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Elsie Elford joined MacEwan as a full-time instructor in 1992. Her leadership ability was immediately evident as, in addition to teaching, she took on chairing and leading a number of college initiatives and committees. These included Chair of the Educational Leadership Institute (ELI), the Academic Vision Steering Committee, Academic Council, and Faculty Roles and Responsibilities. In 2000, MacEwan students presented her with the Student Champion Award, in recognition of exemplary service, support, and advocacy. In 2005, she received the International Exemplary Leader Award from the Chair Academy, a U.S.-based educational leadership institution. Since then, she has expanded her Chair Academy work to become a facilitator for the Leadership program, providing a lead role in MacEwan's strengths-based leadership initiative. In 2009, she was named one of Alberta's "50 Most Influential" by Venture Magazine. In her role as Dean, she works with a dedicated team to lead MacEwan as an institution that offers a variety of degrees, diplomas, and certificates. Prior to her career in education, Elford practiced law for 10 years, and holds both a B.A. and an L.L.B. from the University of Alberta. She stays connected to the profession through membership in the Law Society of Alberta and the Canadian Bar Association. Elford sits on the Board of Directors of Junior Achievement (JA) of Northern Alberta and Northwest Territories and is the Vice Chair of the Edmonton Chapter of the International Women's Forum. <http://macewan.ca/wcm/SchoolsFaculties/Business/OfficeoftheDean/index.htm>

StrengthsQuest for Engineers

ABSTRACT

This research developed as a result of a leadership course presented by the Chair Academy, a U.S. based leadership organization, which introduced Gallup's online strengths assessment tool, Clifton StrengthsFinder® (StrengthsFinder), as a valuable instrument in the development of educational leadership. The Gallup organization has a considerable body of literature on strengths and the use of strengths as a mechanism for enhancing self understanding and improving team performance. It was clear from the outset of this course that this process might be useful as an educational tool (for the students) and as a research tool (engineering educational research) in analyzing the first-year engineering educational experience. As a result, StrengthsFinder was introduced in our first-year program as a part of the curriculum in a course entitled "An Introduction to the Engineering Profession". This initiative has evolved into an ongoing longitudinal study examining the StrengthsFinder talent themes of first-year engineering students, to determine whether or not each engineering group possesses a unique talent theme signature. The results presented in this study are for two similarly sized student groups and span a three year period. A question that remains unanswered from the analysis of the data is whether or not this information can quantitatively improve the teaching practices of engineering instructors. The collection of data and the use of this assessment tool as a part of the engineering curriculum have already qualitatively affected the educational process of the students that were involved to date. Supporters of positive psychology interventions suggest that the use of this type of assessment tool to engage engineering students, by its own nature, improves their engineering education.

This article highlights the process that was required to use the StrengthsFinder online assessment both as a part of the curriculum and as a research tool to study the StrengthsFinder signature themes of first-year engineering students (~200 students). Results are presented showing the engineering students' signature themes and comparing them to academic achievement. The results were analyzed in light of strengths based research. The article presents a preliminary literature survey which establishes a link between Gallup's strength based research and the body of literature on personality assessments of engineering students. In particular, there seems to be a connection between the thirty-four four Gallup signature themes, and the sixteen Myers-Briggs Type Indicator® (MBTI) personality types.

The results that have been obtained to date show a "strengths" signature or a dominant set of talent themes typical for the engineering student groups considered in this study. The same type of phenomenon was observed in the literature, when personality type assessments of engineering students were examined. In particular, a common signature for engineering students using MBTI typing was "(E/I)STJ. In this study, for both groups, a dominant talent theme "competition" emerged in the top five signature themes of ~ 30% of each of the two groups. Furthermore, eight key talent themes were common in the top ten talent themes for both groups: "achiever", "adaptability", "analytical", "competition", "deliberative", "futuristic", "learner" and "restorative". These themes may be linked to the MBTI typing. Based on this study, it would seem that the problem solving based curriculum is well suited to the common StrengthsFinder themes of first-year engineering students.

I. INTRODUCTION

This project and the ensuing research precipitated through the experience of the Advanced Leadership Academy¹ and were initiated to examine the applicability of the Gallup's StrengthsQuest process to career development of first-year engineering students.* Preliminary results of the research published by Lorimer and Elford² identified a unique talent theme signature for first-year engineering students. As a result of these findings, the research in this area has continued and become an ongoing initiative providing data for a longitudinal study. This article further explores the StrengthsFinder signature themes for two independent consecutive groups of first-year engineering students at one university. Through the analysis of this data, the authors have established a connection between these results and other results that have been obtained using Myers-Brigg's type Indicator® (MBTI) for engineering students at universities in both the United States (U.S.) and Canada.

II. BACKGROUND

There has been a substantial amount of literature devoted to personality assessments of engineering students.³⁻¹⁴ Scott et al.³ and Yokomoto and Ware⁴ have provided summaries of the Myers-Briggs Type Indicator® (MBTI) model, which contributed to the literature that has been devoted to the understanding of the role of personality/temperament in engineering education. Both articles provide a substantive treatment of the research that has been done to date, as well as summative discussions of the theory itself. In particular, they have provided the foundation for the analysis considered in this study, and the comparisons used herein. Much of the research in this area seeks to quantify a connection amongst personality types, learning styles and academic success in engineering.

There has been less attention given in the literature to the use of the Clifton StrengthsFinder® (StrengthsFinder) in the assessment of engineering students. Clifton StrengthsFinder is an online talent assessment tool that has been used in an educational setting to assess talents/potential strengths of individuals. The StrengthsQuest process is a Gallup initiative designed to use the information gathered using the StrengthsFinder to develop leadership skills. There is a wealth of data available on the Gallup website¹⁵ and in other Gallup publications about the research undertaken in developing the Clifton's StrengthsFinder profiles.^{16,17} In many ways StrengthsFinder themes are similar to the Myers-Briggs typing, in that they share a commonality in language and keywords. The MBTI dichotomies are sometimes referred to as "preferences", and might be interpreted as behavioral attributes. StrengthsFinder is similar to MBTI in that it typifies individuals according to their preferences, but different in that these traits are seen as latent with a capacity to be developed into strengths. It is possible that the StrengthsFinder assessment tool could be used similarly to MBTI in an attempt to typify engineering students, and that the data and results from previous MBTI studies might be used to enhance the understanding of the StrengthsFinder theory.

* The StrengthsQuest process is the language and body of literature associated with the StrengthsFinder assessment tool. The Clifton StrengthsFinder® is the tool itself.

More recently, Jackson & Magun-Jackson¹⁸ have qualitatively used the StrengthsFinder survey in an introductory engineering management course. The article describing their research provides an excellent summary and interpretation of the StrengthsFinder themes. The authors concluded that classroom experiences with the StrengthsFinder profiling were very valuable and attributed the success of this initiative to that fact that the use of StrengthsFinder profiling is inherently a positive intervention, with a focus on strengths of individuals rather than weaknesses. No quantitative results, however, were presented.

A further exploration of the literature, devoted to the study of positive psychology, demonstrates the effect that positive interventions can have on the well-being of people. Seligman and Steen¹⁹ conducted a study that concluded that positive interventions can increase an individual's happiness, which in turn could translate to individuals (students) becoming more engaged and more successful. Although this study was not directly applied to engineering students, per se, the conclusions can quite easily be extended to the use of the StrengthsFinder assessment tool, which itself would be considered to be a positive intervention. The underlying premise of the StrengthsQuest process is to engage students in self discovery of their positive attributes (talents) so that these attributes could be developed into strengths.

A deeper examination of the literature explores the connection between typification of engineering students and success and retention. Veenstra et al.²⁰ have indicated that it is necessary to understand the attributes of an engineer in order create an educational process that would prepare engineering students for careers in engineering. It is clear from this article that the authors support the contention that engineers have definable attributes which include: strong analytical skills, ingenuity, thinking (creativity), communication skills, leadership skills, adaptability, and lifelong learning (learners) amongst others. Veenstra et al.²⁰ also speak about the competitive behavior expectations of the engineering career as well as the competitive nature of the engineering curriculum. These attributes are consistent with the behaviors associated with the personality types of engineering students identified using MBTI, as well as supporting the results obtained in this study using the Clifton's StrengthsFinder. Based on the StrengthsFinder profile discovered in this study, one would expect that a large percentage of engineering students have innate talents that can be further developed into these specific engineering attributes. It may well be that the educational process should be developed to foster the growth of these talents and nurture them into strengths.

Scott et al.³ have pointed out certain trends in the typification of engineering students using MBTI typing. In particular, based on the information gathered in the databases, they pointed out that engineering students were dominated by thinking/judging types. They presented data showing "double-digit" participation for the MBTI types ESTJ and ISTJ, which arose in three separate databases. These databases, which were derived from the literature cited in their paper, came from a substantial number of longitudinal studies conducted in both the U.S. and Canada. Many of the articles referred to background summary of this article address the uniqueness of the engineering students as a cohesive group. It is this uniqueness that is being explored using the StrengthsFinder assessment tool.

This article examines the connection between MBTI typing and StrengthsFinder signature themes, presents data showing a possible typification for first-year engineering students using the

StrengthsFinder assessment and provides a positive psychology perspective on the use of this assessment instrument in the first-year engineering curriculum. The research was focused on a qualitative understanding of the StrengthsFinder signature themes of first-year engineering students, and whether or not this understanding could be used in any practical way.

III. DATA COLLECTION

The logistics of the research project were more challenging than initially expected. Before the online survey could be conducted, university policy²¹ necessitated that a research ethics proposal had to be written and approved. Each of the students had to sign a consent form to release the survey results for use in this research study. Once this was complete, the process of distributing the access codes for the online survey was done through a first-year engineering course: *An Introduction to the Engineering Profession*. This course is well suited to the use of the StrengthsFinder tool since both the course and the assessment tool can easily be linked to career development, which is an inherent part of engineering professional development.

Once the access codes were distributed, the students completed the online StrengthsFinder assessment with little difficulty. There were a few “hiccups” in the process as expected with such a large group: some students lost their codes, while others had small technical difficulties with their passwords and difficulty interpreting the instructions for completion of the survey. Generally speaking, once the process was completed, analysis of the data was done quite easily using excel spreadsheets.

Two independent groups of first-year engineering students provided the data for this study. The first group (168 students) took the StrengthsFinder online assessment in fall 2009, while the second group (149 students) completed the assessments in fall 2010. It is possible that some of the students that initially took the survey may have dropped out of the program at the end of winter term and may not be representative of a “typical” engineering student. In each of the two student groups, there were almost 200 students enrolled in the engineering program at the beginning of the term, yet the number that participated in the survey was substantially lower. This is due to a fairly high attrition rate in the engineering transfer program at our institution. The attrition rate in the first-year engineering program at this institution is ~50%. Regardless of this, this research was extremely well received by the students, in an extremely positive way.

IV. a) SUMMARY OF THE METHODOLOGIES

It is quite pertinent at this stage to give a brief summary of the MBTI indicator types, and the StrengthsFinder talents/themes and establish a connection between these two assessment instruments.

The MBTI is based on four dichotomies:

E (Extroversion) / I (Introversion)
S (Sensing) / N (Intuition)
T (Thinking) / F (Feeling)
J (Judgment) / P (Perception)

The combination of these four dichotomies gives rise to sixteen definitive personality types. The MBTI personality types and their distribution in the U.S. population are summarized in Table 4A (Appendix).

In more simplistic terms, the MBTI can also be examined in light of four temperaments, which have been described in some detail by Keirsey and Bates.²² Keirsey and Bates²² linked the four temperaments of Hippocrates, to four behavior descriptions that align with MBTI theory. These descriptions are identified using the MBTI dichotomies using the names suggested by Keirsey that describe these temperaments: SP (Artisans), SJ (Guardians), NT (Rationals), and NF (Idealists). Using the data collected by Scott et al. one would conclude that 65-70% of the engineering students (~7000 students), in the studies considered, would have temperaments of SJ or NT. Keirsey's estimate for the occurrence of these temperaments in the general population, {SP (~38%), SJ (~38%), NT (~12%) NF (12%)}, indicates that only 50% of the general population would be described in this way. This literature supports the contention that the engineering group is distinct from the general population, with a higher percentage of SJ and NT temperaments. Statistics provided in Table 4A for MBTI are consistent with these numbers, although the percentages are slightly different.

Yokomoto and Ware⁴ have attached descriptors to the four MBTI dichotomies as follows:

Extroverts – sociable, external, interacting

Introverts – territorial, internal, intensive

Sensing – perceiving, past wisdom, gathering information, sensible, realistic

Intuition – imaginative, speculative, ingenious, inspiration, hunches

Thinking – evaluating, judging, logical, objective

Feeling – subjective, empathetic, humane, persuasive, appreciative, harmony, positive

Judgment – planned, scheduled, working steadily, closure

Perception – open-ended, flexible, adaptable

These descriptors are closely associated with the descriptors used to define the StrengthsFinder themes.[†] It will be shown later that these descriptors can be used to examine the relationship between MBTI and StrengthsFinder.

Jackson and Magun-Jackson¹⁸ have also provided an excellent summative analysis of the strengths/themes of the StrengthsFinder assessment instrument using the information provided by Gallup. They further categorized the thirty-four themes into four general categories, which align with the number of temperaments proposed by Keirsey. Even more fascinating is the discovery that, throughout the course of history, there have been numerous attempts to classify people according to their traits, which have given rise to four distinct categories. Each classification is unique unto itself, yet there are similarities amongst them in the language that they use. The commonality would be the use of the terminology: traits, attitudes, temperaments, spirits, views, styles and so on.

It is not surprising, then, to note that the categorizations for StrengthsFinder themes vary between researchers. Table 1A (Appendix) shows the categorization given by Jackson and

[†] The detailed description of the thirty-four StrengthsFinder themes can be found at www.strengthsquest.com.

Magun-Jackson.¹⁸ Table 2A (Appendix) shows the categorization given by Buckingham.¹⁶ Table 3A (Appendix) shows yet a third categorization of the StrengthsFinder themes. In all cases the themes have been clustered into four domains. A careful comparison of the first two tables shows small differences in classification, which are highlighted in red. The names of the four domains are similar, but the distributions of the themes into the different categories vary. For this analysis, the authors have chosen the categorization proposed by Rath and Conchie²⁴ to analyze the data.

In all of the tables in this article, the top eight common StrengthsFinder themes for the engineering students sampled in this study have been highlighted in yellow (lightly shaded). It is clear that there are slight differences between Table 1A and 2A, but more significant differences exist between Table 3A and the first two. It is interesting to note that both the MBTI and the StrengthsFinder research have attempted to cluster the themes/types into categories. In particular, the placement of positivity, harmony, and the use of the word fairness in place of consistency delineate the differences in the first two categorizations. Further examination of the two assessment tools (StrengthsFinder and MBTI), along with the language and descriptors summarized in the two tables, has led the authors of this paper to propose a connection between StrengthsFinder themes and MBTI typing.

IV. b) COMPARISON OF METHODOLOGIES

It is possible, then, that one might consider associations between the MBTI preferences and the StrengthsFinder themes as follows in Table 1. The descriptors used by Yokomoto and Ware⁴ as well as the engineering attributes provided by Veenstra et al.²⁰ were used to create this mapping of the MBTI dichotomies to the StrengthsFinder themes.

It should be noted that there will not be a completely one to one mapping since there are thirty-four themes and only eight MBTI dichotomies. This proposed mapping will be used later to compare the StrengthsFinder data for this research to the data presented by other researchers using MBTI. It is with this cross-linking in mind that the analysis of this data was conducted, looking for patterns and similarities to identify some sort of profile or signature for the engineering students.

MBTI Types	StrengthsFinder Themes
Extroverts	Command, Communication, Connectedness, Inclusiveness, Relator, Woo
Introverts	Deliberative, Individualization, Maximizer, Significance
Sensing	Restorative, Context, Competition, Achiever
Intuition	Activator, Futuristic, Ideation, Input
Thinking	Analytical, Consistency, Intellection, Learner, Strategic
Feeling	Belief, Empathy, Harmony, Positivity
Judgment	Arranger, Consistency (Fairness), Discipline, Responsibility
Perception	Adaptability, Developer, Focus, Self-Assurance

Further exploration of the connections between MBTI, StrengthsFinder, and Keirsey’s four temperaments, as they relate to MBTI typing, leads to the following connection between the four

leadership domains and the four MBTI temperaments. Table 2 shows a proposed cross linking between Keirsey’s four temperaments and the leadership domains proposed by Rath and Conchie.²⁴ This table will be used later to examine the relationships between MBTI and StrengthsFinder.

Table 2 – Four Temperaments and Four Leadership Domains			
Executing (SJ)	Influencing (SP)	Relationship Building (NF)	Strategic Thinking (NT)

V. RESULTS

Each participant in the StrengthsFinder assessment received a report that lists their “top five” themes. The frequencies of the top five StrengthsFinder talent/themes for the two engineering student groups considered in this longitudinal study are provided in Table 3, alongside a comparative Gallup baseline data set. The baseline data set for StrengthsFinder was taken from Gallup’s StrengthsQuest website, which is updated on a monthly basis. The Gallup data consists of the frequencies of the top five talents/themes for all people that have taken StrengthsFinder assessments through the StrengthsQuest process to date.

The frequencies of these top five StrengthsFinder themes for each student, in each of the two groups were calculated and sorted in descending order for comparison. Unlike MBTI, which has only sixteen personality types, the permutations and combinations of the top five themes for thirty-four different StrengthsFinder themes for each student were too numerous to attempt to quantify. However, in each case, percentages of the total group were provided to normalize the frequency histograms to the size of the group. This facilitated a semi-quantitative comparison with research done using MBTI and amongst the results obtained for the engineering student groups and the Gallup baseline. Most of the data reported in the literature is given as percentages of the total group. However, because there are sixteen definitive types using MBTI, the percentages of the group are more meaningful since the total percentages will add to 100%. For the StrengthsFinder themes, because there are five themes for each student, the analysis of the data in terms of percentage is not as meaningful, but does lend itself to the to the semi-quantitative analysis proposed in this section.

The semi-quantitative information is provided through the frequency analysis, while the qualitative assessment is provided through the comparisons of the commonalities of the themes between groups. The StrengthsFinder signature of the students considered is based largely on these qualitative comparisons.

The StrengthsFinder themes for the ten highest frequencies (of the top five themes) for each student group are provided as follows:

Group 1

Competition, Achiever, Adaptability, Analytical, Restorative
Learner, Futuristic, Harmony, Empathy, Deliberative

Table 3 - Frequencies of StrengthsFinder Top Five Talents/Themes

Gallup Statistics	# People	%	2010 Group 2	#	%	2009 Group 1	#	%
Achiever	307200	27	Adaptability	43	29	Competition	55	33
Adaptability	290209	26	Competition	42	28	Achiever	53	32
Responsibility	276448	25	Analytical	40	27	Adaptability	45	27
Relator	262494	23	Achiever	35	23	Analytical	38	23
Restorative	254203	23	Learner	35	23	Restorative	38	23
Learner	248472	22	Futuristic	33	22	Learner	37	22
Input	231131	21	Restorative	31	21	Futuristic	35	21
Empathy	231010	21	Deliberative	30	20	Harmony	35	21
Strategic	229473	20	Relator	27	18	Empathy	33	20
Positivity	215987	19	Ideation	27	18	Deliberative	31	18
Includer	213340	19	Individualization	27	18	Consistency	31	18
Harmony	211994	19	Strategic	26	17	Strategic	30	18
Developer	200697	18	Consistency	25	17	Individualization	29	17
Belief	178000	16	Maximizer	24	16	Ideation	27	16
Communication	171477	15	Command	23	15	Responsibility	25	15
Woo	164158	15	Empathy	23	15	Focus	23	14
Futuristic	161813	14	Significance	21	14	Includer	21	13
Competition	154490	14	Harmony	21	14	Discipline	20	12
Consistency	149773	13	Input	20	13	Realtor	19	11
Deliberative	128233	11	Responsibility	18	12	Developer	19	11
Individualization	128127	11	Context	18	12	Woo	19	11
Ideation	120333	11	Intellection	17	11	Maximizer	18	11
Connectedness	118485	11	Includer	17	11	Context	18	11
Intellection	113201	10	Focus	15	10	Command	17	10
Context	107550	10	Self-Assurance	14	9	Significance	16	10
Arranger	103568	9	Activator	14	9	Input	16	10
Maximizer	102419	9	Developer	13	9	Intellection	16	10
Activator	101532	9	Positivity	12	8	Positivity	16	10
Focus	88654	8	Discipline	11	7	Communication	16	10
Analytical	86102	8	Communication	11	7	Connectedness	14	8
Discipline	82942	7	Belief	10	7	Arranger	11	7
Command	73914	7	Woo	10	7	Belief	8	5
Significance	61022	5	Connectedness	6	4	Activator	6	4
Self-Assurance	45039	4	Arranger	6	4	Self-Assurance	5	3
TOTAL	1122710		TOTAL	149		TOTAL	168	

Top Ten

Middle Fourteen

Bottom Ten

Group 2

Adaptability, Competition, Analytical, Achiever, Learner
Futuristic, Restorative, Deliberative, Relator, Ideation

The StrengthsFinder themes for the ten lowest frequencies (of the top five themes) for each student group were as follows:

Group 1

Significance, Input, Intellection, Positivity, Communication
Connectedness, Arranger, Belief, Activator, Self-Assurance

Group 2

Self-Assurance, Activator, Developer, Positivity, Discipline
Communication, Belief, Woo, Connectedness, Arranger

It is clear from the data that there are definitely common themes shared in both the ten highest theme frequencies (top ten) and ten lowest theme frequencies (bottom ten) for each group. Eight of the themes are common in the top ten frequencies for both groups, and seven themes common in the bottom ten, although the relative order and frequency occurrence for all of the common themes are slightly different. Of the eight common top ten themes “competition” theme is the one of the highest frequencies in both groups. In both cases ~30% of all respondents who took the online assessment had the “competition” theme in their top five talents. This is particularly interesting, since the description of the “competition” theme coincides with the descriptive keywords for engineers, and engineering program admissions which are, typically by their own nature as pointed out earlier in this article, competitive.

The common themes in the top ten for both groups are highlighted in yellow (or lightly shaded) in Table 3, while the bottom ten frequencies are highlighted in green (or dark shading). Based on the data obtained in this study the eight common themes that create the definitive signature for these first-year engineering students are: “Adaptability”, “Competition”, “Analytical”, “Achiever”, “Learner”, “Futuristic”, “Restorative”, and “Deliberative”.

Exploration of the middle fourteen themes (highlighted in red or darkly shaded) also shows some commonalities. Nine of the themes were common in the middle frequency range. A visual comparison of the color schemes of the two student groups to the Gallup baseline, shows that the theme signatures of the two student groups are similar to each other but quite different from the baseline. All three talent profiles share top themes of “achiever”, “adaptability”, “restorative” and “learning”, which might be expected of people at an academic institution. It is the differences, “competition”, “futuristic” and “deliberative”, which seem to define the engineering student groups. The “competition” theme has nearly twice the frequency in the engineering groups, compared to the Gallup baseline. Also, the “analytical” theme which is near the bottom for the baseline data is near the top of the frequency list for the engineering groups: 8% versus (27% and 23%) respectively for the student groups considered.

Further analysis was made by comparing fall term average Grade Point Averages (GPAs) as a function of StrengthsFinder themes for both groups. The average GPAs for each theme were calculated based on the number of students having a given theme in their top five themes. These results are presented in Figure 1. Here, average Fall GPAs are plotted for each StrengthsFinder theme, and sorted in descending order based on Group 1 data. No obvious consistent trends between the two groups were observed from this analysis. Earlier work had shown a trend of slightly higher GPAs associated with “thinking” themes, but the data obtained for the second group did not confirm these observations. Figures 2 and 3 show the same results now plotted for the top ten theme frequencies and bottom ten theme frequencies based on the order established for Group 1. GPAs are compared for both groups for these themes. There are larger differences between the two groups’ GPAs for the bottom themes, than for the top themes. One really interesting observation is that the students with the “self-assurance” theme in their top five StrengthsFinder themes have a consistently high average GPA of 3.0/4.0 for both groups. These themes had comparatively fewer students: six students in one group fourteen in the other group had “self-assurance” in the in their top five StrengthsFinder themes. The “competition”, “achiever”, “analytical” and “futuristic” themes also show relatively consistent GPA results between the two groups. These themes are in the characteristic theme signature proposed for engineering student groups considered in this analysis. Although this does not suggest that academic performance is tied to StrengthsFinder themes, it does show some consistency of academic performance for students with these themes between the two groups.

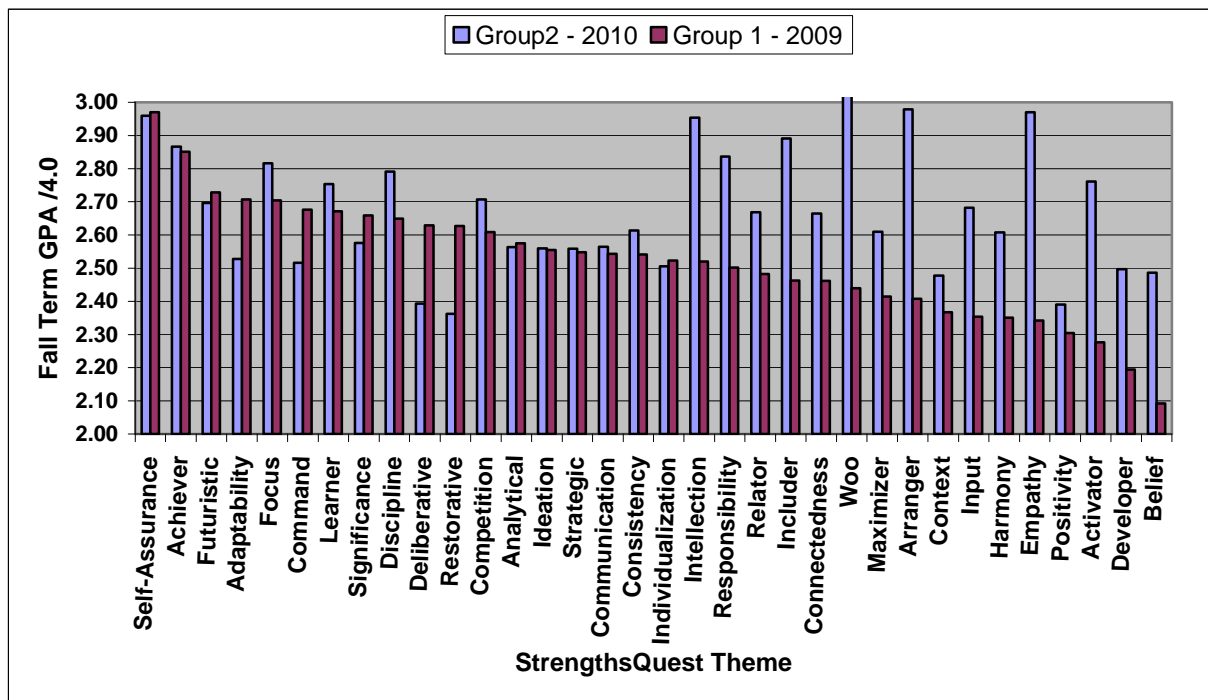


Figure 1 – Fall Term Average GPA for each StrengthsFinder theme for Groups 1 & 2

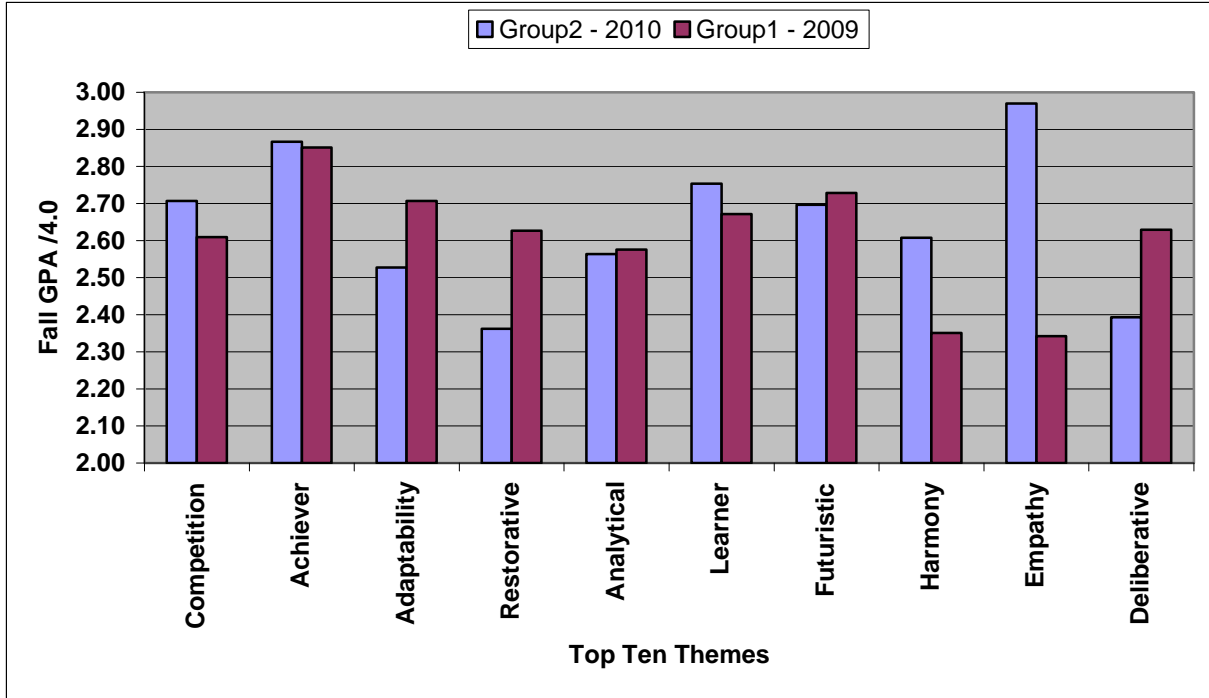


Figure 2 – Fall Term Average GPA for the top ten theme frequencies of Group 1 common StrengthsFinder themes for Groups 1 & 2

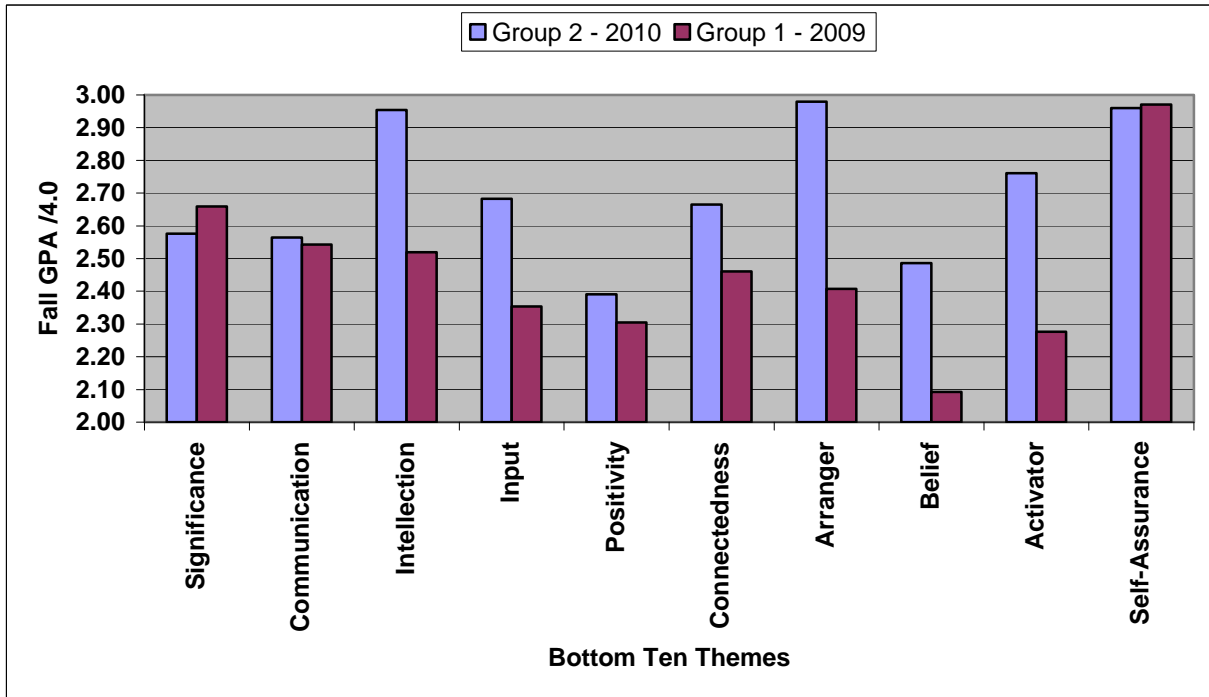


Figure 3 – Fall Term Average GPA for bottom ten theme frequencies of Group 1 common StrengthsFinder themes for Groups 1 & 2

Returning to Table 1, which proposes a cross-linking between MBTI and StrengthsFinder themes, the ISTJ typing of the engineering students is partially confirmed using the StrengthsFinder themes. The eight top common themes for the engineering students considered in this study are highlighted in yellow (or light shading), and a comparison to the MBTI types qualitatively supports IST typing (one theme for I, three themes for S and two themes for T), but not the J typing. Perhaps the cross-linking needs to be further explored by having students take both a StrengthsFinder analysis and an MBTI typing and by directly comparing data from the two assessment instruments.

Looking back at Tables 1-3, based on this analysis, the themes with the highest frequencies associated with the engineering students would be classified into the “thinking” leadership domain. Table 4A (Appendix), shows estimated frequency distributions for the sixteen MBTI personality types for the general population in the U.S. The frequency distributions are shown as both a range, and an average value within that range. Table 4A also shows estimates for the distribution of the Keirsey temperaments found by consolidating the frequency distributions into those four temperaments (SJ, SP, NT, and NF). The data provided in Table 4A indicates that only 10% of the general population would be “NT”, or “thinking” type.

Table 4 summarizes data presented by Scott et al.³ for engineering students and illustrates a comparison to the general U.S. population, and Keirsey’s estimate of the distribution of the four temperaments also for the U.S. population. It should be noted that there are some differences between estimates provided by Keirsey and general population data provided by the Myers-Briggs Foundation.²⁶ The data presented in the table for engineering students was based on data provided by Scott et al.³, with the summary data calculated using a weighted average distribution. The most striking observation is the number of “NT” temperaments in the engineering students (~32%). There is almost three times the expected number of “NT” temperaments in the engineering student group than would be predicted using statistics from the general population in the U.S. Conversely, there are substantially fewer “SP” types for engineering students using the same statistical comparison. This is consistent with the absence of common themes for the engineering student groups that belong to the “influencing” leadership domain.

Temperaments	SJ	SP	NT	NF
Engineering students				
Scott et. al. ³				
University Tennessee	34%	20.2%	29.7%	16.1%
ASEE	37.4%	15.3%	34.8%	12.6%
Canadian	35.1%	20.0%	30.5%	14.4%
Weighted Ave				
Engineering Students	35.9%	17.7%	32.4%	14.0%
General				
U.S. Population ²⁶	46.4%	27.0%	10.4%	16.4%
Keirsey’s Estimate for the general population ²²	38%	38%	12%	12%

These results are extremely interesting and warrant additional investigation into the connection between these two assessment tools and the characteristics of first-year engineering students. Since a link between academic performance and MBTI personality type has been established, and there appears to be a link between MBTI and the StrengthsFinder themes, it is still plausible that academic success is related to the StrengthsFinder themes. A further examination of the data, in more detail, may elucidate the relationships between StrengthsFinder themes and academic success, if they exist. Further study could be also devoted to finding additional ways to develop the students' talents into strengths, thereby improving their chances for success in engineering. The key to this exploration will lie in the detailed examination of the common themes and the use of this information in the development of the curriculum strategies.

V. DISCUSSION AND RECOMMENDATIONS

Wherein much of the literature in engineering education seems to be focused on dramatically changing engineering education, it seems that there might not be such a strong need for this initiative. Engineering curricula have been largely focused on problem solving and the development of these skills. Likewise, typification of engineering students seems to be congruent with the type of curriculum that has been developed. If one considers the preferential attributes of engineers and looks at the distribution of these attributes amongst the general population, it might be unreasonable to expect that one can necessarily increase the number of students that succeed in engineering just by dramatically changing engineering education. Perhaps it might be more worthwhile to consider minor enhancements or improvements to the existing engineering pedagogy. In light of recent developments in positive psychology, increasing the self-awareness of first-year engineering students through psychological instruments like MBTI and StrengthsFinder could improve the chances for success while at the same time increasing retention.

VI. CONCLUSIONS

The literature indicates that there is an interest in the effect of personality type on academic performance for undergraduate engineering students, particularly when this knowledge can be used to improve the educational process. The literature also supports the premise that the engineering students are an identifiable group. In particular, the most common personality type for engineering students based on MBTI is ISTJ, indicating that there is a clear thinking preference in contrast to a feeling preference for this group. The research to date in this area tends to favor the use of the MBTI personality analyses even though there are other similar tools available. Data from two groups of engineering students in this study shows a mildly definitive StrengthsFinder signature for first-year engineering students that is consistent with the MBTI typing. A more detailed analysis of the relationship between these two evaluation tools is necessary to further confirm these observations. It seems clear from the research done in this area that self discovery tools such as StrengthsFinder and MBTI are extremely useful in examining educational needs of engineering students. These results provide additional insight and support of these already developed theories. Based on this study, it seems that the StrengthsFinder instrument might be used as a positive intervention beginning in the first year of the engineering curriculum. In addition, supplemental activities that would challenge the students would

complement the development of the “competition”, “achiever” and “analytical” themes that are common attributes of engineers.

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APPENDIX

Table 1A – StrengthsFinder Categories and StrengthsFinder Themes (taken from Jackson & Magun-Jackson ¹⁸)			
Relating Themes (working with people)	Impacting Themes (influencing people)	Striving Themes (working hard)	Thinking Themes (working smarter)
Communication	Command	Achiever	Analytical
Empathy	Competition	Activator	Arranger
Inclusiveness	Developer	Adaptability	Connectedness
Individualization	Maximizer	Belief	Context
Positivity	Woo	Discipline	Deliberative
Relator		Focus	Fairness
Responsibility		Restorative	Futuristic
		Self-Assurance	Harmony
		Significance	Ideation
			Input
			Intellection
			Learner
			Strategic

Table 2A – StrengthsFinder Domains and StrengthsFinder Themes – Buckingham ¹⁶			
Relating Themes (working with people)	Impacting Themes (influencing people)	Striving Themes (working hard)	Thinking Themes (working smarter)
Communication	Command	Achiever	Analytical
Empathy	Competition	Activator	Arranger
Harmony	Developer	Adaptability	Consistency
Includer	Positivity	Belief	Connectedness
Individualization	Maximizer	Discipline	Context
Relator	Woo	Focus	Deliberative
Responsibility		Restorative	Futuristic
		Self-Assurance	Ideation
		Significance	Input
			Intellection
			Learner
			Strategic

Table 3A – StrengthsFinder Leadership Domains and StrengthsFinder Themes – Rath and Conchie²⁴

Relationship Building	Influencing	Executing	Strategic Thinking
Adaptability	Activator	Achiever	Analytical
Developer	Command	Arranger	Context
Connectedness	Communication	Belief	Futuristic
Empathy	Competition	Consistency	Ideation
Harmony	Maximizer	Deliberative	Input
Includer	Self- Assurance	Discipline	Intellection
Individualization	Significance	Focus	Learner
Positivity		Responsibility	Strategic
Relator		Restorative	

Table 4A – Wikipedia estimate of MBTI types in the general U.S. population²⁶

ISTJ 11 – 14% 11.6%	ISFJ 9 – 14% 13.8%	INFJ 1 – 3% 1.5%	INTJ 2 – 4% 2.1%	IJ 29.0%
ISTP 4 – 6% 5.4%	ISFP 5 – 9% 8.8%	INFP 4 – 5% 4.4%	INTP 3 – 5% 3.3%	IP 21.9%
ESTP 4 – 5% 4.3%	ESFP 4 – 9% 8.5%	ENFP 6 – 8% 8.1%	ENTP 2 – 5% 3.2%	EP 24.1%
ESTJ 8 – 12% 8.7%	ESFJ 9 – 13% 12.3%	ENFJ 2 – 5% 2.4%	ENTJ 2 – 5% 1.8%	EJ 25.2%
ST 30.0%	SF 43.4%	NF 16.4%	NT 10.4%	Totals
SJ 46.4%	SP 27.0%			Totals