical, materials, structures, transportation, and water resources engineering.

Results and discussion

First, we begin with identifying the personality temperament results of our CE 1001 - Introduction to Civil Engineering course students. As shown in Figure 1, the consolidated results for over the six years for four different academic years, “Guardians” were identified as dominant followed by “Artisan” or “Idealists”. “Rationals” seem to have low presence in these groups. These results were derived from students ranging from 125 to 150 per year. This made us curious about the personality trends in our students advancing through the program and led to a hypothesis/speculation that our instructional delivery methods may have had an influence on the student personality temperament. Further evaluations focused on the temperaments of our senior civil engineering students and their areas of interest.

Six years ago, an evaluation of 93 graduating seniors found that 100% of responding students self-identified as Guardians. During this timeframe, several curricular changes were made which allowed greater flexibility in senior design classes taken. The program moved from a structured, product design focus to a concept, creative design format. A few years ago, the program added an environmental concentration to allow those interested in this career field to develop a stronger formal education in this arena. Finally, the faculty made a strong effort to focus on facilitating opportunities for diverse individuals who had different interests.

To evaluate the impact of the above summarized changes, we elected to evaluate the personality of students in different civil engineering senior design elective courses. These data, summarized in Figure 2, are in large part from the students who would have been surveyed in 2012 as part of the freshman survey. A total of 68 responses were recorded which corresponds closely with the number of freshman in the 2012 class. Supplying the data were 11 women and 57 men. Students were also asked to mention if it was a first attempt to take the Keirse test. If their second attempt, they were asked to report their previous temperament result.

From Figure 2 it can be noted that majority of our students are identified as “Guardians” followed by small percentages of “Idealist” and “Artisan” which are 12% and 6% respectively. There were 11 women in these classes. The temperament results for women yielded only “Guardian” or “Idealist” which are 73% and 27% respectively. 84% of men were identified as “Guardian”, followed by 9% of “Idealist” and 7% of “Artisan”. Of all the respondents who took

the Keirsey test previously, nine or 19% of the students said their temperament changed during the program while 39 or 81% mentioned that their temperament did not change. Of those who changed temperament, 75% of Guardians became Idealists; 100% of Rationalist became Guardians; 100% of Artisans became Guardians; and No Idealists changed. Of the women, all are Guardian or Idealist.

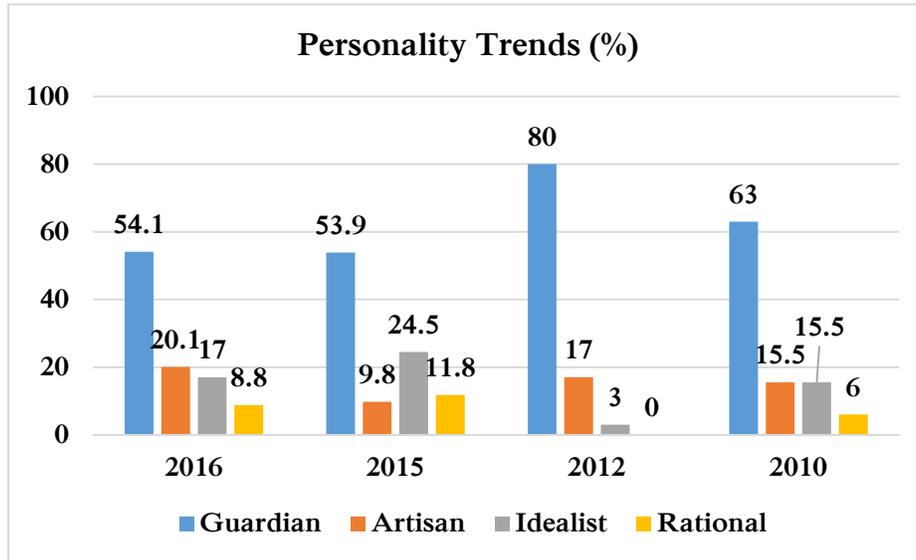


Figure 1. Student personality temperament results over the six years in the introductory civil engineering course

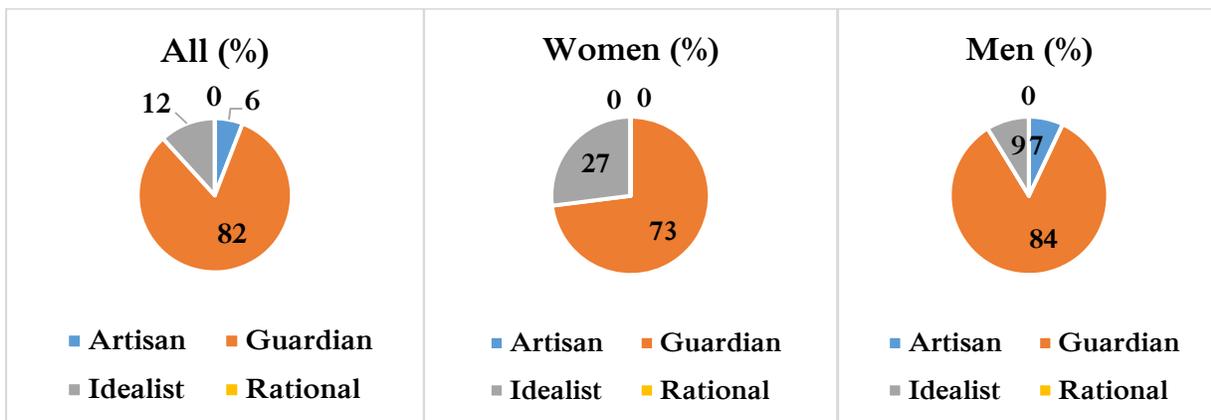


Figure 2. Temperaments of the students in senior design elective courses and their distribution among women and men.

A correlation of the area of interest and the gender was developed as shown in Figure 3. Four areas of interest received significant scores for the responding women, with environment, construction, structures and water resources presented in decreasing order. For the men who

responded to our survey, all seven concentrations offered in the department were reported. They are 35% for construction, 25% structures, 11% for environment, 11% for transportation, 9% for water resources, 7% for materials and 4% for geotechnical.

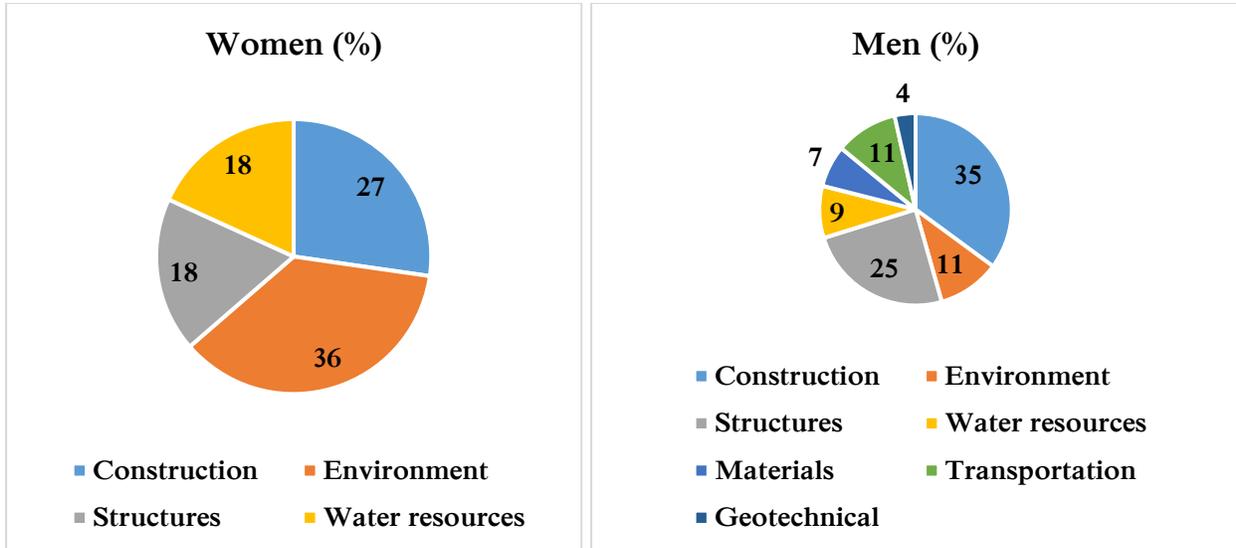


Figure 3. Correlation between the concentration areas and their distribution among women and men.

Further we investigated if there were relationships between the personality temperament and the area of interest for all the students. The results from this analysis are shown in Figure 4. It was noted that majority of students that mentioned construction engineering concentration as an area of interest were “Guardians”. This group also dominates particularly in geotechnical, transportation and water resources engineering concentrations, although not substantial in number. Environmental engineering concentration was more readily embraced by individuals with alternative temperaments.

While it is beneficial to understand student temperaments through Keirse test, some significant problems with use of this test as a measure of psychological types were reported. Many authors pointed out that online assessments cannot be considered to be equivalent to their corresponding paper-and-pencil measures until equivalence has been empirically demonstrated². This may apply to our results but our instructional and student mentoring experiences over the years provide some insight into this issue. In the past, most (or all) of our students were identified as “Guardians” which we believe is associated with pedagogical methods followed in instruction. Overall, it was found that program design can adversely impact the type and number of students in a program if it does not provide opportunities for education and personal development which align with career goals and student temperament. Further, it appears from the data collected that certain civil engineering disciplines align better with different temperaments and interests. Lastly, though a smaller dataset was collected from women in the senior classes, the temperament of senior women does not appear to be as diverse as that of their male counterparts.

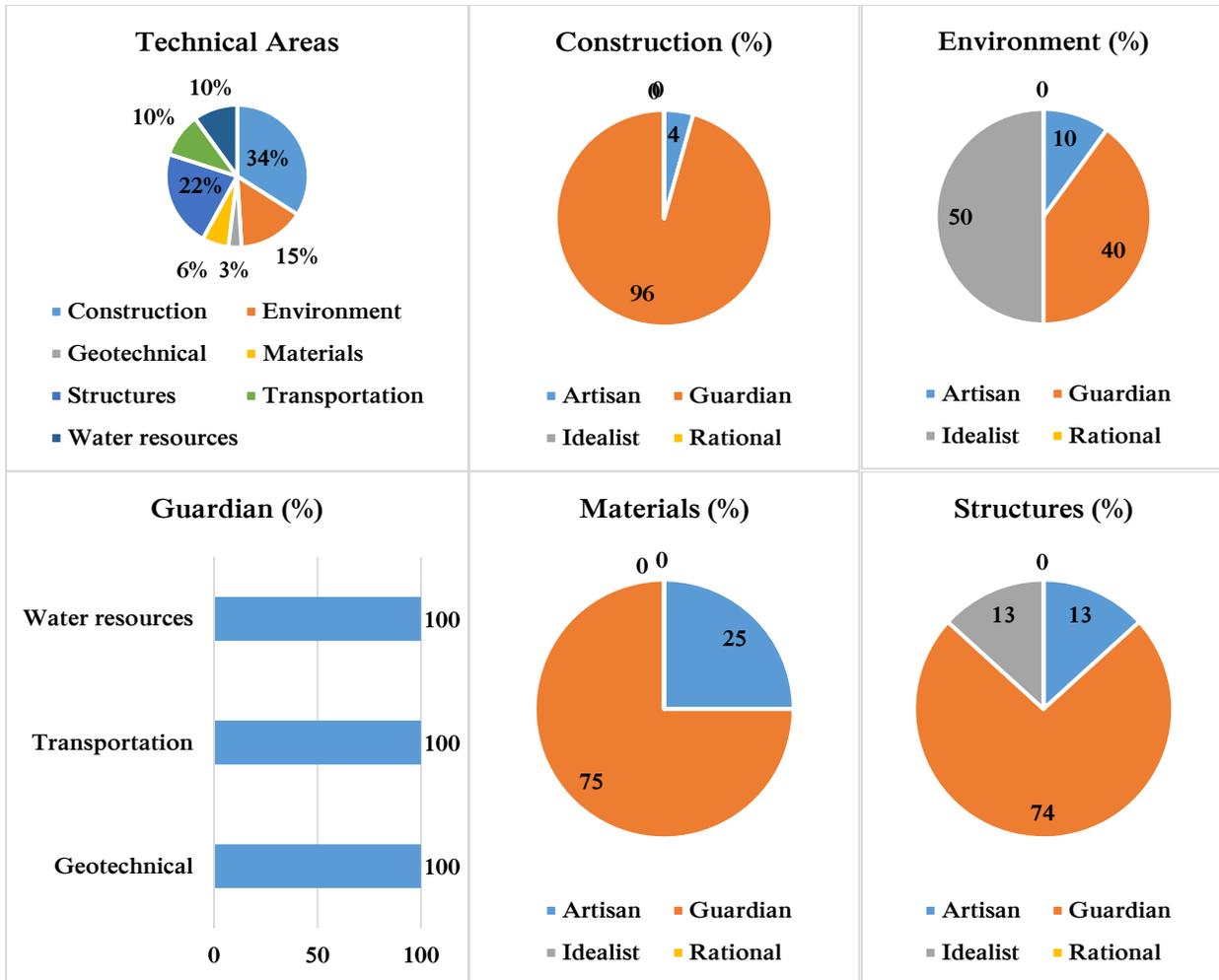


Figure 4. Relationships between the personality temperament and the area of interest for the senior design elective course students

Conclusions

It is obvious to even a casual observer that program's design will have impact on who completes a program. It should be equally obvious if that program design should recognize the different career goals, skills sets, and student temperaments of those who will succeed. Assuming that all those who enter into, and graduate from, a program are of the same temperament is likely to shun those of alternative mindsets and diminish the diversity of the students entering and leaving a degree program.

It was found that program design can positively impact the type and number of students in a program by providing provide opportunities for education and personal development which align with career goals and student temperament. This does not suggest that a program must be made less rigorous. To the contrary, the program at this institution is one of the most challenging in the region; having more diversity of technical fields which all students must complete, requiring

more credits and more contact hour, requiring a level of system design that is approximately twice that required for ABET/EAC-accreditation. However, by providing a program that addresses the career goals of a broader range of student, student performance has increase during a time when student enrollment has almost doubled.

Similarly, instructional content and style can engage students or have the opposite impact. While Guardians report liking structure, rules, and codes, Artisans are less concerned about following examples and focus more on results. Rationals desire for independence can be thwarted and frustrated by an increasing emphasis in curriculums on the need for team work, while the Idealist finds interaction and impact with others rewarding. Therefore, curricula design and delivery emphasizing one type of engineering process over another can disenfranchise some students while embracing others.

In the populations observed for this study, deemphasizing “rote learning styles” has resulted in a significant increase in the diversity of temperaments represent in graduates where only Guardians were completing the program before the change. This increase has produced greater retention, increased enrollment, and higher percentages of students entering the program reaching graduation.

Further, it appears from the data collected that certain civil engineering disciplines align better with different temperaments and interests. As a generalization, Guardians have a temperament which relies on rules, codes and norms to define how to evaluate situations. They tend to accept solutions which only obey the proven approaches of the past. In contract, Artisans are focused on the results of their effort and less on following rules. This opens them up to breaking rules inappropriately, but it also facilitates creativity and a focus on the impact of their work rather than providing a solution that meets all the “regulations.” Programs that embrace both approaches helps individuals of both temperaments, and the others, succeed at degree attainment.

Lastly, though a smaller dataset was collected from women in the senior classes, the temperament of senior women does not appear to be as diverse as that of their male counterparts. Looking at the data from the year they would have been freshmen, women were found to be just as diverse as men upon entering the program. It is not clear if this lack of diversity in the women comes from a shift in temperament of the women, a proportionate number of women to men did change, or if it was because the women who didn’t “fit” left the program, or if those who would have represented alternative personalities elected not to take the three courses providing the students surveyed. We suggest this be studied further.

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Veera Ganeswar Gude is an assistant professor of civil and environmental engineering at Mississippi State University. He has degrees in chemical (BS) and environmental engineering (MS, PhD) disciplines. He has academic, industrial, and research experiences on various chemical and environmental engineering projects. He is a licensed professional engineer and a board certified environmental engineer. His research interests include algal biofuels, bioelectrochemical systems, desalination, and sustainability. Educational activities include enhancing critical thinking skills and metacognitive abilities in civil and environmental engineering students.

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