Who Graduates?

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Abstract

The distributions of Myers-Briggs Type Indicators, Preferences, and Temperaments for entering and graduating BSME students at the University of Houston have been determined and compared with similar data taken at the University of Tennessee. It is clear from both data sets that graduation rates vary significantly for individuals preferring different psychological types. For example, individuals preferring "thinking" over "feeling" (Myers-Briggs Preferences) are almost twice as likely to graduate as those who prefer "feeling" over "thinking."

Introduction

Introduction to Design, a sophomore design course, scheduled in the third semester of our BSME program is usually the first course taken by mechanical engineering students in their major (other than the freshman computing course and a pass/fail freshman seminar, Introduction to Mechanical Engineering). As such, it symbolically, at least, represents the "start" of our program. Over the past ten years, 60% of the students enrolled in this course eventually graduated with the BSME. In this paper the question addressed is who graduates and who doesn't based on Myers-Briggs Type Indicators (MBTIs) and their associated parameters. Myers-Briggs Type Indicators have been determined in the sophomore design course since 1991 and in the capstone course (The capstone course is taken in the student's last semester and about 98% of these students graduate.) only since the fall of 2002, but trends are already evident. The MBTIs are compared between the two distributions and with equivalent data in the literature. This effort does not represent a true longitudinal study since the individual students are not followed. However, it has been noted in the sophomore class that even with the relatively small number of students (averaging around 50), each semester's MBTI distribution is remarkably similar to the "running average" distribution for the class. This running average currently represents data on more than 1400 students and, for the purposes of this paper, is assumed to represent the MBTI distribution of the "input". The distribution for the "output" is that determined for the 111 students enrolled in the capstone design course from fall 2002 through spring 2005.

Myers-Briggs Type Indicators, Preferences, and Temperaments

Myers-Briggs Type Indicators were developed in the 1950s by the mother-daughter team of Isabel Myers and Katherine Briggs based the work of Carl Jung in the early part of the

20th century. There are many descriptions [1-9] of the MBTI, but a brief overview is given here.

The thesis is that people have preferences, or preferred ways of doing things, but a preference doesn't mean that one is constrained to only one way of behaving. The MBTI testing locates ones preferences in four different preference continua. A debate continues about the reasons for these preferences, e.g., nature or nurture, and the permanence of these preferences. However, the fact remains that at a given time most of us have specific preferences, some more pronounced than others, even though we may be "forced" to behave in a contrary matter. Also, there seems to be a "degree" of preference in that people may have a "strong" or "weak" preference for a certain type of behavior. Sometimes the preference is so weak as to be essentially non-existent.

These preference continua are defined with respect to ones behavior in the following four areas: Extraversion (E) as opposed to Introversion (I); Sensing (S) as opposed to Intuition (N); Thinking (T) as opposed to Feeling (F); and Judging (J) as opposed to Perceiving (P).

Extraversion and Introversion: (feelings about people) The person preferring extraversion receives energy from interacting with people while the person preferring introversion receives energy from his/her "space".

Sensing and Intuition: (feelings about information) The sensing person prefers concrete information, "the facts", and the "here and now". The person preferring intuition prefers the abstract and the "what ifs" and is probably bored the details.

Thinking and Feeling: (feelings about decision making) The thinking person bases his/her decisions on logic and prefers "rules" regardless of the uniqueness of the situation. The feeling person prefers to make decisions based on the situation and is seeking to satisfy everyone.

Judging and Perceiving: (feelings about life style) The judging person prefers a planned, orderly life and is uneasy when faced with the prospect of a big decision, desiring to have a speedy resolution. The perceiving person is spontaneous, flexible and adaptable; he/she gathers as much input as possible when faced with a decision and usually puts it off until the last minute.

The MBTI is therefore a four-letter code constructed from the first letter (except intuition is designated as "N" to avoid confusion with introversion) of each of the sets above indicating ones preferences, e.g., ESTJ is an extroversion, sensing, thinking, and judging personality.

Another classification based on the MBTI is the temperament groups[2]. The SJs are practical and organized, often motivated by what they "should do"; the SPs are reality-based and spontaneous, motivated by what is "fun to do"; the NTs are theoretical and

logical, motivated by accumulating competencies; and the NFs are intuitive and seeking harmony, motivated by finding "meaning" in work and life.

Myers-Briggs Type Indicators, Preferences and Temperaments of Engineering Students

For a review of previous studies of MBTIs for engineering students, see reference 9 which summarize the results from references 3-6. Reference 7 provides an historical overview of MBTI, and reference 8 summarizes MBTI's relationship to learning styles. Reference 9 discusses the relationship between MBTI and retention rates for engineering students. For the current study Table 1 summarizes the MBTIs, single preferences, and temperaments for four different populations of engineering students. The McCaulley[4] data is for beginning engineering students at eight US schools, and the Rossati[10] data is for engineering students at Western Ontario University. The Scott[9] data is for engineering freshman at the University of Tennessee from 1990 to 1994. The UH data is for the students in the sophomore design class in mechanical engineering at the University of Houston (UH) from 1991 to 2005 as discussed in the Introduction. All MBTI testing at UH has utilized the Kiersey Temperament Indicator[2].

It is clear from an examination of Table 1 that the MBTIs, the single preferences, and the temperaments for UH students are significantly different from the average results for the other three populations of engineering students. This fact is more clearly illustrated in columns six and seven. In column six, the UH data is compared to the average result from the other three populations for each category with the difference recorded as a per cent difference. (Positive numbers means UH has a larger per cent; negative, a smaller per cent.) For example, for ISTJs the average non-UH distribution is (16.5+13.4+18.1)/3 = 16.0; so the UH value is (17.6-16.0)/16.0 = 10% higher. Some of these numbers are quite dramatic and perhaps a bit misleading in some cases in which the large magnitudes result from dividing the differences in small numbers by small numbers.

A fairer comparison is given in column seven which is based on an assumed total population of 100 for each distribution. For example, for 100 students in each distribution the average number of ISTJs (first row) for the three previous studies is 16.0. Compared to an average per 100 in the UH distribution of 17.6, the UH distribution has 1.6 more students preferring ISTJ. For all the MBTIs taken together, it is clear that the UH distribution is lower in ten categories and higher in six categories than the average for the other populations. Noteworthy is the significantly lower numbers of ISTP, ENTP, and INTP and the significantly higher numbers of ESTJ, ENFJ, and ENTJ. The largest variation (based on populations of 100) from the mean for the other three populations is less than three (e.g., for the other populations the ENTJ average is (9.4+6.2+4.9)/3 = 6.8 and corresponding largest variation is (from the McCaully data) 9.4-6.8=2.6; the UH variation for ENTJ is 11.8-6.8=5.0); yet the UH distribution has six differences greater than four and one of almost 13. There are similar results given for the single preferences and the temperaments. Most notable are UH's significantly increased preferences for Es and Js and for temperament SJ, and the decreased preference for temperament SP.

Table 1: Myers-Briggs Type Indicators, Single Preferences and Temperaments for Four Different Populations of Engineering Students

	McCaulley[4]	Scott[9]	Rossati[10]	UH	UH Above Average	# of UH Above Average per 100
	%	**%**	**%**	**%**		
MBTI	N=3780	N=2017	N=1913	N=1400		
ISTJ	16.5	13.4	18.1	17.6	10 %	1.60
ISFJ	4.6	4.8	3.7	4.1	-6 %	-0.27
INFJ	2.8	1.6	3.0	3.6	46 %	1.13
INTJ	9.4	5.8	8.5	6.8	-14 %	-1.10
ISTP	6.2	7.8	8.2	1.0	-87%	-6.40
ISFP	2.6	4.3	3.0	0.8	-76 %	-2.50
INFP	3.9	5.3	4.4	1.2	-74 %	-3.33
INTP	8.5	8.8	9.4	1.9	-79 %	-7.00
ESTP	4.2	6.3	5.9	2.4	-56 %	-3.07
ESFP	2.4	2.7	2.8	1.7	-35 %	-0.93
ENFP	3.8	6.7	4.4	4.6	-7%	-0.37
ENTP	7.3	8.8	7.7	3.3	-58 %	-4.83
ESTJ	12.7	11.7	10.3	24.4	111%	12.83
ESFJ	3.6	4.3	3.0	7.4	104%	3.77
ENFJ	2.1	2.5	2.6	7.7	221%	5.30
ENTJ	9.4	6.2	4.9	11.8	73 %	4.97
SINGLE PREFERENCES						
E	45.2	49.2	41.6	63.3	39%	17.9
S	52.8	55.3	55.0	59.4	9%	5.0
T	74.2	68.6	73.0	69.2	-4%	-2.8
J	61.1	50.3	54.1	83.4	51%	28.2
TEMPERAMENTS						
SJ	37.4	34.3	35.1	53.5	50%	17.9
SP	15.4	21.1	19.9	5.9	-69%	-12.9
NT	34.6	29.6	30.5	23.8	-25%	-7.8
NF	12.6	16.1	14.4	17.1	19%	2.7

Graduation Rates by Myers-Briggs Preference

Table 2 presents the distribution of the MBTIs, single preferences, and temperaments for the beginning sophomore class (from the UH data in Table 1) and capstone design class in the Department of Mechanical Engineering at the UH and the corresponding distribution reported in the literature for the University of Tennessee[9] (UT). The UT data

Table 2: Normalized Graduation Rates for University of Houston and University of Tennessee[8] by MBTIs, Single Preferences and Temperaments

	Per Cent Starting and Finishing BS					
	U of Houston		U of Tennessee		Normalized Grad Rate*	
MBTI	Start#	Finish##	Start	Finish**	UH	UT
	N=1400	N=111	N=2017	N=1064		
ISTJ	17.6	22.5	13.2	14.8	1.28	1.12
ISFJ	4.1	3.6	4.3	4.4	0.88	1.03
INFJ	3.6	2.9	2.1	1.7	0.81	0.83
INTJ	6.8	7.9	5.7	7.4	1.16	1.29
ISTP	1.0	0	8.5	8.4	0	0.99
ISFP	0.8	0.9	3.9	4.2	1.27	1.06
INFP	1.2	0	5.4	3.4	0	0.64
INTP	1.9	1.4	7.7	5.9	0.71	0.77
ESTP	2.4	2.9	6.8	5.2	1.22	0.76
ESFP	1.7	0.7	3.7	3.2	0.40	0.87
ENFP	4.6	1.1	6.2	7.1	0.25	1.15
ENTP	3.3	2.9	8.6	7.6	0.89	0.88
ESTJ	24.4	33.3	11.5	13.3	1.37	1.19
ESFJ	7.4	5.0	3.9	3.9	0.67	1.02
ENFJ	7.7	4.3	1.7	2.0	0.56	1.16
ENTJ	11.8	10.6	7.2	7.4	0.90	1.02
SINGLE PREFERENCES						
E	63.3	60.8	49.2	49.8	0.96	1.01
S	59.4	68.9	55.4	57.4	1.16	1.04
T	69.2	81.5	68.9	70.0	1.18	1.02
J	83.4	90.1	49.2	54.9	1.08	1.12
TEMPERAMENTS						
SJ	53.5	64.4	32.5	36.5	1.20	1.12
SP	5.6	4.5	22.8	20.9	0.76	0.92
NT	23.8	22.7	29.3	28.3	0.96	0.97
NF	17.1	8.3	15.3	14.3	0.49	0.93

*fraction in graduating class divided by fraction in incoming class

** graduates from 1990, 1994 and 1995 freshman class (different set of students from Table 1 for University of Tennessee)

#Based on 14-year average in sophomore design

Based on capstone design classes in Fall 02 through Fall 05

was taken from the freshman engineering class and from graduation statistics. As noted above the sophomore design class at UH is the first course that mechanical engineering students take in their major. The capstone design course is taken in the last semester, and it is estimated that more than 98% of those that enroll will graduate. The analogy with the UT data is not exact since there is probably a 40% drop out rate before students even enter the UH sophomore design class.

Table 2 lists the per cent of each "class" preferring each of the sixteen MBTIs and the resulting single preferences and temperaments. For example, under the UH more than 1400 entering students have been tested since 1991 and of those tested 17.6% preferred ISTJ. Testing has been conducted in the capstone course since 2002. A total of 111 students have been tested and 22.5% preferred ISTJ. Clearly ISTJ personalities seem to be more successful in the BSME program at the UH. Similar data have been tabulated for UT. (There were a few minor discrepancies in the UT data and some of the currently reported data has been reworked using their "raw" data.). As can be seen in the table, 13.2% of the freshman and 14.8% of the BS graduates preferred ISTJ at UT. Again the ISTJs are slight more successful than the average, but with not so large an advantage as seen at UH. These differences can be better illustrated by comparing the ratios of the success rates for each MBTI, single preference and temperament as listed in columns six and seven of the table. The numbers in the table are reflecting two issues (the increase in one parameter and the resulting decrease in the opposing one) so that it may be difficult to see their combined effect. For example, consider the single preference T. Clearly the T-preferring individuals are more likely to graduate than an F-preferring individual (because the number is column six is greater that one, 1.18). What is perhaps not so obvious is that the T-preferring individual is not just 18% more likely to graduate than an F-preferring individual, but about 96% more likely. To illustrate, assume that we consider a represented sample of 1000 (or any other size) entering the UH program. We see that 69.2 % or 692 prefer T over F. Let x be the average graduation rate; then 815x of the original 692 Ts graduate. Therefore the graduation rate for the Ts is 815x/692 or 1.178x. On the other hand, the entering class contained 308 F-preferring individuals and 185x of them graduated. Their graduation rate is 185x/308 or 0.601x. Therefore a T-preferring individual is 1.178x/0.601x = 1.96 times more likely to graduate than an F-preferring individual. Conversely an F-preferring individual is only 51% as likely to graduate as a T-preferring individual. The relative graduation rates for each preference are summarized in Table 3.

Therefore Is are 1.11 times more likely to graduate than Es; Ss are 1.51 times more likely to graduate than Ns; Ts are 1.96 times more likely to graduate than Ns; and J are 1.81 times more likely to graduate than Ps.

Table 4 has been constructed for the temperaments. For example, SJs are 1.57 times more likely to graduate than SPs, etc.

Table 3: The Likelihood of Graduation for each Single Preference Type with respect to its Opposite Single Preference Type.

Single Preferences	Times as likely to graduate as	Single Preferences
I	1.11	E
S	1.51	N
T	1.96	F
J	1.81	P

Table 4: The Likelihood of Graduation for each Temperament with respect to the Other Three Temperaments

	SJ	SP	NT	NF
SJ	1.00	1.57	1.26	2.48
SP	0.67	1.00	0.80	1.57
NT	0.79	1.18	1.00	1.96
NF	0.40	0.64	0.51	1.00

Discussion

The results related to graduation success are at most only preliminary due to the small number of graduating students considered (111) and the fact that, as noted, the study is not truly "longitudinal" in that individual students were not tracked. However, the conclusions related to the data in Table 1 are clear – that the distribution of the personality profiles of the mechanical engineering students at UH are markedly different from those reported for other engineering students. The most remarkable differences are the appearances of Js and Es at rates over 50% and almost 40%, respectively, more likely in the UH student population than in the average of the other engineering student populations reported. These increased numbers of Js and Es are due to the significant increases in ESTJs, ESFJs, ENFJs and ENTJs at the expense of ISTPs, ISFPs, INFPs, INTPs, ESTPs, and ENTPs. One reason for the increased number of Js (who prefer a more ordered life) may be that our students are older (Average age in sophomore design is 22.) and have more responsibilities than "traditional" students. (Many are married and some have children. Our students work an average of over 20 hours a week while enrolled in an average of 13 hours. Most students are paying their own way through college.) The reason for the increasd number of Es is not so easy to explain other than the same reasons given for increased number of Js, that is, our students tend to be married (Es seek people for their energy) and are financially constrained to attend college near their homes, i.e., in Houston. Over seventy per cent of our students graduated from high schools in the Greater Houston Area even though over a third are foreign born.

Conclusions

It seems clear from the preliminary data that personality type, e.g., note the success for the Js, the SJs, ESTJs and ISTJs at both UH and UT indicated in Table 2, has some correlation with success in engineering programs. The fact that our data seems to indicate a much greater effect than UT's may be due, at least in part, to the relatively small size of the graduation sample in the current study which can lead to exaggerated results.

References

1. I. B. Myers and M. H. McCaulley, Manual: A Guide to the Development and Use of the Myers-Briggs Type Indicator, Consulting Psychologists Press, Palo Alto, CA, 1993.
2. D. Kiersey and M. Bates, Please Understand Me: Character and Temperament Types, Prometheus Nemesis Book Co. Del mar, CA, 1978.
3. M. H. McCaulley, "Psychological Types in Engineering: Implications for Teaching", Journal of Engineering Education, 66, 729-736, 1976.
4. M. H. McCaulley, "Applications of Psychological Types in Engineering Education", Journal of Engineering Education, 73, 394-400, 1983.
5. M. H. McCaulley, G. P. Macdaid, and R. Walsh, "Myers-Briggs Type Indicator and Retention in Engineering " International Journal of Applied Engineering Education, 4, 99-110, 1987.
6. M. H. McCaulley, "The MBTI and Individual Pathways in Engineering Design", Journal of Engineering Education, 80, 537-542, 1990.
7. C. F. Yokomoto and R. Ware, "Applications of the Myers-Briggs Indicator in Engineering and Technology Education—Part II, Proceedings of the 1999 ASEE Annual Conference and Exposition, Charlotte, NC, June 20-23, 1999, Search at http://www.asee.org/about/events/conferences/search.cfm
8. Teresa Larkin-Hein and Dan D. Budny, "Why Bother Learning about Learning Styles and Psychological Types?" Proceedings of the 2000 ASEE Annual Conference and Exposition, St. Louis, MO, June 17-20, 2000. Search at http://www.asee.org/about/events/conferences/search.cfm.
9. T. H. Scott, J. R. Parsons, and J. E. Seat, "Use of Myers-Briggs Type Indicator in the University of Tennessee ENGAGE Freshman Engineering Program," Proceedings of the 2002 ASEE Annual Conference and Exposition, Montreal, Quebec, Canada, June 16-19, 2002. Search at http://www.asee.org/about/events/conferences/search.cfm.
10. P. Rosatti, "Psychological Types of Canadian Engineering Students", Journal of Psychological Type, 55, 35-42, 1997.

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