05D001I

JMW - Soph-46

The Experience of the WPI Classes of 2002 and 2003: A Graduation Outcomes Study by Learning Styles

An Interactive Qualifying Report

submitted to the Faculty

of the

WORCESTER POLYTECHNIC INSTITUTE

In partial fulfillment of the requirements for the

Degree of Bachelor of Science

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Date March 13, 2005

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Abstract

The purpose of this project is to determine how students with specific learning styles have performed at Worcester Polytechnic Institute. The study is conducted using the class of 2002 and 2003 Myers-Briggs Type Indicator (MBTI). The psychological instrument was administered during each class's freshman orientation and performance data was requested by us from the WPI's Registrar. The MBTI is a world-renowned, but controversial personality test that has been around for over a half-century and has been used in hundreds of studies.

In order to determine how students performed at WPI we used information taken from the commencement program that is printed up when students graduate from college. Our goal was to determine whether certain MBTI learning types were more likely to graduate on time or late, whether they received distinction, and whether males outperformed females or vice versa. We discovered that of all the MBTI types, judging types outperformed perceiving types, females outperformed males, and those that graduated late were far less likely to earn distinction.

Acknowledgements

We would like to thank all those who helped us with our Interactive Qualifying Project. We would especially like to thank our advisor Prof. John Wilkes, Christopher M. O'Connor who helped us by installing SPSS on the computers in the laboratory. Also we would like to thank Shannon Christine Hoosick, Jesse Michael Marzullo, Tara Elizabeth Murphy, Greg Doerschler, and Nathan Corbin Shuler for their Interactive Qualifying Projects and the data sets from the Classes of 2002 and 2003. Without the predictions they made we would never have done the project.

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Introduction

Are certain types of people better adjusted to the type of environment created by a specific school than others? Are specific students more likely to graduate early or earn special academic awards? The purpose of this project is to determine how students with specific learning styles perform academically at Worcester Polytechnic Institute, a school that mixes courses with project based education to an unusual degree. By completing this analysis we hope to determine whether there is a specific type of learner that is unusually likely to thrive at WPI, and hopefully this type of study can be used at other colleges and universities to assist them in determining which of their students (by cognitive type) are most likely to thrive or struggle in the current system. This study could also shed new light into the admissions process of determining which students are worth taking a chance on when their academic record looks uneven.

The data sets we are initially looking at are the incoming classes of 2002 and 2003 that arrived together in August of 1998 and 1999 as freshman, not the students who will graduate in May of that year regardless of when they started. The large majority of students in each of those classes took a personality test during freshman orientation called the Myers-Briggs Type Indicator (MBTI). They also took a "creativity" test called the GCSI but that will not be the subject of this inquiry. The MBTI determines the subject's personality type and expresses it in four traits, each with two possible outcomes. There are 16 different possible personality types but often a study will focus on two of them to identify just four types of learners. In this study we will only be using two of the four personality factors (sensing-intuition, and judging-perception) and reduce the total

possibilities from 16 to four. This allows for a simpler statistical interpretation of the data. The four types when combined form the learning styles (SJ, SP, NJ, and NP – which we will discuss later in some detail). For now, the sensing-intuition dichotomy refers to how one processes information and the judgment-perception to the preferred task environment in terms of structure or specific definition.

In order to determine whether a specific learning type outperformed the others, we start first with a preliminary data set which included MBTI results for each class. MBTI type data was gathered from the students taken during freshman orientation. The data sets we received also included the student's name, high school transcript data, CIRP survey results, SAT scores, and the results from the MBTI test. The 2002 data set also included the GCSI measure taken during orientation. We removed the CIRP and GCSI data – as it was not relevant to the study – and added the graduation data, as stated earlier.

To analyze the data we will be using the SPSS program licensed and provided to us by WPI. This program has been used since the 1960s in many social science projects that require statistical analysis.

Original Proposal

Initially, our project was to be a follow-up study of two previous IQPs that looked at looked at the Freshman year at WPI. The first project was done by Hoosick and Marzullo and is titled Exploring the Potential for Data Mining at WPI. The second project was done by Tara Murphy and is titled First Year Experience for the Class of 2003. The existing projects examined the correlation between the four learning styles we are looking at and the performance of those same freshman year students we will be

studying. The term by term grades in the quarter system at WPI revealed distinguishable trends.

The goal of our initial project was to continue the examination of the freshman year project into the Sophomore year. We intended to pick up where the freshman projects left off and continue examination of the effect of the four learning styles on student performance, term by term for very sophomore year.

However, when we requested the Sophomore data the release of which was already approved, no one, including the registrar, could get the Banner Software "view" created for our advisor Prof. Wilkes to work. They claimed they were "too busy" to rewrite it. Those responsible for providing the data claim they were never 'able' to deliver. In fact, after fourteen weeks of asking, requesting, and sometimes even complaining about our missing data, we were still empty-handed. We therefore had no choice but to develop a new focus for our research, and abandoned all of our theorizing about the challenges of the Sophomore year. It was then – fourteen weeks into our 'project' – that we shifted the project to focus on published, publicly available four year outcome data for the same classes rather than the Sophomore transcripts.

Literature Review

The MBTI, or Myers-Briggs Type Indicator, is a psychological test originally developed by Isabel Briggs Myers and her mother Katharine Cook Briggs. It was developed to determine a person's personality with much of it based on the work of Swiss psychologist C. G. Jung[1]. The MBTI looks at four categories of personality traits, which are viewed as dichotomous, and uses them as indicators of learning styles. Because of its simple conception and highly developed literature personality theory it has become one of the most widely used personality tests in the world, with two million tests given each year.[2]

Myers began work on the MBTI beginning in 1942, after several years of studying the work of Swiss psychologist C. G. Jung. Both Myers and her mother had previously studied Jung's work for nearly two decades and theorized that people could benefit from knowing what is their personality type is. Jung believed that all people could be categorized by four mental processes and two types of attitudes towards the world. The processes included sensing, intuition, thinking and feeling while the two attitudes towards the world were introverted and extraverted.[3] There are three assumptions Jung made concerning his personality types. The first is that every person has a true preference, that each person is using one type of thinking or a specific attitude over the other. Although certain people may occasionally switch between the two dimensions, they will initially look at a problem using their preferred way of processing information and coming to decision first then attempt to rationalize the problem using that way of

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[1] Lawrence, 3.
[2] Myers, MBTI Manual, 9.
[3] Ibid, 3.

thinking. The second assumption is that people can reveal their type, directly or indirectly, through self-reporting. This is important because it means that tests can be given to determine the person's personality type. The third assumption is that each preference is dichotomized and that each of the two poles is equally important in life. One type of thinking is not superior to the other but is more useful in certain situations that the other one is not, and vice-versa.[4]

Jung believed that people are born with a predisposition to a specific type and they develop that personality over time. Your environment does not determine your personality but it does affect how it develops. A good environment exercises ones personality type by giving one confidence to make decisions and teaching one when less preferred modes of thinking are called for. A bad environment discourages ones development of a balanced personality type by thwarting the preference, or not allowing for anything else; the person may find this discouraging and difficult to tolerate. Eventually the person may grow up being proficient in neither skill and will have difficulty making decisions and choosing the right method to approach problems.[5]

During the 1950s Myers began a long and arduous study of over 5000 medical students. She followed up with the students five years later to see what different personality types achieved academically (a precedent for this study), and continued to do so into the 60s. These findings helped Myers solidify her theories for the MBTI, which she continued to develop until her death in 1980. In 1957 the Education Testing Service discovered her work and subsequently published it as a new research instrument in 1962. Eventually the ETS lost interest in it and released its rights to the Consulting

[4] Ibid, 11.
[5] Ibid, 28.

Psychologists Press and since then under the auspices of the CPP it has become most widely used personality test in the world.

Personality Types

The Myers-Briggs Type Indicator is based on four different characteristics or personality dimensions. Each dimension is measured as "a continuum between opposite extremes,"[6] however, conceptually the dimensions are dichotomous.

Extraverts and Introverts

The first of the four dimensions is whether the person prefers to interact directly with the outside world or whether they prefer to occupy themselves with internal concerns. Those that focus on the world apart from themselves are called "extraverts" while those who focus inwardly are called "introverts."

The extraverts focus primarily on what is going on "based on outward stimuli"[7]. They are usually very outgoing and try to experience new sensations and usually respond based on how others previously react to them. Because extraverts require outward stimuli, they often have multiple relationships and need continual encouragement for emotional security. Extraverts would rather experience something before they think about whether they will enjoy it or not[8].

Extraverts are not the most independent people; in the most extreme cases because of their outwardness they require the feedback of others before they can make

[6] Tieger, 12.
[7] Myers Gift Differing, 53.
[8] Ibid, 53.

their own decisions. They are more likely to become conformist than introverts, and may have an ideology of accepting popular values instead of creating their own ideology. In extreme cases extroverts can become completely dependent on the will of others, acting solely for their benefit rather than themselves.[9]

Introverts do not focus as much on the outside world but are more independent and focus on themselves instead. Their inwardness involves much self-reflection in their decision making, and they tend to be more cautious than extraverts and undertake actions with more predictable outcomes. Because they are less dependent on the opinions of others, they derive more appreciation from their work because they are not reliant on others to judge their work for them. Their opinions are generally reserved and typically cannot be changed by a loss of popularity for the position they hold.[10]

The introvert is usually more focused on his or her own inward aspects. If their views do not coincide with the outside world, they may become detached from exterior concerns. This can lead to remoteness or suppression. Being more focused on concepts they are familiar with, introverts are less likely to take risks. When attempting new things, their reliance on their own judgment (rather than those with more experience) may result in careless errors and mistakes. Their inward concern at times is associated with self-centeredness, concerned only with themselves rather than those around them. The extreme cases lose touch with the outside world and become completely cut-off from outside influence.[11]

Both extraversion and introversion can affect social preference, and though the E-I dimension can help determine a student's performance in the elementary school level it

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[9] Ibid, 56.
[10] Ibid, 56.
[11] Ibid, 56.

is rarely associated with academic performance at the college level. Therefore, while the extravert/introvert dimension is mentioned, it will not be used as part of the learning styles indicator when comparing students in terms of academic success at WPI.

Sensing and Intuition

The second dimension type deals with what type of information the person is generally concerned with how they process information and their time frame, future, or here and now. The sensors prefer to deal with what can be confirmed through the five senses. These people are generally concerned with what can be seen, heard, tasted, felt, or smelled. They are pragmatic and present oriented. Those of the other type, those that rely on intuition, generally do not focus on what they sense but on what things mean symbolically. They look not as how something appears in front of them but what types of relationships it forms either between objects, people, or ideas. While those that "sense" trust their personal experience, those who use their intuition prefer to use their imagination and value inspiration more, as the focus on future possibilities and longer term implications.

As noted above, sensors try to look at the world realistically or pragmatically, in the here and now, rather than conceptually. They are often more likely to trust something that appears in front of them rather than the future potential of something conceptually possible but not proven yet. Because they prefer to focus specifically on what they can handle and manipulate, they prefer working with the present rather than the abstract past or future. They are very aware of practical restraints in their external environment but not in the same that extraverts are. Sensors make their decisions based on what they acquire

by the five senses, but that does not mean the thought was triggered or stimulated externally.[12]

Sensors tend to focus on whatever is happening around them at the moment and oftentimes they do not take into consideration what is happening on the abstract level. They sometimes are unable to grasp the "big picture" of certain problems, or unable to see the long-term effects of specific actions. Their concern with the present often overshadows what previously happened in the past or what may happen in the future. Indirect or circumstantial evidence – experience or information gathered by someone else – is not trusted as "objective" in the way that their own personal experience would be trusted. Sensors also avoid situations where their senses are hindered or suppressed and they have to rely on instruments to tell what is going on.[13]

Those who use intuition do not focus as much on the senses but focus on the possibilities in a situation. They use more conceptual types of evidence such as writings, concepts, or ideas. They prefer to "read between the lines," using more subjective and less objective data. When faced with a problem they generally use their imagination and also value inspiration in their decision making. Rather than focusing on the present concerns, they try to look at what has happened in the past or try to predict the future outcome by predicting or extrapolating trends. They may present data that may be interpreted not through a tangible medium but through metaphors and analogies. Intuition is also more associated with higher level education; numerous studies have shown that a higher proportion of intuitives attend colleges and universities than those who prefer to use their senses.[14]

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[12] Ibid, 63.
[13] Ibid, 63.
[14] Ibid, 63.

While those that rely on intuition are concerned with the outcomes, the problem is that they do not consider the current realities that are occurring and shaping the future by altering the immediate context of decisions. Their thought analysis becomes flawed when they focus too much on the idealistic imagination and not on checking their facts and practicality, which may lead to a lack of understanding or a digression from the main problem. Those who are intuitive do not like situations where a great deal of concentration and attention to detail is necessary and would rather think out the range of possibilities for how to solve a problem than focus on the task at hand.[15]

Thinking and Feeling

Thinkers and feelers differ in how they prefer to make decisions based on the information one has gathered. Those who are thinkers view the world impersonally and are concerned specifically with the subject at hand. They view information as being beneficial or detrimental, true or false, black or white. Through rigorous logical analysis, an objective solution can be obtained. Feelers do not try to interpret information as being right or wrong but as a varying scale. They are occasionally seen as not taking specific sides but are looking for the balancing point, the equilibrium between the two extremes. Feelers do not look at problems "objectively" but take into account experiences and personal values in their style of rational decision making. This is also the only dimension

[15] Ibid, 63.

that has a substantial gender difference, where the majority of men are thinkers and the majority of women are feelers, though the population on a whole is about even divided. [16]

While many people use both types of information in their decision making, those who prefer thinking to feeling tend to analyze facts rather than weigh opinions. Thinkers back up their judgment using facts and data and in their statements try to be brief and businesslike. In convincing others they will try to be "more truthful than tactful,"[17] relying on information rather than empathy to convey an argument. Later in life thinkers are more likely to benefit society through science and research, and emphasize justice at the expense of harmony.[18]

Thinkers prefer to look at the world as either black and white, and while that works well with objects subject to specific reference, it does not work as well on subjective referents such as people or opinions. People do not like being seen as objects, and even the thinkers themselves prefer not to view themselves in such a manner. Thinkers may have trouble developing convincing arguments about subjective matters such as habits, customs or beliefs. Also extreme thinkers suppress their empathy and feelings in their conclusions which may lead to unethical decisions.[19]

Feelers try to look at the world subjectively and may base their decisions on their own opinions instead of objective facts and figures. Not only are they able to interpret other people's opinions but also to convey their own in a progressive manner. Feelers are more sociable and naturally friendly, taking the time to tell a story rather than abbreviate facts. Because their opinions are based on feelings rather than figures, they are more likely to make decisions based on their moral judgment. More women are feelers than

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[16] Ibid, 65. *New studies using new Form M have challenged Isabel's 60:40 estimates for both sexes. The men are portrayed as roughly 50-50 but 75% of women have the F preference.
[17] Ibid, 68.
[18] Ibid, 68.
[19] Ibid, 68.

men, and thus cultural generalizations about women tend to portray them as being emotional, sentimental, and empathetic. Actually, that is not the case for an important minority of women, and it is case for an important minority of men. The difference is in cognitive style rather than gender per se.[20]

A potential weakness in feelers is that by relying on their own opinion their decisions are subject to change over time. Their decisions may then be considered illogical or inconsistent and when acting out in public discussion they may have a hard time convincing others of their argument's merit due to inconsistencies in logic or presentation of the argument. Feelers also tend to be tactful instead of truthful in arguing their case. Feelers also have difficulty being "businesslike", and when presenting their case "may ramble and repeat themselves with more details than necessary"[21] or diverge from the subject to bring in personal experience or to make an emotional appeal. Although their actions may be morally justified to them, they may have a hard time convincing others in settings that stress dispassionate, ends-oriented, and rational decision making on objective grounds.[22]

Judgment and Perceptive

The final dimension is related to how a person organizes tasks and how they prefer to live life. People with the judgment personality type prefer to have things settled while people of the perceiving type prefer to have things left up in the air and subject to change.

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[20] Ibid, 68.
[21] Ibid, 68.
[22] Ibid, 68.

People who are of the judgment personality type are only satisfied when things are done; they do not like incompleteness, lack of closure, and procrastination. In order to live with completed tasks they will in most part follow a routine to do things by, stressing structure and dependency on scheduled routines. They are also known to be decisive in their decisions and also stubborn in sticking to them as circumstances change. Everything done must have a benefiting purpose to the overall scheme of things.[23]

The drawback is that life is never completely predictable and changes occur randomly. The judgment personality type does not like surprises, and when faced with changes may not be able to accommodate them into their personal schedule without sacrificing the lead times they need to feel comfortable and prepared. Judgment personality types prefer to make decisions well in advance of acting on them, therefore unexpected urgencies that require immediate action tend to bring judgment types the most discomfort. Discomfort causes them to be critical and try to take control of things, and get them back on track.[24]

While judgment types have an ethic of "Work first, Play later," perceptive types prefer to be more relaxed and say "Play whenever, work later." Perceptive types prefer to have an open schedule with lots of free time to do their work, and during that time they prefer to think about how to approach the problem. In fact many P's work all the time as they do not distinguish work from pleasure. They don't get around to what they do not like to do unless outside events create a pressure to do so. They are curious about the possibilities of their actions and live for the experience rather than the conclusion. Unlike the structured judgment types, the perceptive types are elastic in their schedules, adapting to new situations and changes. They see time as a renewable resource although

[23] Ibid, 69.
[24] Ibid, 75.

not infinite. Overall they would rather bear witness and understand what is taking place than act upon the situation and shape it, they do not like to commit to a plan while gathering info so all their commitments are "tentative" and subject to change as the situation clarifies.[25]

The problem with the perception type is that if they wait too long they get nothing accomplished. Perception types' weakness is that they are liable to be procrastinators, putting tasks off until the very end. This comes from their desire not to make decisions before waiting to see if something occurs that would change the result or even make the task unnecessary. Perceptive types are spontaneous, but because of that they tend to stop working on projects that lose their interest until an externally imposed deadline intervention. In the worst case, perception types procrastinate to the point that nothing is accomplished and it is too late to change the result.[26]

[25] Ibid, 72.
[26] Ibid, 75.

Data Collection

As stated before, the MBTI deals with classifying people into certain personality types. It does this by having subjects fill out a 126 item questionnaire and then determining what their dimension types is by the pattern of their answers. There are 16 combinations between four groups with two dimensions in each group. Occasionally in small data sets there are too many types to make adequate conclusions. Therefore for this project we are going to look specifically at two personality di8mensions with a total of four different "type" groupings: Sensing-Judging, Intuition-Judging, Sensing-Perceiving, and Intuition-Perceiving. The decision to use these four is based as much on empirical experience in examining the Freshman year experience of these students as any theoretical grounds for using these two dimensions. Indeed, theoretically the J-P dimension is important only for deciding what a person's dominant characteristic is in the four letter type sequence. It was not part of Jung's original theory at all. Nevertheless how a person organizes tasks is very important academically and therefore essential in our study.

Sensing-Judging

The sensing-judging (SJ) personality has a sense of responsibility and duty to the work that they must do. That means that they feel they must do their work to their fullest ability before they can move past their work. The SJ personality also makes a great leader with a traditional style of leadership. This traditional style allows the SJ to be very thorough and task-oriented with the people that work for them. They do everything by

the rules that they have been taught. They make the work very structured and logical on the way to making the final product efficiently and correct. They know exactly what has to be done in order to complete the project and oftentimes does background research to find the easiest way to get the final product. If the process does not end up being correct, because they are traditional leaders they will often take the blame for the mishaps. The SJ personality wants to be known as a dependable person in their everyday lives. One of the things that can get the SJ personality type into trouble is that they can be too rigid and logical, sometimes called "bureaucratic," when trying to solve problems in their lives. They are sometimes known as "guardians"[27] or "organizers."[28]

Intuition-Judging

Intuition-Judging (NJ's) prefer intuition perception and are drawn to information that is more abstract and having to do with the big picture. They are conceptual and very good at seeing patterns and meanings. They have a good imagination and have the ability to "read between the lines." They see present possibilities as well as possibilities for the future. They do not believe to take life for granted and try to see everything around them. Their judging attitude makes them prefer to lead and they take pride in organizing and planning events. They like to be in control and are always striving for the goals they set for themselves. They try to get the job completed as soon as possible, even if it may not be completed in its entirety. They are considered Entrepreneurial and innovative

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[27] "MBTI Scientific Analysis," Edited by Quipper. n.d. Yahoo Geocities. <http://www.geocities.com/enematic5000/mbti.html> (14 Feb. 2005).

[28] "MBTI Training Example," Interax. <www.interaxcorp.com/MBTI/training_example_1.htm> (14 Feb. 2005).

managers who think big, but stay focused on the task at hand, especially in terms of meeting deadlines. They are known as "planners".[29]

Sensing-Perceiving

The sensing-perceiving (SP) personality types are people that have a lively personality and a creative mind when it comes to making incremental improvements. Some credit them with "ingenuity." They are very resourceful in their work by finding ways to get things done when it does not seem feasible. The leadership qualities that the SP personality type has are that they are great at troubleshooting. When asked to solve a problem they work to try to find the least problematic solution to the immediate issue. They fix and patch. They do not address the underlying problem and solve it for all time elegantly. Although they are often considered creative, they still follow the guidelines that they have been taught. SP's fit into jobs that rely on people to think quickly and try to find the solution with the least complications, such as negotiators or firefighters. For SP's to do their best work, they need the freedom to work things out as they see fit and not allow others to interfere with the way they take to accomplish the task. SP's do not mind taking risks as long as it helps them reach their goals more efficiently. They do rather well when they have to deal with something entirely new in their workplace on the fly, and be the first ones to come up with a way to reach the desired goal. The SP's do not mind surprises because they are ready for everything armed with what they have

[29] Ibid.

personally learned in the past. They are not deep thinking and conceptual or theoretically minded. SP's are also known as the Artisan type[30] or "troubleshooters."[31]

Intuition-Perceiving

Intuition-perception types (NPs) prefer intuitive perception and are drawn to information that is more abstract and having to do with the big-picture. They are conceptual and very good at seeing patterns and meanings. They have a good imagination and have the ability to "read between the lines." They see present possibilities as well as possibilities for the future and consider them equally important. They do not believe and take for granted everything they see around them as the apparent realities of a situation are to them superficial, changeable and sometimes misleading or even contrived. NPs tend to have difficulty focusing on specific tasks, and may take apparent problems for granted. They rarely live in the present, and prefer their lives to be full of flexibility. Because of that they imagine future possibilities but rarely plan out future events. They are also known as "dreamers."[32]

Previous IQPs

Three previous IQPs found that there existed distinct relationships between students' MBTI information and their term grades. The first one was done by Hoosick

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[30] "MBTI Scientific Analysis," Edited by Quipper. n.d. Yahoo Geocities. <http://www.geocities.com/enematic5000/mbti.html> (14 Feb. 2005).

[31] "MBTI Training Example," Interax. <www.interaxcorp.com/MBTI/training_example_1.htm> (14 Feb. 2005).

[32] Ibid.

and Marzullo and was titled Exploring the Potential for Data Mining at WPI. For this project they obtained students MBTI data and compared it with WPI Freshman grade data. They used data obtained by Greg Doerschler and used it for their data mining project. Although they did data reports on all types, the S/N and J/P preferences are the ones we are interested in since they indicate the learning type of the students.

From the data they obtained they reported that SJs on average had the highest GPA for all four terms, further, the performed steadily at about the same level from term to term. They are followed by NJs, then NPs, and finally the SPs. After the types recovered from a B-term slump, the SPs stood out as they did a dramatic climb during C-term and D-term. Overall, the SJ's were consistent performers to NP's and NJ's eroded as the year wore on and the SP's crashed early and rebounded strongly. D-term in fact was the best term for the SPs while the NP's and NJ's had their lowest average grades in D-term (Fig. 1). Were the SPs going to continue to rebound or be erratic for all four years? Are the results reflected in their graduation data?

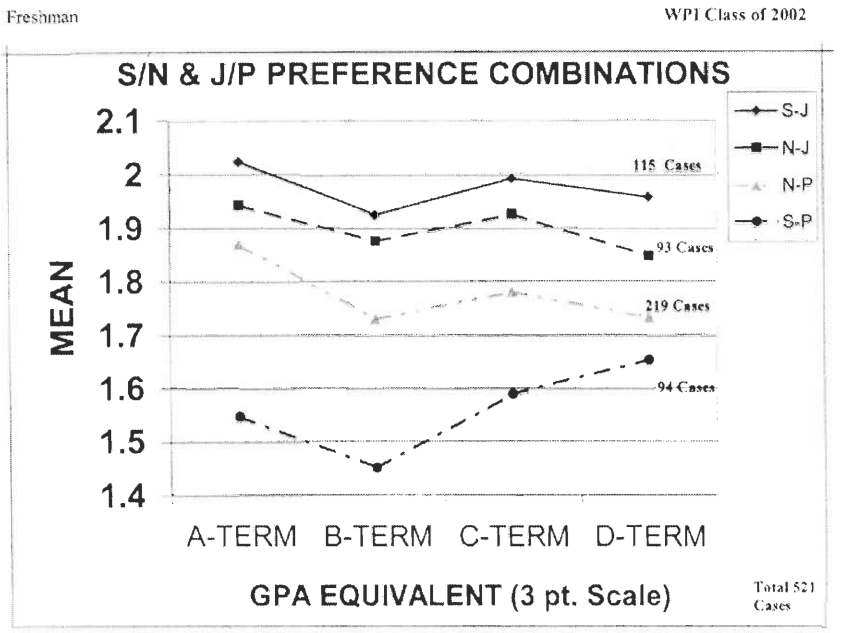


Figure 1: 2002 Average Term Grades Distributed by Learning Style[33]

The second IQP was done by Tara Murphy and is titled First Year Experience for the Class of 2003. The purpose of her IQP was "To one day predict which students are most susceptible to academic troubles and provide them timely support."[34] Part of the information she used was the MBTI data collected during freshman orientation. In it, while the SJs, NJs, and NPs trends appeared to be identical, the SPs got the highest grades A-term, then drop to the lowest for B-term. The SPs do not stay at the bottom for long though for in C-term they rise to be equal to SJs and in D-term they surpass the SJs and again become the learning type with the highest grades (Fig. 2). Does this trend continue for the SJs to graduation?

[33] Hoosick.
[34] Murphy, pg. 5.

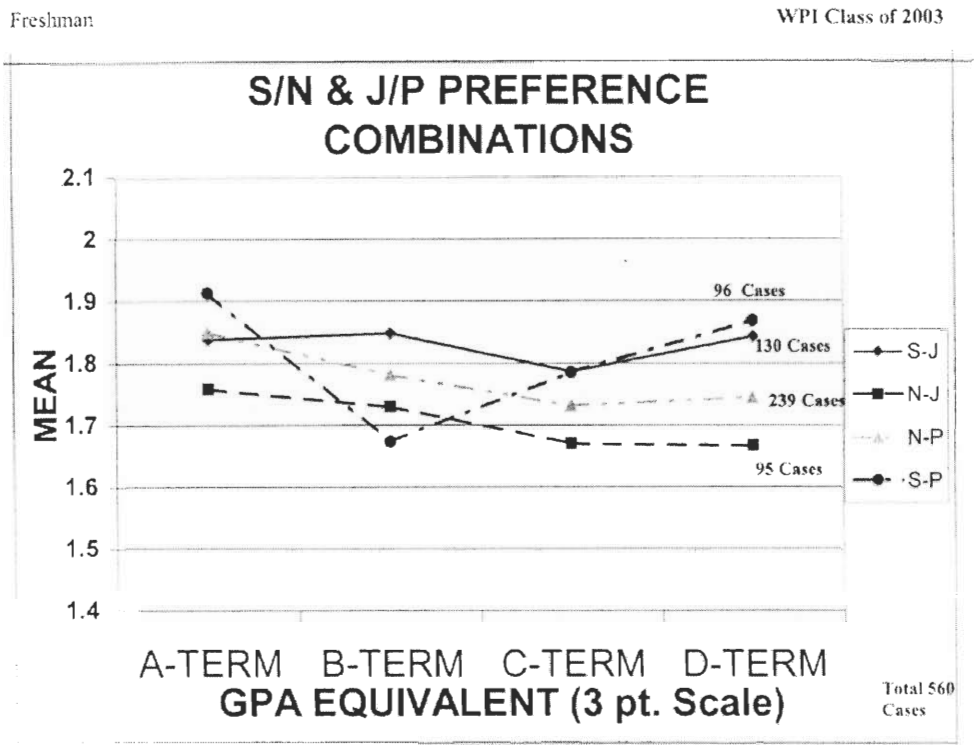


Figure 2: 2003 Average Term Grades Distributed by Learning Style[35]

Finally the third IQP relating MBTI type to academic performance was done by Nathan C. Shuler and is titled *Timely Feedback Study: An Investigation of the Feasibility of Identifying At-Risk Students Based on Personality Type and Initial Grades*. In the study he looked at two different classes and found relationships between learning styles and average grades. In the first class (Signal's Analysis in ECE) NJs on average had the highest grades, followed by SJs, then by NPs and finally SPs. In the second class he looked at (Linear Algebra in Math), NJs had the highest grades again, followed by SJs, then by SPs, and finally NPs. The results are illustrated in Table 1, which shows the grade distribution for each learning type. From these results he concluded that NJs had the highest chance of earning high grades for these classes and that there is a correlation

[35] Ibid.

between class grades and learning styles. Further, he concluded that the SP group is not always the weakest performer and that J's perform better at WPI than P's.

Table 1: Grade Distribution by Learning Style Types of Nathan Shuler's IQP[36]

WPI EE2311 Signal Analysis B term 2002

Learning Style	A	B	C	Not Passing
N-J (19 cases)	47%	32%	16%	5%
S-J (33cases)	36%	24%	30%	9%
N-P (27 cases)	30%	15%	30%	26%
S-P (19 cases)	16%	26%	26%	32%
Total (98)	33%	24%	27%	17%

WPI Math 2070 Linear Algebra B term 2002

Learning Style	A	B	C	Not Passing
N-J (22 cases)	59%	18%	23%	0%
S-J (26cases)	50%	35%	8%	8%
N-P (36cases)	19%	42%	25%	14%
S-P (17 cases)	35%	29%	24%	12%
Total (98)	39%	33%	20%	9%

[36] Shuler.

Methodology

The original plan for this study was find out if a relationship exists between student MBTI results and their sophomore year performance as measured by average grade each term. When the sophomore data was not obtained we switched to their four year graduation data as determined by the commencement program for the year they graduated. We used the freshman transcript data from the classes of 2002 and 2003 and the commencement programs of the 2002, 2003, and 2004 graduation years since some 40% of the students graduate late. The first step was to obtain the existing data sets covering the Freshman year and the MBTI. Once the commencement data were entered and the freshman and commencement data linked together, looking for relationships between the two sets and determining the outcomes of different types of learners during their four years at WPI could be undertaken.

In order to collect the graduation data of the students, information was taken from the WPI Commencement program for the years from 2002 to 2004. They specified which students graduated, when they graduated, whether they graduated with distinction or high distinction, and whether they received any special academic awards.
The combined Freshman – Senior data set allowed us to determine a student's MBTI type and then jump to outcome data such as how long it took them to graduate, how well their fours years at WPI went academically (i.e. whether they graduated with distinction or high distinction) and estimate their degree of success.

Although we should have information on most of the students, some students we do not expect to have MBTI information on. Students we have graduation information on but no MBTI information are probably those that either missed orientation or transfer students who were not asked to take the MBTI. Students who we have MBTI

information but do not have graduation information are those who dropped out, transferred, or those who still have not graduated and are still taking classes at WPI. Students who have no MBTI information or no graduation information are excluded from some analysis in our study, but we still need those with no graduation information to assess the quality of the overall data set. Those who were here as freshman but never graduated are still of interest for they can help us determine which types are more likely to either not succeed at WPI, leave for work, or transfer to another college.

Year comparison

Some comparisons between the two years were made before the data was analyzed. Certain aspects of the graduating classes of both years were looked at, including: number of students, gender, MBTI types, and graduation times.

The class of 2002 consisted of 563 valid cases; meaning cases in which we had sufficient data for analysis. Of the 563 cases, 22.7% were female and the remaining 77.3% were male (Fig. 1). Of the cases, the MBTI type was broken down as follows: 21.4% SJ, 17.1% NJ, 19.0% SP, and 42.5% NP (Fig. 2).

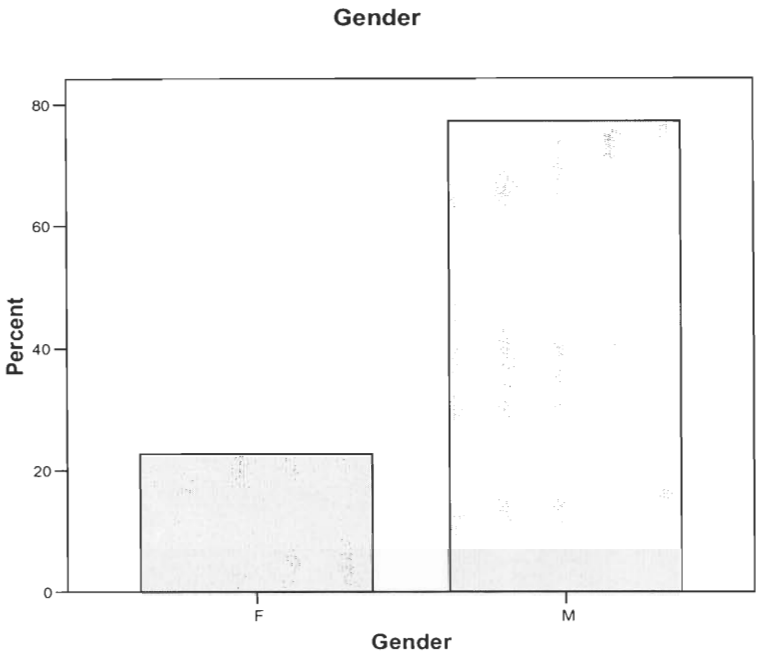


Figure 3: 2002 Gender Frequencies

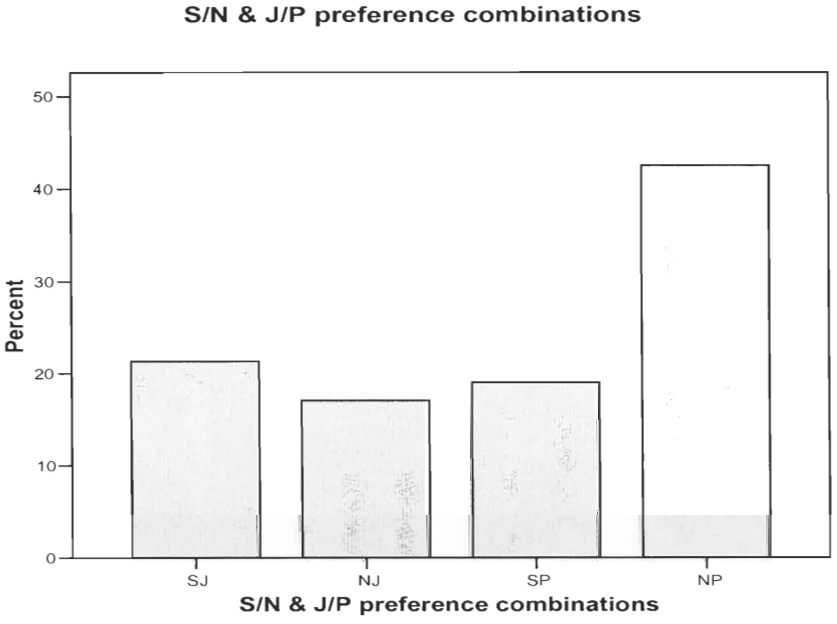


Figure 4: 2002 MBTI Type Frequencies

The class of 2003 consisted of a total of 690 valid cases. Of the 690 cases, 24.8% were female leaving 75.2% males (fig. 4). The MBTI type breakdown of the class of 2003 was as follows: 22.5% SJ, 17.2% NJ, 17.0% SP, and 43.3% NP (Fig. 4).

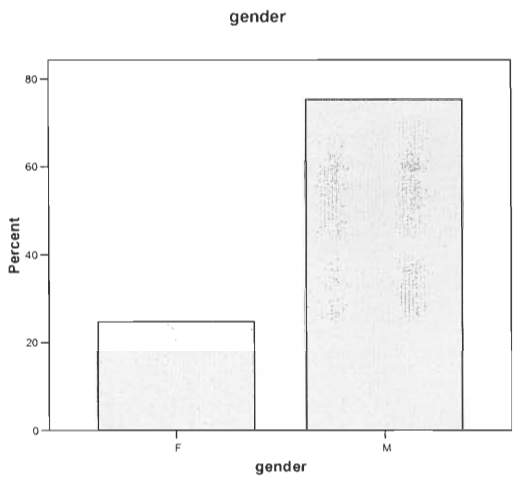


Figure 5: 2003 Gender Frequencies

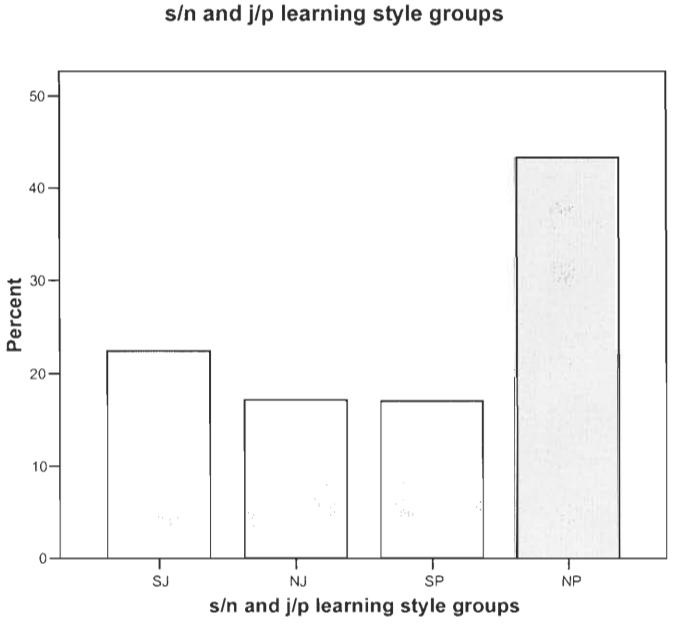


Figure 6: 2003 MBTI Type Frequencies

The question at the time was whether type distribution of the class of 2002 data would replicate. It did in part for 2003. What did not look the same was the higher SAT scores for the NP's (over 1300) compared to 1245 for the SP and ST type. For the class

of 2003 the average SAT scores were comparable between all four types. Also, the rank ordering changed as the NJ's were not as strong as in the prior class and the SP's were stronger. These results are shown in Fig. 7.

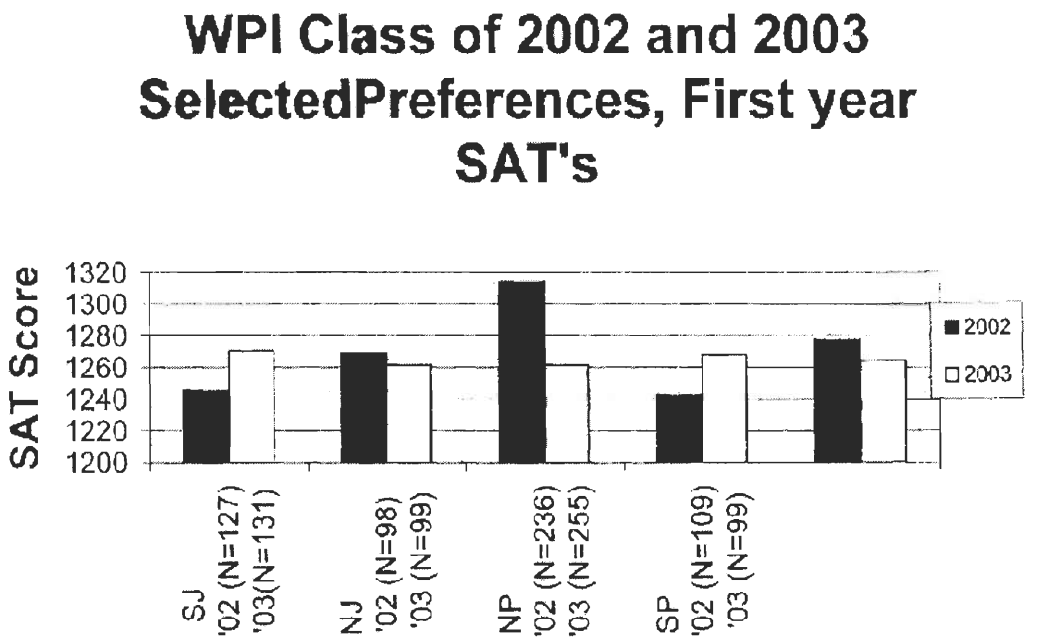


Figure 7: 2002 and 2003 First Year SAT Performance[37]

One could speculate that the varying SAT scores could be a reason why the average grades by term for each learning style differ between the years. However, one observable trend was that the SP's did their B-term plunge for both years, though in this case they dropped from a B average to a C rather than from a C to NR (see Figure 1 and Figure 2). The SJs were still the consistent "stars" of the class. The performance of the NP's in the two years was indistinguishable even though the average SAT scores of the NP group had dropped an average of 60 points from one year to the next. How will these differences in SAT scores between each learning style affect their graduation data?

[37] Hoosick and Murphy.

Hypotheses

The purpose of this study is to determine if a specific learning type seems to disproportionately strive or struggle at WPI. If a higher percentage in one group graduates on time than the other groups, or has more students with distinction and high distinction, then it is reasonable to assume that they are better suited to the four-term school year and the many projects students have to complete in the WPI education system.

Conceptually the NJs are more likely to perform better at WPI than the other groups. Their intuition allows them to have an easier time solving conceptual or engineering problems while their judgment trait also motivates them to organize their work and get more things accomplished on-time. This is especially helpful at WPI since the seven-week terms go by quickly and unless you are organized you are likely to fall behind. It is very rare that a student is given enough time to make-up their work or catch up if behind. Hypothetically this group should be more attuned to the type of workload a student is likely to face. Supporting this hypothesis is the study of two sophomore year classes by Nathan C. Shuler in his IQP. He studied two classes at WPI and found that NJs were more likely to succeed in those classes compared to the other types. The results indicated, as mentioned earlier and expressed in Table 1, that the NJs received the most A's in both classes. NJs during the Freshman year studies never received the highest grades, but that could be because Freshman classes do not focus as much on rigorous scientific and mathematical applications as later WPI classes. We predict that as the years progress and the WPI courses require more intuitive thinking and judgmental organization, the NJs will perform better and eventually graduate with the most distinction.

Are students who graduate late less likely to earn distinction? If students who graduate late are less likely to have distinction, then it is likely that they had a hard time passing classes and may have had to take a few over again. On the other hand students who graduate late might have wanted to put more time into their classes and pass with high grades rather than just pass. Many times students who graduate late are trying to complete a double major or may have transferred majors. Students may also need to graduate late if their projects get held up and they are unable to complete them before graduation. One issue that complicates our efforts at finding out whether students failed classes and then made them up for a higher grade is because when a student fails it is not recorded in their transcript. By ordinary means, it is impossible to determine whether a student fails a class therefore it is to the advantage of the student to take classes over in order to get a higher grade. Our prediction is that students who graduate late have the same chance of earning distinction as if they graduate on time because we believe that many students graduate late because of either projects or to switch majors and end up behind for reasons that have little to do with academic ability or even class performance.

One final relationship we are trying to determine is whether there is a substantial difference between graduation data and gender. It is often assumed that gender plays an important role, that men are more "inclined" at engineering and science due to their socialization and therefore on average outperform women. On the other hand, the women of WPI are far from typical among women in general and may be a more "select" student population, despite the fact that their SAT scores are not higher than those of the men at WPI. Is this expressed in graduation data, that women are less or more likely to earn distinction and less or more likely to graduate late? What effect does the ratio between men and women have at WPI? We hypothesize that there is no difference

between the genders in academic performance, and that while there are fewer women at WPI than men we believe that the average chance of distinction and the rate of graduation are the same.

Results

Of the 563 eligible cases for the class of 2002, 64.1% were known to graduate in 4 years or less, with the remaining 35.9% known to graduate in more than 4 years. The class of 2003 consisted of 389 students graduating in 4 years or less – 56.4% - and the remaining 43.6% taking longer than 4 years to graduate. It seems that the class of 2002 was either stronger academically, less likely to change majors, or lose time on overseas exchange programs than the class of 2003.

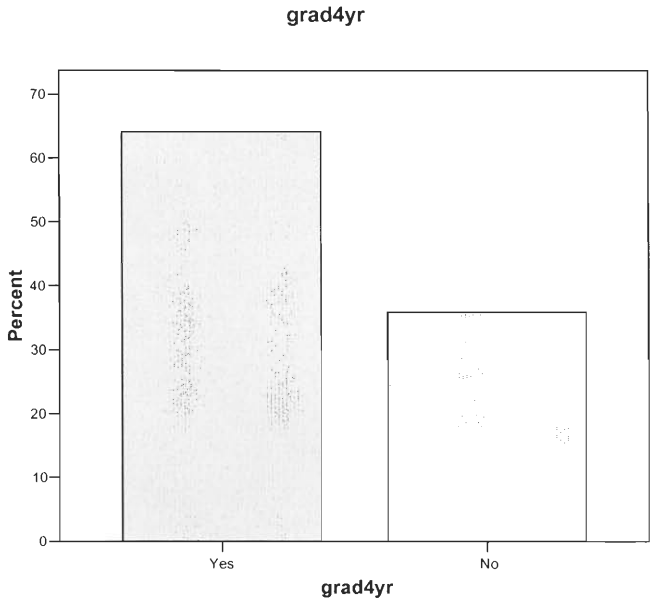


Figure 8: 2002 Graduation Time Frequencies

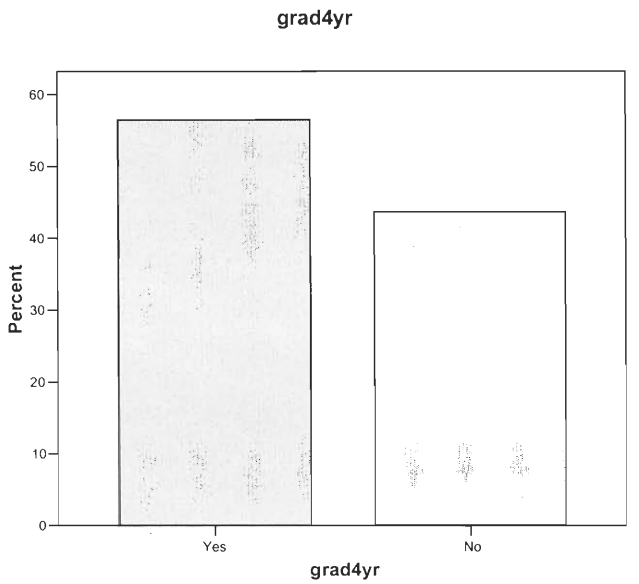


Figure 9: 2003 Graduation Time Frequencies

The MBTI learning types were tabulated with their respective graduation times for both years, 2002 and 2003.

For the class of 2002 (Table 2), the NJs had the highest graduation percentage at the 4 year mark with 72.9%. However, they only have a slight lead over the SJs with a graduation percentage of 70.8%. The NJs lead for only a short time because by the 4.5 year mark the SJs overtook the NJs to have the higher cumulative percentage – 77.4% for the SJs compared to 74.9% for the NJs. In the end, the SJs had the highest cumulative percentage – 83.2% - when all graduation data was accounted for. The NJs, though starting with the highest graduation percentage at the 4 year mark, ended with the second highest cumulative graduation percentage, 81.2%.

Continuing for the other learning styles, the SPs and the NPs followed slightly less dramatic trends. The SPs showed a graduation percentage of 60.7% at the 4 year mark, whereas the NPs showed a graduation percentage of 58.6%. At the 4 year and

summer mark, the SPs had a cumulative graduation percentage of 64.4% yet the NPs had a cumulative graduation percentage of 64.9% at the same mark. The SPs and NPs continued to alternate between third and fourth for graduation percentages, but never varying by more than approximately 2%. In the end, the SPs showed a higher cumulative graduation percentage with 76.4% to the 74.1% of the NPs. The Pearson Chi-Square test is 29.961 while there is a significance of 0.186. The Pearson data cannot be assumed because it requires that there should be a minimum of five cases in for every possibility. In much of our data there are many possible outcomes (or cells) that have less than five values, therefore we will not be relying on the Pearson Chi-Square Test. For our project we will be assuming that in order for data to be statistically significant the significance test must be below 0.08. Although the Chi-Square tests state that we cannot draw statistically significant conclusions, it is assuming that there would be considerable cases for each outcome and the "expected cases" would be evenly distributed. Many of our results do not match those requirements and therefore we will not be relying on much statistical data to draw conclusions although we will be including some in our results.

Below is a table (Table 2) showing the aforementioned data for 2002, as well as a bar graph with the data and the statistical relevance data. The variable "How Long" represents the amount of time it took for a student to graduate.

Table 2: 2002 MBTI and How Long SN/JP vs howlong 2002 Crosstab

			5 category grad variable					
			four yrs or less	more than 4, less than 5	5 years	6 or more years	not "yet" graduated	Total
& J/P ference nbinations	-S-J	Count	85	8	6	1	20	120
		% within S/N & J/P preference combinations	70.8%	6.7%	5.0%	.8%	16.7%	100.0%
	-N-J	Count	70	2	4	2	18	96
		% within S/N & J/P preference combinations	72.9%	2.1%	4.2%	2.1%	18.8%	100.0%
	-S-P	Count	65	7	9	1	25	107
		% within S/N & J/P preference combinations	60.7%	6.5%	8.4%	.9%	23.4%	100.0%
	-N-P	Count	140	24	12	1	62	239
		% within S/N & J/P preference combinations	58.6%	10.0%	5.0%	.4%	25.9%	100.0%
al		Count	360	41	31	5	125	562
		% within S/N & J/P preference combinations	64.1%	7.3%	5.5%	.9%	22.2%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	17.516(a)	12	.131
Likelihood Ratio	18.279	12	.107
Linear-by-Linear Association	5.375	1	.020
N of Valid Cases	562		

a 4 cells (20.0%) have expected count less than 5. The minimum expected count is .85.

Even though the learning styles are not statistically significant when taken as a whole, if we look at the individual dimensions, we can make statistical claims. In this case the J-P dimension, when compared to how long it took a student to graduate, turns out to have a statistical significance of 0.021. This is less than 0.08, our cutoff point for determining whether or not a data correlation is statistically significant. This is shown in Table 3.

Table 3: JP vs How Long 2002 Crosstab

			5 category grad variable					Total
			four yrs or less	more than 4, less than 5	5 years	6 or more years	not "yet" graduated	
J/P preference	J	Count	155	10	10	3	38	216
		% within J/P preference	71.8%	4.6%	4.6%	1.4%	17.6%	100.0%
	P	Count	205	31	21	2	87	346
		% within J/P preference	59.2%	9.0%	6.1%	.6%	25.1%	100.0%
Total		Count	360	41	31	5	125	562
		% within J/P preference	64.1%	7.3%	5.5%	.9%	22.2%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.559(a)	4	.021
Likelihood Ratio	11.830	4	.019
Linear-by-Linear Association	5.297	1	.021
N of Valid Cases	562		

a 2 cells (20.0%) have expected count less than 5. The minimum expected count is 1.92.

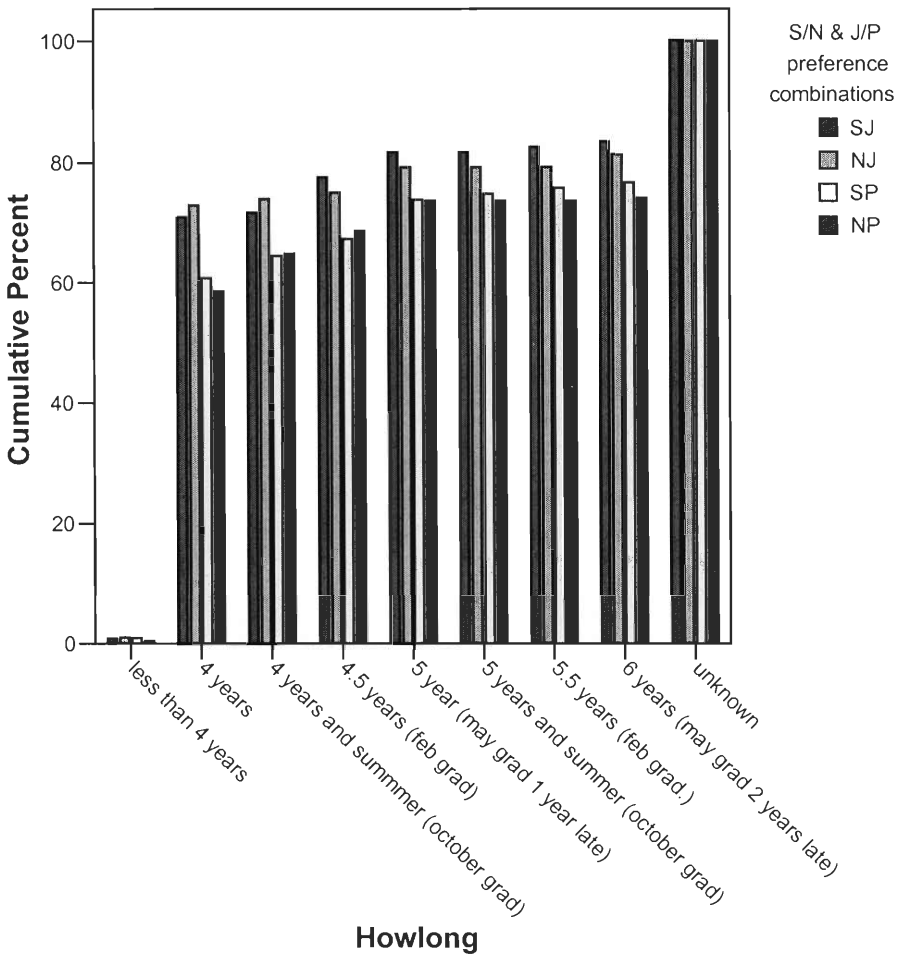


Figure 10: 2002 MBTI and How Long

For the class of 2003 the SJs again triumphed as the cumulative graduation percentage leader, and the NPs again had the lowest cumulative graduation percentage, but the similarities ended there. At the 4 year mark, the SJs and SPs were leading neck and neck with 60.3% and 60.2%, respectively. Yet as each graduation date passed, the SJs took a greater lead, and by the end, the SJs had a 73.5% cumulative graduation percentage compared to that of the SPs, which had 70.9%. The SJs ended up having the highest cumulative graduation percentage, and the SPs had the second highest.

At the 4 year mark, the NPs had the second lowest graduation percentage with 54.6% and the NJs had the lowest graduation percentage with 53.4%. The NPs continued to lead the NJs by approximately 1-2% until the end of the graduation data, were the NJs actually had the higher of the two cumulative graduation percentages – 64% compared to 63.3%. The aforementioned data can be seen below in both tabular (Table 4) and graphic form (Figure 11) as well as the statistical data.

Table 4: SN/JP vs howlong 2003 Crosstab

			How Long with 4 categories				
			4 years or less	more than4, less than 5	5 years	Not "yet" graduated	Total
s/n and j/p learning style groups	sj	Count	82	11	7	36	136
		% within s/n and j/p learning style groups	60.3%	8.1%	5.1%	26.5%	100.0%
	nj	Count	55	5	6	38	104
		% within s/n and j/p learning style groups	52.9%	4.8%	5.8%	36.5%	100.0%
	sp	Count	62	7	4	30	103
		% within s/n and j/p learning style groups	60.2%	6.8%	3.9%	29.1%	100.0%
	np	Count	142	15	9	96	262
		% within s/n and j/p learning style groups	54.2%	5.7%	3.4%	36.6%	100.0%
Total		Count	341	38	26	200	605
		% within s/n and j/p learning style groups	56.4%	6.3%	4.3%	33.1%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.234(a)	9	.613
Likelihood Ratio	7.277	9	.608
Linear-by-Linear Association	2.199	1	.138
N of Valid Cases	605		

a 2 cells (12.5%) have expected count less than 5. The minimum expected count is 4.43.

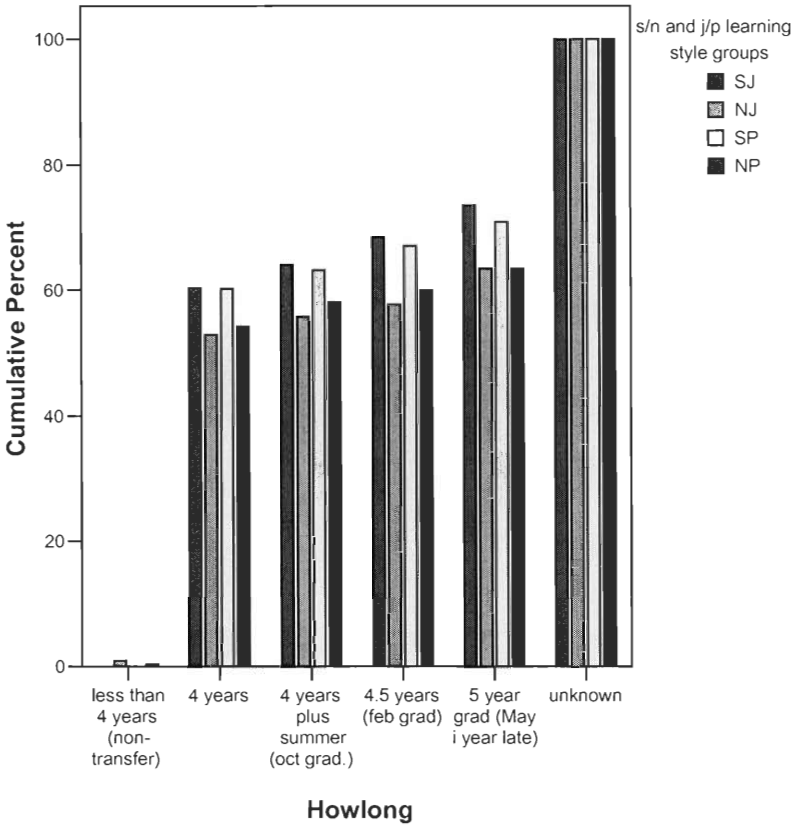


Figure 11: 2003 MBTI and How Long

Although for 2002 the J-P dimension was shown to have statistical significance, the 2003 year is different because it is not the J-P dimension but the S-N that appear to have statistical significance with the gamma correlation, 0.057, being close to the acceptable significant boundary of 0.08. However the Chi-Square tests delivered a statistical significance of 0.141, which would mean the data should be excluded. But again we must mention that this data set is not ideally suited for a Pearson Ch-Square significance test and therefore the asymp. significance can be neglected. This is shown in Table 5.

Table 5: SN vs. howlong 2003 Crosstab

			How Long with 4 categories				
			4 years or less	more than4, less than 5	5 years	Not "yet" graduated	Total
sensing-intution	sensing	Count	143	18	11	66	238
		% within sensing-intution	60.1%	7.6%	4.6%	27.7%	100.0%
	Intution	Count	198	20	15	134	367
		% within sensing-intution	54.0%	5.4%	4.1%	36.5%	100.0%
Total		Count	341	38	26	200	605
		% within sensing-intution	56.4%	6.3%	4.3%	33.1%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.454(a)	3	.141
Likelihood Ratio	5.502	3	.139
Linear-by-Linear Association	4.550	1	.033
N of Valid Cases	605		

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.23.

Symmetric Measures

		Value	Asymp. Std. Error(a)	Approx. T(b)	Approx. Sig.
Ordinal by Ordinal	Gamma	.141	.074	1.905	.057
N of Valid Cases		605			

a Not assuming the null hypothesis.
b Using the asymptotic standard error assuming the null hypothesis.

Contrary to our hypothesis that students who graduate late have an equal chance of earning distinction or high distinction, we discovered that that is not the case. Of the people who graduated with high distinction, 95.6% of those people graduated in 4 years in the class of 2002 and 95.4% for the class of 2003. After four years, the people who graduated with any type of honors greatly decreased. This goes against our theory that people that graduated on time are equally likely to graduate with distinction. The chance for someone to graduate late and still earn any type of distinction is minimal with only

2.5% of the class of 2002 and only 2.5 % of the class of 2003 earning honors and graduating late. Graduating late must have to do with the rate of passing classes, especially in one's major. These results are shown in Figure 12 and Figure 13 and include the statistical data.

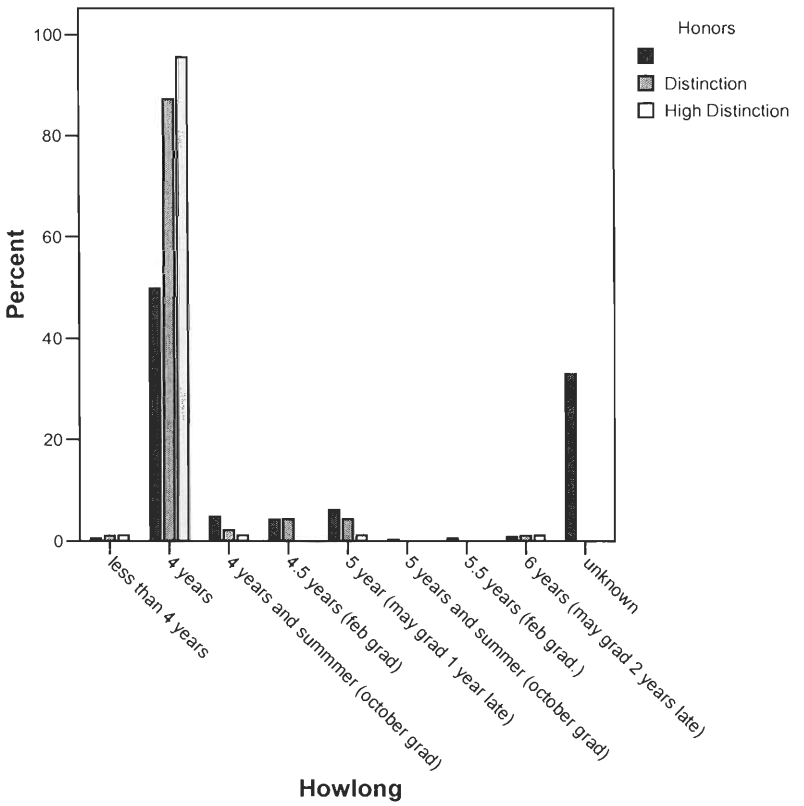


Figure 12: 2002 Honors vs. How Long

Chi-Square Tests

Honors		Value	df	Asymp. Sig. (2-sided)
	Pearson Chi-Square	30.975(a)	24	.155
	Likelihood Ratio	34.976	24	.069
	Linear-by-Linear Association	2.103	1	.147
	N of Valid Cases	378		
Distinction	Pearson Chi-Square	16.661(b)	15	.340
	Likelihood Ratio	15.287	15	.431
	Linear-by-Linear Association	.599	1	.439
	N of Valid Cases	94		
High Distinction	Pearson Chi-Square	20.811(c)	12	.053
	Likelihood Ratio	13.855	12	.310
	Linear-by-Linear Association	.000	1	.990
	N of Valid Cases	90		

a 25 cells (69.4%) have expected count less than 5. The minimum expected count is .15.
b 20 cells (83.3%) have expected count less than 5. The minimum expected count is .13.
c 16 cells (80.0%) have expected count less than 5. The minimum expected count is .11.

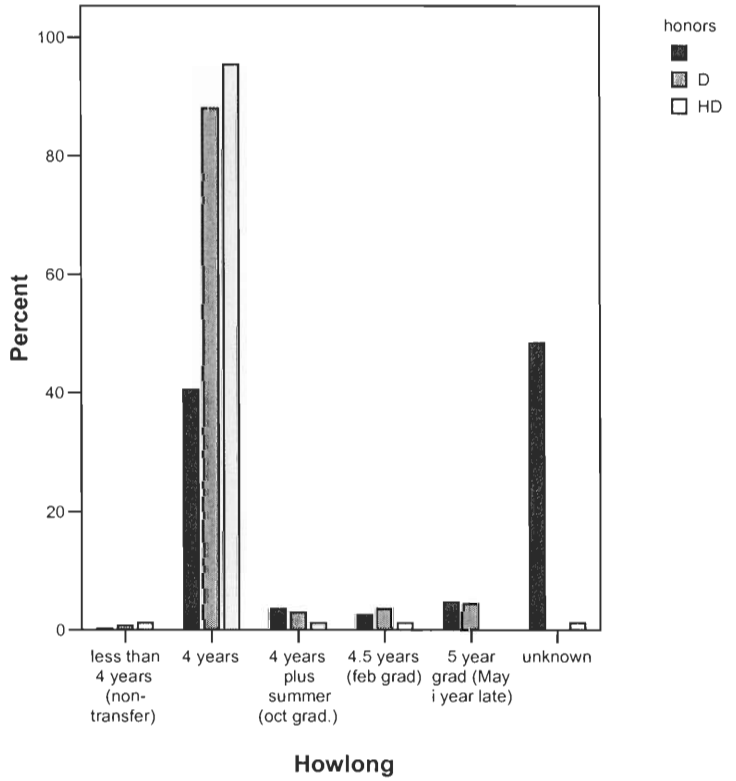


Figure 13: 2003 Honors vs. How Long

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	181.173(a)	10	.000
Likelihood Ratio	241.979	10	.000
N of Valid Cases	690		

a 8 cells (44.4%) have expected count less than 5. The minimum expected count is .38.

We then wanted to look at the four personality types and see if one is more likely to earn distinction or high distinction. Our hypothesis was that NJs would earn more distinction because their type is hypothetically more suited to the rigors of WPI. The data that we gathered from this shows that for 2002 and 2003, the results were significantly different. In 2002, almost as many students earned high distinction as those who earned distinction with 16.0% of the total class earning distinction and 16.9% earning high distinction. The NJs have the highest chance of earning distinction, with 29.2% of the NJ's graduating with high distinction, 12.5% graduated with distinction. For the NP learning style, 11.3% graduated with high distinction and 17.6% with distinction. SJ personality types had 20.8% graduate with high distinction and 17.5% with distinction. The SP personality type had 9.3% graduating with high distinction and 17.8% graduating with distinction. Overall, NJs graduated with the most distinction while SJs graduated with the next highest, followed by NPs and SPs. These results are illustrated in Figure 14 and Table 4.

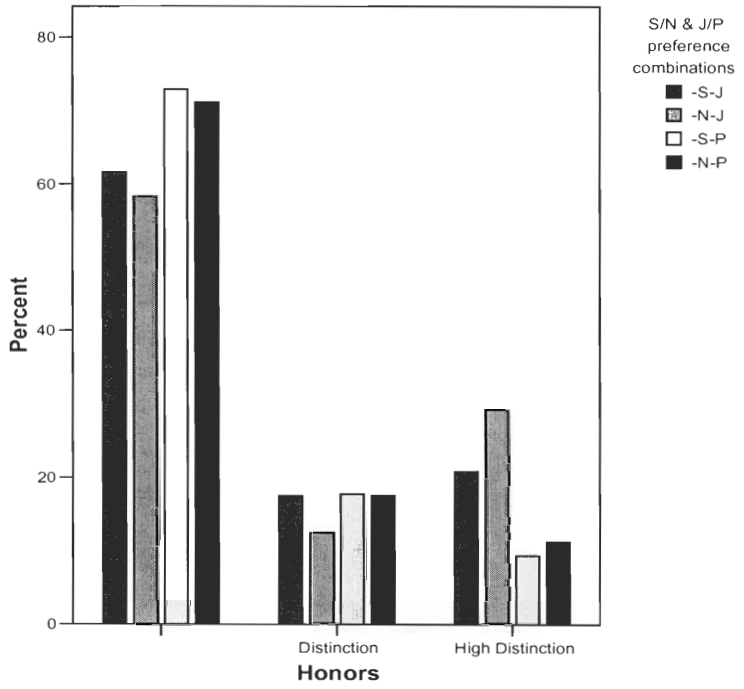


Figure 14: 2002 Type vs. Honors

Table 6: Type vs. Honors (2002)

			Honors			Total
			Distinction	High Distinction		
S/N & J/P preference combinations	SJ	Count	21	25	74	120
		% within S/N & J/P preference combinations	17.5%	20.8%	61.7%	100.0%
	NJ	Count	12	28	56	96
		% within S/N & J/P preference combinations	12.5%	29.2%	58.3%	100.0%
	SP	Count	19	10	78	107
		% within S/N & J/P preference combinations	17.8%	9.3%	72.9%	100.0%
	NP	Count	42	27	170	239
		% within S/N & J/P preference combinations	17.6%	11.3%	71.1%	100.0%
Total		Count	94	90	378	562
		% within S/N & J/P preference combinations	16.7%	16.0%	67.3%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)

Pearson Chi-Square	22.374(a)	6	.001
Likelihood Ratio	21.229	6	.002
N of Valid Cases	562		

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 15.37.

The class of 2002 appears to agree with our hypothesis that NJs are most likely to earn distinction and therefore perform better at WPI. But surprisingly the results from the class of 2003 barely match with those of 2002. In 2003 the NJs, who were the "stars" of the class of 2002, had only 9.6% of the NJs graduated with high distinction and 16.3% graduated with distinction. This is far different from the results from the previous year, and in fact the NJs end up having the lowest chance of getting distinction for this year. The NP type was more consistent from each class, but their overall percent graduating with any type of honors was not elevated; 13.0% graduated with high distinction and only 19.8 % with distinction. The SJs move up from the last year to have the highest chance of earning distinction in the class of 2003. 14.0% and 21.3% of SJs graduated with high distinction and distinction respectively. For the SJ personality type the high distinction had a deviation of about 6%, but they were very consistent when it came to how many graduated with distinction. SPs had about the same amount as the prior year, with 15.5% graduating with distinction and 14.6% graduating with high distinction. So from those numbers, the SP personality is not more likely to gain high honors either year and remains constant. Nonetheless, the result is very different when compared with the class of 2002, with SJs having the highest chance to graduate, followed by NPs, then SPs, and finally NJs. These results are expressed in Figure 15 and Table 5.

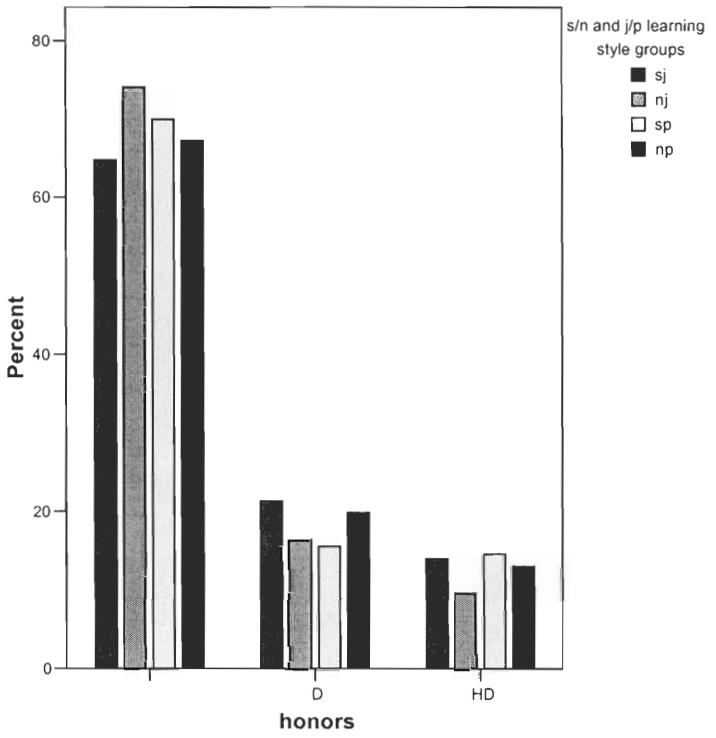


Figure 15: 2003 Type vs. Honors

Table 7: Type vs. Honors (2003)

			honors			Total
				D	HD	
s/n and j/p learning style groups	SJ	Count	88	29	19	136
		% within s/n and j/p learning style groups	64.7%	21.3%	14.0%	100.0%
	NJ	Count	77	17	10	104
		% within s/n and j/p learning style groups	74.0%	16.3%	9.6%	100.0%
	SP	Count	72	16	15	103
		% within s/n and j/p learning style groups	69.9%	15.5%	14.6%	100.0%
	NP	Count	176	52	34	262
		% within s/n and j/p learning style groups	67.2%	19.8%	13.0%	100.0%
Total		Count	413	114	78	605
		% within s/n and j/p learning style groups	68.3%	18.8%	12.9%	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.587(a)	6	.732
Likelihood Ratio	3.683	6	.719
N of Valid Cases	605		

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 13.28.

Gender Graduation Percentages

Contrary to our hypothesis that females were equally likely to graduate as males, when the data was tabulated and the genders separated, the females actually had a higher chance of graduating than the males. Even though the males vastly outnumbered the females (434 males to 128 females for 2002, 519 males to 171 females for 2003), 76.6% of the females graduated on time while only 59.4% of the males graduated on time for the class of 2002. For 2003 64.9% of the females graduated on time while 53.9% of the males graduate on time.

As part of a lower percentage of males graduating on time, males had a higher percentage graduating late than females. For the class of 2002, 16.0% of the males graduated late compared to 6.3% of the females who graduated late. For the class of 2003, 10.3% of the males graduated late while 8.8% of the females graduated late. But even so, the males were never able to catch up to the females in total graduations. By the end of 2004, 84.4% of the females graduated while 75.8% of the males graduated for the class of 2002. For the class of 2003, 73.7% of the females had graduated while only 64.7% of the males had graduated. These results are illustrated in Table 6 and 7 and Figure 16 and 17.

It is hard to interpret this data that females are more likely to graduate from WPI than males. It probably does not mean that males are weaker academically but they do

seem less committed to actually obtaining the formal degree as opposed to attending the institution. Sometimes students get job offers during their time at WPI, especially those who go on co-ops. They may leave WPI in pursuit of a job or transfer to another school. For some reason the women are more single-minded or the men are more distractible. We do not have information as to whether students leave WPI because they are failing classes or because they have been offered a job or transfer to another college, but that information, if available, would help one make sense of the gender difference.

Table 8: Gender vs. How Long (2002)

			How long									
			less than 4 years	4 years	4 years and summer (October grad)	4.5 years (Feb. grad)	5 year (may grad 1 year late)	5 years and summer (October grad)	5.5 years (Feb. grad.)	6 years (may grad 2 years late)	unknown	Total
Gender	F	Count	2	98	2	1	3	0	0	2	20	128
		% within Gender	1.6%	76.6%	1.6%	.8%	2.3%	.0%	.0%	1.6%	15.6%	100.0%
	M	Count	2	259	19	19	25	1	2	3	105	435
		% within Gender	.5%	59.5%	4.4%	4.4%	5.7%	.2%	.5%	.7%	24.1%	100.0%
Total		Count	4	357	21	20	28	1	2	5	125	563
		% within Gender	.7%	63.4%	3.7%	3.6%	5.0%	.2%	.4%	.9%	22.2%	100.0%

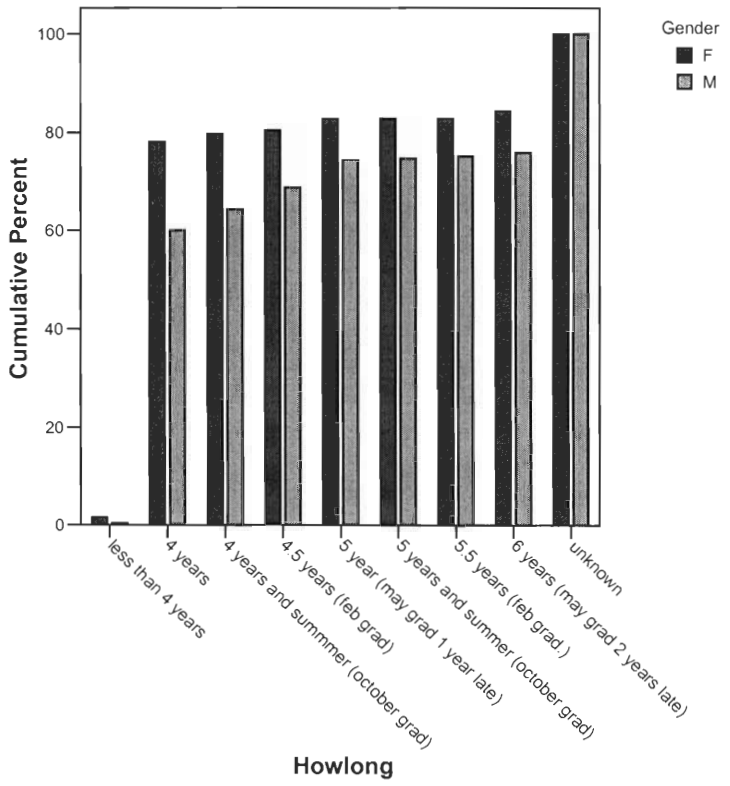


Figure 16: 2002 Cumulative Graduation Percentages by Gender

Table 9: 2003 Gender vs. How Long

			How long						
			less than 4 years (non-transfer)	4 years	4 years plus summer (Oct. grad.)	4.5 years (Feb. grad)	5 year grad (May 1 year late)	unknown	Total
gender	F	Count	0	111	3	4	8	45	171
		% within gender	.0%	64.9%	1.8%	2.3%	4.7%	26.3%	100.0%
	M	Count	3	280	19	14	20	183	519
		% within gender	.6%	53.9%	3.7%	2.7%	3.9%	35.3%	100.0%
Total		Count	3	391	22	18	28	228	690
		% within gender	.4%	56.7%	3.2%	2.6%	4.1%	33.0%	100.0%

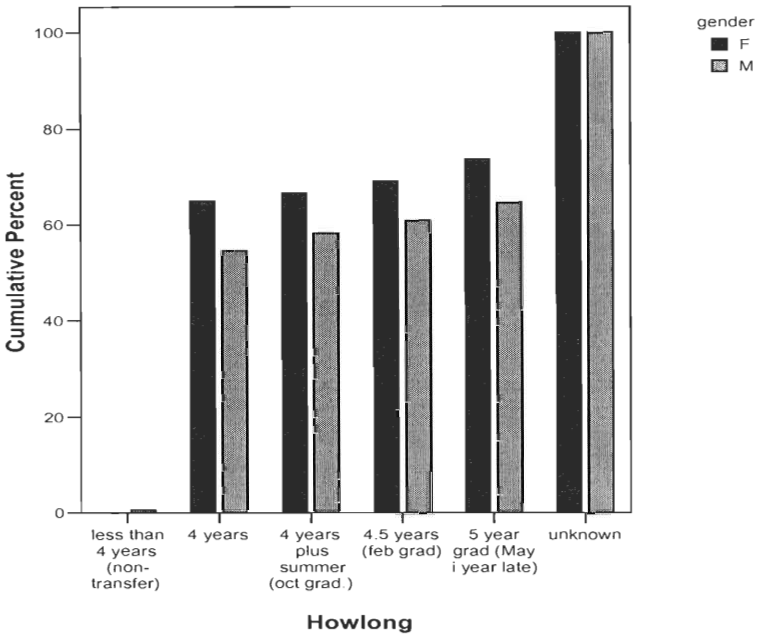


Figure 17: 2003 Cumulative Graduation Percentages by Gender

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	8.575(a)	5	.127
Likelihood Ratio	9.570	5	.088
N of Valid Cases	690		

a 3 cells (25.0%) have expected count less than 5. The minimum expected count is .74.

There was a significant difference between genders when looking at those who earned honors; both 2002 and 2003 had a much larger proportion of the female population earning honors than males. For the class of 2002, 28.1% of females earned high distinction when only 12.4% of males did so. For distinction, the scenario showed its ugly face again with 21.9% of female earning it when only 15.2 % of males did so.

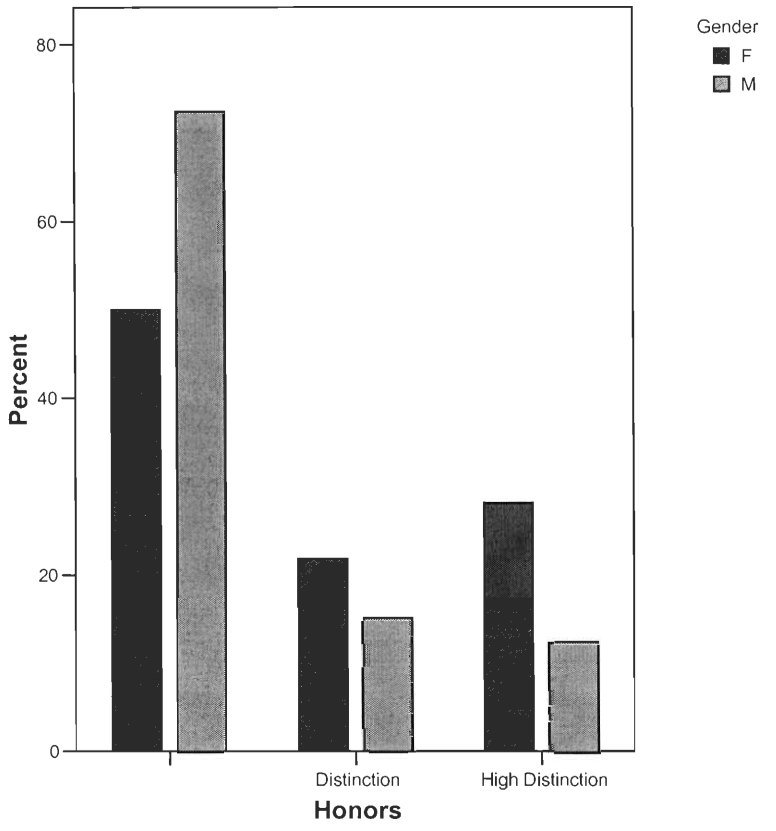


Figure 18: 2002 Gender vs. Honors

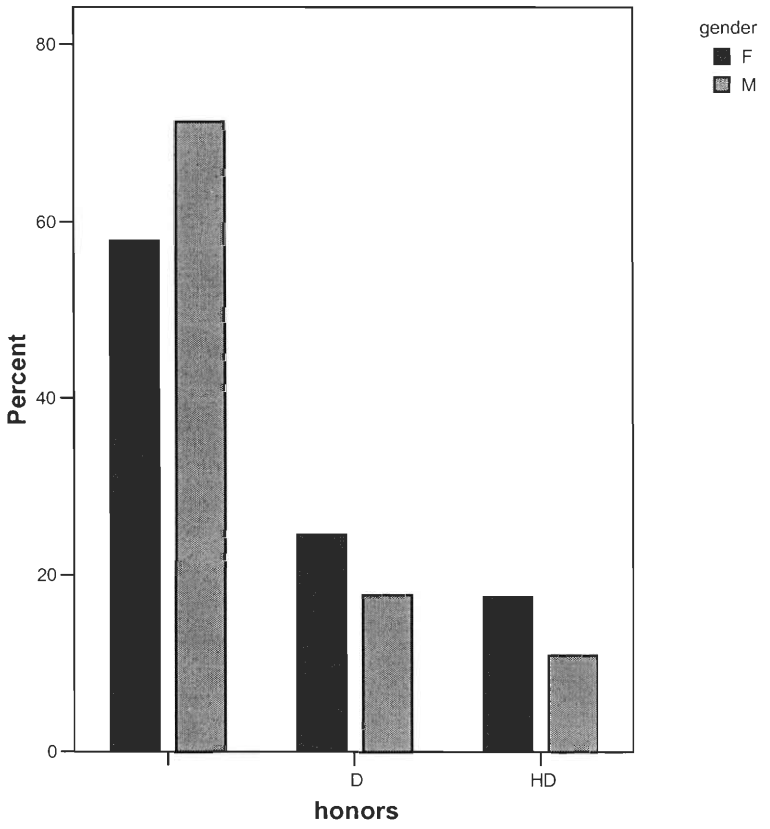
Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	25.313(a)	2	.000
Likelihood Ratio	23.764	2	.000
N of Valid Cases	563		

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 20.46.

For the class of 2003 the same trend showed up with 17.5% of females and only 11.0% of males receiving high distinction. For distinction, 24.6% of females received it with only 17.7% of males doing the same. One can see that females surpassed men in earning both distinction and high distinction for both years.

Figure 19: 2003 Gender vs. Honors



Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.881(a)	2	.004
Likelihood Ratio	10.534	2	.005
N of Valid Cases	690		

a 0 cells (.0%) have expected count less than 5. The minimum expected count is 21.56.

Discussion

Based on the analysis of the data we obtained, one can conclude that SJs and NJs are most likely to graduate early or on time (in four years). For the class of 2002, NJs had the largest % of students graduate with distinction while for the class of 2003 SJs had the most and NJs had the least students graduate with distinction. Having the NJ's jump from most to least in a year is disconcerting and raises questions about whether the pattern is simply random variation or not. However, there is a history of complications in comparing these two classes. They have failed to replicate key features since their Freshman years; the class of 2002 is stronger on paper and in addiction to higher average SAT scores, especially for the NPs, they failed fewer courses for the first year. The SPs also did better in 1999 than in 1998. Females were also more likely to graduate early and more likely to earn distinction than their male counterparts in both years.

Many of our hypotheses were disproved in our study. The NJs did receive more degrees "with distinction" in the end and initially had higher graduation rates for 2002, but in 2003 the SJs ended up with the "most" distinction and had higher graduation rates. The J-P dimension had the highest relationship when compared to how long it took the class of 2002 to graduate. On the other hand, the S-N dimension had the highest relationship when compared to how long it took the class of 2003 to graduate. Those that graduated late did not have an equal chance to earn distinction and in fact had far less of a chance to earn it. One can then conclude that the majority of students who graduate late do so because they have failed several classes. Finally, women do not perform equally as well as men but outperform them by earning more distinctions and having a greater percentage of students graduate on time, and graduate at all.

Although our data generated substantial results, were we able to observe distinct trends with different learning types? We expected that NJs would outperform the other learning types overall, but there were no specific observable trends that were constant throughout the years. For the 2002 data set, NJs appeared to outperform the other groups. That changed in the 2003 data set, where the SJs were better than the NJs overall. In fact, the NJs got the least amount of rewards in 2003. Was there a substantial difference between the years? The populations of the two data sets are almost identical, so it is unlikely that differences between the groups are being exaggerated by population differences. Between the two years there should not be so much variation. More years would have to be accumulated in order to determine whether there are substantial relationships.

The class of 2002 and 2003 had very different high achievers, with NJs for the class of 2002 and SJs for the class of 2003. Also the significance of the J-P dimension for the class of 2002 and the S-N dimension for the class of 2003 made their respective year more distinct from the other. These differences between the two years are also expressed in the Freshman data, where different groups excelled for different years. Even so, there is little relationship between the Freshman term grades and the final graduation distinction. Those that outperformed for Freshman year (SJs) did not have the highest rate of graduating on time nor the most distinction for both years. Therefore one can conclude that Freshman year has little relevance to graduation distinction and how long it takes to graduate. More years should be analyzed before an adequate conclusion can be drawn.

Gender on the other hand is far easier to analyze. The females clearly outperformed the males in terms of gaining distinction and graduation rate. What is most

peculiar is that females seem to be adjusting to WPI more easily than their male counterparts. Although women are vastly outnumbered, they were somehow able to outperform the men on the variables we tested in the class years we examined. The women's greatest advantage might be because they are so few of them they are a more select group; while men vie for attention, women easily find work and study groups to assist them. Another reason could be because of innate differences between the genders. Women tend to be less competitive and more cooperative then individualistic males. Because of this, women are more likely to ask for assistance rather than males who prefer to solve it independently. The consequence though is that men are less likely to solve the problem correctly, and eventually score lower grades than the women. A final reason could be that women are more responsible in their schoolwork and more determined to succeed than their male counterparts. Overall this can be used as evidence that women can perform just as well in an engineering school as men.

Finally, has our study shown a "trouble group," a specific learning type that might find it difficult at WPI? Just as looking for one learning type that outperforms the others is difficult, so is looking for the bottom group. The last two groups in graduating rates, the NPs and the SPs, would alternate many times. In terms of distinction, the SPs were generally last if not for the NJs during 2003 when they surprisingly end up last. The SPs appear to be last most of the time, but it varies. One can be certain that perceptive types do not perform as well as the judgment types, not that sensing types outperform intuitive types.

Conclusion

Overall the project was a success although not the one we intended. We were able to analyze freshman data and correlate it to graduation data but because a lot of our results were not statistically significant we could only make generalizations of the data we collected. From that data we were able to determine that judgment types specifically had an advantage over perceptive types. Those that graduated late were less likely to earn distinction in the process. Also, women outperformed men in both proportion graduating with distinction and rate of graduation in four years, or ever.

Follow-Up Recommendations

To those whom may research further into this area in the future, these are a few suggestions we have as to possible topics to look at that we were unable to cover. We were unable to cover some of these avenues due to factors such as a lack of consistency between both data sets, no information available at all on certain variables, and lack of time due to delays waiting for a data from the WPI registrar.

1) A continued analysis of existing data set. Because a lot of data was statistically insignificant, we were unable to verify many of our results. By lowering the possible outcomes one can significantly increase the possibility of finding relationships between variables and eventually drawing conclusions. If a study was to work with this data, it is recommended to either reduce the amount of outcome variables or include more years.

2) An analysis to see if high school GPA correlate with elements such as whether the individual earned distinction; graduated early, on time, or late; how it affected GPA's during their time at WPI; whether they received any special awards, etc.

3) Look into whether SAT scores appear to have a relationship to any of the aspects of the WPI experience that we measured. An interesting idea to try, if all the necessary data is available that is, would be to see how each MBTI type performed in high school and compare that to how they perform at WPI. Do the trends stay the same? Or do they change with the transition to college.

4) From what we've heard, a survey is sent out to WPI graduates who have been recently employed. An interesting study would be to check out factors such as those who graduated early, did they get jobs faster? Did they get a greater starting salary than those who graduated on time or late? Is there any correlation between MBTI types and the time it took to find a job, their salary, and the starting positions they received.

5) The CIRP Freshman data survey included many questions about student's initial expectations to college. It includes questions about how well they think they will do in college, and what they expect to accomplish. These could be compared to actual performance.

This entire study was designed to determine where different learning styles of students ended up in terms of overall performance relative to one another. But in the process we missed the majority of the undergraduate experience at WPI. What we simply did in our study was connect two dots together. It would be interesting if we could see what happened in between those two points, to connect all the dots and see specific trends that occur throughout the years. If one could obtain the class of 2002 and 2003's transcript data throughout the four years, they would be able to answer many questions we could not answer. Beyond the transcript it would be nice to be able to differentiate between students who drop out or students who change majors or career goals. Some probably leave early to transfer or receive job offers, whether specific

groups of students vary in classes or majors, and whether specific years provide different challenges for students. The difficulty is that such a study would require a survey of people who departed WPI. Our project has only scratched the surface of the potential in this kind of study. There is much more information out there that should be in the data set and should be examined to see if it can be used to improve the WPI experience.

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