First Year Experience for Class of 2003

An Interactive Qualifying Project Report

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By

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Submitted to:

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Abstract

Entry of Cognitive Styles data for 625 members of the Class of 2003 provided the opportunity to do a psychometric study seeking proxy measures for the Differential and Remote Association measures. An attempt to predict academic outcomes based on gender and learning style was also undertaken. At the end of their freshman year, the grades of the class of 2003 were analyzed in terms of the results of personality and cognitive tests. The relative academic performance of the different types of students is in some ways predictable.

1.0 Introduction

This study involved the analysis of the freshman year experience of the Class of 2003. During Freshman Orientation this class was administered the MBTI (a personality indicator) and the GCSI (a cognitive indicator). A new set of items of items derived from Mike Lynch's IQP(1991) was administered as part of the revised GCSI form. Mike was attempting to develop proxy indicators for the Differentiation and Remote Association (RA) the two dimensions of the GCSI. He considered Differentiation (Diff) too "vulnerable" to manipulation by a knowledgeable subject and RA too cumbersome and culturally biased to be used in their current form. The proxy item result had to be entered for analysis, some 650 cases, before they could be analyzed. Diff and RAT also involved considerable data input before they could be scored. Further, prior findings from the Class of 2002 study involving term-by-term freshmen grades and the MBTI's S-N and J-P dimensions showed promise of identifying those students most at risk of having a rough freshman year. An attempt to replicate those findings with Class of 2003 data were certainly in order, as was a comparison of the predictive power of the SAT to the MBTI as an indicator of academic promise in the WPI setting. By analyzing these data it may be possible to one day predict which students are most susceptible to academic troubles and provide them timely support.

The Academic Advising office deals with the students who are most at risk, providing academic warnings and placing people on probation. The Academic Advising office only has enough resources to work closely with the 50

to 70 students who are most at risk of not succeeding at WPI. The major problem is "Triage"; i.e. distinguishing between the students that will improve on their own (so as not to spend limited resources on them) and those who can succeed but aren't likely to on their own. The focus should be on those students who can be saved by timely intervention, but probably can't make it without help. Those who probably will not succeed anyway, are an ethical dilemma. One does not want to ignore their plight or keep them trying if it is futile.

The class of 2001 and 2002 data sets did not include proxy GCSI items, but the MBTI and grades were analyzed in some of the same ways we planned to organize the data for this project. In 2001 they focused mainly on the how the SAT scores compared to the first year results. In summary, they basically found that challenge level in the / program (courses taken, not grades) high school were their best indicator of how that student would perform freshman year at WPI. Sheldon et al also showed that the women performed better than the men did. There was little or no variance in the different average grades of the Cognitive Styles (GCSI Types) of the women, but when it came to the different personality types of the men there was considerable variance in the average GPAs for the year.

The Class of 2002 analysis was generally less detailed than that of 2001, but included a term-by-term analysis of the grade data by MBTI type that was very revealing, and which we wanted to repeat. However, the 2002 team did not look into the gender finding and examine it by MBTI and GCSI type, a serious oversight in our opinion.

This project will concentrate on the GCSI, MBTI and the first year grade results by gender. However, we are testing our own original theory as well. Our original goal was to code social groups into the data set – clubs, fraternities, sororities, and especially sports teams. We wanted to see if WPI students cluster in these groups and organizations by GCSI or MBTI type and whether those students competing in varsity sports have and easier or hard time with their academic classes if they are Introverted Sensing (IS) or Introverted Intuition (IN) types. Our theory is that ESP and ISP students are more likely to participate in team sports and when so engaged will do better than those of their same type who are not getting a physical outlet for their excess energy. Hence, students of same types participating seriously in a varsity sport or intramural sport will typically have better grades despite the time demands of the sport. Indeed ESPs and ISPs will have an easier time with time management and have support of their upperclassmen thereby resulting in even better grade averages than ESPs and ISPs not involved in physically demanding team or club activities. Unfortunately, the theory cannot be tested until the team and club data for last years freshmen (Class of 2004) are obtained from WPI and entered into the data set. We never got that far due to the lack of response from WPI administration over the summer. We barely got the Freshman grade data for the Class of 2003, much less the social data in the available time. Basically what we hoped to achieve was to find out if we had replicated previous findings. Also we had looked in to the GCSI, we had theorized that a way a person would rate themselves would reflect in how they would rate other on creativity and focus.

2.0 Literature Review

2.1 The Cognitive Traits

Gordon's Cognitive Survey Indicator (GCSI)[ref1] was administered to each student to assign them a probable cognitive type (integrator, assessor, problem solver, or implementor). The GCSI, like the MBTI, is considered to be accurate about 85% of the time.

"Cognitive style" in this context, refers to a four-fold typology derived from two important cognitive traits: Differentiation, and Remote Association. These two traits have been the subject of study in a number of previous research efforts, which have shown that these two cognitive traits in particular can have significant influence on career choice, team interaction and success in various task environments such as taking the SAT. Gerald Gordon and Edward V. Morse developed the GCSI in 1969. At that time Diff was new, their contribution, and they adapted Sarnoff Mednick's R.A.T to go with it.

Differentiation (Diff) is the ability to make subtle discriminations, that is, the ability to perceive fine gradations of differences within or among aspects of phenomena in which the individual is interested.

Individuals with high differentiation ability seem to be attuned to discrepancies of fact or theory, which leads to an ability to formulate questions or conceptualize issues in a domain. It is a facility at identifying the problems that are significant enough to have major implications. Such individuals seem able to

appreciate complexity and note subtle nuances in a complex field. According to Gordon and Morse,

"High differentiators perceive their environment as a series of discrete parts while low differentiators see their environment as a highly homogeneous. The high differentiators welcome differences in the environment, while low differentiators overlook or reject them." [Gord69, p42 ff]

Simply, the High-Diffs seem better able to distinguish which underlying factors are important in order to make sense of a confusing or ambiguous situation such as an unexpected outcome.

Note that differentiation does not refer to the ability to perceive obvious differences that anyone can see, but to the subtle differences that generally elude most people. This can be seen in artists, writers, and people who consider a discriminating eye on the key to success in many of the more non-technical fields.

Remote Association (RA) refers to the ability to form connections between that would seem, on the surface, to be dissimilar or unrelated phenomena. The cognitive trait of RA was first described systematically by Sarnoff Mednick [Medn63], who posited that RA was in fact one important component of creativity, namely, that ability to form new or useful combinations from otherwise disparate materials. In Mednick's words, creativity is:

"the forming of associative elements into new combinations which either meet specified requirements or are in some what useful. The more mutually remote the elements of a new combination. The more creative the process or solution"

[Medn63, p221, quoted by Gordon, Gord71, p110]

For example, the ability to formulate and appreciate puns – combining unrelated words for humorous effect—is one reflection of RA. The RA trait is present in this particular verbal ability, but RA appears to address a more fundamental skill than that one which goes to the heart of a more generalized problem-solving ability.

In the scientific engineering domain, Remote Associated ability is the basis of inspired problem solving: the ability to see the solution to a previously insoluble problem by the intuitive (non-logical) and sudden combination of seemingly unrelated concepts or elements.

Note that neither trait is related to classical notions of logic or intelligence; good scores on IQ tests generally do not necessarily correspond to high scores in Differentiation and Remote Association. Rather, these cognitive traits are more accurately seen as measures of creativity, where this 'creativity' can be manifested in many ways, both artistic and scientific. However, a study of Worcester high school students by Pieper (1996) reported that Remote Associators scored 126 points or higher on the PSAT than their Local Associator classmates. He reported that 1/3 of the students scored in the high range (5+ out of 10 correct).[refPieper]

Traditionally, differentiation scores are interpreted by dividing the subject group about the median value established for the population from which the sample is drawn. Thus, Differentiators may be divided into Differentiators and Non-Differentiator at the median, Remote Association scores were originally treated that way as well, but no longer, since general population norms have been established for the 10 and 12 item scales devised by Wilkes that are becoming the standard in the field. For the Class of 2003 a 12-item scale was used and 6 or more had to be correct to be scored as a "remote". Thus the individual may be classified into one of four possible combinations:

Diff / RA

Diff / LA

NonDiff / RA

NonDiff / LA

This four-fold typology is similar in logic, though the terminology is slightly different, from that used by Gordon and Morse [Gord69] in their study of R&D personnel in various industries. This work was the first to show the value of Differentiation and Remote Association in the study of group dynamics of scientific and engineering personnel. Based on their study of the characteristic behavior of these four types, they were able to attach descriptive names to the types. The current terminology in use is listed below, with Gordon's older terms noted.

Diff / RA – "Integrator"

Diff / LA – " Assessor" ("Problem Finder" in Gordon's terms)

Non-Diff / RA – " Problem Solver"

Non-Diff /LA – "Implementor" ("Bureaucrat" in Gordon's terms)

Two of the four they used are still in use, their "Problem Finder" is now the "Assessor," and their "Bureaucrat" is now the "Implementor."
Cognitive classification is the basis of both parts of the research project described by this report the psychometric study and the search for lead indicators of academic success. The questionnaire developed for this project is called the GCSI (Gordon's Cognitive Style Indicator), which tests for Differentiation, Remote Association, and "divergent thinking" through a series of item and word games. Divergent thinking is Guilfords term for "ideational fluency"- a standard creativity test from another psychological tradition than that which produced the "remote associates" test.

2.1.1 GCSI results from Previous Class Studies

There have been previous psychometric studies done. One of the first was an IQP written by Mike Lynch in 1991 called "A Proposed Study of Group Dynamics in Engineering Teams". The goals of his project were to: 1) To develop a presentable, high quality survey questionnaire which can be used with actual groups solicited from industry, 2) To develop a set of techniques for administering the survey and a set of scoring protocols and statistical methods for analyzing the data that it produces, 3) To develop a new self-assessment

measure (ASES) derived to elicit cognitive style data that would ideally replace the difficult-to-administer measures for Differentiation and Remote Association currently in use and 4) To solicit a few engineering teams from industry and administer the questionnaire to them in order to demonstrate that the questionnaire was free of confusing instructions or questions and to produce a small body of data for a trial analysis. Gordon's Cognitive Style. Indicators is a four-fold typology derived from two more important cognitive abilities (or qualities) Differentiation and Remote Association. These cognitive characteristics have a significant influence on interpersonal interactions and team success.

Differentiation (Diff) is the ability to make subtle discriminations, that it, the ability to perceive fine gradations of differences within or among aspects of phenomena in which the individual is interested. In short, people with high differentiation ability are better able to identify and make some sense of underlying factors that are important to understanding a confusing situation. Artists also refer to this ability to pick out subtle, but significant details in their own way, calling it the 'discriminating eye.'

In Mr. Lynch's study, he expressed the greatest concern about the differentiation measure, which he considered "fragile". His point was that once the scoring formula was well known it could be easily falsified. He used a version of the Diff. indicator developed by Gerald Gordon and Edward V. Morse and the abbreviated 10-question subset derived by of Mednick's Remote Association Test developed by John Wilkes to classify his respondents in the usual way. Then he would look

for other indicators and do a study of team dynamics. Lynch wanted to find out if it really made a difference in a group if the leader, or supervisor was a Differentiator. Gordon had made this claim already so that would be a replication. From there he wanted to go on an look at the group task and see which groups performed better, depending on the mix of cognitive types. It made sense to have this type of indicator development done at WPI, because of the project based curriculum. There was a lot of group work going on and if being aware of the mix could improve outcomes the advisors of projects would want to know this.

Lynch's development of the ASES measure was undertaken to learn if a new self-assessment measure could be designed which would reliably elicit cognitive style information without the traditional 'test' being administered. He hypothesized that if this could be done with something more like the MBTI questionnaire, which was self-administered, then, later versions of the ASES questionnaire could omit the traditional DIFF and RA measures. He knew that he was a long way from establishing the ASES survey as the sole means for obtaining the subjects' cognitive style, but that was the ultimate goal. Recall that he considered the former measure "fragile'. In addition he viewed the Remote Associates Test culture biased. Hence, proxy measures for each would be welcomed on the basis of convenience, long-term robustness and better measurement of people from other cultural backgrounds.

The Differentiation measure requires the subject list ten people (friends, acquaintances and colleagues), and then rank them on a scale of 1 to 10 for

each on the dimension of creativity and commitment to studies. (Sometimes "Focus" is used as the second rating criteria.) Scoring the Diff measure has traditionally been accomplished by using the Morse formula, though Yorar Neuman criticized it long ago, Neuman proposed that measuring deviation from a diagonal representing a perfect score- (one use of each category) would be more precise. He did not develop an actual formula.

Morse formula-

Diff = Std Dev * (#of categories/range +1)

In the Morse system, a high Diff score is obtained when the subject uses as many different 1 to 10 scores as possible when rating the list of ten people, also the wider spread of numbers, the higher the score. A 'perfect' Diff score would be obtained when each of the numbers from 1 to 10 appears exactly once. Although there are two scores computed, (one for each matrix). The traditional practice in the literature is to use the score based on the rating given for Creativity. That is the accepted measure for Differentiationshould there be a discrepancy. John Shutt later (1998) operationalized both Neuman's concept and another one of his own conception designed to ferret out "contrastor's" (people who rate using both extremes but not the middle). Contrastors have a high variance or S.D. - should get a low score. Shutt noted that Morse's manner of dealing with them by creating a correction based on the number of numbers used was ineffective and scrambled the relative scores of legitimate cases. Now Diff data is scored all 3 ways and if there are any discrepancies a decision is made by a 2 out of 3 'vote' majority rule.

The Remote Association measure Lynch used is timed and consists of 10 sets of words. Each set contains three words, which together suggest a fourth,(the answer) which the subject is asked to supply. A strict time limit is imposed, usually 6 minutes and no more than 12 minutes. The time limit is imposed because High-RA individuals will generally complete at least half of the items on the test with a high score in 6 minutes- and then sit there making little further progress, but Low-RA individuals usually cannot get half no matter how long you give them up to a half an hour. (Given 2-3 days some have gotten them all.) It is hard on people to keep trying when they are not making progress, so a time limit is imposed. That way everyone can tell himself or herself, they could have done it with 'more time'. Thus, this procedure gives one a honest determination of Remote Associates ability, in a reasonable period of time, with less test stress. One of the most important aspects of this indicator is that it is essential that words be well known and that there is nothing trivial about them. This is because if the words are slang our only known to people from one part of the country then it becomes culture biased. In the 12 items GCSI, a score of 6 or above is considered a high score.

Lynch's ASES (Attitude, Style, and Experience Scale) was being developed to address the shortcomings in the present cognitive style research: in obtaining the cognitive style information with measures that had to be administered in person to naïve subjects. Both measure, Diff and RA, are relatively cumbersome to administer. The Diff measure depends on its scoring protocol remaining secret. The Remote Association is a timed test, which requires that a secret set of word

list be given to the entire group at one sitting, during which the group must remain under supervision to avoid collusion between subjects.

It was by no means certain that a self-paced, self-assessment measure could in fact yield cognitive style data. It was meant to become a “proxy” measure, that is, one, which reveals cognitive style in an indirect manner. Thus, a prototype questionnaire was developed, and a pilot study was conducted to validate it as a measure of cognitive style by statistically analyzing it against the standard Diff and RA measures obtained from that same body of subjects. This evaluation is necessarily made on a question-by-question basis, comparing actual Diff and RA scores from the subjects against their responses to the questions from the prototype measure.

Originally for each question, the subject is asked to answer A (agree) or D (disagree). By deliberate intent, no neutral answer was provided, nor any shading like “strongly” or “mildly”. The objective was to force the subject to commit to one or the other without waffling. But in the GSCI proxy survey distributed to the WPI class of 2003 (based on ASES) there was shading to the questions. The subject’s could answer agree, strongly agree, disagree, and strongly disagree but there wasn’t a column for not applicable, One could still decide to skip an item, of course but if they answered there was still no middle ground. It was entirely possible that no particularly strong correlation’s might have been found for a given question when Diff and RA are considered independently, but that a strong correlation might nevertheless exist and be detected when a question is

correlated against each type in 4-fold typology of the cognitive styles individually. Both analyses were carried out.

Lynchs' ASES measure was administered to a group of approximately 50 students in Dr. Wilkes SS-1202 ("Introduction to Sociological Concepts") class in December of 1990. The students were given the traditional Diff and RA measures at the same time, which were needed to qualify the ASES. Lynch's interest is the possible correlation's between the 108 questions of ASES and the other measures under consideration: MBTI, Diff, RA and Divergent Thinking (all 4 dimensions), all cognitive style measures. (Lynch's items were typically drawn from literature sources discussing technologists- such as Tracy Kiddler's book Soul of a New Machine.)

There were a fair number of questions that produced significant correlations with the Diff and /or RA scales, indicating that a production version of the ASES ought to be possible to develop. One note to make from Mike Lynch's made when assessing his survey is that he felt that some questions should be discarded because the had the 'flavor' of MBTI questions. They seemed to be more personality specific, meaning he would see if they correlated more with an MBTI dimension that the GCSI.

In the end, Lynch found that despite the problems associated with qualifying the ASES based on the small sample available, it was still possible to demonstrate that self-assessment questions can be designed which would elicit cognitive style data from subjects. In the search for Remote Associates Proxy items, involved about 25 R&D scientists from Gillette Lab, 18 of home were "Native" speakers of

English. The full set of results can be seen in Appendix D. The Gillette found some high correlations but when the same items were given to about 42 American English speakers, the findings were diluted. Even worse was that some of them started to shift and correlate with Diff.rather than with RA, and vice versa.

In October 1984, a student names Brian Starr conducted an experiment on the WPI campus with a goal similar to Mike Lynch's later study- but different methodology. The experiment was designed to determine whether judgments of cognitive type-based on the typology defined by Gordon – could be made through the subjective analysis of interview data gathered from a subject unobtrusively rather than by administering the usual measures.

The interview data already existed. It came from a group of 50 doctoral students' from four fields, Physics, Chemistry, Economics and Sociology. Half of them were women. About 12 of these cases were used in the study- the female Chemists and the Male Sociologists and Economists. The majority of these interviews involved traditional personal career line interview probes focusing on the process whereby they found themselves training as scientists in their field. However, there were sections explicitly designed to elicit cognitive information through self-image as well. Each interview was roughly one hour in length and each interview subject had been given the traditional cognitive tests for Remote Association and Differentiation ability at the completion of the interview. The problem was that the interviews were so full of traditional psychological material involving choice and impression that it was hard to focus on only the issues that would show a how a person approaches problem solving. Although the interview

data was filled with enough cognitive cues that it allowed Starr to predict the cognitive test results 90% of the time, it was hard for him to train others to do so, especially if they were schooled in traditional psychological theory and got distracted at the level of personality rather than focusing on cognitive style ones. Starr found that females were more difficult for the judges to assess accurately than men, but as the panel became 'trained' in the process there was virtually no difference in their ability to identify the 4 types in the male and females interview data. The results also showed that one cognitive measure was easier to predict that the other. In fact, three of the eight judges correctly identified the Remote Associates measure 100% of the time.

The two main objectives from the study were:

1.Determine the overall success rate of these judges in making the determination of cognitive type among the four possibilities.

2.Determine whether specific types of information served as cues for successful judges or whether a more general overall style of presentation in the interview proved necessary for cognitive interpretation. To what extent would the judges rely on the same "key" passages in the data? Could they do it as well from excerpted interviews as full text?

The overall success rate of the judges was somewhat disappointing. Seventy percent of the time they, as a group, were able to correctly predict how the subjects would rate on the individual cognitive measure. Sixty-four percent of the time they were able to predict whole cognitive types. One significant finding was that there was noteworthy improvement with workshop style 'training' and they

were able to gain a better understanding of the types of information required to make these judgments with practice. The most successful judges were trained high differentiators with no prior psychological training. The excerpted passages led to judgments as good as the whole interview, but the judge had less confidence when working from such limited information. Starr concluded that key passages focused on career decision and self-description were the most fruitful base of judgment. He successfully trained 2 of 8 people to be as accurate as himself, 90% accurate.

In 1997, a student by the name of Stephanie Baldwin took, a completely different approach to measuring remote association, she tried a non-verbal method hoping to make a cognitive style indicator for children which would avoid culture bias and vocabulary concerns. She attempted to devise a visual method, that would be much more difficult to specify exactly what will be perceived as elements in a given stimuli. Some possibilities are shape, color, texture, or style. It is equally difficult to describe a collection of these visual elements in terms of cognitive style, that it, mutually remote or local, because the 'solutions' to such collections of complex elements cannot be pre-determined. She was an artist interested in collages and considered seeing how the types responded to symmetrical and asymmetrical images. That was not going too well so she shifted to on using comic strips without captions letting the respondents provide their own text to see who went for discordant characterizations of the action and

who provided connected action flows. The key was more what sequence they decided to caption that in what the attributed to the ambiguous action sequence. Baldwin developed comic strips in response to this challenge, because of their appeal, and because of the spontaneous search for associations that are generated by text-free sequence of frames. Although there was some correlation, this type of measure was deemed too weak to be a proxy. That requires a .9 correlation. On the other hand, it was promising. The comic strip test showed that it was easier to distinguish the high and low differentiator's than the Local and Remote Associator's by this means. Actually, it was the Integrators and Implementor distinction that was the clearest in her results. The problem was that Problem finders and Problem Solvers responded too much alike, both going for the discordant sequences.

Then this past year, there was an IQP done by Jennifer Headman, and Sarah House that was titled A Psychometric Study of the KAI, GCSI, and MBTI and the Class of 2001 Major Changing Study. They examined three different cognitive styles measurements, the Kirton Adaptation Innovation Indicator (KAI), Myers-Briggs Type Indicator (MBTI) and the Gordon's Cognitive Style Indicator (GCSI). Their biggest problem was getting people who already taken the GCSI and MBTI to take the KAI. Hence their psychometric sample came from about 60 students enrolled in two social science courses at WPI. An odd assortment of other people who were asked to do the KAI when they filled out the other two measures also participated. This included ten to fifteen graduate students at WPI attending a

summer course, 50 mechanical engineers in a class at Boston University, and 30 professionals from the Gillette Corporation.

The KAI is considered a measure of creativity but it is from a different tradition that the RAT. Its asks, "What method of creativity does this individual employ when being creative?" rather than " to what degree is this person creative?" In theory, this test (unlike the others) doesn't classify people strictly into categories. A subject can fall anywhere along a continuum between extreme Adaptor to extreme Innovator and a 20 point difference is associated with difficulties in mutual communication and decision making. However, in practice a score of 96 is used to describe the Adaptive Range from the Innovator Range. The theory describes characteristics, including both advantages and disadvantages that have been observed for each range along the scale. It was primarily developed for use in business and industrial settings and deals with how comfortable one is in departing from established ways of doing things in incremental steps (adaptives) as opposed to major or massive watershed changes that transform the system (innovators).

Their findings showed that there wasn't a correlation between the overall KAI scores and the Remote Association and Differentiation results. Further, there was no significant correlation between the two variables making up the GCSI and the 3 sub-scales of the KAI. There was no correlation between the KAI and the 4 outcomes on the GCSI, either (Integrators, Assessors, Problem Solvers and Implementors), which is interesting, since both claim to measure creativity via "cognitive style".

But in comparing the KAI, and MBTI, three of the dimensions were found to be significantly correlated, the highest JP and the KAI was at .75 on the Gamma correlation coefficient. The thinking/ feeling dimension was the exception with no correlation at all. It was found that extraverts are more likely to be innovators. Therefore, introverts would be adaptors. In the sensing/ intuition, dimension they found that the adaptors would more after fall into the sensing category and vice versa. In the judging/ perceive dichotomy, the judging aspect would be the characteristic of the adaptors, and the perception facet would more than likely fall in to the range of the innovators on the KAI.

Given such a high correlations on the areas of S/N and J/P dimension they were crossed so as to be examined together and more closely. The SJ's were found to be 91% adaptors, and NP's 81% innovators. After some thought, it made sense to the authors that this would be the result. According to the literature, the sensors prefer to work with the tangible material, with the intuitive's would rather read between the lines and propose things that are a bit 'off the wall'. Again the 'judging' prefer structure and predictability, while perceiver's are always preserving their options and going off in new directions. The S/N dimension crossed with the J/P groups had been revealing about the grades WPI student has received in the Class of 2002 study examined by Doerschler. Indeed, the J/P scale of the MBTI and the conformity subscale of the KAI were highly correlated and the heart of their overall relationship. For Headman and House's purposes this was a useful finding. They had hypotheses about how adaptors and innovators would approach major changing at WPI to test- and their WPI sample

had not taken the KAI. Now they had a new proxy level correlation and could use the J/P dimension of the MBTI instead. For our purpose however, it is the finding that the KAI and MBTI are not strongly enough related to the RAT or Diff measure to serve as proxies that matters. Lynch had come closest without recourse to expensive interviews- so his work would become the basis of the WPI Class of 2003 Psychometric study.

Further, since it seemed that the same MBTI grouping was tied to reaction to change and flexibility. I decided to repeat the use of the SN, JP cross variable in the analysis of the Class of 2003 data to organize term-by-term grade – (freshman performance data)- taking gender into account, a factor that Doerschler did not examine with care. This too proved revealing and simple use of MBTI data.

The study of the class of 2001 by Peter Kline, Eric Niccoli, and Kane Sheldon (1998), found that the original GCSI indicators were useful for their study. They found that the freshman year program at WPI is not a good fit for people who are highly divergent thinkers. The grades of the most divergent are lower than the least divergent and are slightly lower at the end of the year thatn the beginning. Of course that's freshman year data. In junior and senior year, on project work in general, they may be the stars since divergers generate lots of alternative approaches and are considered unusually original or creative. However, they probably don't stress bringing things to conclusion and that could be an even bigger problem on a project than in the more structured classroom setting. In the right environment these people could be a real asset, but on their own they

experience difficulties that tend to lower their average grades relative to their peers.

The class of 2001 study also reported gender differences in average grades for the year, Cognitive Style and gender differences in grades from the year, housing and dormitory differences, Also the study compared SAT scores to grades by cognitive types. It was a good precursor study for the Class of 2003 study.

2.2 The Myers-Briggs Type Indicator

Swiss psychologist Carl Gustav Jung proposed a theory of psychological type in 1921, based on observations over time. He asserted that everyone is either extraverted or introverted in orientation toward the world, and prefers one way of "perceiving" (sensing or intuition) and one way of "judging" or deciding on action (thinking or feeling) (Bonham, 1987). Jung proposed that personality, or psychological type, is formed by the ordered combination of these three preferences concerning the use of perception and judgement. The measure has four bi-polar preferences encompass Extraversion-Introversion, Sensing-Intuitive, Thinking-Feeling, and Judging-Perceptive. The latter indicates whether it is one's mode of judging or perceiving that is most visible to the outsider. This provided a means of determining a person's dominant and auxiliary mode of information processing.

Katherine Cook Briggs became interested in personality similarities and differences about the time of World War I, after beginning to develop her personality typology; she discovered and adapted that of Jung instead. In 1942, she and her daughter, Isabel Briggs Myers, began to work on an instrument that would reveal individual type, the Myers-Briggs Type Indicator (MBTI). The MBTI is reported to measure the three Jungian dichotomies plus a fourth dimension, perceiving (P) versus judging (J). All four of the factor dichotomies are related to learning style but the sensing-intuition preference is said to reveal the most about one's basic learning style differences. The thinking-feeling dimension shows a pattern of commitments and values of the student. The judging-perceiving dimension is indicative of work habits (Schultz, 1985).

Type is identified as preference among four opposites and is identified by a four-letter description. The sixteen MBTI types are derived from the possible combinations of these four factors or dimensions of personality. Descriptions are provided for the individual preferences and 16 types, in general terms and in such specific areas as education, management, counseling, and volunteer work. Type is considered stable and unmodifiable (Bonham, 1987), in the sense that one's preferences don't change as one learns to appreciate and be competent in one's less preferred modes over time.

MBTI results indicate the respondent's likely preferences on four dimensions:

Extraversion (E) or Introversion (I)
Sensing (S) or Intuition (N)
Thinking (T) or Feeling (F)
Judging (J) or Perceiving (P)

Introversion (I) -- Extraversion (E)

Introverts prefer:
- An orientation to the inner world
- Focusing on internal impressions, ideas, and concepts
- Quiet reflection
- Thought before action
- Working alone
- Theory based problem solving

Extraverts prefer:
- An orientation to the outer world
- Focusing on people and things
- Active engagement with the social world
- Environmental scanning for information
- Trial and error problem solving

Sensing (S) -- Intuitive (I)

Sensing types prefer:
- Perception through sensation
- Practical and factual details
- Living in the present
- Confining attention to what is said and done
- Letting the "eyes dictate to the mind"
- Seeing things in a straight-forward, linear fashion
- Seeing the "trees" not the "forest"

Intuitive types prefer:
- Perception through cognition
- Seeing patterns and meaning
- Seeing the possibilities
- Living timelessly
- Reading between the lines
- Letting the "mind dictate to the senses"
- Seeing the "forest" rather than the "trees"

Thinking (T) -- Feeling (F)

Thinking types prefer:
- Using logic over emotion
- Using objective criteria

Prizing orderly information
Being skeptical and firm-minded

Feeling types prefer:
Applying personal priorities
Using human values and subjective criteria
Being trusting
Valuing harmony and relationships

Judging (J) -- Perceiving (P)

Judging types prefer:
Deciding and planning
Organizing and scheduling
Controlling and regulating
Goal-oriented activity
Gaining closure

Perceiving types prefer:
Gathering information
Adapting and changing
Flexibility
Open-mindedness
Delaying decisions for more information

There are 16 possible ways to combine the preferences, resulting in 16 MBTI types:

ISTJ ISTP ESTP ESTJ

ISFJ ISFP ESFP ESFJ

INFJ INFP ENFP ENFJ

INTJ INTP ENTP ENTJ

2.2.1 Scoring the MBTI

The items scored for each variable force a choice between the extremes of the chosen preference. The choices are between what appear to be inconsequential everyday events. Every question offers a choice between the two poles of a particular variable such as E or I, never E or N. The possible

responses for each question are weighted zero, one, or two points. Responses with an overall prediction rate of 72% or higher carry a value of two, those that range between 63% and 71% carry a value of one and those below 63% carry a weight of zero. The totals for each variable are called points. Those with a higher number or points in favor of E than I are classified as extraverts. The amount of this difference (between E and I) is computed by formula to produce a preference score, for example E17 or E4. Just as the letter predicts overall type, the number describes the relative consistency of clarity of your pattern of responses on that MBTI survey administration. In Jungian theory you are one or the other, though the indicator may not be clear about it. It is not a linear dimension where relative score matters. The weight tells you only the likelihood of misclassification – which gets smaller as the weighting number rises. The question of how clear your response pattern was is all it answers. The MBTI is 85% likely to be correct on at least 3 dimensions as indicated by the results of verification interviews of about 30 minutes each given to people after they finished taking the indicator.[ref2001]

Since the MBTI is made up of four variables, and each is a dichotomy, it is important that choices at opposite ends of the spectrum be treated equally. Questions are not supposed to have right and wrong answers, or superior and inferior choices. This is important since the goal of the test is to find out what people prefer, not whether they know the right answer. One should never be placed on the defensive just as they should not think their preference is better than someone else's is. The question is whether they would agree that it is descriptive of them.

The choices involved in each question also cannot be very extreme. This is because accuracy near the middle of the spectrum is more important than it is at the ends. For example the magnitude of difference between E34 and E36 as opposed to an E1 verses an I1 is the same. However whether one is an E34 or E36 is of little consequence, as both values indicate the same thing, a clear pattern of extraversion. On the other hand an E1 is classified as extraverted while and an I1 is classified as introverted. Thus a question that deals with the fine line between introversion and extraversion is much more important than a question that describes whether one's likelihood of being extrovert is 80 or 85%.

The importance of setting up each question as a choice between a dichotomy is that it prevents both poles of a variable from being chosen. If the question dealt with which is the more appealing word, "build or invent", the respondent had to choose the one that is preferable over the other. Whereas if the same thing was asked as a group of two questions such as "Do you like the meaning of this word? Build." And then "Do you like the meaning of this word? Invent." A person might choose both as each of them is easily construed as good. This would prove nothing relative to the MBTI as the fundamental basis of the test is finding out what one's preference is.

2.2.2 The 16 Personality Types

ISTJs are quiet, serious, responsible, sensible, patient, conservative, loyal and steadfast--maintainers of society's time-honored traditions and institutions. This "Rock of Gibraltar" type needs to be needed and readily takes on a parental role, in their working relationships, as well as with friends and family. They often

settle in occupations in law enforcement or government, teaching, banking and finance, religious service or administration, or business. They are ideally suited to positions in bureaucratic organizations, and they naturally adept to playing the roles assigned to them--whether as leaders or followers. ISTJs function well in jobs requiring accurate record keeping of facts and figures. They are the enforcers of law, policy, procedure, schedules and principles, and they exert a stabilizing effect on society. Hard work, honesty, politeness, timeliness and faithfulness to family, friends and country are foremost among the ISTJ's honored values. They tend to resist unnecessary change in all aspects of their lives and they see most innovation as disruptive.

The Class of 2001 study found that the ISTJs averaged a freshman year GPA of 1.94. While the Class of 2002 study found in more detail that the ISTJs started off A term with about a 2.0 GPA and continually declined throughout the rest of the year to end up with about a 1.89 GPA in D term. The ISTJ has been accounted for about 12% of the freshman population over the past three years.

ISTPs are factual, sensible, logical and reflective. They enjoy activity, independence and solitude and may work happily and productively for 20 hours at a stretch. Curious, practical and often mechanically adept, many excellent craftsmen and production artists are ISTPs, as are professionals in electronics, engineering and mechanics and stars in individual athletic competition and team sports. ISTPs are masterful at analyzing complex systems and introducing change to improve productivity and efficiency. This type is noted for working out

easier ways to get things done: often a great asset, but also a potential liability if the ISTP side-steps regulations, codes and laws. In business and finance, ISTPs often rise to the top because they combine a no-nonsense facts-and-figures approach with a "why not try it?" openness to strategy. They tend to be objective, competitive and coolly rational in most life pursuits. More feeling types may perceive the ISTP's approach to personal relationships as detached, conditional and utilitarian, but ISTPs retort that their behavior is merely unemotional.

The Class of 2001 study's GPA was based on a three point index that the norm was A=3, B=2, C=1, NR (Not Recorded)=0. It was used again in the class of 2002 and 2003 studies as well.

The Class of 2001 study found that the ISTPs averaged a GPA of 1.61 for their freshman year. While the Class of 2002 study found in more detail that the ISTPs started off A term with about a 1.52 GPA and then took a significant dip in B term to average about a 1.44 GPA. However, in C and D terms the ISTPs continually rose to end up with a 1.68 GPA in D term. The ISTP has been accounted for about 8% of the freshman population over the past three years.

ESTPs are outgoing practical thinkers--masters of experience, observation and the analysis of cause-effect relationships, free from the biasing influence of theory, tradition or emotion. Action is the ESTP's middle name. This type thrives on it and creates it when life gets too boring. Resourceful troubleshooters, dynamic entrepreneurs and engaging negotiators, ESTPs apply a flexible, common sense reasoning approach to any problem they tackle: planting a

garden, fixing a car, settling a dispute, or reorganizing a multibillion-dollar corporation. Just don't try to sell this type on fantasies and abstract ideas! Spontaneous, competitive and generous, ESTPs turn work into play, whenever possible, and apply the model of an athletic team to all their relationships. Teamwork matters to the ESTP. Although they can be charming, clever and seductively open, rarely do ESTPs merit description as deeply feeling people. When life becomes too complex with unwanted obligations and personal entanglements, count on the ESTP to want to escape from the situation.

The Class of 2001 study found that the ESTPs averaged a freshman year GPA of 1.54. While the Class of 2002 study found in more detail that the ESTPs started off A term with about a 1.49 GPA and then took a small dip in B term to average about a 1.45 GPA. However, by D terms the ESTPs recovered and rose above the A term GPA to end up with a 1.65 GPA in D term. The ESTP has been accounted for 5% of the freshman population over the past three years.

Assertive, practical, rational, loyal, opinionated and decisive, the ESTJ is an organized, take-charge person who brings others into line by assigning tasks and roles, giving clear-cut instructions, following up regularly to check progress and giving formal recognition to those who do as they've been told. The ESTJ usually prefers to enforce existing policies, rather than to innovate, revise or otherwise introduce unnecessary change into any system. Traditional and conservative, the ESTJ tends to apply a military model to most life situations, preferring linear channels of communication and command and eliminating any

disorganization or confusion. In business, education, administration, law enforcement or the military, this type is evident as the outgoing, no-nonsense leader, gratified by the precision of smoothly functioning organizations and the power and control that come with being in charge. While others may charge that this type is sometimes short on feelings and finesse, ESTJs will tell you they express their caring by looking after others' welfare in unemotional ways.

The Class of 2001 study found that the ESTJs averaged a GPA of 1.68 for their freshman year. While the Class of 2002 study found in more detail that the ESTJs started off A term with about a 2.0 GPA and then took a slight dip in B term to average about a 1.96 GPA. However, in C term the ESTJs excelled to an average GPA of 2.25, but declined to a 2.09 GPA in D term. The ESTJ has been accounted for about 5% of the freshman population over the past three years.

ISFJs are private, faithful, sensible and sensitive. Shy, modest and unassuming, this type needs to support and minister to others in order to feel useful. Others count on the ISFJ's steadfast caring and help--so much so that they may become irresponsibly dependent on this type's support. Martyrdom is often an occupational hazard for self-sacrificing ISFJs, who may have to struggle with inner doubts and fears before expressing their personal needs and desires. Work is life to these conservative souls, who put in long hours at the workplace, as well as at home. ISFJs volunteer their help generously, often behind-the-scenes. Innovation, change and uncertainty are unnerving to these folks. They prefer a stable, organized, well regulated, scheduled life, even if someone else is

to control what will happen and when. The deeply compassionate ISFJ gravitates toward traditional helping occupations: human services, the ministry, homemaking, teaching and clerical work. They are happy handling details and routine, especially if there is a human element in the work they do.

The Class of 2001 study found that the ISFJs averaged a GPA of 1.86 for their freshman year. While the Class of 2002 study found in term-by-term detail that the ISFJs started off A-term with about a 2.06 GPA and then took a dip in B term to average about a 1.98 GPA. In C term the ISFJs average continued to fall to an average GPA of 1.86, but then increased up to a 1.97 GPA in D term. The ISFJ has been accounted for about 3% of the freshman population over the past three years.

ISFPs are quiet, practical, sensitive and spontaneous. Somewhat shy and retiring, folks of this type are drawn to a complex array of occupations, which offer some measure of solitude and also allow them to keep a finger on the pulse of life. Forestry, horticulture, farming, scuba diving, mining and construction attract some ISFPs, as do the hands-on fields of carpentry, woodworking, pottery, weaving and production art. Professional athletics, music and performance also draw a disproportionate number of this type. You'll find other ISFPs at work in a variety of human services fields, where their sensitivity and skill at observation arm them well to help others. Sensuous and earthy, many ISFPs make working or playing in the out-of-doors a high priority. The ISFP values independence strongly and tends to retreat or escape from situations,

which become too unpleasant, confining or demanding. This free spirit's natural characteristics run counter to the expectations of most business organizations, so you'll rarely find this type at the top of the corporate ladder.

The Class of 2001 study found that the ISFPs averaged a GPA of 1.76 for their freshman year. While the Class of 2002 study found in term-by-term detail that the ISFPs started off A-term with about a 1.60 GPA and then took a dip in B term to average about a 1.65 GPA. However, in C term the ISFPs rose considerably to an average GPA of 1.78 and remained at this level throughout D term. The ISFP has been accounted for about 3% of the freshman population over the past three years.

The ESFP is warm, outgoing, optimistic and caring--cheerful people who's always ready for a good time and avoids the company of dreary "doom and gloom" people who take themselves too seriously. Count on ESFPs to settle in occupations that let them be "people people"--working in sales, human services, business, nursing, crisis intervention or the performing arts. They are naturally gifted at observing human behavior and figuring out what others want. Whatever the ESFP's work choice, talking must be part of the job! To be at their best, ESFPs need to be around other people--and this type will go to great lengths to avoid solitude and isolation. ESFPs believe that life, work and relationships should be fun and rewarding. ESFPs are unlikely to stick around when clouds darken the skies for too long at a stretch. Charming, clever and open-minded, the witty ESFP is likely to be seen by others as a party person--so much so that this

type may be ill-at-ease in business fields which expect seriousness, formality, logic, conceptual thinking, organization and punctuality.

The Class of 2001 study found that the ESFPs averaged a GPA of 1.63 for their freshman year. While the Class of 2002 study found in term-by-term detail that the ESFPs started off A-term with about a 1.57 GPA and then took a small dip in B term to average about a 1.55 GPA. However, by D term the ESFPs rose to an average GPA of 1.67. The ESFP has been accounted for about 3% of the freshman population over the past three years.

ESFJs are outgoing, sociable, practical and organized. They pride themselves on their reflexive skills to harmonize, entertain and nurture others. Duty, personal service, manners and social order are a second hand nature to this type. Warm, friendly and naturally talented at working with others and organizing people and events, ESFJs make excellent salespeople, health care providers, teachers, homemakers and hosts. They work well as club and committee members, and their type numbers conspicuously among volunteer, church, charitable, social and civic organizations. Traditional, conservative and loyal, ESFJs work hard, devoting their time and energy to family and friends. This caring type has little tolerance for those whose actions or omissions hurt others' feelings, and they may let the offender know! Although ESFJs derive personal satisfaction from helping others, they need verbal and tangible strokes of appreciation for their good work. When they do not receive the kind of recognition

and reciprocation they feel is due, ESFJs may suffer attacks of righteous indignation.

The Class of 2001 study found that the ESFJs averaged a GPA of 1.91 for their freshman year. While the Class of 2002 study found in term-by-term detail that the ESFJs started off A-term with about a 1.95 GPA and then took a small dip in B term to average about a 1.88 GPA. However, in C term the ESFJs rose substantially to an average GPA of 2.13, but returned to a GPA of 1.85 in D term. The ESFJ has been accounted for about 2% of the freshman population over the past three years.

INFJs are intuitive, caring, quiet and peace loving: deep and complex people who may seem equally at home dealing with the personal and analytical spheres of life. The interior world of vision and ideas is this type's most comfortable domain, but some degree of human connection is essential for the INFJ's happiness; a potential conflict for this type. Articulate, empathetic and idealistic, INFJs often say they just know things, they know them directly, and they may not be able to tell you how or why! INFJs seem to be able to feel others' feelings vicariously and sense the good and evil in situations: an almost psychic ability, which may be an asset in many "people professions." Spiritual, sensitive and committed, INFJs enjoy being of service to others. Once this type's goals are set and the mind is made up, no argument based solely on reason and practicality is likely to divert the passionate INFJ from a mission or chosen project. Whether this characteristic manifests itself as admirable tenacity or bull-

headed stubbornness may determine the individual INFJ's potential for life success.

The Class of 2001 study found that the INFJs averaged a GPA of 1.94 for their freshman year. While the Class of 2002 study found in term-by-term detail that the INFJs started off A-term with about a 2.0 GPA and then excelled in B term to average about a 2.15 GPA. In C term and D term the INFJs held that level averaging a 2.1 GPA in both terms. The INFJ has been accounted for about 3% of the freshman population over the past three years.

INFPs are quiet, creative, sensitive and perceptive souls who often strike others as shy, reserved and cool. These folks have a rare capacity for deep caring and commitment--both to the people and causes they idealize. INFPs guide their behavior by a strong inner sense of values, rather than by conventional logic and reason. Forced to cope with this facts-and-figures "real" world we inhabit, INFPs may appear to have been imported from another galaxy! They gravitate toward creative or human service careers, which allow them to use their instinctive sens of empathy and remarkable communication skills. Strongly religious, spiritual or philosophical people, INFPs may see the purpose of their lives as an inner journey, quest or personal unfolding. More practical or rational types may tend to discredit the INFP's sources of understanding as mystical. The search for a soulmate is a preoccupation for many INFPs, who must balance their need for privacy and peace with their yearning for human

connection. If there seems to be an air of sadness in the INFP's spirit, blame it on this type's longing for the perfect in all things.

The Class of 2001 study found that the INFPs averaged a GPA of 1.58 for their freshman year. While the Class of 2002 study found in term-by-term detail that the INFPs started off A term with about a 1.90 GPA and then took a dip in B term to average about a 1.84 GPA. However, in C term the INFPs recovered back to an average GPA of 1.95, but happened to take a large fall to a GPA of 1.75 in D term. The INFPs have accounted for about 9% of the freshman population over the past three years.

ENFPs are open-minded, imaginative, caring and outgoing. They thrive on the drama of life by observing everything enthusiastically and associating meaning and human motive with all they survey. To the ENFP, no life event is devoid of significance--a belief which may justify others' perception of them as hyperalert, oversensitive and even suspicious at times. Charming, interactive, charismatic, communicative and ingenious, ENFPs often are expansive in their approach to life, love and work--multitalented individuals who may succeed in a number of creative endeavors, so long as a strong human element is present. "Do this, do that!" jobs demanding strict compliance with rules, regulations and procedures, and attention to logic, facts and details are stressful for most ENFPs. Their characteristically short attention span and diversity of interests may sabotage their accomplishment in enterprises demanding tenacity and single-

mindedness. This type's natural gift for inspiring others often is their salvation: their followers may complete the projects ENFPs start.

The Class of 2001 study found that the ENFPs averaged a GPA of 1.49 for their freshman year. While the Class of 2002 study found in term-by-term detail that the ENFPs started off A-term with about a 1.78 GPA and then took a slight dip in B-term to average about a 1.76 GPA. However, in C term the ENFPs rose a bit to an average GPA of 1.80, but took a fall to a GPA of 1.70 in D term. The ENFPs have accounted for about 8% of the freshman population over the past three years.

ENFJs are imaginative harmonizers that work well with people. They tend to be expressive, orderly, opinioned, and conscientious. They are curious about ideas and possibilities. Having extraverted feeling as their strong mental process, they are at their best when responsible for winning people's cooperation with caring insight into their needs.

The Class of 2001 study found that the ENFJs averaged a GPA of 1.73 for their freshman year. While the Class of 2002 study found in term-by-term detail that the ENFJs started off A term with about a 1.81 GPA and then improved in B term to average about a 1.95 GPA. However, in C term the ENFJs declined back to an average GPA of 1.75, and then basically stayed there, with a GPA of 1.79 in D term. The ENFJ has been accounted for about 3% of the freshman population over the past three years.

Independent, innovative, logical and driven by the inner world of ideas and possibilities, the INTJ often appears to others as a quietly self-confident (and sometimes stubborn) critic of the status quo, convinced that reality could be altered, the future reshaped. Wherever there is a need for change in systems, programs, concepts or theories, INTJs will be working behind the scenes to reorganize and revise. This type's focused attention to the personal mission may be inspiring or frankly obsessive, depending on the observer's viewpoint or the success of the enterprise. Introspective and somewhat shy, INTJs place their trust in logical analysis and intuition to guide their thoughts and decisions. More feeling types may find them chilly and more practical types accuse them of being unrealistic, but INTJs take their cues mostly from those they recognize as intelligent. Often attracted to theoretical, analytical and methodological areas of inquiry, INTJs succeed in a wide variety of fields, from ones heavily dependent on mathematics and science to more philosophical, literary or applied disciplines.

The Class of 2001 study found that the INTJs averaged a GPA of 2.03 for their freshman year, the highest for this study. While the Class of 2002 study found in term-by-term detail that the INTJs started off A-term with about a 1.94 GPA and then took a dip in B term to average about a 1.80 GPA. However, in C term the INTJs rose back to the A term average GPA of 1.94, but took a yet another dip to a GPA of 1.77 in D term. The INTJs have accounted for about 8% of the freshman population over the past three years.

Private, intellectual, impersonal, analytical and reflective, the INTP appears to value ideas, principles and abstract thinking above all else. This logical type seeks to understand and explain the universe—not to control it! Higher education often holds a particular appeal to this type who tends to acquire degrees and amass knowledge over the entire course of life. Abstract or theoretical subjects are usually the INTP's cup of tea, and academic or research careers may seem attractive to this type. From science and math to economics and philosophy: just name the discipline and you'll find INTPs perched on the loftiest rungs of theory and analysis. In whatever field they choose, INTPs take on the role of visionary, scientist or architect, and they usually prefer to make their contributions in relative solitude. The mundane details of life may be the INTP's undoing, since this type lives in a world guided by intuitive thinking. Often perceived to be arrogant and aloof, the quiet and sometimes reclusive INTP may have to struggle in the personal realm, as well, for feelings are not this type's natural forte.

The Class of 2001 study found that the INTPs averaged a GPA of 1.83 for their freshman year. While the Class of 2002 study found in term-by-term detail that the INTPs started off A term with about a 1.99 GPA and then took a notable dip in B term to average about a 1.76 GPA. However, in C term the INTPs rose back to average a GPA of 1.82, but finished of D term with their lowest GPA of the year at 1.70. The INTP has been accounted for about 14% of the freshman population over the past three years.

Outgoing, logical and decisive, the ENTJ leads by providing conceptual structure and setting goals, rather than by detailing and enforcing procedures, codes and regulations. This "big picture" type rises naturally to conspicuous positions of power and responsibility in all organizational settings (business, military, educational, governmental.) Disorganization, confusion, emotion, inefficiency and illogic drive ENTJs to take charge of situations and institutions. Their intuition fuels their vision and defines their goals. They deal with the world boldly, in an assertive, analytical, objective and organized way which inspires others to salute them and do whatever the ENTJ needs done--including all the detail work! ENTJs certainly do get things done, both at home and at work, but often at substantial cost in terms of wear and tear on the human spirit, for they may neglect the importance of the personal element in accomplishing their purpose. More than any other, this type seems to struggle between an inner drive toward creative spontaneity and the desire for order in the universe.

The Class of 2001 study found that the ENTJs averaged a GPA of 1.60 for their freshman year. While the Class of 2002 study found in term-by-term detail that the ENTJs started off A term with about a 2.00 GPA and then dipped in B term to average about a 1.63 GPA. However, they managed to improve the GPA their in C and D terms and finished of D term with a GPA of 1.80. The ENTJs have accounted for about 4% of the freshman population over the past three years.

Enthusiastic, outgoing, analytic idea people. ENTPs often are multitalented characters interested in nearly everything. Independent, non-conforming and sometimes a little rebellious and confrontational, this type may be an inspiration to others that will follow the ENTP guru into uncharted waters--sometimes shark-infested! Many ENTPs have a hard time dealing with long-range planning, facing practical constraints to their projects, coping with structured working situations and authority figures, and keeping their interpersonal relationships on an even keel. Entrepreneurship may meet this type's needs when more conventional business situations are unattractive. The ENTP has the ability to succeed in a variety of careers--and may move from one to another over the course of a lifetime--always seeking new opportunities and retreating from projects, which have degenerated to humdrum routine. Whatever their chosen field of endeavor, from sales to science, art or writing to psychology, ENTPs always play the role of visionary, promoter, marketer and instigator.

The Class of 2001 study found that the ENTPs averaged a GPA of 1.79 for their freshman year. While the Class of 2002 study found in term-by-term detail that the ENTPs started off A-term with about a 1.99 GPA and then took a dip in B term to average about a 1.76 GPA. However, they managed to improve the GPA modestly in C and D terms and finished of D term with an average GPA of 1.84. The ENTP have accounted for about 10% of the freshman population of WPI over the past three years.

2.2.3 MBTI results from the Class of 2001 Study

The results from this project led Sheldon et al. to report that the MBTI was of limited use to them in predicting grade performance, given that they looked at averages for the year. The highest and lowest scoring personality types for that year were within 0.3 grade points of the overall mean. They also found that it was more useful as an intervening variable, not statistically significant or predictive on it's own, but of much greater value when used in conjunction with other factors like the SAT. They attempted to predict the performance of twelve randomly selected cases from within the class using High School transcript data from the admission and MBTI information in addition looking at what classes they had taken. They did reasonably well in rank ordering the students, but tended to systematically underestimate grades. Based on their experience they further tuned their data for stronger correlation's and felt they could significantly improve on the previous rate of error. On a 3.0 scale they were in the last 10% of the variance without knowing exactly how to use the MBTI data to the greatest effect. In the end they were unable to fully explore all the possible predictive uses of the data they had assembled. Our project is in one sense a continuation of theirs given the attention to the gender issue and the GCSI. However, we also have the advantage of knowing that they over aggregated the first year grade data and thus missed the MBTI finding lurking in the time series.

2.3 CIRP Survey

The acronym CIRP stands for Cooperative Institutional Research Program. The CIRP survey is issued to freshmen during orientation every year at

WPI and hundreds of other schools around the country to better understand how students are affected by their college experience. It is pre-college data focusing on their perception, aspiration and expectations as well as their self-image.

CIRP is the nation's largest and oldest continuing program of research on American higher education. Over the years it has gathered data from more than 9 million individual students, and 250,000 faculty, at 1,400 different colleges and universities. The American Council on Education in Washington founded the Cooperative Institutional Research Program in 1966, D.C. CIRP then moved to UCLA's Higher Education Research Institute in 1973.

CIRP's principle purpose is to assess the impact of different types of higher education institutions and programs on the enrolled students by means of periodic follow-ups of each entering freshman class. The CIRP data has become a major resource for higher education scholars at UCLA and other universities across the country, and it has been used in hundreds of scholarly books and articles over the past 31 years.

The CIRP survey questions the students on many different topics to try and from a picture of what kind of background the student came from, some personal information, what they are looking for in a higher educational program, and why they chose that particular program.

Typical questions include race, gender, age, family income, marital status, and occupation of parents. Other questions go into detail about why the school of attendance was chosen, is the first choice, what is the major, and what degree they'd like to obtain.

Combining all of this information provides a fairly complete picture of the student, their attitudes, and beliefs, and their background. Follow-up surveys are then issued to see exactly how each particular institution changed it's students, if they changed at all. Using this data can be very helpful to colleges and universities in gaining a better idea of what their student body is like assessing their impact on the students who matriculate there.

It is currently possible to get a frequency distribution of the WPI student responses to describe the student body as a whole. However, the data ~~at~~ that WPI receives no longer has student identifiers on ~~is~~ it so it makes it impossible to link this data to the class of 2003 data set. So it would require an expenditure of $250/ student cohort (graduating class) to obtain these data in a form that could be linked to other data. Other teams are acquiring the Class of 2001 and 2002 data this year as an experiment. Based on their results, a case may emerge for obtaining the Class of 2003 CIRP data. We did not undertake that effort to elaborate the data set.

3.0 Methods

3.1 Database Creation

The GCSI data for the WPI Class of 2003 was collected in booklets distributed by a company called Correlates, They were filled out by over 600 of the members of the WPI Class of 2003. Our job was to enter all the raw data in to Excel files for scoring. Each section was assigned a score so that when the 2 major indicators were combines a comparison could be made between cognitive types.

The first game, Divergent Thinking, was a task involving the listing how many different ways each student could think of to use a barrel, they were awarded 1 point for each way. For example, using a barrel as a container only counts as one point, regardless of how many things you can think of which could be kept in a barrel but boat, planter, doorstop, clothes ….etc are all different uses. This game is part of a research project not a part of the GCSI per se. It is a separate measure.

Game two involved convergent thinking, where each student was given three words and was asked to find the fourth related word. This is Mednick's Remote Association test and a key part of the GCSI, shortened form 30 items to 12 by Wilkes. We scored this section but assigning different values for each attempt, if they had no answer at all it was a 0, if they guess and were wrong they received a 1, and if they guessed it right they received a 2. The score was based on the number right.

The next section was a set of 24 preference and self-image questions. We entered these into the database just as they were circled, 1=Strongly Agree, 2=Agree, 3=Disagree, and 4=Strongly Disagree. This was the new set of proxy items devised by Wilkes and Busch based on Lynch's prior research.

The last section was Group Perception, this part had each of the students rate 10 of their closest classmates on focus and creativity. Each of the 10 classmates was awarded on a scale of 1-10, 1 being the least, and 10 being more creative or focus. This was Gordon and Morse's Differentiation indicator.

From this database we can score 3 measures classify by GCSI type and then see if the proxy items for the RA variable had any merit for their sample. Hopefully a scale based on 5 or 6 of them will be likely related to the RA score. Culture bias problem in the RAT prompted this effort to find a new indicator, but a proxy for Diff would also be welcome.

3.2 Grading System

The WPI grading system is somewhat different than that at most schools because project work is considered more important than the classes and works better under a quarter system. The system is set up so that there are only four outcomes for each class. These are A, B, C, and NR. NR means "No Record", there are no penalty grades such as a "D" of "F" in the system that stay on one's record. Failure is not getting credit for a course- and that requires getting a "C" or better. The progression of the academic year is also somewhat different as there are a total of five terms, four arranged as a quarter system with 7 week terms and a fifth summer term, although many fewer students elect to take classes E-

term. Our analysis concentrates only on the first four quarters of the freshman year.

As noted above, an "NR" technically means "not recorded" but usually means dropped out, incomplete, or failure. The difficult part is that since NR's are not recorded it is impossible to tell which classes a student attempted to take without a copy of their schedule. So that we could work around this problem, GPAs will be calculated based on the assumption that 3 classes were taken each term, normal load. Hence, if 2 grades are there, one was an NR. This is not precise as a student could take 4 classes in a term and NR one and we'll never know, but if he or she passed4 we'd give them credit for an overload. So,overall and term GPAs will be calculated based on twelve and three classes attempted, respectively.

For the people who elected to overload and pass more than three classes per term, there is a bonus of sorts, as the number or grade points they achieved is still divided by twelve or three.

Finally GPAs are not calculated at WPI. It is difficult to draw comparisons between large numbers of people without some sort of quantitative measure, so we will use a modified GPA scale that consists of a three point scale, A = 3, B = 2, C = 1, and NR = 0, rather than the normal 4 point system. No minus or plus grades are acknowledged in this system. Finally, students take 12 classes each in a WPI year, 3 in each of the 4 terms.

3.3 Merging Databases

Once our database was completed we had the task of obtaining the freshman year grades from the registrars office. This took a very long time, and required Prof. Wilkes and Greg Doeschler's support and assistance. Finally we were able to merge the MBTI results with freshman grade data to see if the different personality types performed differently than they did in the Class of 2002, the year before. We hypothesized that the similarity would be great especially for the SP and SJ learners who were the extreme grouping in the Class of 2002. After completion of the cognitive database the challenge was to link our new data to the existing MBTI database and the freshman grade data. We had permission to obtain High School transcript data too for 90% of the students but did not undertake this task. We were more interested in mapping social groups and teams in the WPI population under study.

4.0 Analysis

4.1 MBTI

Although this study is similar enough to that of the WPI Class of 2002 study to be a replication of it, there are a few differences. The first involves the analysis plan. A complete breakdown

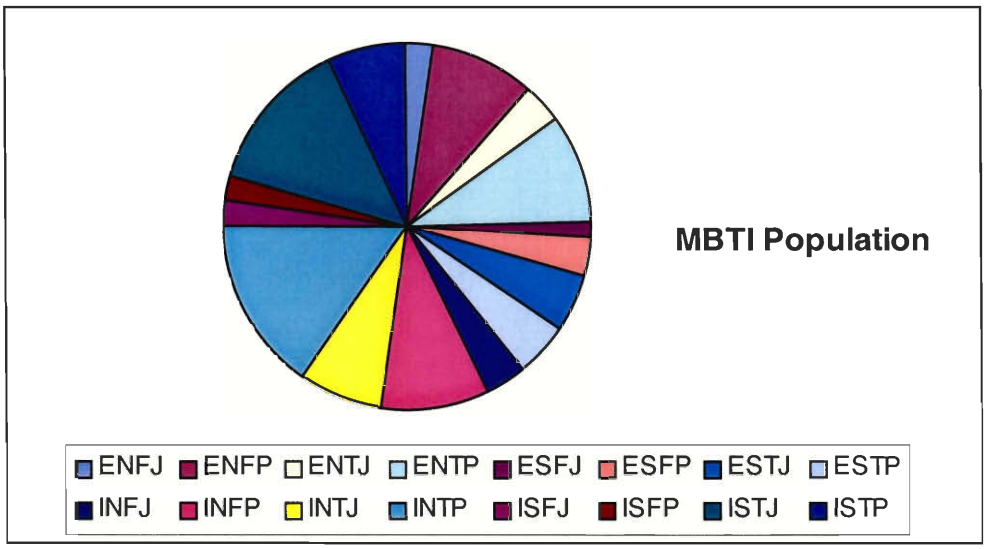


Figure 1: MBTI Population Pie Chart

of performance by gender and type had not yet been done. The second feature of the study is the psychometric analysis, which is unique to the data set. A third difference involves the lack of high school data in the Class of 2003 data set. It was gathered only for the class of 2002.

The first step of this analysis was to describe the MBTI population for the Class of 2003 in the same manner in which the Class of 2002 was described. (The pie graph above shows the breakdown for the Class of 2003) It is obvious that there are a few personality types that are more common than the others. Yes, the distributions of the 16 MBTI types are almost the same as the Class of 2002. The

most common types are still ISTJs, INTPs, ENTPs with INFPs and ENFPs just a little behind. The largest percentage belongs to the INTPs, they take up approximately 15% while the ISTJs are right behind them with 13%. (Appendix A shows percentage breakdown for the Class of 2002 and 2003) I then took all 16 types and broke them down further into four groups for each gender; EN's, ES's, IN's and IS's.

Frequency of Learning Types: Class of 2003

	# of Male's	# of Female's	# of Overall
EN's	110	41	151
ES's	59	30	89
IN's	176	44	220
IS's	120	34	154

Table 1: Numeric breakdown of EN's, ES's, IN's and IS's

Although these graphs don't show the overall GPA, it should be considered that 75% of the WPI population is male, so it is logical to assume that the overall graphs would almost be identical to that of the male's GPA graph. Another consideration in reading this analysis is the size of the groupings. The dissection of the male vs. female performance has never been done to this extent; hence the cell size for some female types is dangerously small, too small to interpret. The extrovert groupings are smaller than the introvert groupings at WPI. The extroverts make up only 40% of the population, 24.5% are the EN's and the EN's are 63% of the total number of extroverts. The similarities between the male and female GPA's are that all four types are close to converging in C-term. The female EN's GPA begins in A-term with a C+ to a B- average. The female GPA in

A-term is close to 2.5 but then drops in B-term to 2.0 and continues that way through C-term. The ENFPs and the ENTPs work in the reverse of each other. They cross at three distinct points. First they start off roughly at 2.0. As the ENTPs begin to rise in B-term as well for D-term, the ENFJs dip, and as C-term approaches the ENTPs drop and the ENFPs rise. The ENFJs have their own pattern. Their highest point is in A-term and they steadily drop through the C-term. Another thing to note is where they begin and end. The male and female ENJ's begin around the same area in A-term, but yet they at quite separate levels in D-term. The male and female ENP's on the other hand, begin with ENTP below ENFP, but how they end in D-term is completely opposite. The ENTPs are higher than the ENFPs. Note that the females are substantially over represented.

Frequency of Learning Types: Class of 2003

	# of Male	# of Female	# of Overall
ENFJs	9	6	15
ENFPs	36	20	56
ENTJs	14	7	21
ENTPs	51	8	59

Table 2: Frequency of types of EN's by sex

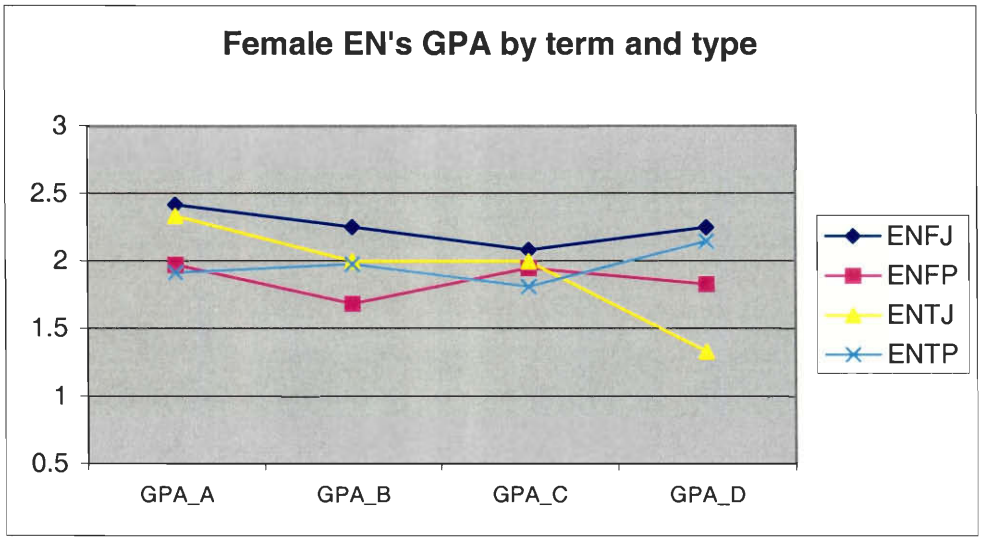


Figure 2: Graph of Female EN's GPA

The male graph shows something else going on. The ENFJs are the only one's that have a higher GPA in B-term than in A-term, they dip in C-term and recover fully in the end with a GPA higher in D-term than in A-term. The ENFPs GPA stay pretty constant throughout the entire year, the same goes for the ENTPs. The ENTJs start slightly lower than the other three but in C-term, they have caught up and have the highest GPA in C-term. They only drop slightly in D-term, but still end up higher than what they had started with in A-term.

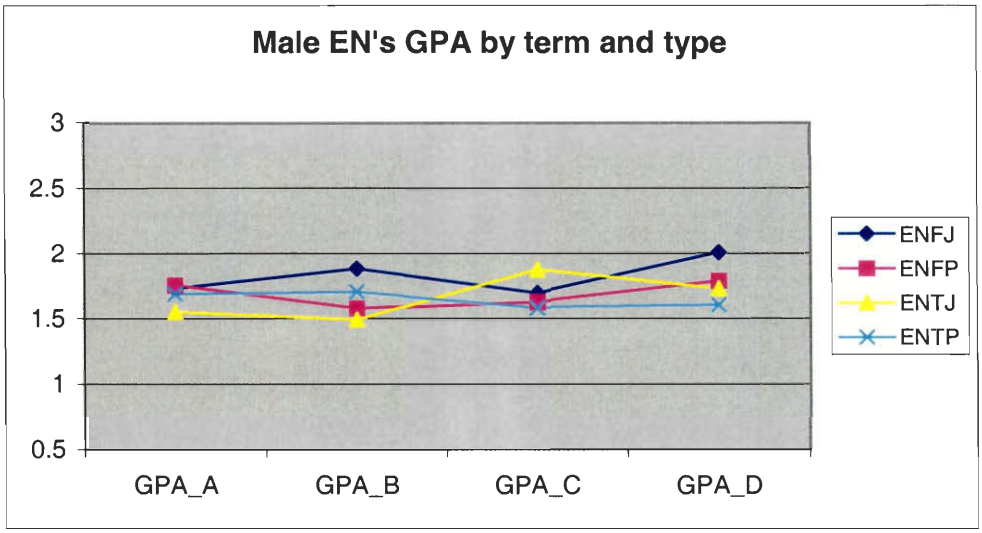


Figure 3: Graph of Male EN's GPA

The ES's make up the smallest portion of the population only 14.5 %, overall. Again note how the over representation of the females.

Frequency of types of ES's by sex

	# of Male	# of Female	# of Overall
ESFJs	5	5	10
ESFPs	14	5	19
ESTJs	17	14	31
ESTPs	23	6	29

Table 3: Numeric breakdown of ES's

There is a striking gender difference by type. The curves are in different regions, representing different grade levels. The females out performed the males. The females are almost off the charts. The female ESFJs scored a 3.0 in C-term, Meaning that they had straight A's. The female ESFJs have the highest average per term for all 16 types, B+ to A average. The ESTPs follow the same pattern as the ESFJs, but yet at a lower GPA level, representing a B- and always stays within a range of 2.1 – 2.3. The ESFPs consistently have the lowest GPA

of this cluster, with the largest B-term drop. They take the expected dip in B-term, but are able to almost fully recover to their GPA from A-term, and they stay at the same level through D-term. It is mostly the B-term grades that will keep them form getting a B average for the year. The ESTJs start above 2.1, but then drop to 1.8 for C and D-term, but rebound in D-term to end with a 2.1. They end up with barely a B- average overall.

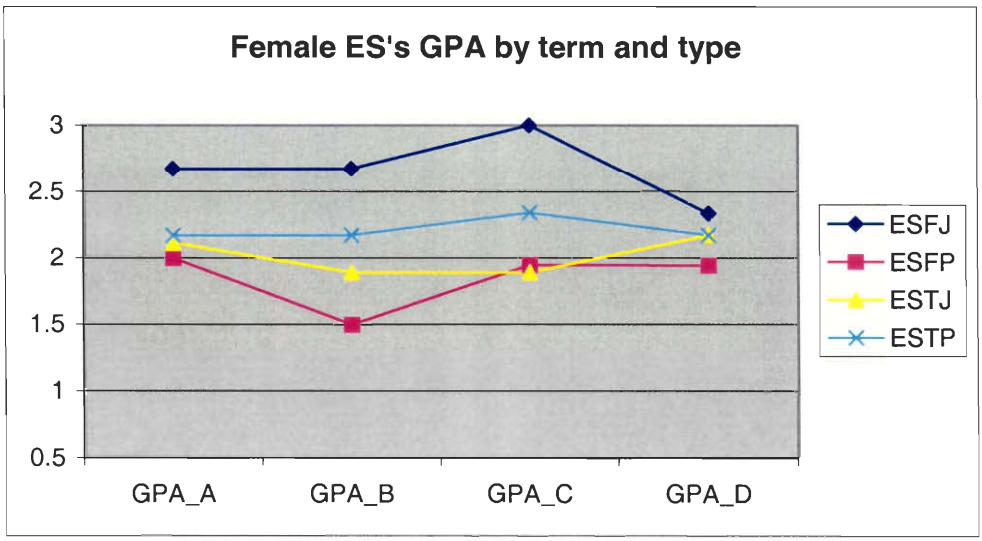


Figure 4: Graph of female ES's GPA

The male performance for the ES's is quite different. The GPA's are all lower than that of the females. The one thing to notice is the similarity in curves for the ESFPs ESTJs, and ESTPs. They begin in A-term with a GPA around 2.0, but they all drop in B-term, then rise in C-term. Both ESTJs and ESTPs fully recover form their dip in B-term, however the ESFPs don't. They are able to climb back to the 1.5 level and stay there through D-term. The ESFJs are completely different than the others in this group for instead of dipping in B-term, their GPA is at its highest in B-term and declines from there. The male ESFJ GPA pattern is similar to that of the females' but instead of the peak in C-term

they have it in B-term, and the line drop's approximately 0.25 from its highest peak. After B-term the males are on a downward slope, and their GPA for D-term ends below their GPA for A-term. They end the year with a C+ average.

Now we move into the Introverts. The introverts are approximately 605 of the population for the Class of 2003. The first group will be the IN's, which are about 36% of the total population. They are the largest learning style grouping. Again note the females being overrepresented.

Frequency of Types of IN's by sex

	# of Male	# of Female	# of Overall
INFJs	12	11	23
INFPs	49	8	57
INTJs	36	10	46
INTPs	79	15	94

Table 4:Numeric breakdown of IN's

The females of this type stay within the 1.5 to 2.0 ranges or a C+. The INTPs GPA is almost a straight line. They seem to be consistent performers. The INTJs are also pretty consistent, though they finish stronger than they started the year. The INFPs are the most radical of the bunch. The start A-term at 1.5, the lowest average amongst the IN's, but yet end D-term with a GPA roughly at 2.1, the highest in the IN grouping. The INFPs do not dip in B-term but raise their GPA to about 2.0. They slide to a C+ average in C-term, but are able to get back on track and have a B- average in D-term.

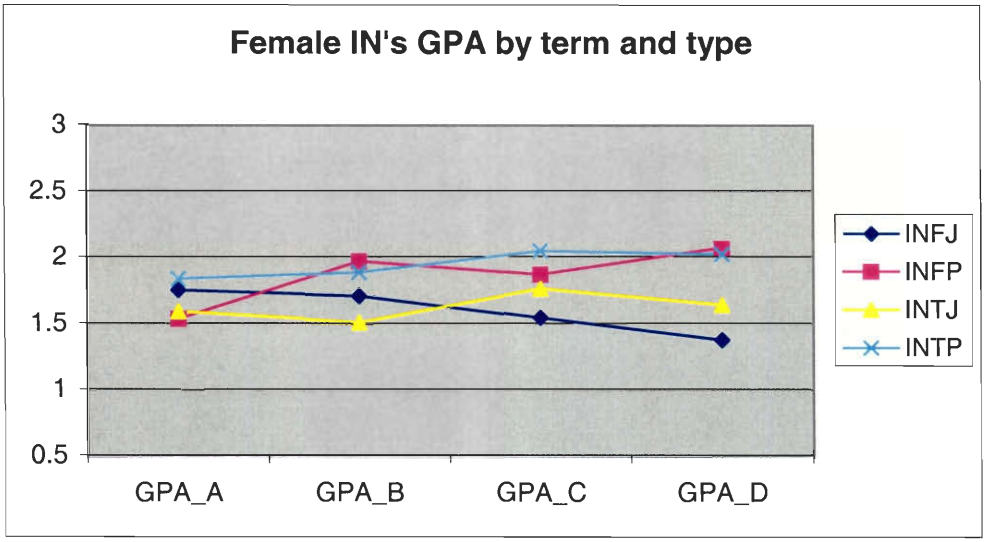


Figure 5: Graph of female IN's GPA

The men, however, are not behaving like the women. A pattern seems to be forming within the INFPs, INTJs and INTPs. The three groups are behaving in the same manner as the ES's meaning the three groups are following the same pattern but at different GPA level's. The INFPs, INTJs and INTPs are on a negative sloping line from A-term on. The INTPs and INTJs slopes are almost zero, with only a 0.2 difference from A to D-term. The INFPs change is .3 from A to D-term. However the INFJs pattern is completely different that of the other FJ's, seen in previous figures. In the three previous figures they were improving in that term. Further, their average never fully recovers from that dip, C+ to C-, even though in C-term their GPA does get back to the middle of the C range.

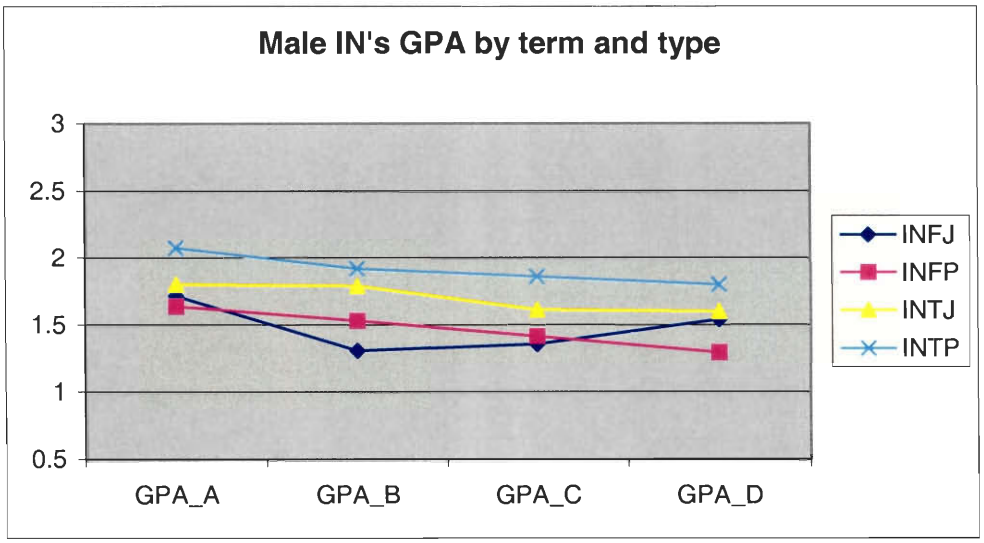


Figure 6: Graph of male IN's GPA

The last grouping are the IS's, they make up 25% of the total population. This time the females are the majorities in the ISFJs and ISFPs.

Frequency of IS's Types by Sex

	# of Male	# of Female	# of Overall
ISFJs	5	15	14
ISFPs	8	9	14
ISTJs	70	6	84
ISTPs	37	14	42

Table 5: Numeric breakdown of IS's

The females' GPA's are all over the place among the IS's. The four groups start in A-term with approximately the same average, roughly 1.5. The ISTJs and ISTPs again follow almost the same pattern., but except they are on different GPA level's. This time the IST's are the one's who raise their GPA in B-term. For the ISTJs B-term is their highest GPA, but by the end of D-term they only drop 0.2 point, which is still higher than their GPA in A-term. The ISTPs change is

more gradual over the next three terms. Their highest point is in C-term with a GPA of 1.7 and then in D-term it drops only to 1.6, which is still higher than their GPA in A-term (1.4). The ISF's on the other hand, have a more dramatic year in terms of changing GPA, the ISFPs more drastic than the ISFJs.The ISFJs dips slightly in B-term, then jump up to 0.3 points in C-term, then drop 0.4 to end D-term at 1.2. The ISFPs have the most radical year, they start in the same area as the others but then they drop to 06 in B-term to below a C- average, meaning that they are not passing all their courses. They come fighting back in C-term with a 2.0, but lose it again in D-term to end up with a 1.1, or C- .

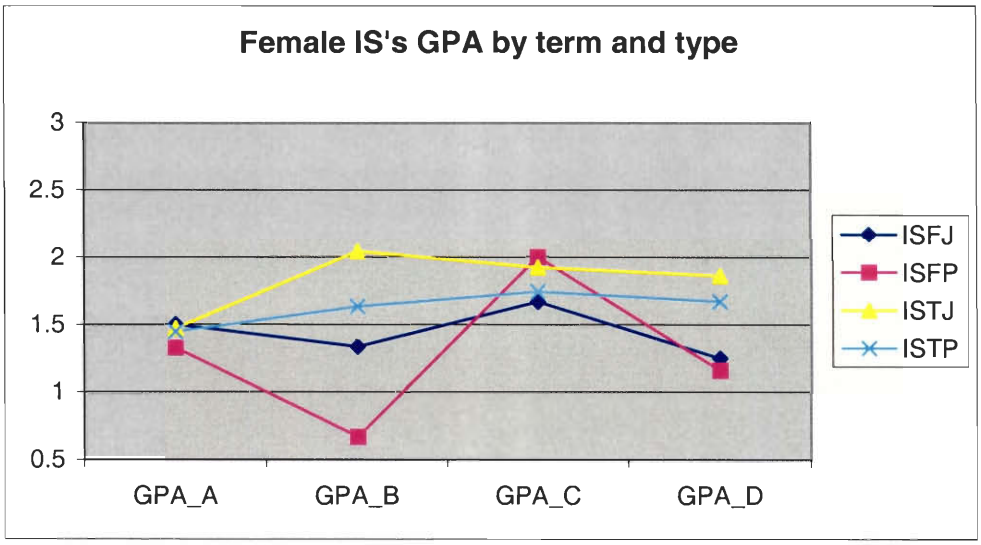


Figure 7: Graph of female IS's GPA

The male GPA's for the IS types of learners is completely different than that of any other cluster. They are so close that in some places they merge and it is hard to tell them apart. But again the ISFPs never reach the GPA they had started with in A-term; they dip, recover, then dip again. The ISFJs stay consistent through A and B-term with a GPA of 1.8, they raise their GPA slightly

0.2 points to a B average in C-term, but then back down to 1.8 a C+, The ISTJs along with the ISFJs are consistent through A and B-term, then in C-term they drop slightly 0.1 of a point then recover in D-term, ending with a 1.9. The ISTPs dip in B-term but from there on, they are on an upward sloping line. They end D-term with a 2.0. Basically the whole group has a C+ for the year.

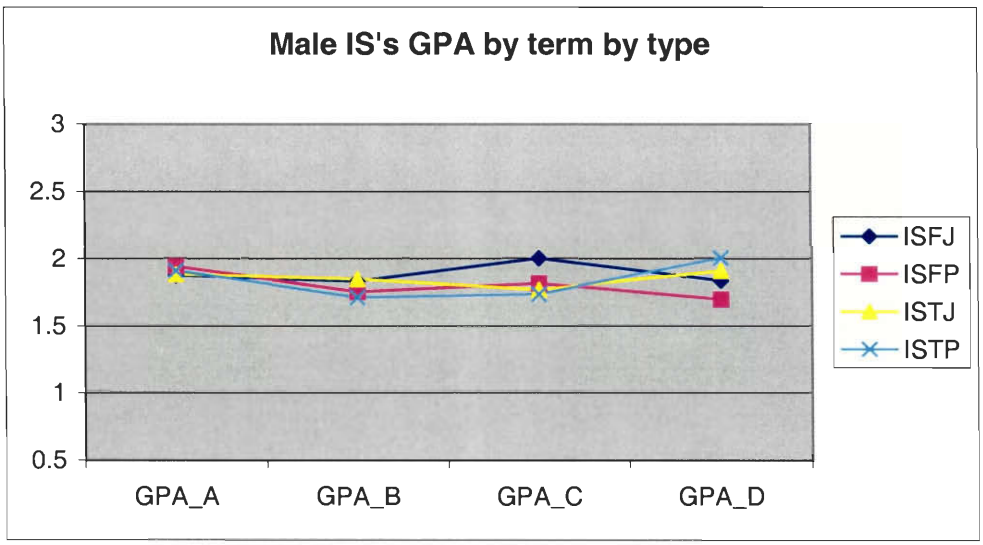


Figure 8: Graph of male IS's GPA

From there the groups were broken down again, in the 2002 study done by Greg Doerschler and Professor John Wilkes, they broke down the 16 MBTI types into four groups SJ's, NJ's, NP's, and the SP's. The percentage for each group are as follows: 21%, 17%, 43%, and 19% respectively. When they took the overall GPA for each type they noticed that the SP's had the most distinctive freshman year of any psychological type (MBTI based learning style). The SP's had the lowest GPA overall, they took the greatest GPA dip in B-term, but they were also able to recover and end up with a higher GPA in D-term, than they started with in A-term, before the dip. The other three groupings seemed to have followed the

same pattern. They started in A-term with a GPA's ranging from 1.88 to 2.0. All three took a dip in B-term and recovered in C-term but then dipped again in D-term. Together the graph looks like two mountain peaks separated by two valleys.

Percentages of all classes passed for the first semester (2 terms or 6 classes) by the 4 types differed considerably. The SJ's had the highest average with a 74%, meaning that 74% of the SJ's passed all 6 classes. By contrast, the SP's were the lowest with only 49% passing all 6 of their first semester classes. By the end of the year the SP's had almost caught up to the pack. Satisfactory Progress is passing at least 8/12 courses for the year. 81% of them did that, as did 84%of the NP's and NJ's. The SJ's were about half as likely to be on academic probation at the end of the first year as the SP's, so 90% of them were considered to be making satisfactory progree.

For the class of 2003, the frequency distribution in percentages of the four types representation in the class was almost identical to that of the class of 2002. The percentages for the class of 2003 went as follows: SJ-23%, NJ-17%, SP-17%, NP-43%.

Frequency Distribution of the Four Types for the 2002 and 2003

Type	Class of 2002	Class of 2003
SJ	21%	23%
NJ	17%	17%
SP	19%	17%
SJ	43%	43%

Table 6: Frequency Distribution of the Four Types

For their relative GPA's the graph looks a bit different. This time the SP's did not have the lowest GPA in A-term. They had the highest. Nothing about the SJ line

is the same but in the 2003 study the SJ group has one of the highest GPA's as it did in Class of 2002. It starts right below the NP's at 1.81, but it doesn't take a dip in B-term, unlike the other groups, however it does modestly dip in C-term, but only about 0.02 of a point. Overall the SJ group stays within 1.80 to 1.85, GPA range a very stable performance all year. The most drasticly dipping line is again that of the SP's. The line begins at approximately 1.93 for A-term, but then drops to 1.65 in B-term. Then in C-term, the recovery starts. They climb back to 1.77, and continue on the rise to 1.88 in D-term. The NJ's and NP's are almost parallel. Their highest point is A-term, and they drop .1 in B-term, then the line stays straight through D-term.

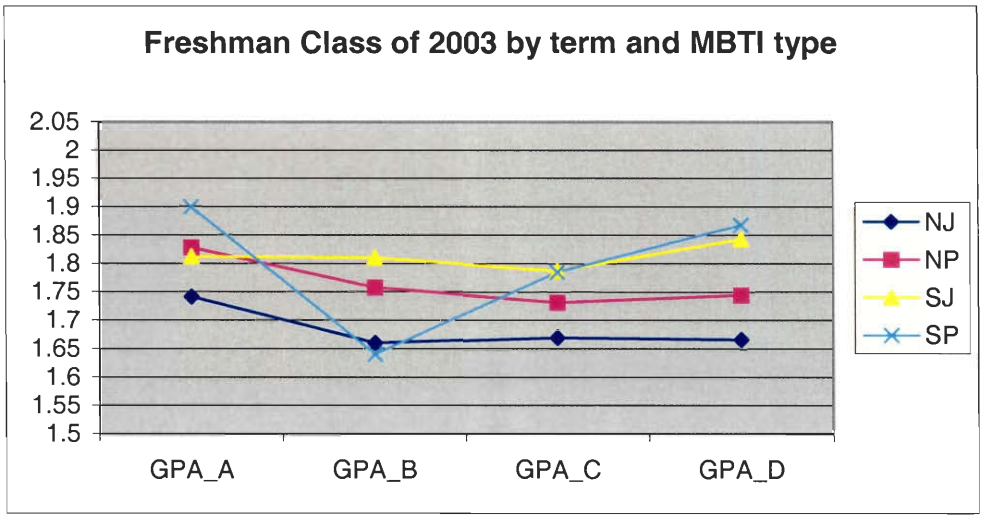


Figure 9: Graph of Overall GPA for NJ, NP, SJ and SP

When the type groupings are broken down further by gender, the graphs takes on a different look. The female GPA changes for the four groups are more drastic than that of the males.

Although the female population for the class of 2003 is only about 25% of the total, that still means a group of 149 subjects. These differences cannot be

seen in the overall graph because of the dominant male population. The NP group consists of 51 subjects, and their GPA almost looks like a straight, positive upward sloping line, unlike that of the overall GPA graph. And the female SJ line is the inverse of the overall SJ line in the prior graph. The number of subjects in that grouping is 42, still enough to make it a significant finding. There are 34 NJ subjects, and 22 SP's subjects among the females.

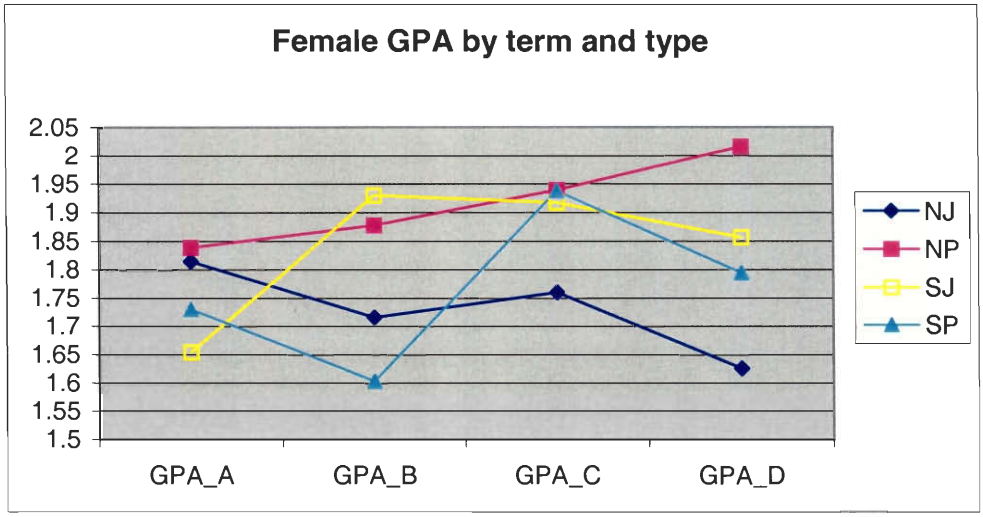


Figure 10: Graph of female GPA for NJ, NP, SJ and SP

When you look at the curves in the male GPA graph it is similar to that of the overall population since ¾ of the cases are the same. The only difference is that the NP's and NJ's cross going into D-term. And the SJ line looks like a smile without the females.

The male participation numbers are as follows: NJ's –71, NP's-215, SJ's-97 and SP's- 82. Obviously the NP's are most strongly represented, but their GPA is not stellar or improving. They start around 1.83 but end at 1.65, eroding slightly through the year. (They did the same thing in the Class of 2002)

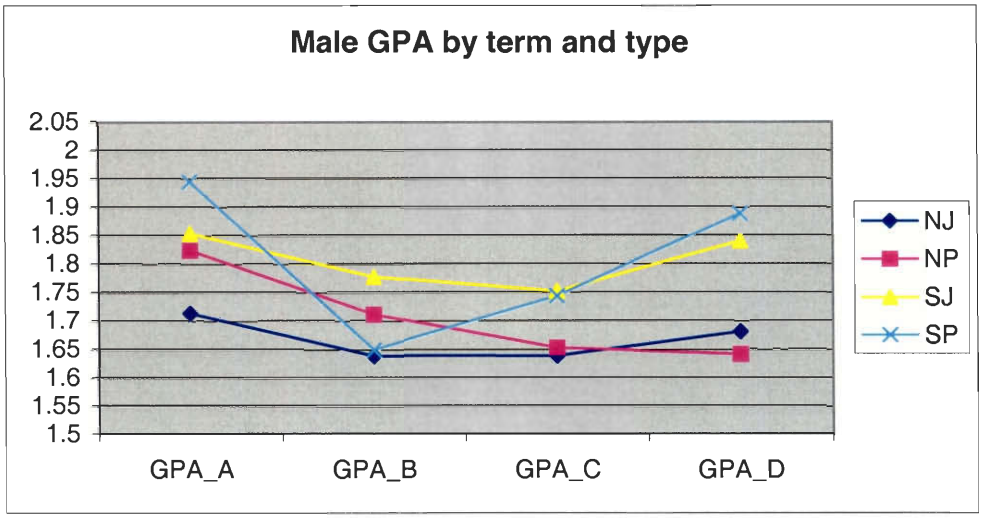


Figure 11: Graph of male GPA for NJ, NP, SJ and SP

However the average SAT scores for the four types are quite different in Class of 2003 compared to the year before (Class of 2002). There isn't a distinct leader in the scoring (as the NP's were (1310) compared to the SP's (1243) for the Class of 2002 the year before). All four types are around the same in the class of 2003, the highest being 1270 and the lowest, 1260.

4.2 Cognitive Style

The GCSI (Gordon Cognitive Style Indicator) was issued to the Class of 2003 as well as the MBTI. The GCSI for the Class of 2003 consisted of the Diff scale, Remote Associate test 18 proxy items from remote association section of

the Gillette study, which was based on Lynch's work discussed earlier. These were the items devised to identify the subjects Remote Association skills rather than Differentitation, due to concerns about culture bias in the diverse R&D staff of that company. The proxy originated with the 30 people in the Gillette study group. In their cases RA was assessed using Mednick;s original 30 items including the 10 items used by Wilkes for years- including the WPI for the Class of 2001 study. In 2002, the same ten items and ten more (from a previous high school RA measure) total 20, and were distributed to the freshman during orientation. The 12 best items coming out of the WPI class of 2002 and Gillette studies because the new standard set. Hence, Remote Association is measured a bit differently in each of the 3 years of the continuing WPI GCSI study.

The relevant cognitive qualities are usually tested through a series of tasks and word games. For example, divergent thinking is tested through a word game. In this task the students had to come up with as many use's as they could (in 3 minutes) for a barrel. Each use received a point. When the scores were tallied the median score used to separate the high group from the low group.

The 'game' that followed was the one for remote association called convergent thinking. It was a word association game consisting of 12 questions that had three-one words for each question and the student was given eight minutes to complete all 12. For example the words given were shopping, washer, and picture, the answer is window. The connections are not logical but associative. This test was graded as such: 0- no attempt, 1- attempt but wrong answer, 2- attempt and correct answer. A score of 6 or more was enough to be put you in

the high category. The Differentiator indicator was presented to the students as a rating task. They start by making a list of 10 people they know pretty well. This is supposedly to get their perception of the group they work with most often. On the next page, they were to rate each person on a scale of 1-10 on creativity and focus, 10 being the highest level of each quality. This was scored in a different manner that that of the word games. In this particular section, the scoring depended on the rating pattern each student used. For example, some students graded their reference people on the high and low end, meaning they gave everyone either 8,9,10, or a 1,2,3 never venturing into the middle of the spectrum. Then there were others that only concentrated on the middle and then again there were students that had a great mixture of ratings. The students that used the whole scale were considered differentiator's. Non-differentiator's come in 3 forms- those using one end of the scale, those using only the middle of the scale, and contrastors- who use only both extremes and very few numbers in total. The scoring process produces 4 types by crossing these two variables.

	Differentiator	Non-Differentiator
Remote Association	Integrator (1)	Problem-Solver (3)
Local Association	Assessor (2)	Implementor (4)

Table 7: Four cognitive types organized by high/low diff, RA and LA

Each student's data was entered into a database that consisted of their answers for each of the questions. From there the scoring was done, and each student received a code of 1,2,3,or 4. Our focus again was on differences in gender performance. The percentages for each type are very similar there is not one

group that is significantly better represented in the student body. (This partly due to the decision to split the Diff Scores at the median.)

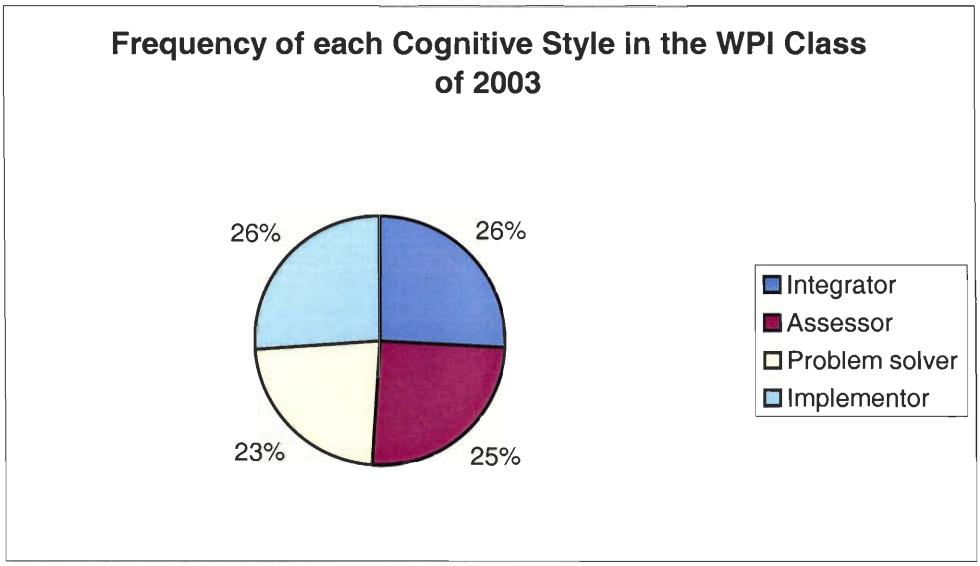


Figure 12: Pie chart representing percentages per Cognitive Style

But when you look more closely into gender differences, the graphs look similar but the most common type among the females is the implementor, while the most common male type is the integrator.

	Male % (# per type)	**Female %** (# per type)
Integrator	28% (103)	22% (36)
Assessor	25% (112)	26% (30)
Problem Solver	23% (97)	20% (27)
Implementor	24% (101)	32% (43)

Table 8: Frequency of cognitive styles by percentage breakdown

Just by sight, it's noticeable that the females are not quite as likely to be integrators or problem solvers, meaning that they are less likely to have remote association ability.

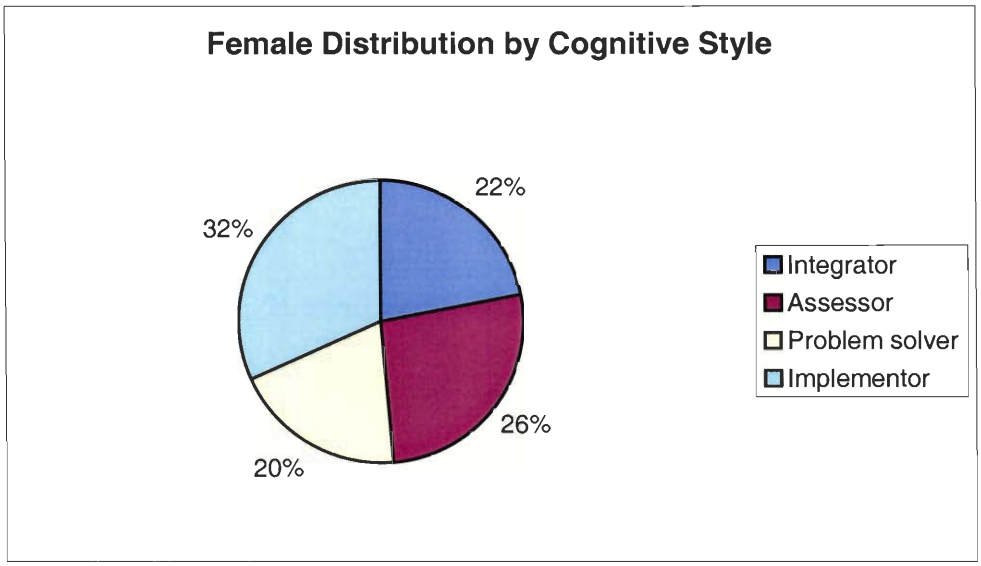


Figure 13: Pie chart of females by cognitive style

The male graph, on the other hand, looks a bit different. Showing that the males in the population are 5% more likely to have differentiation, and 9% more likely to be Remote Associators.

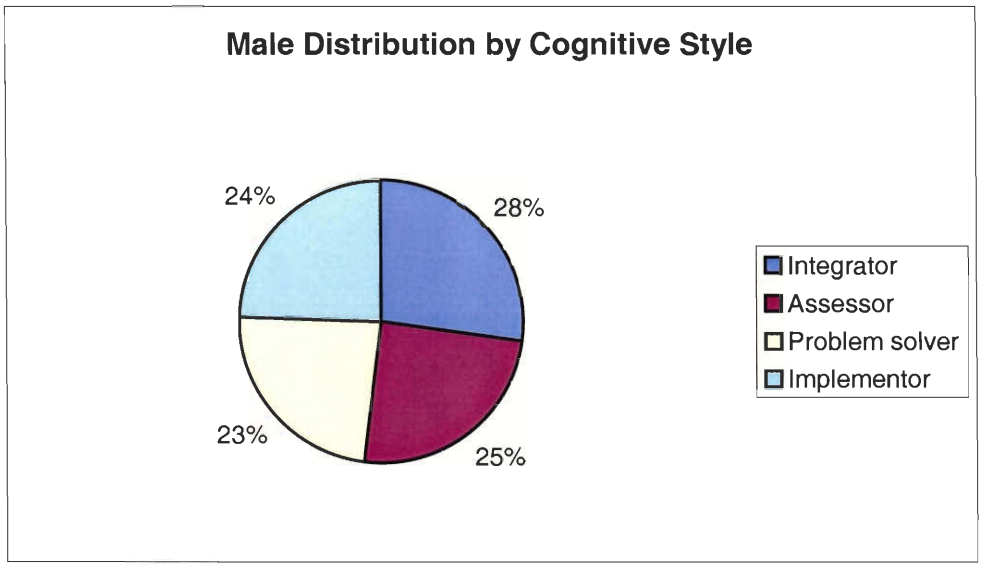


Figure 14: Pie chart of males by cognitive style

When examining the academic overall Gap performance for each style it looks similar to the findings in the class of 2002. There is an overall dip from A-term to

B-term in GPA. However, the Class of 2002 recovered from that low point immediately. The academic problem drags on into C-term for the Class of 2003.

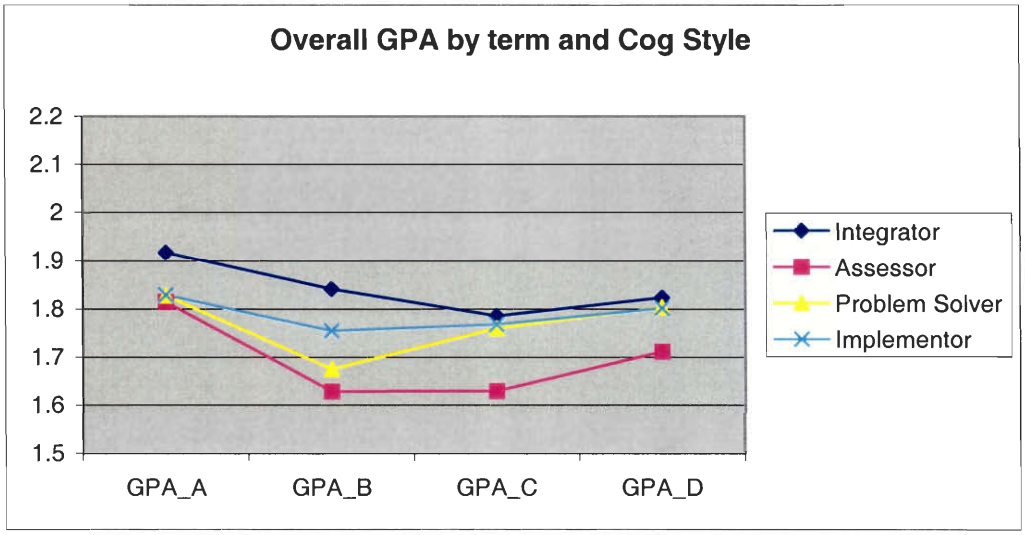


Figure 15: Overall GPA by term and Cognitive Style

Also, unlike the findings in the study of the Class of 2002, three out of the four types converge toward the end of the year. The Assessors lag behind in their recovery. In the Class of 2002 the Implementors and Assessors met at 1.74.

The female analysis of GPA per cognitive Style produces the opposite of the findings from 2002. In 2002, the lowest female GPA was for the Problem Solvers, while they were the stars among the men. Given the difference in Male and Female averages they sort of met at the same level, actually so there was no difference. In 2003, it is the complete opposite, the female Problem Solvers have the highest GPA and stay on top, although the female Problem Solvers are the smallest group with 27 cases, this was expected the year before and did not happen.

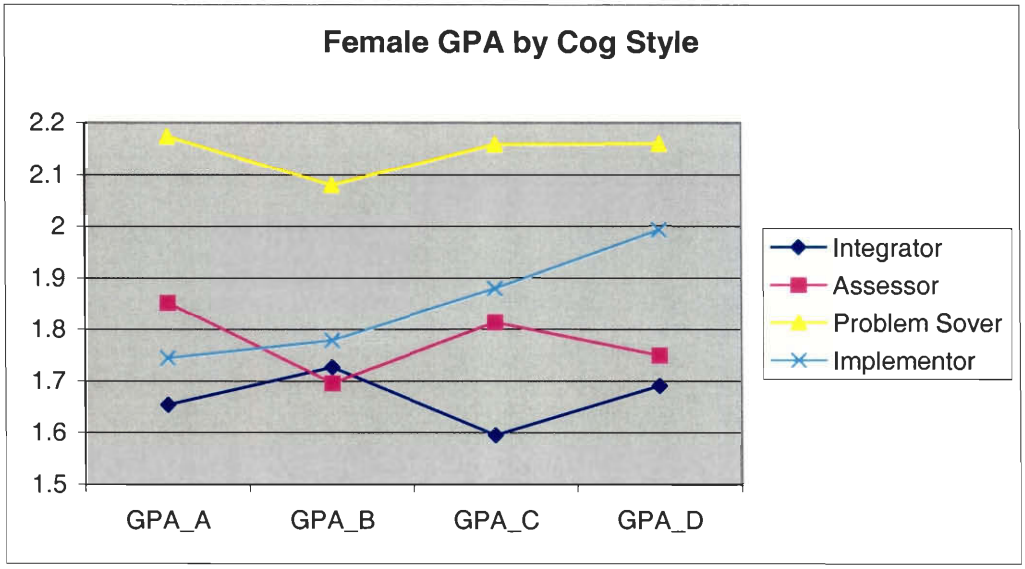


Figure 16: Female GPA by Cognitive Style

The male analysis is only similar to that of the Class of 2002, in the manner that there seems to be a pattern of parallel lines each year. As in 2002, the four styles all start at different points, and seem to follow the same pattern. The greatest different between the two is the Problem Solver, in 2002, started at the highest GPA, and ended at the same point as the Integrator. But in 2003, the Problem Solvers start with the lowest GPA and meet the Assessors in D-term at the low end of the distribution. Now it is the male Problem Solvers that are weaker than expected.

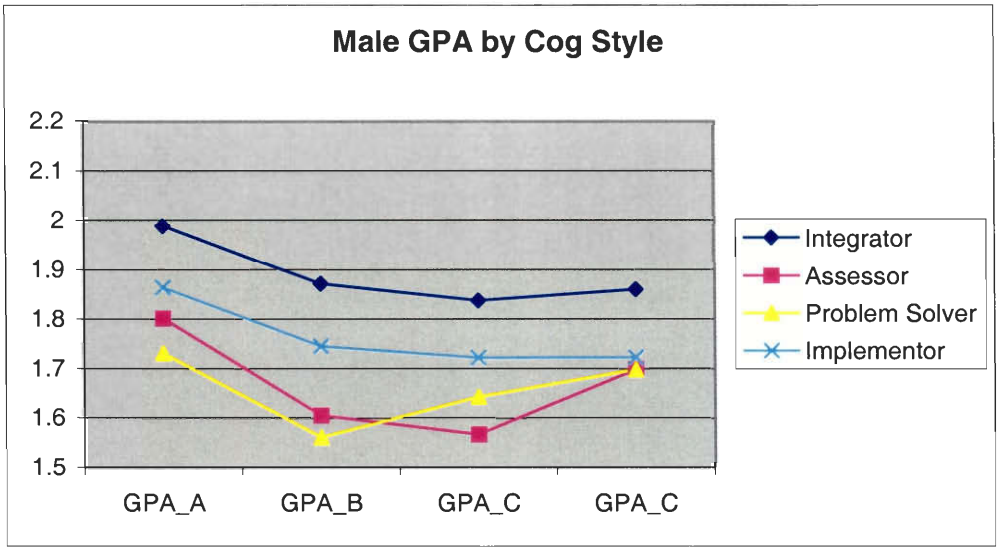


Figure 17: Graph of male GPA by Cognitive Style

But when looking at the types themselves it is easier to see such patterns, especially when it comes to the Problem Solvers. (Appendix B) The lines are fairly parallel between the male and female GPA's. The Assessors are different in that, the GPA line for both male and female are parallel until C-term, where they pull apart, but return together for D-term. The Implementors are the most dramatic. A-term GPA's are different, but then their GPA's cross in B-term and never come near each other again. The female GPA starts off much lower than that of the males, but as the progresses, the male's GPA dips and never recovers, while the female's GPA is on a constant upward slope. Their GPA almost looks like a straight line, finishing with them at 1.97, almost a B average. The female Integrators begin the year with close to a 2.0 but then they fall to 1.85 and stay within that range. The males on the other hand, start 1.65 and go to a

1.72 in B-term, but fall again in C-term to 1.6 and end the year in D-term with a 1.7 GPA.

We considered crossing each MBTI types with the cognitive style types, but the numbers of cases in each group is not great enough to support a conclusive analysis.

5.0 Conclusions and Recommendations

The Class of the 2003 study showed that during freshman year, gender differences still matter as they did for Class of 2001 when it comes to predicting performance. The women performed better as a group. Further, when personality types were examined by gender the results were quite different than just comparing the types themselves. Female and male versions of these types of learners are not the same and some types rare among the man are more common among the women. The female population for the WPI Class of 2003, is 25% of the whole- the highest in WPI history. This study would be a significant landmark for that reason even if it were not the first serious attempt to examine learning style difference at WPI by gender. Our results show that gender was a neglected variable and that it would be valuable for future studies to include it.

When analyzing the GCSI data to the grade data, the analysis began to make a little more sense, first because the population was divided into 4 parts instead of 16, and that it analyzed learning style rather than personality. The learning style is more important, especially in the WPI study, because again the group work that is involved. Personalities are important, but although you may have a conflicting personality with a partner, you may have the ultimate working relationship because of the way you solve a problem.

At the beginning we were very ambitious in examining every combination that we could think of, but as time went on we soon realized that all of our ideas could not be tested due to time constraints. However we were able to touch upon the psychometric analysis. We first hypothesized that how one judges

themselves would reflect on how they judge others. We found some correlation, but we also felt that the proxy items that were distributed to the Class of 2003 were unfair. We felt that pre-frosh were unable to respond honestly, because of the fact that high school curriculum is not geared towards project work that involves working in teams. Another issue we had with the proxy measure, was that there wasn't a column for not applicable, forcing the respondent to give a rating, even though they may not even have experience with the situation presented in the statement therefore not giving an accurate profile of the student. It is hard to say that Mike Lynch's proxy items are viable, we believe that more testing would be needed to prove its worth. Also the setting in which the test is distributed has a lot to do with the results. Just like the MBTI, the mixture of people will vary. When they did the study on the Gillette R&D center, the group wasn't as a great mixture, unlike that of Class of 2003. To have a proxy measure that would accommodate high school and college students would have to be able to relate to their experiences, or the lack of their experience.

This type of analyzing would be most beneficial to administration if the this study could be follow the performance of the Class of 2003, as well as other incoming classes. Because how you did freshman year doesn't necessarily mean you will continue to follow that pattern for the four years. If a few class years were to be documented in this manner, we would hope that it would be advantageous to the faculty as well as the administration in that one would be able to predict the performance of future students, and be able to adjust accordingly.

We recommend that a few classes be documented from freshman to senior year keeping track of GPA's, major changes, as well as extracurricular activities such as jobs and sports. Therefore giving a more distinctive profile of the WPI student. Also to explore the Diff ratings and proxy variable in their own right. Cross them with CIRP data, as well as retrieving the high school data.

6.0 References

1.) Baldwin, Stephanie. "A Non-Verbal Approach to Measuring Remote Association". August 1997.

2.) Headman, Jennifer, House, Sarah. "A Psychometric Study of the KAI, GCSI and MBTI and the Class of 2001 Major Changing Study." January 2001.

3.) Kline, Peter, Niccoli, Eric, and Sheldon, Kane. "Class of 2001 SAT Study." August 1998.

4.) Lynch, Michael. "A Proposed Study of Group Dynamics in Engineering Teams." August 1991.

5.) Starr, Brian. "Assessing Cognitive Style Through Interview Data." December 1992

7.0 Appendix

Appendix A-

Tables of MBTI frequency's by number of cases and percentages

Class of 2003- Number of Cases Per MBTI type

MBTI TYPE	TOTAL #	# OF FEMALES	# OF MALES
ENFJ	15	6	9
ENFP	56	20	36
ENTJ	21	7	14
ENTP	59	8	51
ESFJ	10	5	5
ESFP	19	5	14
ESTJ	31	14	17
ESTP	29	6	23
INFJ	23	11	12
INFP	57	8	49
INTJ	46	10	36
INTP	94	15	79
ISTJ	14	9	5
ISFP	14	6	8
ISTJ	84	14	70
ISTP	42	5	37

Class of 2003- Percentage per MBTI type

MBTI TYPE	TOTAL%	% OF FEMALES	%OF MALES
ENFJ	2	40	60
ENFP	9	36	64
ENTJ	3	33	67
ENTP	10	14	86
ESFJ	2	50	50
ESFP	3	26	74
ESTJ	5	45	55
ESTP	5	21	79
INFJ	4	48	52
INFP	9	14	86
INTJ	7	22	78
INTP	15	16	84
ISFJ	2	64	36
ISFP	2	43	57
ISTJ	14	17	83
ISTP	7	12	88

Percentage of MBTI type for 2002 and 2003

MBTI TYPE	Class of 2002 %'s	Class of 2003 %'s
ENFJ	2	2
ENFP	8	9
ENTJ	3	3
ENTP	11	10
ESFJ	2	2
ESFP	3	3
ESTJ	5	5
ESTP	5	5
INFJ	4	4
INFP	9	9
INTJ	8	7
INTP	15	15
ISFJ	4	2
ISFP	4	2
ISTJ	10	14
ISTP	8	7

Cognitive Style Population for 2003

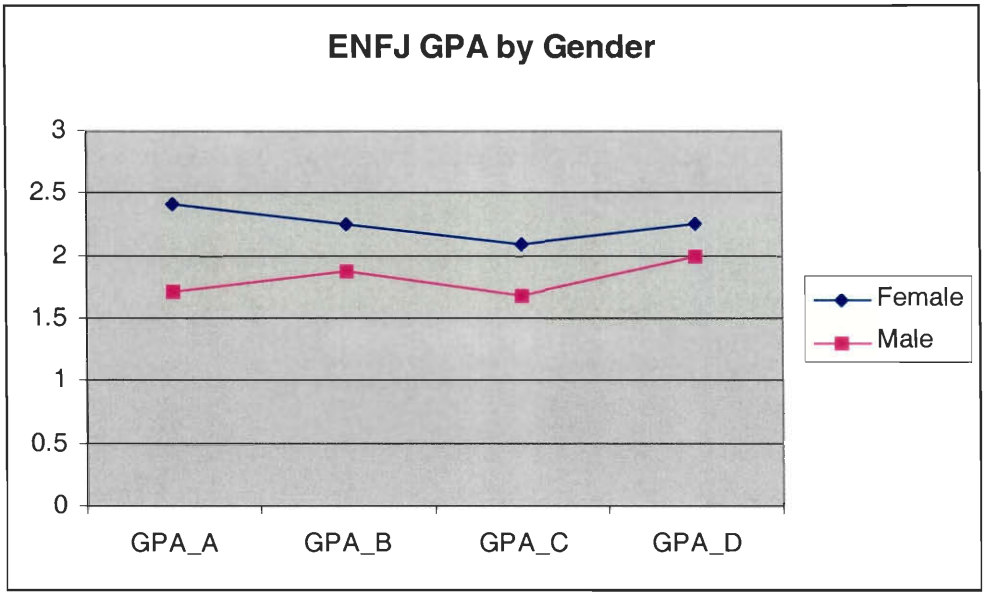
Cognitive Style	Total	# of Females	# of Males
Assessor	139	36	103
Integrator	142	30	112
Problem Solver	124	27	97
Implementor	144	43	101

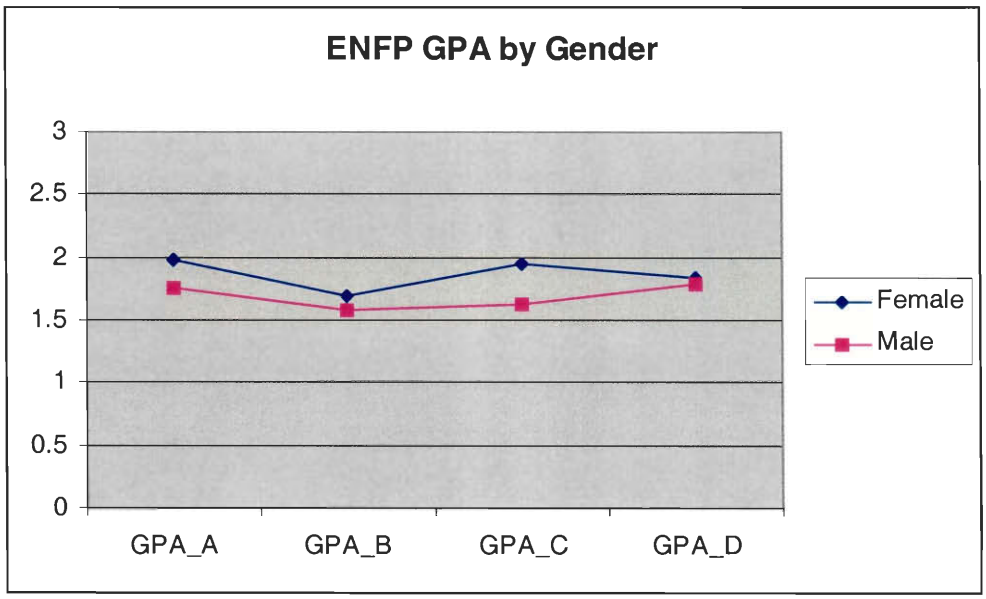
Cognitive Style Percentages for 2003

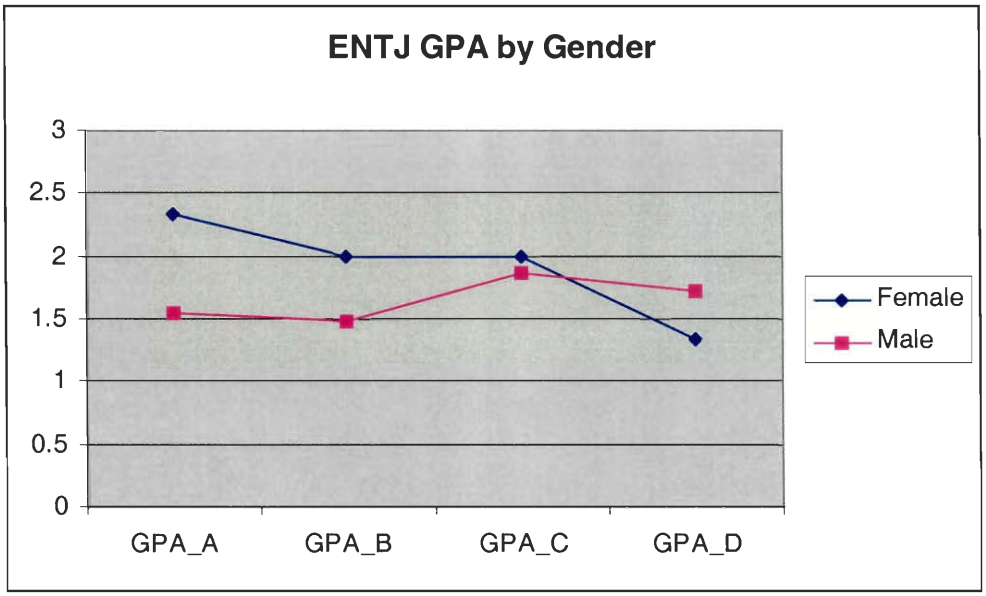
Cognitve Style	Total	% of Females	% of Males
Assessor	24.42%	25.90%	74.10%
Integrator	24.96%	21.12%	78.87%
Problem Solver	21.79%	21.78%	78.22%
Implementor	25.31%	29.86%	70.14%

Appendix B-

Graphs of MBTI GPA by Gender for the Class 0f 2003






ENTJ GPA by Gender
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0.5
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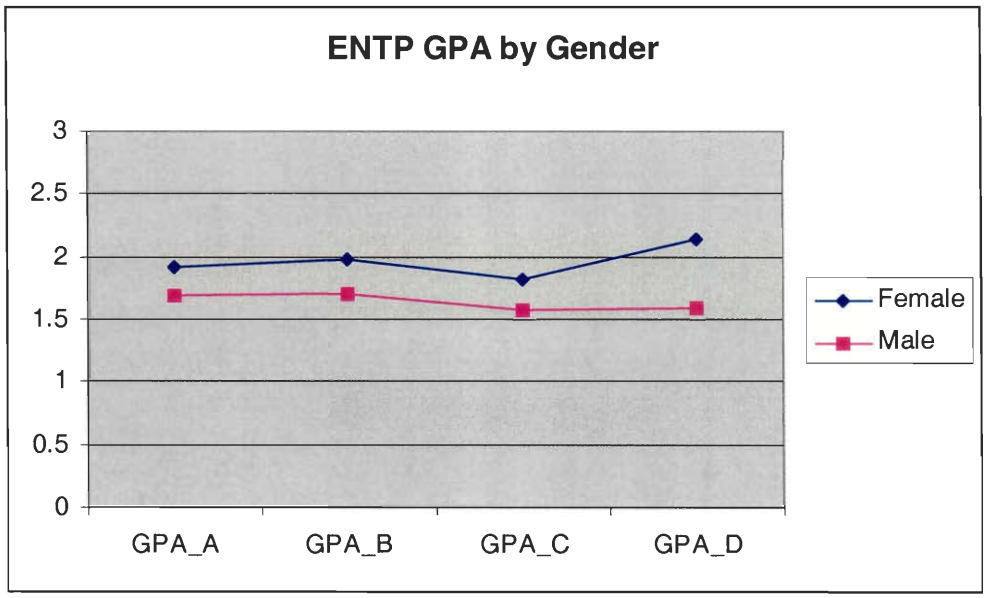
GPA_A
GPA_B
GPA_C
GPA_D
Female
Male


ENTP GPA by Gender
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0.5
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GPA_A
GPA_B
GPA_C
GPA_D
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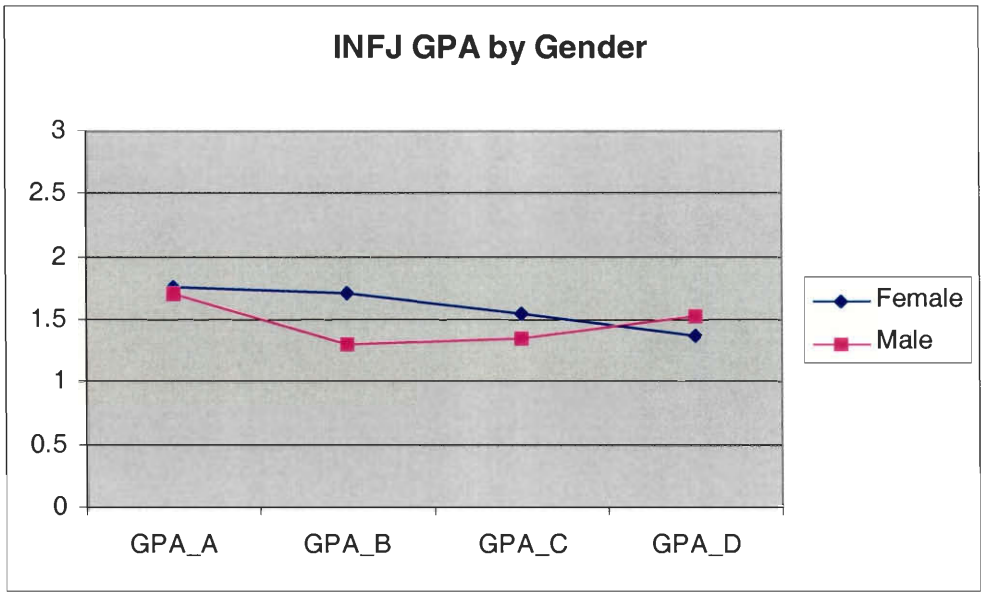
Male


INFJ GPA by Gender
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1
0.5
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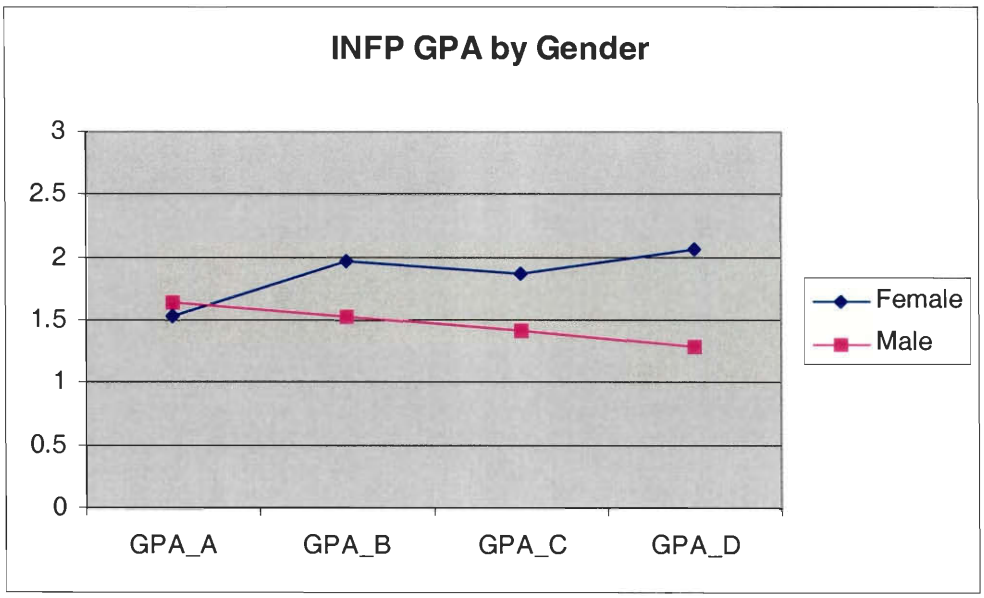
GPA_A
GPA_B
GPA_C
GPA_D
Female
Male


INFP GPA by Gender
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1
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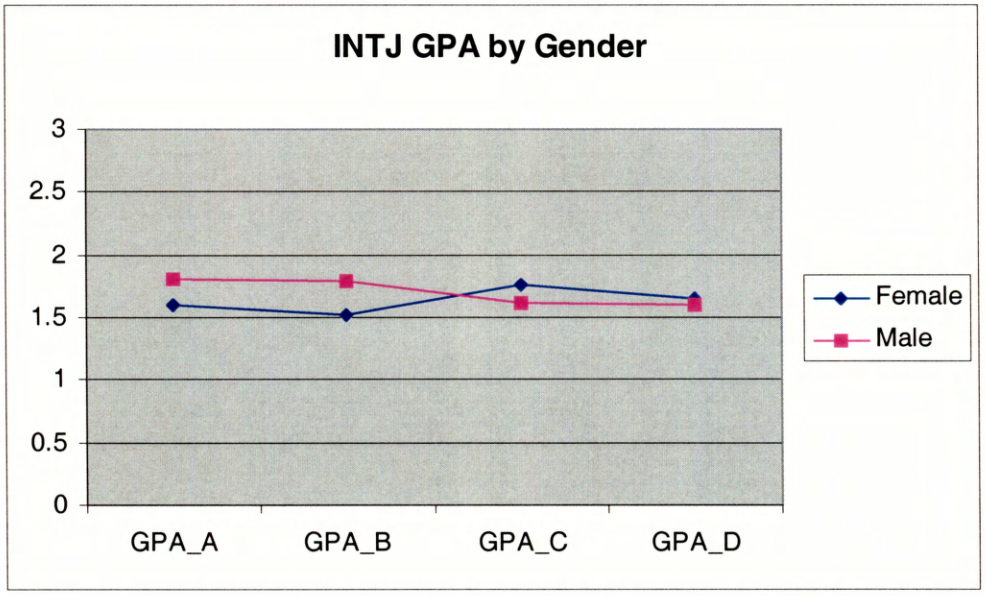
GPA_A
GPA_B
GPA_C
GPA_D
Female
Male


INTJ GPA by Gender
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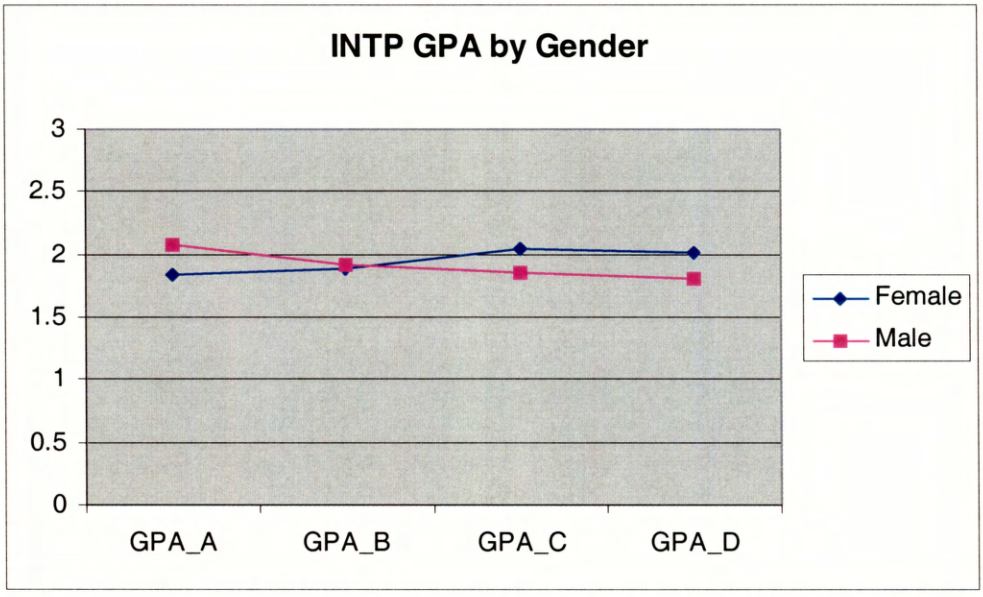
2
1.5
1
0.5
0
GPA_A
GPA_B
GPA_C
GPA_D
Female
Male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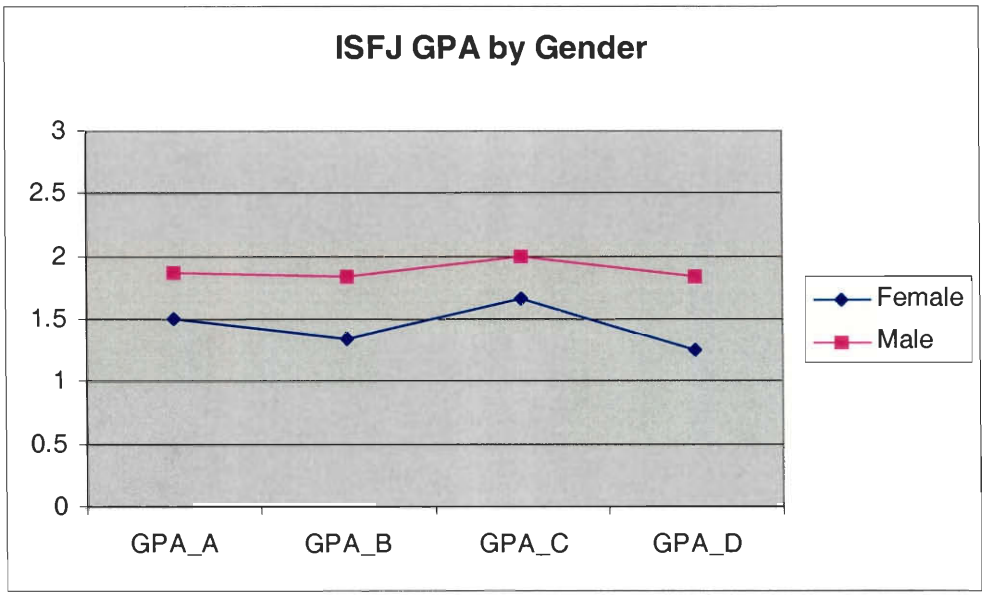
2
1.5
1
0.5
0
GPA_A
GPA_B
GPA_C
GPA_D
Female
Male


ISFJ GPA by Gender
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1
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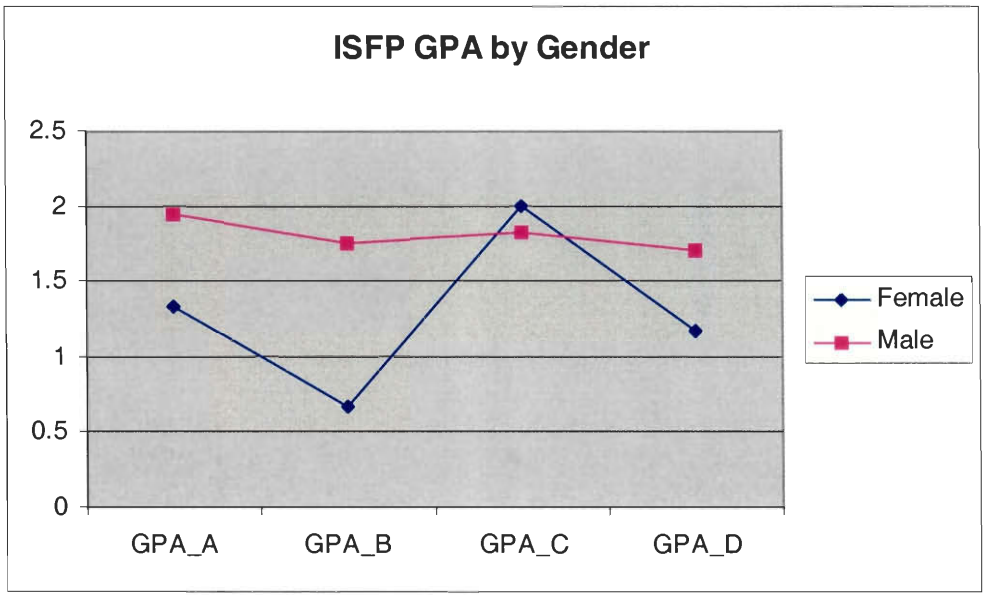
GPA_A
GPA_B
GPA_C
GPA_D
Female
Male


ISFP GPA by Gender
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1.5
1
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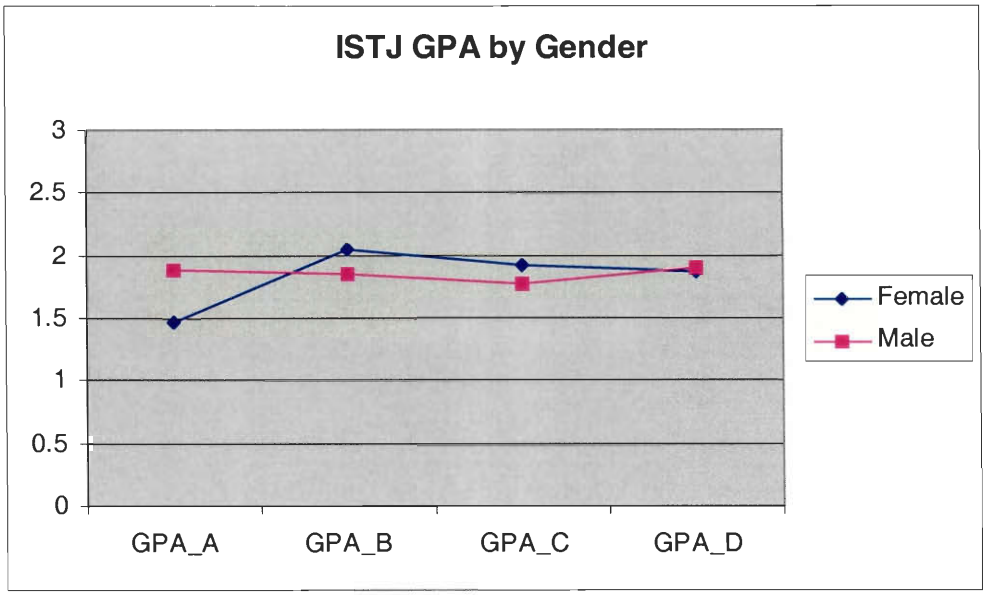
GPA_C
GPA_D
Female
Male


ISTJ GPA by Gender
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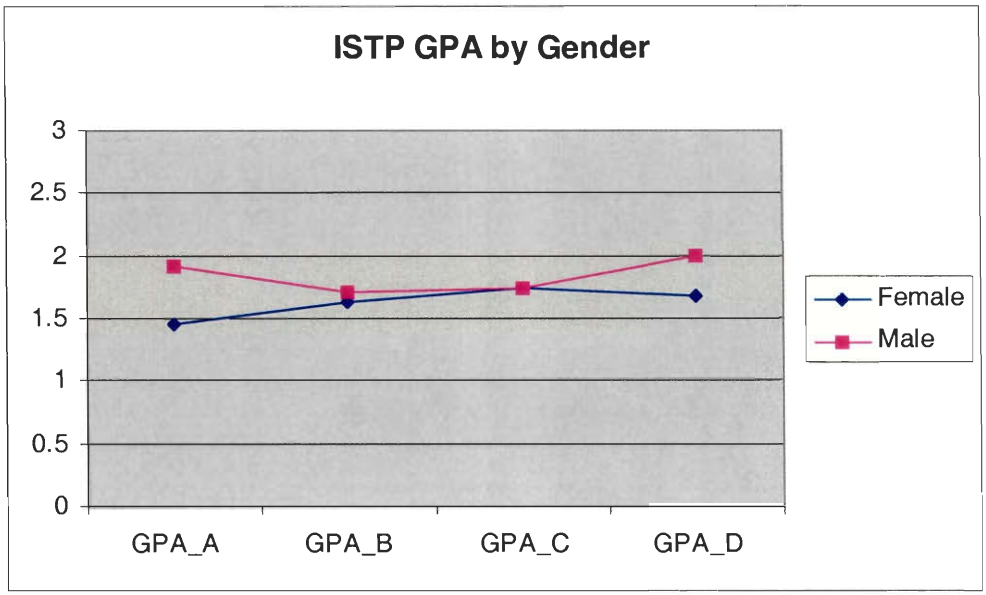
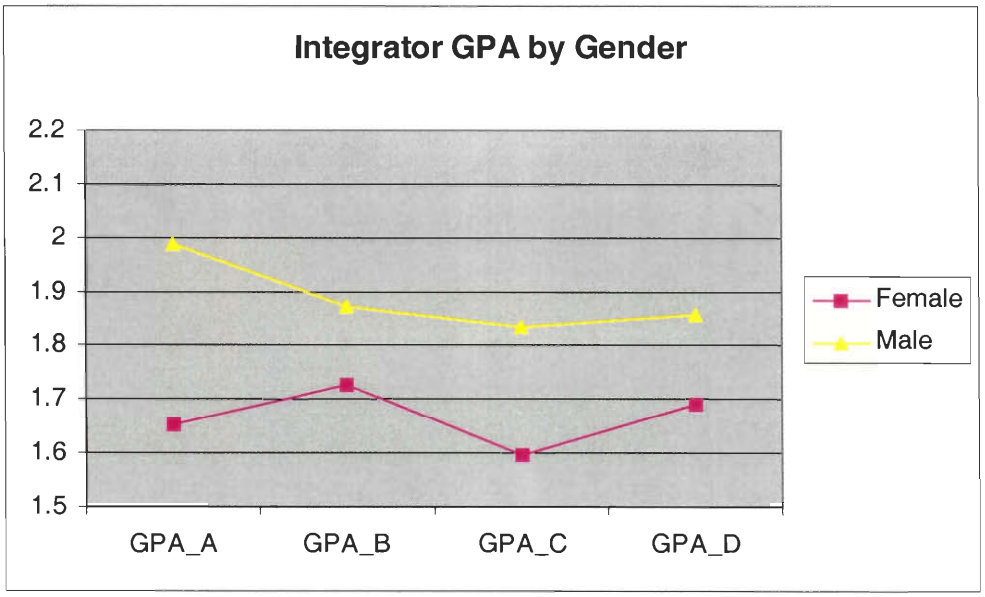
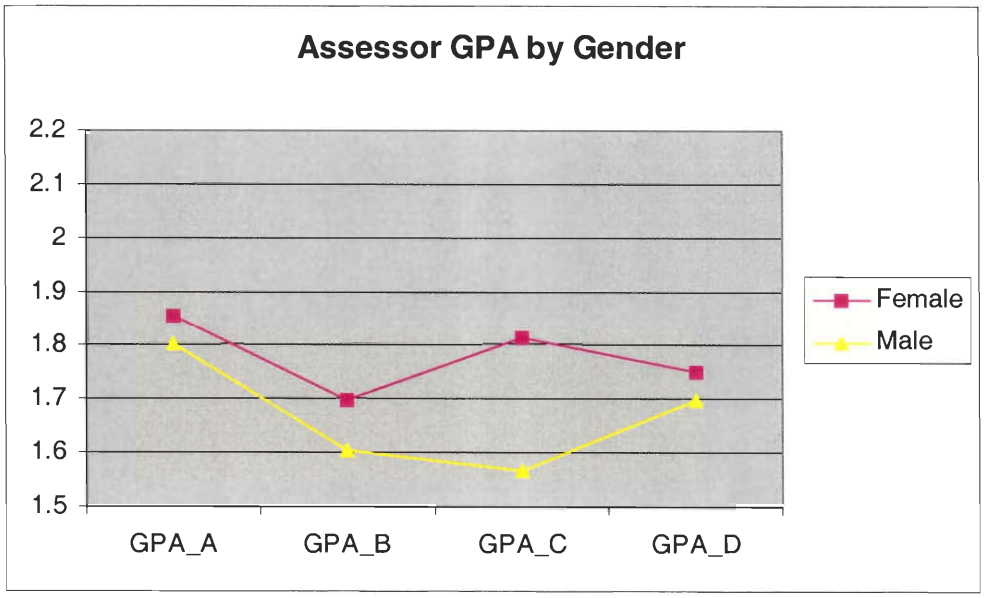
2
1.5
1
0.5
0
GPA_A
GPA_B
GPA_C
GPA_D
Female
Male

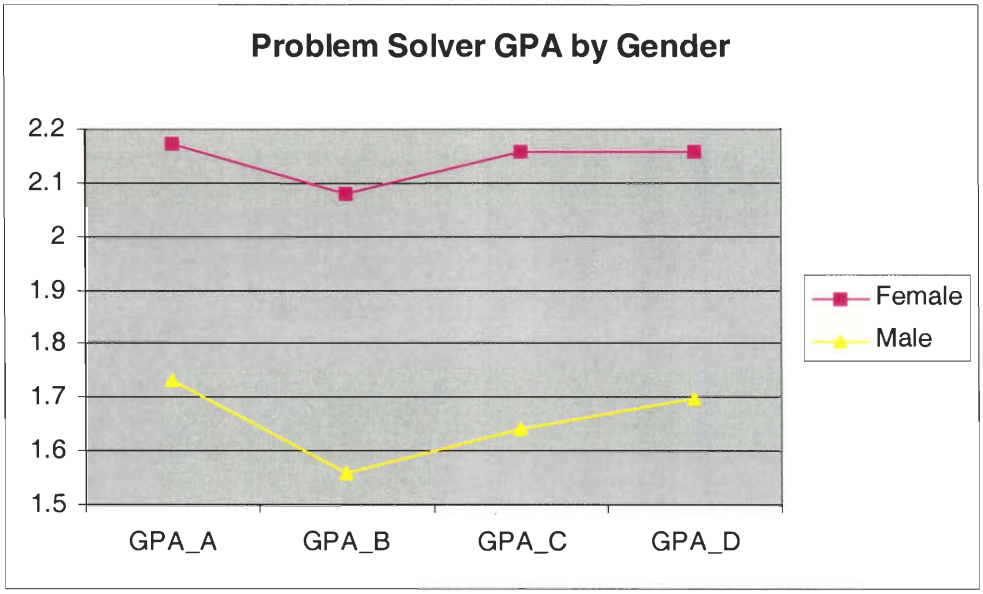

ISTP GPA by Gender
3
2.5
2
1.5
1
0.5
0
GPA_A
GPA_B
GPA_C
GPA_D
Female
Male

Appendix C-

Cognitive Style Graphs by Gender and Term






Problem Solver GPA by Gender
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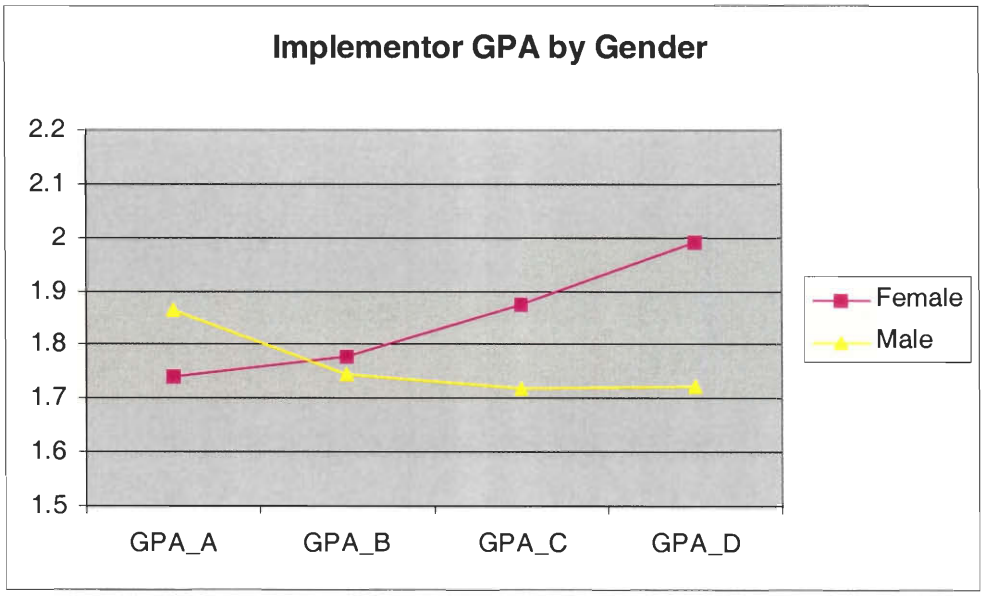
1.9
1.8
1.7
1.6
1.5
GPA_A
GPA_B
GPA_C
GPA_D
Female
Male


Implementor GPA by Gender
2.2
2.1
2
1.9
1.8
1.7
1.6
1.5
GPA_A
GPA_B
GPA_C
GPA_D
Female
Male

Appendix D-

Results for the Search for RA Proxy Items

The Search for Remote Associates Proxy Items

The psychometric aspect of the study involved an extension of the search that Lynch had begun for MBTI like items that could be scaled an produce a strong correlate of Differentiation or Remote Association. In this case the object was to find a proxy for remote association due to its culture bias and inconvenience of use. The R and D environment was so culturally diverse that key members of many teams would be lost if only native American speakers of English could be reliably assess for R A ability.

As a first step, Lynch's items were reviewed by speakers for whom English was a second language. Several items were revised based on their comments. Then it had to be ascertained that they still meant the same thing to American speakers of English as the original items had, so a special form was devised with "duplicate items" to see if indeed they would get the same response. The very large majority did and the culture biased versions were dropped.

The first test of the proxy item against the original (30 item) RA and standard Diff measures involved about 25 R and D scientists from a Gillette Lab, only 18 of whom were "Native" speakers of English. As the attached pages indicate, for this group all in one lab of the company with the corporate culture that led to questions being raised about the working of some of these items in the original, there was a promising pattern. 6 of 13 items Lynch had proposed for Differentiation got correlations above .3, the highest being ,49 with differentiation. As a composite index the correlation was .81 with the dichotomous Diff indicator. Things went even better with the R.A. proxy items. Eight out of 18 were correlating above .45 with the dichotomized 30 item scale, the highest being .89 with the original .

However, the sample was clearly too small so people from another lab and three WPI faculty members and 2 WPI alumni were recruited to bring the sample of native American English speakers to 42 cases.
The impact of the broadening of the sample was to dilute the findings.

	18 (one lab)	42 (2 labs and WPI)
Item 1	-.65	-.33

Item 3	-.67	-.33		
Item 5	.46	-----		
Item 7	-.55	-.39		
Item 8	----		.36	
Item 10	-.65	-.24		
Item 11	----	-.37		
Item 12	-.89	-.27		
Item 17	.54	----		
Item 18	-.67	----		

Worse, some of them started to shift and correlated with Diff. instead of RA. and vice versa.
The single best correlate with RA was now D13 an item involving not needing to understand how all the parts of a complex project come together to feel in control of it. .50 with RA.

On the other hand, R12 was now correlating .48 with Dichotomized Diff. and R 4, 14, 15 and 16 were correlating ..22-.34 with dichotomized Diff. Of these only R 12 had been a good RA correlate in the first study, but the sense that we knew something about these items was shaken by such a large shift from Lynch's findings. Clearly these items no longer showed as much promise as they had for being a potent composite scale.

Seeking to increase the sample size further, and despairing of doing so with practicing professionals, we resorted to the addition of Senior ME students at BU and Graduate Students taking a summer course at WPI to boost the sample another 30 people. The initial examination of this group as a separate sample to see if it was going to replicate the original Gillette lab findings or continue the process of dilution through diversity was more decisive than expected. Among the students the original findings were no longer in evidence. Only one item correlated with the RA criterion measure at all. This was disconcerting since Lynch's sample had been WPI students, and he had found a pattern in about 50 of them.

As an acid test of whether the proxy items could be used with a diverse student population the decision was made to include it the Class of 2003 study of incoming WPI students. They were interested in science and technology and aspiring to a career in those field, but certainly had not yet experienced the WPI student culture, much less the corporate culture of R and D in which the original finding

had emerged. If it re-emerged with them the self image items would be robust enough to use almost anywhere. Lynch had been gathering data in an introductory course taken by freshmen and sophomores, so this was possible, though not considered likely at that point.

Of the 613 respondents in the study 533 answered both the RA and Diff items and were native speakers of American English. Among them the following findings emerged:

All of the first 18 items were supposed to correlated with Remote Association, based on prior research.

Item 4 "things leap to mind very quickly and I instinctively know when these ideas are right or on the right track"-- Significantly related to Diff. Gamma Corr. -.26 (.001) .

Item 7 " I tend to be a careless dresser wherever possible" Significantly related to being an Integrator- Significant at the .03 level, Gamma Corr. -.13 with Diff (Sig. .02) as well.

Item 8 "I am Basically a Philosophical Person" was also significantly related to being an Integrator- at the .001 level. Both Diff and R.A. were Gamma correlated -.19 (sig, at the ..01 level)

Item 11 " I like it when I can be completely immersed in my own little world" Significantly related to being an Integrator, primarily a Gamma Corr. With Diff . -.20 (sig at .007 level).

Item 12 " I don't like to stop working on a problem until I have solved it, no matter how difficult it is." Gamma Corr. to Diff. -.16 (.02)

Item 13 "I try to tackle the tough problems first, then go back and solve the easier ones" Gamma Corr. to Diff -.16 (sig. .01).

Item 16 "During periods when I am doing nothing but practicing and improving my existing skills I begin to feel restless and restricted." Gamma Corr. to Diff. .18 (sig. At .04 level).

The next six items were supposed to correlate with Diff., based on prior research.

Item 19 (Originally D12) "I like jobs in which I am trusted and left alone to do something important- but which I have practiced and know that I can do well." Gamma Corr. .21 with Diff. (sig at .008 level)

Item 21 (Originally D7) " If there wasn't a crisis every once in a while, I'd be tempted to create one" Gamma Corr. -.13 (sig. at the .01 level)

Item 23 (Originally D1) " I like to work in intense burst s of effort that can go on for a few days or weeks, rather than work at a slower steady pace". Gamma Corr. -.17 (sig. at the .02 level.)

Item 24 (Originally D9) "I'm not a technical genius, but I do have a gift when it comes to figuring out why something won't work." Gamma Corr -.16 (sig. at the .03 level).

In conclusion, a closer look at Lynch's work reveals that he too had an easier time finding Diff correlates that RA correlates when working with his WPI student sample. Since he did not report correlation coefficients, but only significant findings at the .05 level, it is not clear whether he had stronger relationships in his sample of older students that we found or not. However, the weak nature of these relationships and the lack of Remote Associates correlates suggests that his belief that there would be straightforward self descriptive proxy items for RA available in the literature was unfounded. The position that there are generally meaningful items to which students and professionals from diverse fields and backgrounds could relate also seems untenable at this point. The size of this sample makes it easy to find "significant" differences. Having 10% as many cases that was a respectable goal for Lynch's study. However, the strength of the relationships is not impressive enough for one to consider this line of research promising. Brian

Starr's study now seems to hold the greatest promise of developing an alternative way to measure Remote Associates ability in a fashion that minimizes culture bias.

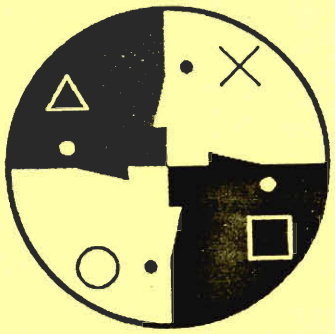
Appendix E

Sample of GCSI survey distributed to the Class of 2003

Pages incorrectly numbered in original

IQP/MQP SCANNING PROJECT

Cognitive Correlates



A Group Perceptions and Cognitive Style Indicator

Designed for the
1999 Learning Style Study

Conducted as Part of New Student Orientation at

WPI
Clark University
Worcester State College

Contact J. M. Wilkes at:
"Cognitive Correlates" 25 Institute Road Worcester, MA 1609
(508) 755-1138

99

Name:_____

Student ID# [ ] [ ] [ ] - [ ] [ ] - [ ] [ ] [ ] [ ]

Sex: ____ **Male** ____ **Female**

Transfer Student: ____ **Yes** ____ **No**

What is your native language: _____ **American English**

_____ **Other**
(please specify) _____

GENERAL INSTRUCTIONS FOR WORD GAMES

The first part of the indicator consists of two different kinds of word games. Each word game will be timed by the administrator. Please do not begin until instructed to do so. When the time is up, you will be asked to move on to the next word game, even if you have not completed the one you are working on.

GAME 1: DIVERGENT THINKING

INSTRUCTIONS: You will have 3 minutes from when you Administrator says "begin" to complete this word game. Below is the word ***Barrel.*** Write down as many possible uses as you can think of for this object. Let your imagination run wild if you wish, since answers need not be plausible, only possible. Each use should be a distinct function. For instance, using a barrel as a container only counts as one answer, regardless of how many things you can think of which could be kept in a barrel. (Deconstructing the barrel to use one of its various parts is allowed, but such partial uses rarely get as much "credit" as a use involving at least half of a barrel.)

Example: If we were talking about a "brick", using it as a hammer, missile, paper weight, and chalk would be different uses. Throwing it through a window and throwing it at someone would not be different uses.

A BARREL

101

GAME 2: CONVERGENT THINKING

INSTRUCTIONS: In this game you are presented with three words and are asked to find a fourth word which is related to all three. Write this word in the space to the right.

For example, what word would you think is related to these three words?

cookies ***sixteen*** ***heart*** _____

The answer in this case is "sweet". Cookies are sweet; sweet is a part of the phrase "sweet sixteen" and a part of the word "sweetheart".

Here is another example:

poke ***go*** ***molasses*** _____

You should have written "slow" in the space provided. "Slowpoke", "go slow", and "slow as molasses". As you can see, the fourth word may be related to the other three for various reasons.

For practice, try these next two:

A. ***surprise*** ***line*** ***birthday*** _____

B. ***base*** ***snow*** ***dance*** _____

Practice Answers: A) party B) ball

The next page lists twelve of these word puzzles. You will have<u>eight minutes</u> to work on each page of these puzzles, at which time you will be asked to move on to the following section even if you have not completed them all. Few people do all of them. When you have completed reading these instructions, please look up at the administrator so that they know you are ready to begin this word game.

SECOND WORD GAME

(Spend no more than 8 minutes on this section)

1.	lick	sprinkle	mines	_____
2.	shopping	washer	picture	_____
3.	envy	golf	beans	_____
4.	bald	screech	emblem	_____
5.	inch	deal	peg	_____
6.	stop	petty	sneak	_____
7.	elephant	lapse	vivid	_____
8.	sea	home	stomach	_____
9.	board	magic	death	_____
10.	chocolate	fortune	tin	_____
11.	habit	pouch	road	_____
12.	soap	shoe	tissue	_____

Instructions: Answer the following questions:

	Word Puzzles	Barrel	Neither
Which did you prefer?	**1**	**2**	**3**
Which did you find easier?	**1**	**2**	**3**

Preference and Self Image Items

Circle the number of the answer that best fits the way you see yourself.	Strongly Agree	Agree	Disagree	Strongly Disagree
1) If a "quick and dirty" solution or "brute force" way to deal with a problem occurs to me first, I'm done. I don't keep on looking for the perfect or "elegant" solution to a problem.	1	2	3	4
2) I make decisions quickly, and rarely change my mind.	1	2	3	4
3) I feel that I have the ability to make something really intricate work.	1	2	3	4
4) Things leap to my mind very quickly, and I instinctively know when these ideas are right, or on the right track.	1	2	3	4
5) I'm really smart, you know…right off the charts, but that is not always an advantage.	1	2	3	4
6) I really do not like computers.	1	2	3	4
7) I tend to be a careless dresser whenever possible.	1	2	3	4
8) I am basically a philosophical person.	1	2	3	4
9) So far, others have overlooked or underestimated my talents most of the time.	1	2	3	4
10) I like to play little practical jokes. I even enjoy a good one played on me.	1	2	3	4
11) I like it when I can be completely immersed in my own little world.	1	2	3	4
12) I don't like to stop working on a problem until I've solved it, no matter how difficult it is.	1	2	3	4
13) I try to tackle the tough problems first, then go back and solve the easier ones.	1	2	3	4

Preference and Self Image Items Cont.

Circle the number of the answer that best fits the way you see yourself.	Strongly Agree	Agree	Disagree	Strongly Disagree
14) I'm happiest when I can work alone, even on a team assignment. What the other team members do doesn't interest me much.	1	2	3	4
15) I think that I could do some really difficult, even amazing, things if I didn't know in advance how difficult it was going to be.	1	2	3	4
16) During periods when I am doing nothing but practicing and improving my existing skills, I begin to feel restless and restricted.	1	2	3	4
17) I am quite disappointed in peers who can't understand my way of looking at things, don't see what I see, or don't grasp the important implications right away.	1	2	3	4
18) I trust my hunches and take things as they come day by day.	1	2	3	4
19)I like jobs in which I am trusted and left alone to do something that is important – but which I have practiced and know that I can do well.	1	2	3	4
20) I generally approach problems indirectly so as not to assume that a problem is what it seems to be on the surface.	1	2	3	4
21) If there wasn't a crisis every once in a while I'd be tempted to create one.	1	2	3	4
22) I would prefer to be the person assigned to put a big project together by myself rather than try to do it as a group effort.	1	2	3	4
23) I like to work in intense bursts of effort that can go on for a few days or weeks, rather than work at a slower steady pace.	1	2	3	4
24) I'm not a technical genius, but I do have a gift when it comes to figuring out why something won't work.	1	2	3	4

GROUP PERCEPTIONS

The purpose of this final section is to see how you view the mix of people with whom you have been going to school over the last few years.

This is not a timed section but it is not supposed to take long since we are interested in gathering first impressions, reports of observations you have already made, rather than something that will require a lot of thought.

Step 1- Preparing a list of the ten people (fellow students) with whom you have the most contact in the last school that you attended.

Detach the last page of your booklet which should contain a blank list labeled A to J, and place it next to your booklet.

From A to J print in the names (first names or initials are fine) of the ten people, preferably peers, with whom you came into the most regular contact in school. One need not know these people as friends to answer the following general impression questions about them, in fact you don't have to have liked them at all, just have had a reasonable chance to observe them. You will not be turning in this work sheet.

Step 2- Line up the names with the lines A through J offered for one of the two rating criteria.

Step 3- Carefully read the explanation for each term,*focus* or *creativity*, as we mean them, and rate these ten people relative to one another on that criterion.

Repeat step 2 and 3 for the other rating criterion.Be sure that the same person is referred to in the same row of each set of ratings.

Step 4- Dispose of the list of names you used. - Do not turn it in.

Proceed at your own speed. However, you are encouraged to move along rapidly because the first answers that come to mind are fine and this will make it easier for you.

Remember: When in doubt, pick your first impression, and move along.

Please turn to Step 1 and begin.

After making your list, begin.

Question 1 – FOCUS

Based on your experience and observations, circle for each individual (A-J) a number from 1-10 which represents your opinion of how **focused** they are about their work in the sense of being **able to concentrate their attention** on what really matters, given the overall task at hand.

REMEMBER The higher the number is, the more focused a person is, the lower the number the less focused a person is- in terms of being able to concentrate their attention.

Please do not circle more than one number for each individual.

	Less									More
A	1	2	3	4	5	6	7	8	9	10
B	1	2	3	4	5	6	7	8	9	10
C	1	2	3	4	5	6	7	8	9	10
D	1	2	3	4	5	6	7	8	9	10
E	1	2	3	4	5	6	7	8	9	10
F	1	2	3	4	5	6	7	8	9	10
G	1	2	3	4	5	6	7	8	9	10
H	1	2	3	4	5	6	7	8	9	10
I	1	2	3	4	5	6	7	8	9	10
J	1	2	3	4	5	6	7	8	9	10

Question 2 - CREATIVITY

Based on your experience and observations, circle for each individual (A-J) a number from 1-10 which represents your opinion of that person's **creative ability**, meaning their **capacity to be innovative** or bring something new into existence, such as new images, ideas, devices or processes.

REMEMBER The higher the number is, the more creative a person is, the lower the number the less creative a person is - in terms of being able to innovate.

Please do not circle more than one number for each individual.

	Less									More
A	1	2	3	4	5	6	7	8	9	10
B	1	2	3	4	5	6	7	8	9	10
C	1	2	3	4	5	6	7	8	9	10
D	1	2	3	4	5	6	7	8	9	10
E	1	2	3	4	5	6	7	8	9	10
F	1	2	3	4	5	6	7	8	9	10
G	1	2	3	4	5	6	7	8	9	10
H	1	2	3	4	5	6	7	8	9	10
I	1	2	3	4	5	6	7	8	9	10
J	1	2	3	4	5	6	7	8	9	10

Appendix F

Pilot Study of the Cognitive Styles Proxy Items

Pilot Study of the Cognitive Styles Proxy Items

Phase two of the FB form

Gillette Foreign Born and Native Validation Study

Name_____

Case number_____

Proxy Items for Cognitive Style D

Strongly Agree- Strongly Disagree	Strongly Agree	Agree	Disagree	Strongly Disagree
1) I rather like intense bursts of effort at work as long as they only last 2 or 3 months of 80 hour weeks and the result is likely to be the creation of something novel or important.	1	2	3	4
2) I often refuse to fix things for other people so that they will learn how to do it on their own.	1	2	3	4
3) I like to work on projects that have a sense of crisis associated with them.	1	2	3	4
4) I generally approach problems indirectly so as not to assume that a problem is what it seems to be on the surface	1	2	3	4
5) When I don't know how to do something that I am sure can be done, instead of planning my approach, I like to jump into it and explore the possibilities until a solution emerges..	1	2	3	4
6) I like challenging assignments that are beyond what I am known to be able to do and will push me to my limit if I succeed- real "growth experiences".	1	2	3	4
7) If there wasn't a crisis every once in a while I'd be tempted to create one.	1	2	3	4
8) When I was in college, I thought about majoring in one of the social sciences, like psychology or anthropology.	1	2	3	4
9) I'm not a technical genius, but I do have a gift when it comes to figuring out why something won't work.	1	2	3	4
10) If I were a popular (not classical) musician, I would be the kind that improvises and plays variations on the main theme rather than sticking to the music as written by the composer.	1	2	3	4

	Strongly Agree	Agree	Disagree	Strongly Disagree
11) I would prefer to be the person assigned to put a big project together by myself rather than try to do it as a group effort.	1	2	3	4
12) I like jobs in which I am trusted and left alone to repeatedly do something that is somewhat specialized and not too important- but which I have practiced and know that I do well.	1	2	3	4
13) I don't need to understand how all the parts of a complex project fit together to feel in control of it. I am confident of seeing how it is supposed to come together after I get into the details of it.	1	2	3	4

Proxy Items for Cognitive Style R
(5 minute alternate for the Foreign Born to the Convergent Thinking Word Game)
Very strongly agree- Very Strongly Disagree

	Strongly Agree	Agree	Disagree	Strongly Disagree
1) I'm just not satisfied with anything less than a truly elegant solution. Brute force, "quick fix" or "quick and dirty" solutions that work just don't appeal to me.	1	2	3	4
2) My personal style is decisive and exact.	1	2	3	4
3) I feel that I have the ability to make something really intricate work.	1	2	3	4
4) Things leap to my mind, very quickly, and I instinctively know when these ideas are right, or on the right track.	1	2	3	4
5) I'm really smart, you know...right off the charts, but that is not always an advantage at my kind of work.	1	2	3	4
6) I really do not like computers. They are too sensitive to errors on small details and far too logic bound.	1	2	3	4

	Strongly Agree	Agree	Disagree	Strongly Disagree
7) I tend to be a careless dresser -- real casual whenever possible.	1	2	3	4
8) I am basically a philosophical person.	1	2	3	4
9) In my career so far, others have overlooked or underestimated my talents most of the time.	1	2	3	4
10) Sometimes I play little practical jokes. I even enjoy a good one played on me.	1	2	3	4
11) I often wonder if it is good for me to be as completely immersed in the specialized little world of engineering as I am.	1	2	3	4
12) I don't like to stop working on a problem until I've solved it, no matter how difficult it is.	1	2	3	4
13) I try to solve the tough problems first, then the easier ones.	1	2	3	4
14) I'm happiest when I can focus on my piece of a project. What the other team members are doing isn't of great interest to me.	1	2	3	4
15) I think that I can do things that most people would consider nearly impossible, if I don't know in advance how difficult they really are.	1	2	3	4
16) During periods when I am doing nothing but practicing and improving my technical skills, I begin to feel restless, restricted and quite concerned that I am becoming too narrow.	1	2	3	4
17) I am very disappointed in colleagues who can't understand my way of looking at things, don't see what I see, or grasp its implications.	1	2	3	4
18) I trust my hunches and take it as it comes, day by day.	1	2	3	4

Paragraph Length (5-7 minute) Self-Descriptive Essay

People generally have a favorite or preferred part of their work. In research and development projects go through phases from early conceptualization of the problem to demonstration of feasibility and the design of the production process. Along the way a lot of different tasks come along, some of which you probably look forward to more than others. What is your favorite part of the product development cycle?

It could be a special task you enjoy which only comes up periodically or it could be a part of a process you and your team members go through repeatedly-but that is your favorite part. Explain why it is appealing.

Is there some part of the cycle that you really dislike enough that you wish you could just skip that part or not be involved when it comes up? Explain why it is unappealing..