A FOLLOW UP STUDY ON THE CLASS OF 1990?

An Interactive Qualifying Project

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By

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Abstract

This paper is a proposal for a longitudinal cognitive gender study on the class of 2002. 138 alumni of the class of 2002 have been matched with a counterpart of the same year by major, grades and cognitive type. Sources of attrition and difficulty have been identified by a past attempt at contacting the WPI alumni of 1990. A system of contacting and maintaining data sets on these alumni is proposed that would allow for attrition of the sample pool without compromising the study.

Acknowledgements

I would like to thank Professor John Wilkes

for staying on course throughout this

dynamic and trying project.

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I: Introduction

This project began as a follow up of about 120 alumni each in the classes of 1985 and 1990. Our reasons for following the members of the class were to test the theory of gender and cognitive type as described in the GCSI literature. The prevailing theory is that people of a certain cognitive type would have more or less success in the work force of different fields. The gender aspect is developed so as to explain how woman fare in some of the "hard" sciences currently, compared to the social sciences. Shablin (1985) and Francis and Peitras (1990) adapted the theory to cover the case of "pioneering" women entering engineering at WPI when the sex ratio was about 4:1.

Our reasons for choosing the classes of 1985 and 1990 are two fold. First is that we have cognitive data for a representative sample organized by major. The classes under study at WPI were also part of a cross sectional study with samples from Brown and Clarkson, but those aspects of the studies are not relevant here. This aspect is of particular importance because this study was to be a pilot test of a much larger study involving multiple schools and over 1000 students majoring in the physical and social sciences. The second reason we wanted to follow up these student samples is because they are sufficiently far along in life to have developed career paths, if they entered the work force with that goal. We hoped to use the comparative gender engineering career path results to justify the budget and develop procedures for a full scale follow-up study of the science sample. We also hoped to pilot test the theory to be more fully tested in the larger study as well. In short, this study was a trial run designed to help write a proposal to fund the larger study to follow.

This larger study which was conducted in 1983 and 1984 gathered data from a dozen of the northeast's leading academic institutes and involved four carefully selected majors. These were physics, economics, chemistry, economics and sociology. Half of the respondents were graduate students, the other half undergraduate. To make it even more interesting there was data about the professors of those institutes gathered eight years prior.

The smaller test study we attempted to conduct at WPI would have respondents drawn from electrical, mechanical, civil and chemical engineering disciplines as well as computer science. This pool would be too small to derive conclusive information from, unless there were striking correlations, but would be useful in getting an idea of how valid the theory of GCSI types is, and also seeing how easy it would be to find these people 15-20 years later.

In attempting to track down alumni and contact alumni we ran afoul of several different problems, one of them was expected, the others were not. The first problem we ran into was backwards compatibility of the software that was being used. The SPSS package is theoretically backwards compatible even with versions designed a decade ago. However WPI choice of an ENCORE "super computer" mainframe a decade and half ago resulted in such a rare platform implementation that when WPI discarded it, even the providers SPSS Inc. could not open the data files. This left us with no way to access the 1985 data and with just hardcopies of the 1990 data. These data consisted of the original surveys and a 10 page printout listing of the entire class, marked up in such a way that we could make reasonable guesses as to who was in the sample- and responded. The problem we knew we were going to run into was that the study was "confidential" so the

students were not asked to put their names on the survey forms. Still, we felt that there was sufficient demographic information to decipher who was who. The other problem we encountered, and had not anticipated, was that the letters we mailed out to alumni, both conventional mail and email, had a rather low hit rate. By this I mean that many messages and letters came back undeliverable and those that did not rarely produced a useable response. Even when the right people got the right mailings, more often than not they had no idea what we were talking about. Some denied ever having taken part in the study, or even having had a family profile that fit one of the respondents we were sure they had to be.   In the end about 20 people responded and only 14 of those could be linked with their original survey form. Of those 14, 8 provided a resume or letter describing their careers thus far, and a few other were not in the work force but described what they were doing. Thus, about 8 cases that could be coded resulted for 120 follow-up attempts.   Clearly no study of male and female success controlling for cognitive type could be carried out on such and small and unrepresentative data set.

It is at this point we took a step back and went back to the drawing board. The immediate loss of data was minor compared to the question raised about whether the 12 universities in the proposed larger study actually had the information necessary to find their alumni after a 20 year lapse.   The WPI data base had not been regularly updated, perhaps the other were not either. Considerable effort was devoted to finding out if WPI had better records held by another part of the institution, possibly the career placement office or the "hall of biographical records" which seems to serve the office that solicits alumni for money rather than to invite them to reunions. The Alumni Affairs office that does the reunions depends on the alumni to take the initiative to update their contact

information, and in fact only about 15% do so. The office involved actually considered our response rate to have been pretty, good, better than they had come to expect. Our inquiry to the Hall of Biographical records was passed around between several administrators but one finally responded with the estimate that they could contact 94.8% of last year's alumni. A promise was made to look into the coverage of the two years of interest to us, 1990, and the next year for which we have cognitive data on a class of WPI students, the Class of 2002. Falling back to graduates only 5 years out as of which they would be contacted next year, is a whole different matter from a 15 year follow-up. However, we reasoned that if they were contacted now and the files updated, it might be possible to contact them at 10 and 15 years out into their careers and do the originally planned study in the future.

The new project goals became 1) Ascertaining whether the original 1990 sample could be contacted with information not available to the alumni office. If so the larger follow-up study is probably still viable. 2) Planning a study that will answer the questions we started with about male and female engineering careers, based on the Class of 2002 study archive of cognitive styles data. 3) Arranging to have the male and female students selected for the future comparative study contacted within the next year, by some part of the WPI organization to update their records before we lose track of them.

II: Background of the GCSI

The purpose of this study is to look at how gender and cognitive types affect career advancement. We used a different cognitive style indicator than the well known MBTI. The MBTI is one of the most popular and well documented psychological type profilers. Anyone who has taken a course in leadership, management or psychology has

at least a passing knowledge of the MBTI system, and most can recite to you their four letters that describes their type right off the top of their head. However there are flaws in the MBTI. A person answering the test can give answers to two different items that appear to be contradictory. For example a person could say they enjoy gatherings, but dislike parties. The reason they dislike parties could be because they dislike alcohol and have an association that parties always have alcohol. Later on the might decide they like parties and then change their answers, resulting in a different letter and a potentially different label. The MBTI handles this sort of problem reasonable well in reporting both the weight of evidence on the 4 dimensions and the reliably of the classification based on how consistent the responses were. However, the test-retest reliability of the MBTI over a 5 year people is not high enough to be reassuring to the psychometricians. MBTI advocates talk about a "true" type that is stable over time and a "reported type" that the indicator approximates subject to all the usual problem of working through self image data to get to underlying psychological traits. The advocates also note that verifications of type data suggest that 85% of the time the respondent agrees with 3 or 4 of their descriptive ratings if asked about it shortly after being administered the indicator. These potential sources of difficulty are important to us since the study plan involves correlating behavioral outcomes with cognitive data collected 15 years earlier. It would not due to be wondering if they had changed type in the meantime, as there are no plans to re-administer the cognitive indicator, which were administered to these people when they were in Freshman orientation. Thus, the MBTI and GCSI data on the Class of 2002 was really collected in August of 1998.

The psychological test used for this study, the GCSI, is not as well known or popular, but it measures cognitive ability rather than personality via cognitive preference and is probably not as heavily influenced as a person matures and changes over time. The MBTI advocates say that they expect people to change, and develop into a "mature version of the person's "true" type. This means that they never change their preference but they do learn how behave in ways appropriate to the situation and thus their behavior is less and less a reflection of their preference as they become more and more competent in their less preferred mode of behavior. Their point is that personality really does not change. It is stable but people act differently as they mature. They develop their less preferred side of skills. We are interested in career choice and really need to try to predict behavior. The cognitive theory under investigation deals with a process of finding positions that are better and better fit with one's cognitive style over time. We think this is harder for women to do than for men due to cultural stereotypes impeding access to certain careers and jobs that might be a good personal fit. More on that later.

The point for now is that there is every reason to believe that the pattern of cognitive abilities measured by the GCSI is stable over time and therefore would be better to use for long term longitudinal studies. However, both MBTI and GCSI data are available for the Class of 2002. The question is which one to use in matching the male and female members of the sample. I have decided to use the GCSI for that purpose.

The details of the GCSI were mentioned briefly above, but they are worth going into in more detail. It was developed in 1969 by Gordon, who incorporated work from Mednick, who was trying to create a test for creative ability. It was used successfully by Gordon and Morse (1969) to predict success in getting patents and contracts in Research

and Development. It seemed to reveal a person's aptitude for either finding and conceptualizing problems or being able to solve them. These abilities are called differentiation and remote association respectively. A person would either have or not have these abilities and the resulting binary system could be used to generate a 2X2 Matrix of possible answers. People with the differentiation ability are good at finding problems. This is the ability to see shades of grey and discriminate between them. A person who says everything is "good" or "bad" is probably on the low end of differentiation. Picking up on discrepancies in theory and data is the hallmark of this ability. A person who uses terms like "very" "quite" "semi" and other qualifying adverbs and adjectives to describe things is most likely on the upper end of the differentiation scale. One of the ways to test a person for differentiation is to give them a score sheet and ask them to grade people, events, etc. on a scale of 1 to 10. The questions asked are using criteria in which there are no clear observable references, making the assessment entirely subjective. A person who uses the full scale to quantify things is said to be differential, able to make subtle discriminations between similar things. It is worth mentioning that these abilities are not always as beneficial as they first appear. They reflect more on how someone thinks than it does on any cognitive "gifts". For example, a differentiation ability to see the details and read between the lines is not always a good thing. While better able to gather information and formulate questions, a high differentiator is fully capable of "missing the forest for the trees" and can get hung up on things that seem to be of trivial importance and not see the general trend of data due to a few outliers. For most industry practices, the bottom line is what matters the most, and a person with high differentiation can easily get stalled. A point of interest is how

widespread differentiation is in the general population. When an indicator of differentiation was first being formatted, the measure of someone's differentiation ability was relative, i.e. the median case, so it was based on what other's responses were. With experience a narrow range of possible break points was defined.

When at last a large population representative of the general population was gathered, it was reassuring to find that the median score was indeed falling where the estimates indicated that it should. Thus an absolute scores range for high and low was developed based on experience. It turned out that roughly half of the high school students who took it could be considered differentiators. This resulted in a bimodal distribution of data that is now used as a reference point to compare to other groups as being more or less differentiable. One group that has far more differentiators than the general population is college professors. The college students are also a bit above average.

This would at first glance seem to suggest a correlation between intellect and differentiation. I would postulate that the job aspects of being a professor, specifically attempting to broaden the understanding of their field, generate new research opportunities and grading, particular in a field involving essays and material that has more subjective qualities is much easier if you have the ability to notice small things than if a person has the tendency to gloss over material.

Remote association, the other ability measured for a GCSI profile has a low correlation with differentiation of 0.21 in most studies of college students and professionals, though the large study of Worcester High School students the two did not correlate at all. Based on this same study, it appears that about 1 in every 3 people are remote associators.

Remote association is a measure of a person's ability to pull together seemingly unrelated objects or ideas and connect them to make a common thread or solve a problem. For example, a person with remote association might look at a list of words like king, circus and cage and tell you that they all have something to do with a lion. A remote association is the quintessential light bulb going off; they suddenly have an idea or answer. With no prior steps or logical reasoning a person with remote association knows the answer with great certainty just by looking at something. This is not to suggest that a remote associator will instantly figure out the answer, often times the answer will spring to mind while doing something else, even things like sleeping. Remote associative ability has a tie in with the intuition characteristic described by the MBTI. In college sample correlations as high as .5 have been reported, but it is typically closer to .4.

It was found in a study that a person with remote association will score 126 points higher in the SATs than a person who does not. The MBTI has a letter devoted to sensing and intuition. People who are more intuitive, rather than sensing, will score on average 140 points higher than their sensing classmates. Those individuals who are both remote associators and intuitive will score four hundred points higher on average on their SATs compared to other students who do not have remote association and are sensing.

People with one quality or the other (but not both) score very similar averages in about the middle of the distribution. Again this might lead one to draw the conclusion that people who have the ability of remote association are more intelligent than people without it, but there is little evidence to support that. In fact, Intelligence Quotient tests are only useful in predicting success in an academic setting; it does not expand out to

careers or the "real world". The reason for a remote associator's score difference on the

SATs could be that the SAT is a timed test. A remote associator does not need to take the

time for intermediate steps to recognize the solution in a multiple choice test. They can

therefore answer questions well within the time limit given, and also benefit from a good

hit rate when guessing. These two traits form the matrix of possible cognitive style

combinations.

		Remote Association	
		Yes	No
Differentiation	Yes	Integrator	Assessor
	No	Problem Solver	Implementer

Looking at the chart above, the names of each of the groups is fairly clear what

they do. An Assessor disproportionably finds and lays out problems since they have

differentiation ability and a problem solver can intuitively figure out how to solve

problems by rearranging different elements, even bringing in materials that were not

there to begin with. The absence of either results in a person who is called an

implementer. The name again says it all, a person with this profile type who is logical

and persistent can be a given a task and they can work through it smoothly and

meticulously. As long as the work does not rapidly change from what they expect, they

are role models when given a prototype of an item and then putting it together. Their

lack of a discerning eye and lack of making jumps in their trains of thought can be very beneficial when things need to get done in a specified order. Provided the tasks they are given does not deviate from expectation and require some ingenuity or fundamental innovation. An implementer can perform acts of innovation, but they are typically an incremental process done one step at a time, unless a happy circumstance brings together the elements that a remote associator could connect in their minds without their being in physical proximity.

The last group, integrators would seem to be a one man research and development team. While the idea that they have both abilities seems to be beneficial, the truth of the matter is that they rarely outperform other cognitive types. Due to the interaction effect between differentiators and remote associators most integrators act like problem solvers. It is only when they end up in situations where the task environment changes, i.e. a project shifts from production innovation to production processes improvements, when they become the leader, or finally when a task environment is unstructured , complex or counterintuitive that an integrator will "show what they can do" and live up to the hypothetical potential they have.

III: Background on Cognitive Conflict

This GCSI data has been used in the past at attempting to understand an interesting phenomenon in the work place. Specifically there was an interest in the relative absence of woman in several areas of science and technology. It was first postulated that this was simple discrimination against woman in the work place and that as the woman's movement became more developed equality would spread throughout all

the occupations. This however did not occur, woman flourished in biology, psychology, law and other "soft" sciences, and yet were still underrepresented in some of the harder or applied sciences like engineering. An alternate theory has been presented by Professor John Wilkes.

Science goes in a cyclical fashion, questions are posed and then solved, then more questions are developed and they need to be solved and so on. The term coined for this issue of how much a field is codified and governed by consensus at any given point, also referred to as its "paradigm" state. The more codified a field is the higher the paradigm state the more defined the important questions in the field are. I will use the field of physics as an example. In 1915 the Theory of General Relativity was presented ending the pre-paradigm phase. In 1945 we saw the first application of nuclear physics demonstrated. In the late 1960's the seemingly random fluctuation of a non linear dynamic system introduced a "crisis" and brought on the post paradigm phase. By 1970 this evidence was starting to be formulated into chaos theory and contending paradigms were produced. Right now the new thing in physics is quantum computing and quantum cryptography, and attempts to develop atomic replacements for what are currently electrical systems. Thus, we find the field in the midst of having defined the problems and it is now back in the puzzle solving high paradigm phase of the cycle.

What does this mean for woman attempting to break into these harder sciences? Woman who are going to challenge gender stereotypes are disproportionably high differentiators and especially assessors. An assessor in particular is a born maverick looking for difficulties, challenges and discrepancies in principle or values and practice.

This brings us to the theory tension between scientists are less likely to be a clash of male versus female, but rather a clash of opposing cognitive types.

Sometimes the men are of one cognitive type and the woman are the other, they make the mistake that their mutual distaste for each other is based on visible differences, rather than an underlying cause. Most of the successful senior members of the harder sciences in a paradigm phase are problem solvers, who are inclined to challenge the prevailing paradigm or the social statue quo. This is the source of difficulties for woman since assessors and problem solvers, for obvious reasons do not get along well and have trouble appreciating and understanding what the other is good at. Furthermore, the problem solvers are senior to the assessors and in a position to judge them for their potential and contributions. Peter Francis and Mark Pietras did a study to test this theory and did a cross sectional survey. They gave out surveys at two different universities Clarkson and WPI. The surveys they handed out were supposed to be tests of an individual's capacity for differentiation and remote association. However, the differentiation measure was omitted from the Clarkson study. These surveys were then broken down into groups by major and sex. They then analyzed the results comparatively between the schools, WPI and Clarkson were technical schools of similar male/female composition. So even though there was an error in the Clarkson data, it was not too serious as the data they did have available compared favorably. They also compared the results to those from another study on Brown, an Ivy League school that had an engineering school as well as an Arts and Science School that had computer science majors. They had mixed results with their tests. It was expected that the woman would be predominately high differentiators, representing a maverick population who

was willing to challenge the status quo. This occurred at WPI. The female sample there

had a higher percentage of assessors than found in the average population. This was

confirmed with both the 1985 study (Shablin) and the 1990 (Pietras and Francis) study of

cognitive types.   The Brown data exhibited the reverse pattern. There, the men were the

assessors and the woman the problem solvers. The suspected reason for this difference

between WPI and Brown was thought to be due to the more diverse liberal arts nature of

Brown. A woman could apply to Brown University and not to any specific school within

it. Thus a woman could start in engineering and transfer within the school easily and

would not to be seen as such an iconoclast to go to this university. In any case, it seems

that the woman had a high rate of transfer out of the school of engineering at Brown,

approximately 60%. The men on the other hand stayed in engineering. It seems likely

that the male and females had similar distribution as freshman, but then all but the remote

associative woman left for the school of arts and sciences. When some of the transfer ex-

engineers were tracked down at the school of science they proved to mostly be

integrators. So the woman who initially challenge the male stereotypes of engineering

are disproportionally high differentiators and at WPI there was no Arts College to

transfer to, so they stayed in engineering and graduate.

IV: Study

This entire background story about cognitive measures and what has been done in

the past brings us up to our present day questions. We have psychological profiles for a

sample of the assessor WPI woman of 1985 and 1990 and we have information about

their male counterparts as a point of comparison. The Pietras and Francis student sample

consisted of 120 WPI students, 60 men and 60 women. They were selected at random from within five different majors when they were juniors. This was used to put together a cross sectional survey. The next step for my project is to follow up these WPI alumni and create a longitudinal study covering the next fifteen years, in order to see how well the theory of cognitive styles predicts career choice and success. The theoretical logic would be that the more codified the field and the better defined the job the more success should correlate with have the remote association quality.   Conversely the less codified a field of study is when a person enters it the greater the success rate of differentiators. Since integrators have both skills and implementers have neither it is difficult to predict their rate of success based solely on the state of the field. However, an implementer should do best in codified fields while an Integrator can succeed in either setting, but prefers a more codified one. So it really comes down to what the assessors are doing in contrast to the problem solvers.

In order to establish the context for a study on the state of the scientific and engineering fields that the class of 1990 entered, a necessary part of this study was going to be to talk with experts in these fields and get a sense of how their field has been moving and developing for the past 15 years. It was evident that the faculty in the mechanical engineering department was heavy with problem solvers, but the students were assessors. By contrast, the electrical engineering department faculty was disproportionably assessors while their students were implementers and problems solvers. The biotech student body was composed of mostly problem solvers and in the computer science a majority of students were found to be integrators.

Students are attracted to the reputation or perception of the field compared to what alternatives are available. The more the discussion is about implications and new discoveries the more we would expect problem finders to be highly successful. Likewise if scientists are "working out the possibilities and meaning" of their research it, the hypothesis is that problem solvers would have more successful careers in that area. Integrators should outperform both groups, but they are not useful for drawing comparisons between the two cognitive traits since they possess both.

There are hosts of potentially confounding variables involving the work force opportunity structure that need to be considered in the proposed study. Whether a person has the opportunity to work in the field they trained for, started a family life, was offered more money to take on a different job or different responsibility, like managing, or if a person married and moved with their partner etc. etc. All of these can influence whether they found their niche and could stay in it. That is why it is important to gather a timeline of their careers and activities, not just an isolated snapshot of what they are doing currently. The kind of trend we are looking for is if a problem finder switched jobs as their field was shifting to a more codified form to go to a new field just opening up. In order to recognize these shifts as shifts in occupation and not a shift in location to a more remote area to live with their spouse and not having the opportunity to pursue work in their field is why the whole picture is needed.

To proceed with the longitudinal study we needed to contact the alumni and ask them to send us their resume or some sort of timeline of their activities as their career unfolded. The next step would then be to gauge their relative success in their chosen fields. In order to better understand a person's career the original plan required

consulting with the career development center and getting an idea of what is more representative of "success" in a field, differentiating between a senior research and developer and a vice president of production or whatever. Once this was accomplished we could hopefully draw correlations between the GCSI types and the relative success, financial and otherwise of the alumni by field and sex. In the end we are doing a gender comparative study.

This research plan encountered obstacle after obstacle. The first problem encountered was that due to an odd choice of computer platform chosen years ago by WPI, the decade old Encore computer file that held a list of the participants of the survey and their results could not to be opened by staff at WPI or SPSS. The file was an SPSS version 3.0, and even though the school has a licensed copy of SPSS 12 and it is supposedly backwards compatible, we were not able to open it. After contacting SPSS tech support and explaining the situation we learned that essentially there was no way we were going to get that file open because so few people used Encore computers at the time[1]. This left us with a different recourse. Hidden away in boxes we found the old surveys and on top of that stack of surveys we found a marked list of the class of 1990 sample. After studying these 10 sheets of paper it became clear that the designers of the cross sectional study, Pietras and Francis, had tried to get ten males and females of the following majors; electrical engineering, mechanical engineering, civil engineering, chemical engineering and computer science. The list was ordered by school box number, which seemed to deliver a fairly random sample in terms of people's names and majors. The marking and notations on this sheet were not completely clear on the list, a person

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[1] We did not check if the 1985 could be opened, but looking back it was probably made on a different computer, one of the more common DEC-10 or DEC-20

who was "completed" and someone who was "not available" were both crossed off. To err on the side of caution anyone with any sort of marking next to their name was copied down and then entered into a spreadsheet. This list was then sent to the alumni office who had informed us earlier that they would supply the information stored in the alumni gateway in an excel spreadsheet for the people we sent them.

The next step was a strange one, and would not have needed to be taken if we were able to connect people with their cognitive data by opening the file. In order to figure out whose survey and accompanying cognitive type went to each person, the paper surveys were grouped by sex and major, in an identical fashion to the cross sectional surveying done 15 years ago. Then each gender and major combination that we had contact information for received a spreadsheet that contained all of the members of that group and asked to point out which survey was theirs. They were supposed to connect to their survey through the demographic information gathered from the survey itself. The survey has the ages and occupations of the mother and father as well as siblings. Upon identifying themselves they were then asked to mail or email back their response along with a resume if everything went according to plan. As will be made apparent, not much went according to plan.

Originally there were ten male and female sample members of five different majors, resulting in a pool of 100 people. There was a spreadsheet with 120 names and locations and in Mark and Peter's cross sectional study they used 103 students, we seemed to be on the right track. However, things went awry rapidly. We were hearing little to nothing back from the alumni, and certainly nowhere near the numbers we would

need to compare a roughly comparable group of men and women. It then became necessary to examine what we had and locate any potential mistakes.

The first thing that was discovered was that the marked up hard copy of the class of 1990 did not have enough females. The ten males had been easily reached for the majors, but the women were in amazingly short supply, particularly in computer science. This was a problem because that means they started drawing from some other pool besides the class of 1990. We know this because the hard copy sheet contained 30 females and they ended up with 50 females, of whom 18 were mechanical engineers. Given these numbers the original surveyors Pietras and Francis were getting any woman they could to take the cognitive measure. They also had run into problems with generating enough chemical engineers, and then started to include chemistry majors as being close enough to chemical engineers to use in that pool. Before any attempts to contact have begun there is a very significant source of attrition. Since we do not know who they contacted as they departed from their original sampling frame for females.

Our next road block was the alumni office information. I have since learned that the alumni gateway is a self reporting system, and that alumni are expected to update their information periodically. It was apparent that they do not actually do this. Mail sent to these addresses was bounced back and even as I sent out the letters I knew there was no way that this person was still living in some apartment in Cambridge. A second wave was sent out after the first one after realizing that little of the data the alumni office gave us was updated.

I thank the alumni office for their help in giving me the information, but the way data was stored and given to me in excel was silly. When you put a person's full name

and year of graduation in one cell you make the whole thing resistant to being sorted or analyzed. The only way to look at it is sorting by first names, which would not be horrible if the other data I received wasn't sorted by last name. However, the worst part about the data was that it looks like it was manually alphabetized by last name, but in the 120 or so names a few were misplaced, out of order. This pushed everything off by a couple of cells. This caused some very vexing issues, with one person getting misplaced and having all the addresses shifted by one spot.

The last source of attrition to our pool is the human factor and the one we can least control. Some individuals will not want to disclose a resume, others will not care, or do not want to spend the time and whatever other reasons people can come up with. Others said the demographics did not fit them or that they would never have participated in such a study, so they did not even attempt to cooperate

In the end a total of eight resumes were received, 14 surveys were identified and 20 responses from letters and email came back. In an attempt to understand what we had done wrong I went and talked to the office of alumni relations to see if there were any missed opportunities or other paths I could have taken. I was informed that I had gotten a good response rate. I suppose given the fact that only eight members of the entire class of 1990 showed up for their reunion in October, they are probably right in thinking that 1 in 6 is pretty good.

V: A New Study

Despite the failure of this follow up effort, there are still questions about the GCSI as a career success measure that should be answered. The better we understand ourselves

the better we can educate ourselves and others, so there is still hope to go through with this study at another time. The question that needs to be asked and answered, is what would it take to have a successfully performed a longitudinal study of this type if we had planned it in the original study.

There is a new opportunity to do this study and do it right. There was a host of data collected about the classes of 2001-2003 that includes student cognitive types. There is a SPSS file for the class of 2002 containing roughly 100 variables. With a pool of over 600 students who arrived at WPI in August of 1998 and complete data we can do our best right from the start to eliminate as many confounding variables as possible. I have tagged over 100 students from the class of 2002 and "paired" them with a member of the opposite sex who shares virtually identical characteristics. These matched sets, are as close as possible to having identical graduation dates, academic success, major and cognitive profiles GCSI and when possible MBTI as well. There is a slew of potentially interesting data that can be gathered from these 2002 alumni as the data also includes high school transcripts, SATs and their performance at WPI on projects like the MQP. There needs to be some sort of agreement to keep track of them though, this cannot be done through self reporting as the Alumni office currently handles it. Some office within WPI would need to take the time to keep yearly and at the very least bi yearly tabs on these ex-students if there is going to be any hope of minimizing attrition of the pool of students in the study. It is worth noting that some attrition is expected and an additional 38 students have been matched up with others to allow for this. If this is done right there will be no need to ask them for a resume later, as we will have for every other year a job title, company and location. I would propose setting up a database as follows.

This is what I received

ID NUMBER	FULL NAME	DEGREE	BUSINESS ADDRESS	HOME ADDRESS	MARITAL STATUS	NUM OF CHILD	FRAT/SOR	EMAIL
A19900465	Lisa R. Ricker Allen '90	BS:MFE		221 Karnes Drive Nashville, TN 37064-5759 (615) 790-9637	Married	3		lallen124@attbi.com

By simply adding in columns like

Business Title 2006	Business Location 2006	Business Title 2007	Business Location 2007	Business Title 2008	Business Location 2008	Business Title 2009	Business Location 2009	Business Title 2010	Business Location 2010

It would be possible to have a group come in and look at this data set and be able to start making comparisons and watching the progression of this study in "real time". A study conducted right now on the class of 2002 could be highly informative. There are high school records, college records, and fours years out in the job market. This gives twelve years worth of information to analyze. Given how the students are matched up to eliminate confounding variables this could be made into a powerful study in its own right, above and beyond being a pilot study for the 1000 student population. There is the ever present fear of losing track of people, but if a group makes a special effort to stay in touch it should be very possible and informative.

The appendix holds the list of the 138 students we would like keep tabs on. They have been matched up using a filter process. First they had to be of the same major, then of the same GCSI type. Those are the first two priorities, however with the richness of the data set I then used graduation time as a factor, so that the paired individuals would enter the same job market. The last two filters were whether a student had earned distinction or not and also if they had matching MBTI types. The reason the students

were so carefully matched is because we would like to eliminate any potentially confounding variables

In conclusion there is a very interesting study that should be done on the cognitive information from WPI alumni. Our first attempts were thwarted by a variety of factors, some foreseen and others not. Having gone through the difficulties once before and now having an idea of where the troubles will come from I have selected a new group of students, the class of 2002, to follow up on. There is currently enough data gathered on them to do an interesting study, and if a group within WPI will make it their task to keep track of these selected individuals this study can be attempted again in ten years. At this point ten years out, we will have over 20 years of information on these careful selected people, and that would be grounds to make some claims on whether the theories presented here are valid. The most important thing that needs to be done to make this study a success is not losing track of where the alumni have gone. If we can successfully do that then there is a great opportunity for analysis and a very large study that is waiting to be done if we can prove that it is possible. This all depends on who we can find in a decade.

Appendix of Student Names

name	gender	grad4yr	major	GCSI	Honors	MBTI
Adams, Ashley Ann	F	#NULL!	CS	1		ESFJ
Correa, Luiz Felipe	M	#NULL!	BBI	4		ENTP
Corriveau, Nicole Pierrette	F	#NULL!	CS	3		ESTP
Dacunha, Christopher Mark	M	#NULL!	BBI	4		ENTP
Demars, Andrew Kenneth	M	#NULL!	CH	1		ISTJ
Foley, Anna Ruth	F	#NULL!	BE	4		INFP
Grant, Angela Marie	F	#NULL!	CE	2		ENFJ
Halvorsen, Louise Marie	F	#NULL!	BBI	1		ISFJ
Hill, Genevieve Marie	F	#NULL!	BC	4		ENTP
Johnson, Chris Nangar	M	#NULL!	EE	3		ISTP
Kurtz, Benjamin Larme	M	#NULL!	BE	4		ENTP
Lewis, Valerie	F	#NULL!	ME	4		ENTP
Mazzarelli, David Thomas	M	#NULL!	ME	4		INFP
McCue, Eileen Lydia	F	#NULL!	BE	2		INTJ
Mills, David Alexander	M	#NULL!	EE	4		ENTP
Mullen, Stephen Bernard	M	#NULL!	BBI	4		INTP
Polito, Michael Anthony	M	#NULL!	MG	2		ENTJ
Richardson, Christopher Tracy	M	#NULL!	BE	4		INTP
Rigsby, Theresa Katheryn	F	#NULL!	CS	1		ISTJ
Rouleau, Brian Robert	M	#NULL!	BBT	4		INTP
Schaffner, Brynn David	M	#NULL!	CS	3		ISTP
Shier, Leah Melissa	F	#NULL!	EE	4		INTP
Shirley, William Dean	M	#NULL!	CE	2		ENTJ
True, Joshua D	M	#NULL!	BE	3		ISFP
Wolff, Robert Charles	M	#NULL!	CS	4		INFP
Machon, Kris Machon	F	1	BBI	1		ESTJ
Powers, Brendan Michael	M	1	ME	4	1	INTP
Abrahamsen, Lauren Marie	F	1	CS	4	1	ENFP
Ackerman, Lucas Yates	M	1	CS	4	1	ENTP
Adams, Amy A	F	1	BC	4		ENTP
Adams, Corey Spencer	M	1	BBI	2		ENFJ
Ananiev, Eugeni E	M	1	BBI	4		INTP
Anderson, Shani Lee	F	1	BBT	4		ENFP
Armitstead, Suzanne Mareda	F	1	BBI	4		ENFP
Baker, Elisa Schulz	F	1	BBI	4	1	INTP
Blackwell, Brian Patrick	M	1	BE	3		ISTP
Blauvelt, Keri Elizabeth	F	1	ME	4	2	ENTP
Bliven, Amy Lynn	F	1	BBI	3		ESFP
Bolduc, Julie Ann	F	1	EE	1		ISTJ
Bowers, Rachel Ilyse	F	1	CM	2		INTJ
Brown, Jessica K	F	1	BE	4		ENFP
Bullio, Marc Christophe	M	1	CE	3		ESTP
Caldwell, Stephen Andrew	M	1	CM	4		INTP
Campbell, Meredith Leigh	F	1	CE	2	2	INFJ
Campo, Jodi Anne	F	1	EE	3		ISFP

Name	Sex		Code			Type
Caswell, Elizabeth Anne	F	1	CH	1	2	ISTJ
Cavallari, Daniel Joseph	M	1	ME	1	1	ESFJ
Christopher, Stephen James	M	1	BBI	2		INTJ
Coates, Rachel May	F	1	BBI	3	1	ISFP
Connery, Luke Stevenson	M	1	BBT	1		ESFJ
Daniels, Craig Edward	M	1	CM	2	1	ENTJ
Deluca, Lonnie Anne	F	1	ME	1	1	ESFJ
Dorrian, Jennifer Lynn	F	1	BBT	2		ENFJ
Duff, Michael Raymond	M	1	CH	1	1	ISTJ
Fowler, Richard Lawrance	M	1	EE	1		ISTJ
Fraizer, Meghan Ellene	F	1	ME	4	1	ENFP
Fyfield, Jahdiel Kyle	M	1	ME	3		ESTP
Gamache, Charles William	M	1	CM	4	2	ENTP
Gilman, Evan Andrew	M	1	ME	1	2	ESTJ
Gilson, Erin Elisabeth	F	1	BBI	3		ESFP
Goller, Carlos C	M	1	BBI	1	2	ISTJ
Green, Theresa Christine	F	1	BE	4		ENFP
Harley, Robert-Sean Patrick	M	1	BC	2		INFJ
Hart, James Joseph	M	1	CE	4	2	INTP
Howard, Nikole Kae	F	1	ME	2	2	INTJ
Howland, Tiffany Whittemore	F	1	MG	1		ISFJ
Hufnagle, Kerri Anne	F	1	ME	2	2	INFJ
Hughes, Alison	F	1	ME	1	2	ESTJ
Hull, Lynn Christine	F	1	CH	2		ENTJ
Hurynowicz, Jill Anne	F	1	CE	1		ISTJ
Jennings, Michelle Lynn	F	1	CE	4	1	INFP
Johnson, Katherine Elizabeth	F	1	CE	3	2	ISTP
Kahan, Jason Michael	M	1	BBI	4		ENFP
Kalinowski, James Michael	M	1	EE	1	1	ISTJ
Kenniston, Jody Lynn	F	1	CE	1		ESTJ
Kilty, Jason William	M	1	CE	3	1	ISTP
Koniers, James Peter	M	1	ME	1	1	ISTJ
Kosinski, Karen Claire	F	1	BBI	2	2	INFJ
Kozulin, Elena V	F	1	EE	1	1	ESTJ
Kuzsma, Richard C	M	1	CS	4	2	ENTP
Leblanc, Scott Edward	M	1	BBI	1	2	ISFJ
Lee, Kevin Fun	M	1	CE	2	2	INFJ
Lemire, Charles Romeo	M	1	BBI	4		INTP
Leonard, Robert John	M	1	CM	1		ISFJ
Leung, Woon Yee Jennif	F	1	CM	3	1	ESTP
Look, Jennifer	F	1	CS	4		INFP
Lovell, Sarah Anne	F	1	CM	4	1	INFP
Maisey, Heather Clair	F	1	BBI	2	2	INFJ
Marzullo, Jesse Michael	M	1	CM	4	2	ENFP
McHugh, Jaclyn	F	1	ME	1	1	ISTJ
Miller, Ian Anthony	M	1	CM	3	1	ISTP
Morgan, Melissa June	F	1	CS	4	2	INTP
Morin, Kimberly Mary	F	1	BC	1		ESTJ
Morrison, Joshua Philip	M	1	BBI	1		ISTJ
Murphy, Jill Elizabeth	F	1	ME	4	1	ENFP

Newman, Andrew Dennis	M	1	ME	3	2	ESFP
Ngo, Robin	M	1	EE	1		ESTJ
O'Brien, Daniel James	M	1	CE	4	1	INTP
Orlik, Gillian Elizabeth	F	1	BBI	2		INTJ
Paquette, Nicholas Paul	M	1	BC	2		INTJ
Patel, Hema R	F	1	CS	1		ISFJ
Paul, Laura Theresa	F	1	BBI	1		ISFJ
Redden, Robert Douglas	M	1	BBI	4	1	INFP
Richter, Starla Marie	F	1	CH	2	2	INTJ
Rojko, Christine B	F	1	CE	1	1	ESFJ
Rosendahl, Mikal Renee	F	1	CM	2		INTJ
Ryder, Burke Joseph	M	1	CS	4		INTP
Schady, Marianne	F	1	BBI	4		ENFP
Scharff, Sarah Elizabeth	F	1	CE	2	2	INTJ
Scherer, Ursa Gaia	F	1	ME	3		ESTP
Schmeer, Justin Stephen	M	1	ND	3		ISFP
Schoenmann, David Alan	M	1	ND	4		ENTP
Spino, George Carmino	M	1	CS	4	1	ENFP
Stanton, Mark Jason	M	1	CE	3	1	ESFP
Stern-Gottfried, Jamie	M	1	ME	4	1	ENFP
Steward, Victoria	F	1	ME	3	1	ISFP
Sullivan, Erin Marie	F	1	ME	2	1	ENTJ
Swaim, Calvin Faunce	M	1	CS	1		ISTJ
Swick, Zachary Stephen	M	1	ME	4	1	INTP
Syed, Nadia Shah	F	1	MG	1		ISFJ
Thomas, Jessa Anne	F	1	CE	1	2	ISTJ
Towne, Anthony H	M	1	ME	2	1	ENTJ
Vega, Nicole Marie	F	1	ND	4	2	INTP
Vitello, Peter Vincent	M	1	BBI	3	2	ESTP
White, Toby Jacob	M	1	ME	1	1	ESTJ
Williams, Nicholas Joseph	M	1	CE	1		ESFJ
Wood, Alycia Jean	F	1	CM	1	1	ISFJ
Yamartino, David Ernest	M	1	ME	2	2	INTJ
Zgambo, Frances-Feliz	F	1	BBI	2		ENFJ
Zhu, Karen (Yong Ci)	F	1	ND	3		ISTP
Zimet, Rachel E	F	1	CM	2	2	ENFJ
Zhu, Bai Lan	F	2	EE	1		ISTJ
Lashmit, David Christophe	M	2	MG	2		ENTJ
Boucher, Jeffrey Ian	M	2	CH	4		ENFP
Couture, Steven Edward	M	2	CH	1		ISFJ
Johansen, Peter Norman	M	2	BC	4		INTP
Swiatlowski, Sara Jean	F	2	CM	4	1	ENFP