The Personality of a Computing Major: It Makes a Difference

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Abstract

For the past several years, there has been an increase in the number of job opportunities in the computing field. As a result, many schools and universities are facing a significant increase in the number of students seeking to major in one of several computing disciplines. This increase in the numbers and variety of majors in the computing field poses challenges for higher education institutions in the areas of advising, retention, scheduling, and enrollment management. This paper builds upon prior research documenting the association of personality type and affinity for a computing career, and proposes using personality testing early in a student's university experience by including it as one factor in the advising process. This study employs the Myers-Briggs Type Indicator (MBTI) as a tool to help students select an appropriate computing major better suited for their given personality. This initial exploratory study shows that there is a significant difference in personalities among computing majors, specifically in the area of introversion versus extroversion, and intuition versus sensing. Testing students early, before starting a specific major, allows institutions to provide better advising to students as they choose their major, with the goal of increasing retention, degree satisfaction and completion of the degree.

Keywords: Advising, Retention, Myers Briggs Type Indicator, MBTI, Computing, Enrollments

1. INTRODUCTION

Many schools, colleges, and universities offer a variety of majors within the computing field. These majors typically fall into one of the computing disciplines: Computer Science (CS), Information Systems (IS), or Information Technology (IT). If an institution offers more than one computing major, then students are faced with the challenge of deciding which major is best suited for them.

The increase in the number of advertised computing jobs that has been occurring over the last few years has fueled the increase in the number of students wanting a degree in

computing (Lazowska, Roberts, & Kurose, 2014). Unfortunately, this phenomenon attracts students to the computing field and increases the pressure to decide on a major simply by the title of the major, whether or not the student is well suited for that particular major.

The problem is further complicated by the often limited number of common courses between the different majors, forcing students to select their desired major early in the process rather than later. If a student makes a poor choice, and then attempts to switch to a different computing major, the time and cost of taking additional courses can be significant.

The challenges of increasing enrollments include: managing the limited seats in course offerings, the subsequent scheduling of additional sections, and then finding faculty to teach those additional classes. Even if space is made, it does not guarantee that the student will succeed in that course and when a student fails a course, then one of two things happens. Either the student retakes the course, placing an additional burden on an already overloaded system; or, the student leaves the computing field, reducing the number of graduates available to fill the increasing number of job opportunities.

Today, advising has become a key component in enrollment management (Brown, DeMonbrun, Lonn, Aguilar, & Teasley, (2016). Advising students early in the process, before a major is selected, has many potential benefits, but primarily trying to ensure students start in a suitable major. Successfully placing a student in a major in which they can be successful benefits the student, the institution, and the computing industry.

2. BACKGROUND

The Myers-Briggs Type Indicator (MBTI) has been a source of research since its creation in 1944. Since then, researchers have tried to predict aspects of a person's life based on that person's MBTI type. It has a long history of being used to predict college majors; first by Goldschmid, (1967) and continuing through to Pulver & Kelley (2008). Soon after, McCaulley (1976) began using the MBTI to examine psychological types specifically in engineering disciplines followed by two collaborative studies by McCaulley, Godleski, Yokomoto, Harrisberger, & Sloan (1983) and McCaulley, Macdaid, & Walsh (1987). Rosati (1993) showed that successful engineering students are largely INTJ, and that female retention could be improved by including tasks

and activities geared towards ESFP types. Scott, Parsons, & Seat (2002) showed that ISTJ, ESTJ, INTJ, ENTJ are the primary types for engineering students, confirming McCaulley's (1976) earlier observation of the commonality of "TJ" types. One recent paper used correlations between MBTI type and interest in sustainability to hypothesize ways to attract "atypical engineering types and females into civil engineering" (Braxton & Nossoni, 2015).

Naturally, investigating correlations of the MBTI to the computing disciplines started much later. An early paper by Jones and Wall (1985) looked at the MBTI as it relates to anxiety about using computers. One pioneering paper tried to use the MBTI (among other factors) to predict student performance in a beginning class. Although Werth (1986) noted "no relationship between grade and the personality type", she did discover marked differences in the personalities of CS students and the general population. Werth (1986) found that "[c]omputer science students were found to be far more introverted, intuitive and thinking than the population as a whole, though they were about the same on the perceiving/judging index." Similarly, Bishop-Clark & Wheeler (1994) found that "personality type influenced achievement in programming performance, but did not influence achievement on exams or overall average." Rountree, Rountree, Robins, & Hannah (2004) also looked at the MBTI as a possible factor of success in CS1 courses. Greathead (2008) looked at code comprehension specifically and found that "[i]ndividuals who had a leaning towards Introversion on the Extroversion/Introversion preference were significantly better at the code comprehension task".

Looking more broadly at computing as a field, Teague (1998) performed an extensive literature review and found that "[t]wo types, ISTJ and INTJ, appear in the list of the three most commonly occurring personality types in all studies. ISTJ was the most common personality type in four of the studies, with INTJ second in each case," mirroring the findings reported by McCaulley (1976) for engineers nearly twenty years earlier. This was somewhat confirmed by Benest, Carter, & Chandler (2003) who reported that "[a]pproximately 50% of the [computer science] students fall into either the ISTJ or ISFJ category," and that "more than a quarter of the computer science students have an ISTJ personality." Recently, Cruz, da Silva, & Capretz (2015) conducted a review of forty years of the literature on how personality preferences relate to programming and software engineering. Not surprisingly "the most frequent MBTI personality

types found among them are the ISTJ, INTJ, and INTP." Kruck, Sendall, Ceccucci, Peslak, & Hunsinger (2014) also discovered the dominance of thinkers and judgers: "Thinking type students performed better than Feeling types, and Judgers performed better than Perceivers."

Most of the previous literature has been concerned with either engineering or CS, with the exception of a longitudinal study at one institution. Sendall, Peslak, Ceccucci, & Kruck (2015) showed that extroverts and judgers in CIS have increased since 2001 and that "there was a significant difference in course performance based on whether a student self-classified as Perceiving versus Judging. This factor is a significant influence in performance in our CIS course and has not changed over the last 10 years."

Within IS, (McPherson & Mensch, 2007) looked specifically at business information systems, computer information systems, and management information systems. Between all three, ISTJ and ESTJ were the two dominant personality types. The top three personality types for each major were BIS: ESTJ, ESTP, ESFJ; MIS: ISTJ, ESTJ, ESFJ; CIS: ISTJ, INTJ, ISTP. They concluded that the predominant personality types for BIS students were extrovert/sensing; MIS students were largely sensing/judging; and CIS students were introvert/thinking.

Unfortunately, little work has been done to see if there are any differences between the various disciplines of computing: information systems, information technology, or computer science. Further, the literature to date focuses on the sixteen different combinations of preferences rather than the individual preferences themselves.

3. THE PROBLEM

Currently, typical advising uses several tools to help assist students select a major such as the student's ACT (or SAT) scores, high school GPA, interview with the student, etc. The difficult task of advising of students would benefit from having an additional tool that would help a student be more successful in their selection of a major. This paper shows the results of a study conducted at GVSU that shows potential benefits of using the MBTI survey in the advising process.

This study seeks to answer the question: Are there significant patterns in the personality preferences, as measured by the Myers-Briggs Type Indicator (MBTI), of CS and IS majors

enrolled in their respective capstone course at [institution to be inserted]? The MBTI was chosen as an additional component in the advising process because of its documented validity noted earlier, and it is the "most widely used professional personality test" as well as that it fundamentally measures cognitive processes, rather than behavior, as shown in Figure 1 (Kim & Han, 2014).

Figure 1. The Four MBTI Preferences

4. HYPOTHESIS AND RESULTS

As noted in section 2, there has been little work in the area of describing and distinguishing the personality preferences of different majors within computing disciplines.

The purpose of this study is to evaluate the personality preferences of successful students in ABET accredited computing majors in both CS and IS. In this context, successful is being defined as completing the capstone course in the respective majors.   The data for this pilot study were collected from students in the capstone course of each major in 2015.

Between the two majors, the personality profiles were compared on the individual MBTI preferences.

1) Is there a difference of E/I between majors?
   H_1: Information Systems majors will have a different percentage of students who are E compared with Computer Science.

2) Is there a difference of S/N between majors?
   H_2: Information Systems majors will have a different percentage of S compared with Computer Science.

3) Is there a difference of T/F between majors?

H₃: Information Systems majors will have a different percentage of T compared with Computer Science.

4) Is there a difference of J/P between majors?
   H₄: Information Systems majors will have a different percentage of J compared with Computer Science.

Statistical Methodology

For each of the four hypotheses, the null hypothesis will be accepted or rejected using the significance level of .05. To compare two independent groups based on binary variables, most statistics guidelines suggest using the chi-square test of independence as long as the sample sizes are large enough. Sauro & Lewis (2008) contend, however, that the "latest research suggests that a slight adjustment to the standard chi-square test, and equivalently to the two-proportion test, generates the best results for almost all sample sizes."

To determine whether a sample size is adequate for the chi-square test, calculate the expected cell counts in the 2x2 table to determine if they are greater than 5. When the values in this study met this test, the chi-square test results were used. When the values of one or the other of the subgroups did not meet this test, the N-1 chi-square test was used. The formula for the N-1 chi-square test (Sauro & Lewis, 2008) is shown in the next equation using the standard terminology from the 2x2 table:

$$\chi^2 = \frac{(ad - bc)^2 (N - 1)}{mnrs}$$

Test Results

Hypotheses are supported when the null hypothesis is rejected. In this study, the null hypothesis is rejected when there is a statistically significant difference between the proportions represented by $p<.05$. Accordingly, the first hypothesis (H₁) is supported since there is a significant difference between the 82% of E who are IS majors and the 32% of E who are CS majors. The second hypothesis (H₂) is also supported since there is a significant difference between the 91% of S who are IS majors and the 53% of S who are CS majors. Both majors had a majority of students who were T, and while IS had a higher percentage, both the third hypothesis (H₃) the fourth hypothesis (H₄) are rejected since there is no significant difference.
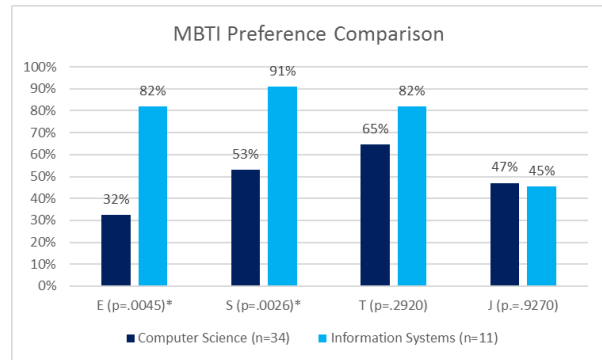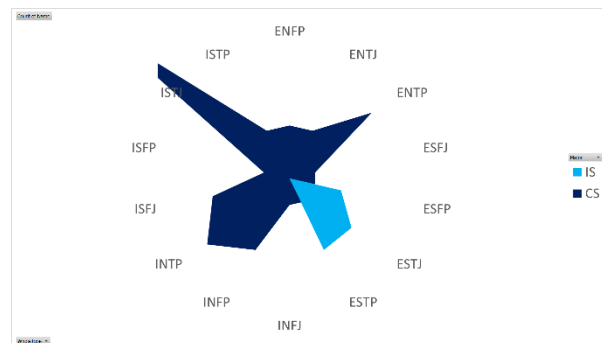

Chart 1.0 – MBTI Preference Results

Chart 2.0 MBTI Personality Types

Since most prior literature focused on comparisons using the complete MBTI profile, Chart 2.0 is a Pivot Chart that was generated to show the clustering of majors by whole personality type.

While the sample size in this pilot study was too small to statistically compare all 16 combinations of personality preferences, the Pivot Chart does confirm the overall results of previous studies, that is, for IS majors EST is the predominate combination. The data are less clear for CS majors. While I and N and T are predominant, the Pivot Chart shows they are sometimes combined with other less predominate preferences in this sample.

5. DISCUSSION AND CONCLUSIONS

This research expands the current state of knowledge of how personality preferences correlate with specific majors. The data show that IS majors and CS majors have different preferences that are common to a significant majority of students in the respective major. Further, the results of this study match and confirm the findings of McPherson & Mensch (2007). In that study, there were clear differences between extroversion vs. introversion and sensing vs. intuition types. While they compared different types of information systems

majors, that study found significant differences between "business/management" and "computer" information systems majors. The conclusion that can be drawn from this is that students who had the choice of a major focused more on the computing part of information systems, would most likely be more aligned with students choosing CS over IS.

As with the McPherson & Mensch (2007) results, the most significant differences found were that successful IS students tend to identify with extroversion and CS majors identify with introversion. Also significant, IS majors identified much more with sensing then did CS majors. The following algorithmic format illustrates these results in more specific advising choice terms:

> IF "E" THEN choose Information Systems
>   ELSE choose Computer Science.

> IF "S" THEN choose "Information Systems
>   ELSE choose Computer Science"

Anecdotally, the pattern of the overall data is that IS majors are strongly EST, while CS majors are more mixed (INT, IST, ENT) when combining attributes. This advice could be very helpful to new undergraduates trying to determine which major to choose if they have an interest in a career in the computing field.

6. FUTURE WORK

Since the pilot study provided additional insight into the differences between specific computing majors; IS and CS, the GVSU has decided to implement personality profile assessment beginning in the fall 2016 for the capstone courses in each major. Data gathered in future semesters will be used to refine advice given to incoming majors.

While this study has confirmed prior research, and provided insight for academic advisors, further study would be helpful to provide more confidence in this advice. Expanding this study to include (1) students from different institutions that provide a different alignment of majors across academic units, and (2) additional majors, such as information technology, in addition to IS and CS. It is the intent of the authors to seek collaboration to expand and broaden this study.

7. ACKNOWLEDGEMENTS

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