Educational Effects of FIRST Robotics:

An Evaluation of FIRST Robots' Impact at the College Level

An Interactive Qualifying Project Proposal

Submitted to the Faculty
Of the

WORCESTER POLYTECHNIC INSTITUTE

In Partial Fulfillment of the requirements for the

Degree of Bachelor of Science

By

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Date: May 10, 2007

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Abstract

The project investigates the possible correlation between students who participated in FIRST robotics in high school and academic success in college. Utilizing registrar records and surveying, we noted the differences in performance and school engagement from year to year, to see if FIRST prepares students for the education of Worcester Polytechnic Institute. The time commitment, group environment, and immersion in education and technology lead us to believe that students who participate in FIRST will be excellent candidates for admission.

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Introduction

Technology changes the way in which the world is perceived. Processes that would have taken hours or days in the past, such as traveling to another town, now take only hours and minutes. With these leaps in technological capacity, our way of thinking about things has changed and our standard of living has improved. However, to secure the continuation of improved life style it is necessary to focus on the furthering of science and technology. One of the best ways of doing this is through education.

One organization that promotes science and technology is FIRST (For Inspiration and Recognition of Science and Technology) Robotics. FIRST is a high-school based robotics program designed to stimulate interest in science and engineering in today's youth. Several reports currently exist which show FIRST to be successful at promoting science and technology at the high school level. Many of the reports also show students becoming more successful at school and entering college. However, while these reports imply that students involved in FIRST are more prepared for college in a technological field, there is currently no evidence showing that they are more prepared or will tend to do better then other students.

The purpose of the project is to determine if a correlation exists between students who have participated in FIRST Robotics at the high school level and students who are academically successful at the college level. If a correlation is made, it is not an objective of this project to determine whether it is due to involvement in the FIRST program or an undefined secondary trait shared by FIRST members in the population. Even so, establishing a correlation would still be useful in showing what kind of traits members leaving the FIRST program will demonstrate at the college level.

A secondary objective for this project is to lay a foundation for a future large scale projects by providing a systematic way of gathering accurate data. This project will also help future projects by defining key terms.

To achieve these central goals several sub-goals must first be accomplished. One key sub-goal is defining academic success along with other terminology. Another important aspect is determining how to collect data from the population in a fashion that is un-biased. Also, the development of a methodology for conducting this survey at larger, national level needs to be taken into consideration.

The major audience for this project will be WPI admissions. Admissions currently looks for FIRST participation on applications, however, admissions does not view it to be much different from model UN or other team-oriented extracurricular activities. Since there is currently little or no

information on how, if at all, FIRST impacts students once they've entered college it is hard to tell whether or not this policy is justified.

Information from this project may also influence college support for FIRST in general. Many colleges, including WPI, currently sponsor high school FIRST teams. With more information available on what effect this program has once students enter college, schools may want to revaluate their level of support for the program.

This project may eventually be of interest to FIRST. However, the small scale nature of this inquiry would require a much larger nationwide follow up to prove of real value to FIRST. Even so, there is currently data showing student improvement during high school from involvement in the program (Brandeis). With the addition of college data, FIRST may be able to start determining the long reaching effects of the program.

Goal of the Project

The goal of this project was to determine if there is a correlation to being in FIRST during high school and success in college. Based on these results, it was hoped a conclusion could be made as to whether or not being in FIRST was a good indicator for academic success in college. These findings would hopefully be of interest to Admissions who would then be able to make better decisions on admitting students in the future.

Background

FIRST Robotics

FIRST (For Inspiration and Recognition of Science and Technology) is a high school-based robotics program designed to stimulate interest in science and engineering in today's youth. What started in 1992 with 28 teams in a high school gym has grown to over 1,300 teams filling the largest of sports stadiums.

Each year, teams are provided with a "kit of parts" and have six weeks to design, prototype, and build a working robot to perform a goal within a set of rules. During these six weeks students work

alongside professional mentors in a hands on environment that encourages group participation and teamwork.

In 2007, teams can compete in one of 37 regional events as well as the championship. Winning is not always measured in points and round, teams are rewarded for design, team spirit, maturity, and ability to overcome obstacles. It should be noted that the highest award in FIRST does not go to the winner of the competition, but the team who has demonstrated an overall well rounded effort in all aspects of the competition as well as promoting science and technology in their community. This award is known as the Chairman's Award.

Similar forms of Education

While robotics education is nothing new, a study of how participation in such programs affected a student's performance at the collegiate level has never fully been investigated. To find more about the educational effects of FIRST, it became apparent that it would be necessary to study how similar programs affect education.

One of the best examples was that of apprenticeships and trade schools. While not a largely publicized learning process in the United States they do occur. Apprenticeships and trade schools offer similar origins and similar objectives as our project.

Apprenticeships, trade schools, and FIRST robotics in high school all have the same educational idea. Each seeks to take a skilled worker and set them to work teaching new students how to successfully perform their task, and to perform it in conjunction with others on the job. After the education process, each then seeks to remove the skilled worker from the equation whenever possible to see how the student does. Generally, this system is successful, as researcher Stephen F. Hamilton notes, "...West German employers prefer hiring 15- and 16-year-olds as apprentices in order to instill in them the kinds of attitudes, work habits, and skills they require. The success of the German system suggests that some kind of apprenticeship might improve the transition of U.S. youth from school to work."(Hamilton)

While Hamilton is clearly referring to students who graduate high school and enter directly into the labor force, the ideas behind it apply to students bound for college as well. Further reading of the book also mentions that the researcher acknowledges that college is similar in ways to apprenticeships but that, given the nature of college, many young adults cannot afford it or drop out. Those students who drop out highlight the lack of work habits and the right attitude that is necessary to graduate.

Editor Thomas Bailey further writes that high schools, "isolate young people from adults who could act as models and mentors"(Bailey) and "do a poor job of teaching the so-called advanced generic skills or workplace basics such as problem solving and teamwork, and the job-specific skills that are taught atrophy as young people spend a few years churning through unskilled youth jobs; and do not teach the attitudes and maturity needed on the job."

FIRST seeks to cover many of these issues brought up by Thomas Bailey. On their official website, it is stated that "*FIRST* redefines winning for these students. Teams are rewarded for excellence in design, demonstrated team spirit, gracious professionalism and maturity, and ability to overcome obstacles. Scoring the most points is a secondary goal. Winning means building partnerships that last."(FIRST) This is accomplished through providing students with mentors who can instill this attitude in their everyday work.

While the numbers do not seem to be readily available as to how many apprenticeships maintain their positions in the German apprenticeship program, what is known is that Germany's system consists of a dual system in which apprentices spend 3 or four days a week at work and one or two days at school. It is also known that "the dual system serves more than 60 percent of youth 16 to 19 years old and provides respected entry-level qualifications for some 370 occupations covered by federal apprenticeship regulations."(Vickers) The sheer magnitude of this program that has been in existence in ways since the medieval times shows the overall success that apprenticeships can grant through skills learned on the job.

When this is considered alongside the low retention rate of freshman engineers, one begins to wonder about what can be done to improve the retention rate and education level of skilled workers. In one case study performed for Arizona State University's College of Engineering and Applied Sciences, the researchers found that in their engineering programs they had a freshman retention rate of approximately 69%. "However, some of the CEAS freshman (10%) changed to other disciplines in the University during or just after the first year. Therefore, in the CEAS, the freshman retention rate is about 60%. These rates are not inconsistent with those of other similar engineering schools, but represent a large loss of potential engineers."(Anderson) So it becomes necessary to find factors that increase retention rates. Programs such as apprenticeships may help, but another important factor that applies to our project that may affect retention is the use of robotics in education.

At the Indiana University – Purdue University Fort Wayne, they were having the same problems with low retention rate as most other schools teaching engineering. In their case they recorded a 51.72% percent retention rate for students enrolled in 1996, in their School for Engineering,

Technology, and Computer Science which was about on par for their type of university which was a commuter-only school whose students averaged in age around 27 (Pomalaza). In an attempt to increase their retention, they created an introduction course which used robotics, in particular the LEGO Robotic Command eXplorer, or RCX, to communicate course objectives. Through this program in which students were required to work in teams to understand, learn, and improve their technical skills students became proficient in an introductory sense to the technology and the project. When the data was measured over the coming years they found that in their program, retention rates had improved. For their spring 2001 class, they had found retention was at about 95.92%. While this was recorded only for the course of one year versus the four for the first study, this was correlated to be a positive increase in retention.

The data is not concrete but offers a positive relation to our project. Students who generally do not have experience in engineering prior to becoming fully involved in the major generally do not retain as well as those who've had hands on experience and come to enjoy it. If the study conducted at Indiana University – Purdue University Fort Wayne offers any insight into our project, we hope to find that those who've had experience in FIRST during high school gain that necessary skill, knowledge, and interest in engineering that leads them to be better students at the college level. Based on this study it is believed that a positive correlation between FIRST and higher retention rate will be made.

Worcester Polytechnic Institute (WPI)

Worcester Polytechnic Institute, is a college located in Worcester Massachusetts. In the early 1970's WPI adopted a rigorous educational program dubbed "The Plan". For this reason, courses at WPI today are completed in seven-week terms resulting in a four quarter system. Students are also required to complete two major group-oriented projects, the IQP (Interactive Qualifying Project) and MQP (Major qualifying Project). Class rank and GPA are not openly published or tracked at WPI. By taking the focus off grades and rank it is hoped that students will be more likely to help one another in a cooperative effort to tackle courses. In order to maintain the integrity of this view, GPA and class rank will not be considered in this report as a measure of academic success.

WPI is an avid support of the FIRST Robotics program. Currently, WPI has scholarships available for FIRST members to apply too. The school also help fund and mentor FIRST team 190. Due to increasing interesting in robotics the school has of developed a robotics major. The student

body at WPI is also responding to this interest with the recent establishment of a robotics club specifically for the college level.

Admissions

The admissions department is responsible for the year to year recruitment of new students to WPI. They are a diverse department who spreads their efforts between setting up booths at college fairs at high schools, communicating with counselors and teachers at high schools, to creating and reviewing applications for entrance into Worcester Polytechnic Institute. The admissions department is overseen by the Director of Admissions Edward Connor, who has offered his insight and advice for this project. The admissions department is part of a group of entrance programs under the oversight of Kristin Tichenor, Associate Vice-President for Enrollment Management, who also oversees the Registrar and financial aid. Since it is a part of this system, as soon as a student opts to enroll at WPI, they no longer maintain any record or contact with the student. All their records are forwarded onto the Registrar's office for future record keeping.

Career Development Center (CDC)

The Career Development Center is an office of WPI designed to help students prepare for internships, co-ops, and job placement. The CDC also provides online resources to help students search for jobs and internships. In order to evaluate the effectiveness of the CDC, a survey is conducted on every graduating class. While the CDC is not specifically interested in FIRST participation (unless students are acting mentors), they may be able to provide a unique perspective on what companies find to be desirable traits in students at the college level.

The Office of the Registrar

The registrar's office is responsible for maintaining the records of student enrollment, project work, course work and more. This inherently leads them to also be the arbiters of a student's current enrollment status, academic warnings and holds, and most importantly in regards to our project, their

current status in completing their degree. The current registrar, Alaina Weihn, has the responsibility of overseeing the registrar's office. However, Ron Fontaine, the assistant registrar, is the one in charge of releasing any information from the registrar. With his assistance raw data on both know FIRST students and on the student body as a whole was able to be obtained.

Methodology

Defining Key Terms

In order to complete this project several preliminary steps had to be taken before data could be analyzed. One of the main obstacles was defining some of the terminology of the project. Specifically, what defined success at college? To answer this question, measures of merit for a successful college student needed to be defined and categorized. While many studies, such as the Brandeis report, had clear definitions for what was needed to enter college few studies actually defined what success was in college[1]. Since there was no clear definition, and our target population was at WPI, it was determined that a series of interviews with some of the major administration departments on campus could help resolve this issue.

Interviews were conducted with the CDC, Admissions, and Academic Advising. An on-going dialog was also maintained with the Registrar[2]. While it may seem unnecessary to interview Admissions, because it deals with students coming into the school, it was believed that by asking how their criteria for entrance to the school was derived something could be learned about what had made students successful.

Based on the interview with Admissions it was found that Admissions main concern was that students would be able to graduate on time(Connor).There was also concern about academic probation or academic warnings. Perhaps the most important statistic for Admissions was retention rate. If Admissions has done their job correctly for the year, the retention rate of students should be high. This also makes sense from the financial perspective of the school since students who stay continue paying tuition.

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1 For more information on the Brandeis report go to www.usfirst.org

2 Transcribed copies of the interview can be found in appendices E, F and G

When asked about GPA, the response was mixed. Maintaining a good GPA was considered important, but not essential. Instead it was considerrd better for students to "...have a good experience here and take advantage of some of the things we have to offer"(Connor). In other words, campus involvement, through clubs and participation in campus events, is also considered an important part of success.

Another key point of this interview was finding out what was currently used by the school as indicators for academic success in college. This would give the group something to compare FIRST students against if a correlation could be established. It was found that the three major determining factors were high school GPA, SAT scores, and class rank. While none of these indicators was a good predictor on its own, they prove fairly effective as a group. It was also mentioned that general standards, such as required SAT score, were adjusted by Admission for every in coming class of students. This was the result of variations from year to year in the tests difficulty, as well as other factors. This would inevitably make comparing students from different year difficult.

The second interview was with the CDC, where a better understanding of what businesses are looking for internship applicants and job applicants was obtained. During the interview they confirmed that on time graduation, 4 or 5 years, was important for most companies. They also felt that projects, such as MQPs and IQPs, along with actual work experience, contributed considerably to preparing students for internships and jobs. This was mainly because these experiences stress teamwork and communication, which many companies have complained is a major problem for new hires(CDC). Club participation, by the same token, was also considered important, especially when a student achieved a leadership role in club. However, GPA was treated slightly different. While it was not considered the most important part of a student's resume, many companies require a 3.0 or above to apply.

The final interview was with Academic Advising. They confirmed what was found in the previous interviews. They also stressed that GPA was not considered an essential part of student success at college. It was also brought up that a student's success at completing college could often be forcasted based on their performance in key freshmen courses. Academic honors, the Charles O'Thompson award[3] were also considered important. Since WPI has no official deans list, the O'Thompson award could possibly act as a substitute.

With the interviews completed a clear definition for academic success was devised. A student is

[3] An award for which students must receive all A's and B's with a minimum of 6 A's their freshman year.

likely to be successful at college if: they graduate within 4 or 5 years of entering school, are involved in campus activities and clubs, receive academic honors, and complete key freshmen courses without difficulty.

Survey Methodology

To help deal with this problem a questionnaire was generated to fill in missing information[4]. The survey was conducted on the student body. It was done by questionnaire, since it is an effective and cost efficient way to gather data of a determined population. In order to develop the survey some background research on sampling and questionnaire design was first conducted followed by development and implementation.

The questionnaire is an effective data collection instrument in that it is easy to construct and administer. It provides good levels of precision when the level of returns and participation is high. The level of participation can be increased by creating a simple to use and relatively short questionnaire which is usually made up of three parts.

The first part consists of a cover page which explains the purpose of the survey. It should also identify to the respondent why they were chosen and how the survey relates to them and confidentiality should be discussed. The second part consists of a set of instructions on how to complete the survey properly. The third part consists of questions; there are several different question types which one must consider in questionnaire development. Question types are described as follows;

Classifier or Background Questions are used to obtain information about certain characteristics of a group.

Multiple Choice or Closed Ended Questions are questions in which the answers are predetermined and the respondent chooses the appropriate answer from a list.

Intensity Questions are used to measure the respondent's feelings on a particular subject or statement.

Open Ended Questions are questions in which the respondent writes in their own answers (Nardi 64-68).

It is important to keep the language simple and to avoid long questions. Each question should be limited to one concept and should allow for all possible answers. The questions should also be

[4] A copy of the questionnaire can be found in appendix C

organized in a random fashion with alternating question types and the final questionnaire should look profession and presentable.

The Survey Plan

After the background research was completed the survey plan and questionnaire were developed. Surveying can be achieved by applying several different sampling methods. Preparation for a survey can be completed by developing a survey plan. Several steps are included in developing a survey plan and are listed below (Air University 49).

1. Define the purpose of your survey. It is important that the problem you are studying is well stated and your objectives are clearly defined.
2. State a hypothesis which is an educated guess of the final survey results.
3. Determine the appropriate sampling method.
4. Define your appropriate sample population.
5. Develop the survey questionnaire followed by edit and review.
6. Obtain required approvals
7. Gather data
8. Analyze results.

Our Survey Plan

Using these steps the survey plan was developed. The survey plan for this project is as follows;

1. Purpose - The purpose of this survey is to study the effect of high school experience in FIRST robotics on college performance.

2. Hypothesis - It is expected that a positive relationship between high school FIRST involvement and good college performance exists.

3. Survey Method – Though it is not an objective of the project to determine a correlation between FIRST involvement and positive college performance, it is still useful to try and determine what traits of students involved in the FIRST program have been demonstrated at the college level. In order to achieve this comparison, the appropriate sampling method was chosen to be a purposive sampling method.

4. Sample Population - The sample population is limited to WPI undergraduate students with high school FIRST involvement.

5. Questionnaire - A questionnaire was developed and is included in the appendix C. The questionnaire contained classifier, multiple choice close ended, intensity, and open ended questions.

6. Required Approvals - The dean of students, Phillip Clay, determined that no special approvals were required other than the advisors approval which was obtained.

7. Gather Data - Data was be gathered by two separate methods. The first method involves table sitting in the campus center to identify students with high school FIRST experience as well as administer the survey to such students. The second method involved emailing the undergraduate student body and asking students with high school FIRST experience to complete our survey which was posted online. A copy of the email sent to the student body is located in appendix C.

8. Analyze Results - Results from the survey were analyzed as discussed in the survey results discussion section.

Survey Results

As mentioned before a survey of the student body was prepared, administered in the campus center, and posted online then emailed out to the undergraduate student body for voluntary completion. Data was gathered in a confidential manner ensuring that no response could be identified to the respondent. A summary of the survey results are given below and the actual survey results can be found in Appendix G. The summarized survey data is as follows.

There are several points that can be taken from this survey of students who had indicated involvement in FIRST robotics in high school. These will be broken down into several sections for discussion.

Years of High School FIRST Experience

The average student surveyed participated in FIRST for 2.61 years in high school. This number is critical in our understanding of the impact of a student's high school FIRST involvement on their

performance in college. The average of 2.61 years indicates that the average student of our survey population has spent a significant amount, more than half of their high school career involved in FIRST robotics. It can be deduced, that with such a significant time period, FIRST robotics played an influential role to a student's high school career. The even distribution in the percentages of students per years of high school experience indicates that the survey data represents the entire spectrum of levels of high school FIRST involvement, ranging from one to four years.

Years Of HS Experience	Number of Students	%
1	13	21
2	15	25
3	16	26
4	17	28
Total	61	100

Average Years of HS FIRST Experience	2.61

Participation in FIRST While Attending WPI

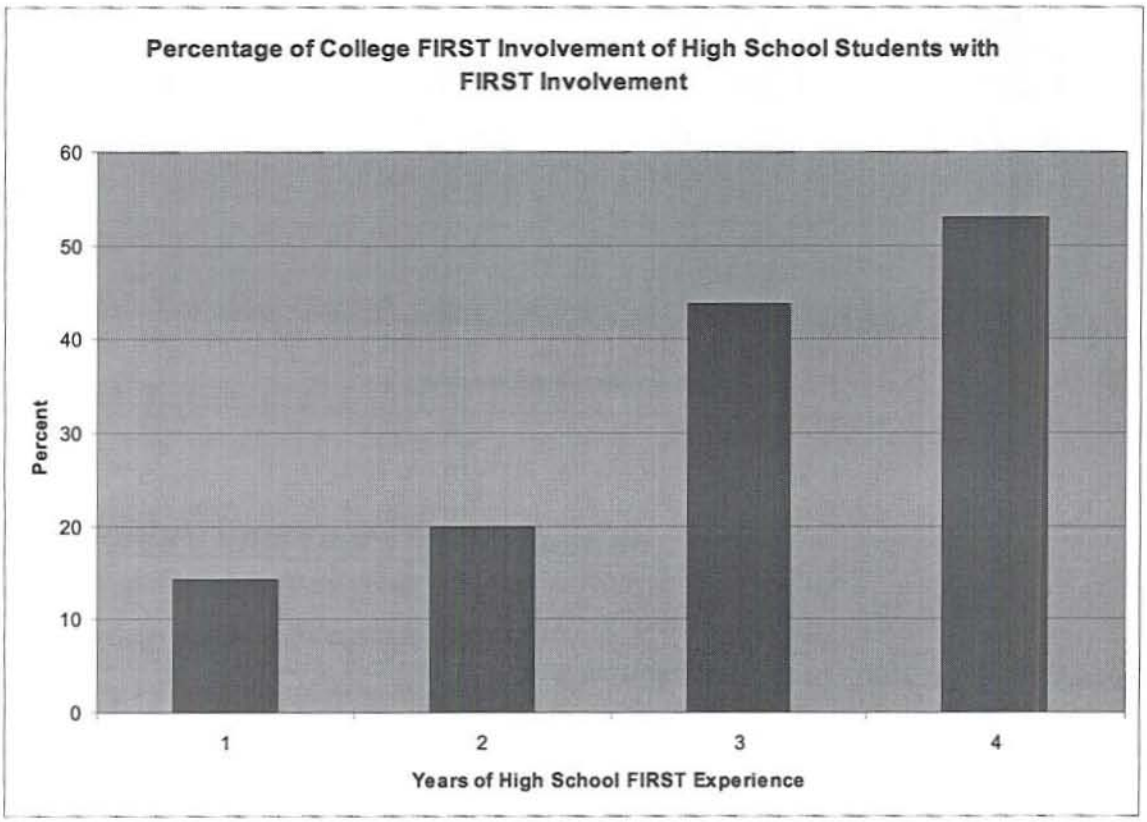
It was determined beneficial to find out if high school students continued their involvement with FIRST robotics while attending WPI. It was learned through our interview with Ed Connor from the WPI admissions department that the admissions process does take into consideration a student's ability to stay involved in college in a program that they participated in high school. Data from this part of the survey is represented in the table below.

	#	%
Number of Students Who Continued Participation in College	21	34
Number of Students Who Didn't Continue Participation in College	40	66
Total	61	100

Average Student Participation In Years	1.76

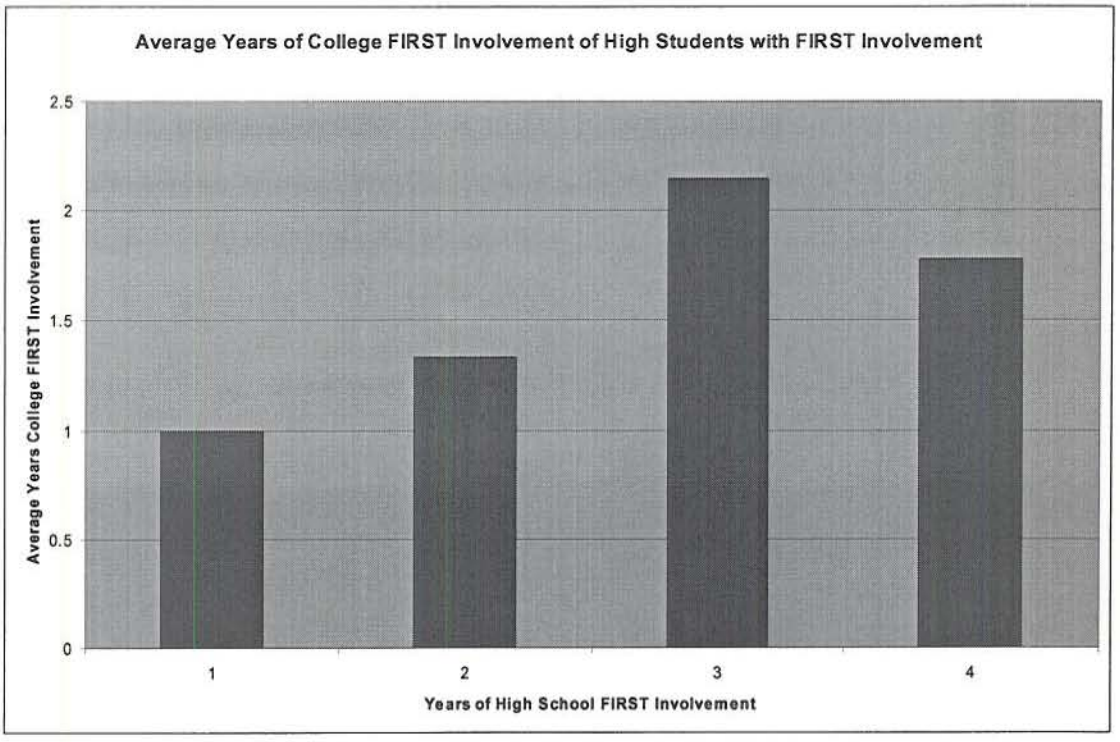
Overall 34.4% of students with high school FIRST involvement continued their involvement while attend WPI and the average student that did participate did so for 1.76 years.

After analyzing the data from the survey it was evident that the percentage of students with FIRST involvement in high school that continued their involvement while attending college is directly related to the level of involvement in high school. Students who participated for four years in high school were up to 38% more likely to be involved while attending college. The data from this part of the survey is represented in the graph below.



We were not only interested in determining how many students continued their involvement in FIRST while attending WPI, but the amount of years that they continued to participate as well. The survey data again illustrated that there is a direct relationship between the years of high school involvement and the years of college involvement. This relationship can be easily seen in the graph

below which illustrates the average years of college involvement of high school students with different years of high school involvement.



Academic Honors and Years to Graduation

With 17% of six graduating students receiving academic honors and 50% receiving honors indicated that students with FIRST involvement are 67% likely to complete their degree with some honor status. FIRST involved students appear to graduate faster with an average of 3.5 years to completion of an undergraduate degree. It is important to note that these results are not of considerable accuracy due to such a small sample of graduated students and the fact that some students might have attended Mass Academy and received WPI credit while attending high school and entered WPI as a sophomore. The data for this question is summarized in the table below.

	#	%
Number Of Students With High Honors	1	17
Number Of Students With Honors	3	50
Number Of Students Without Honors	2	33
Total	6	1

Charles O'Thompson Scholars

The Charles O'Thompson Scholar award is issued to students with outstanding first year performance. In order to be eligible for the award students must receive all A's and B's with a minimum of 6 A's their freshman year. Academic advising has indicated that over the past three years there was an average of 18.5% of the freshman population listed as Charles O'Thompson scholars. Out of the students with high school FIRST experience, 8.3% were listed as Charles O'Thompson Scholars, a number which is significantly lower than the class average. This percentage does not indicate that students with high school FIRST experience are more likely to be listed as Charles O'Thompson Scholars. The data for this part of the survey is summarized in the table below.

	#	%
Number Of Charles O'Thompson Scholars	5	8
Number Of Non Charles O'Thompson Scholars	55	92
Total	60	100

Negative Academic Standing

Students were asked if they had received any negative academic standings while at WPI, with 6.6% of students surveyed said they had, which is a number far below that average calculated from our registrar data of 18.5% for the entire student body. It is possible to deduce that students with FIRST robotics experience in high school are less likely to receive a negative academic standing than the average student. The value of 6.5% might not be accurate since the survey involves voluntary participation which does not ensure the accuracy of the value. A more accurate value for the percent of FIRST experienced students who had received negative academic standings can be calculated from data obtained from the registrar. The data from this part of the survey is summarized in the table below.

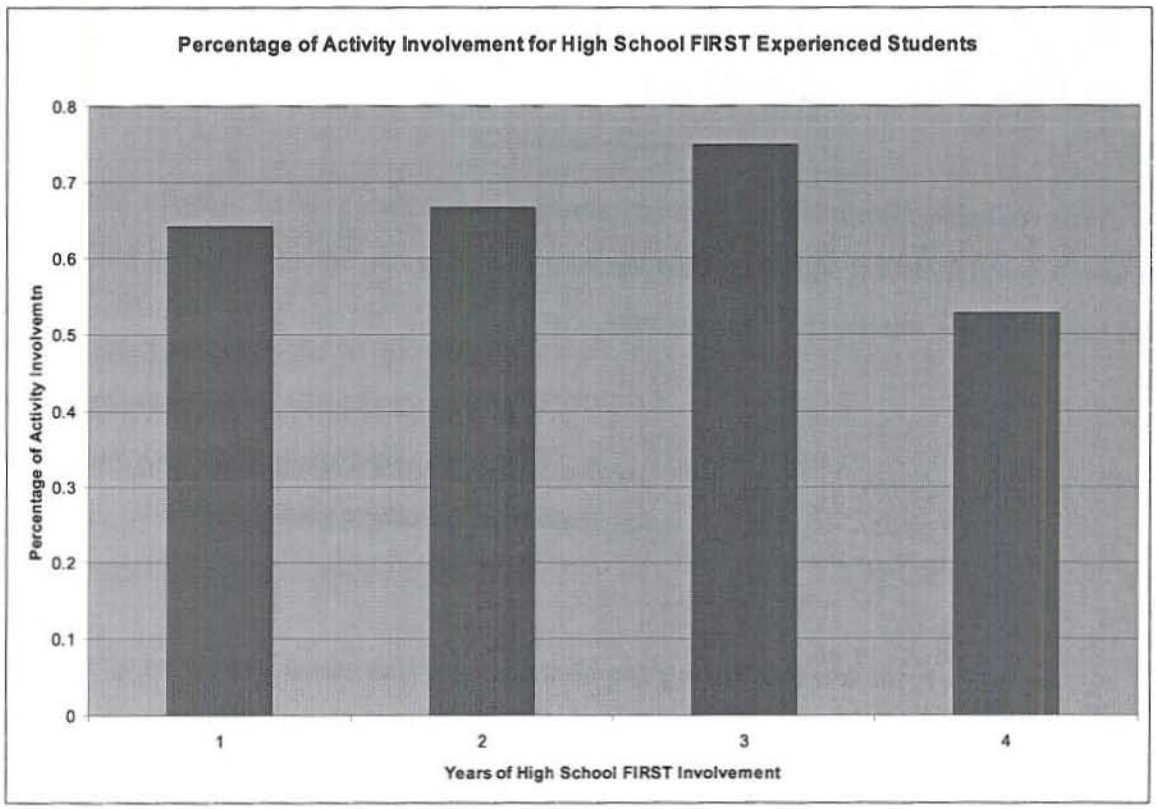
	#	%
Number of Students With Negative academic standings	4	7
Number of Students Without Negative academic standings	57	93
Total	61	100

Activity Involvement and Leadership Positions

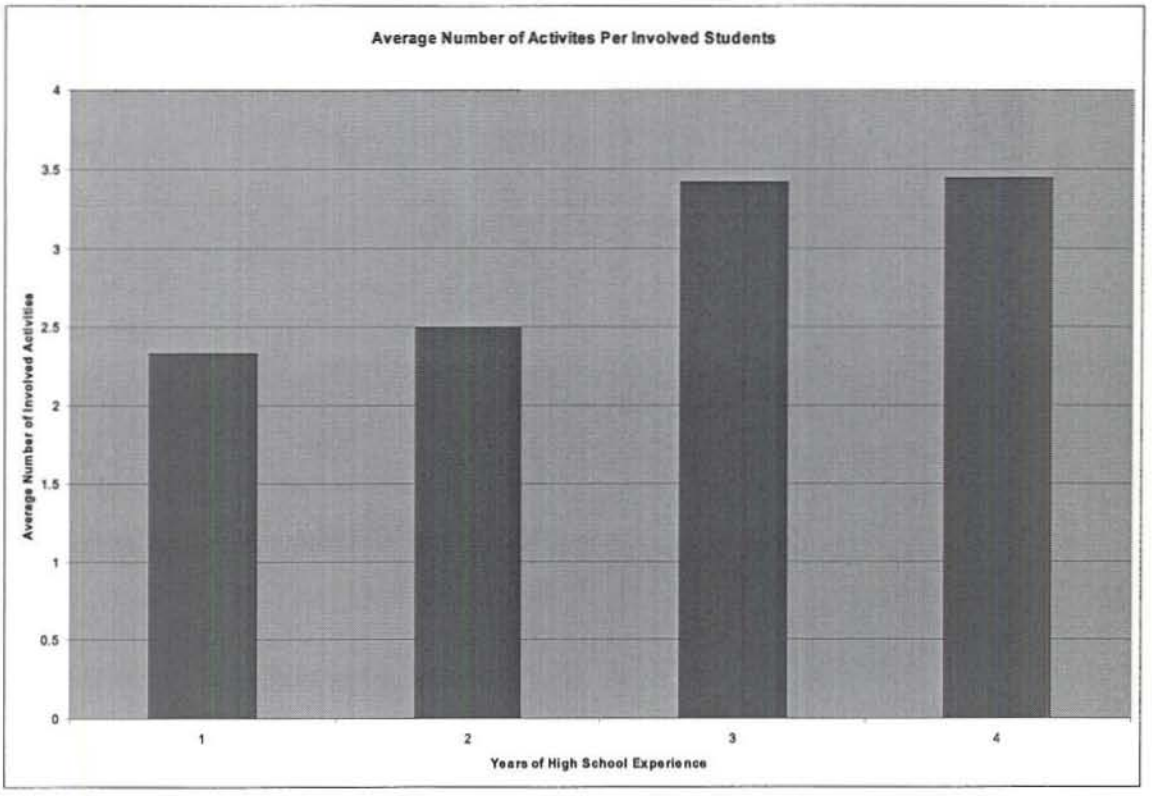
Students were asked to list any extracurricular activities in which they were involved at WPI. This question was designed to determine the level of participation FIRST students had in extracurricular activities. The number of students who were involved in extracurricular activities is given in the table below.

	#	%
Number of Students Involved in Activities	40	65
Number of Students Not Involved in Activities	22	35
Total	62	100

When you compare the percentage of surveyed students involved in extracurricular activities to the number of years of high school FIRST participation there is no evident correlation as shown in the graph below.



When you compare a student's number of extracurricular activities to the number of years of high school FIRST involvement there is clear relationship between an increased number of activities and an increased number of years of high school FIRST involvement. This relationship is clearly visible in the graph below.



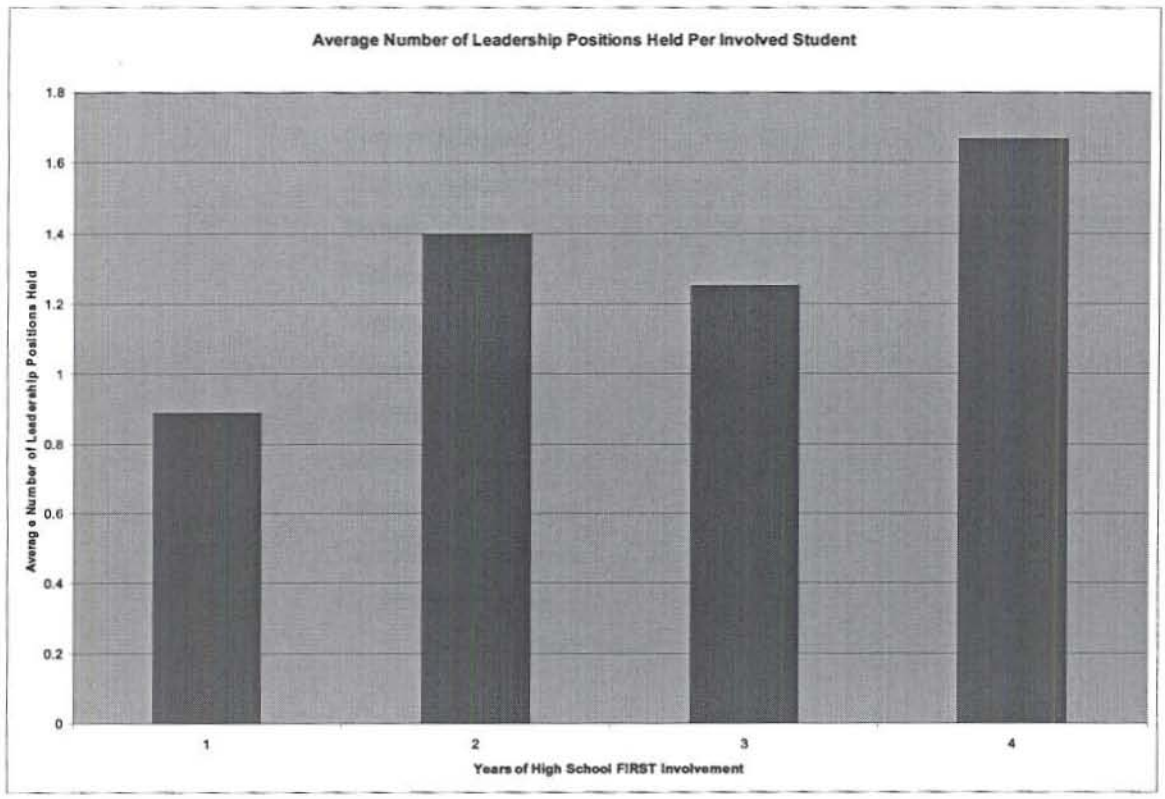
Students were also asked to list any leadership positions that they held in the activities involved. This question was asked to determine the percentage of students with high school FIRST involvement that held leadership positions. The number of students who held leadership positions is given in the table below.

	#	%
Number of Students With Leadership Positions	30	48
Number of Students Without Leadership Positions	32	52
Total	62	100

The average number of leadership positions held per student that was involved in an extracurricular activity is given in the table below.

Average Number of Positions Held Per Involved Students	1.3

When you compare the percentage of students with leadership positions to the number years of high school FIRST involvement there is clear relationship between and increased number of activities and an increased number of years of high school FIRST involvement. This relationship is clearly visible in the graph below.



Intensity Questions and Likert Scale

The student survey also contained several intensity questions which can be evaluated using the Likert scale. Intensity questions are used to gage a respondent's feelings or attitude on a particular topic or statement. These questions allow the surveyor to gather quantitative information about the survey subject. The Likert scale allows the respondent to choose one of several degrees of agreement of a statement. The answers are then assigned a weight to each a degree. For each question the

weights are averaged and an overall degree of agreement can be obtained. Values for the weighting for each degree are given below.

Phrase	Mean
Decidedly Agree	2.77
Quite Agree	2.37
Considerably Agree	2.21
Substantially Agree	2.1
Moderately Agree	1.47
Somewhat Agree	0.94
Slightly Agree	0.67
Perhaps Agree	0.52
Perhaps Disagree	-0.43
Slightly Disagree	-0.64
Somewhat Disagree	-0.98
Moderately Disagree	-1.35
Quite Disagree	-2.16
Substantially Disagree	-2.17
Considerable Disagree	-2.17
Decidedly Disagree	-2.76

Likert Scale Values

Leadership Abilities and Capabilities

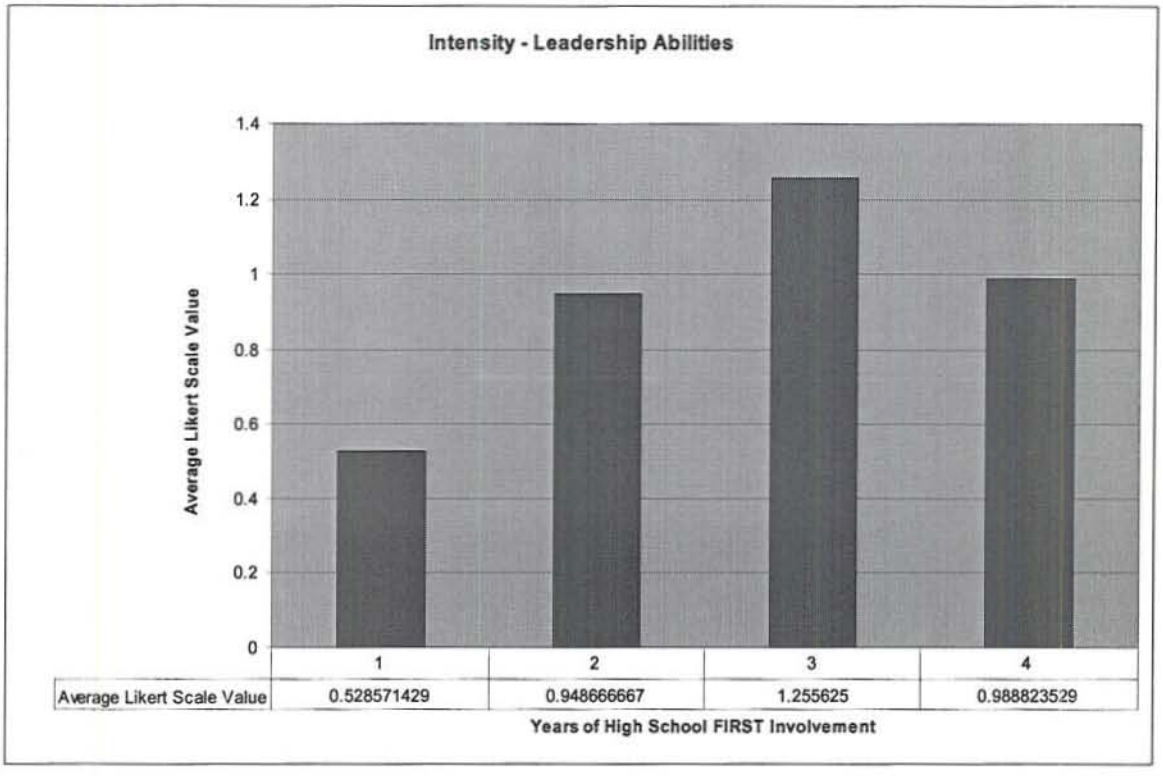
One intensity question was designed to determine if students agreed with that statement "FIRST Robotics has positively affected my leadership abilities / capabilities." The overall results of this question are given in the table below.

Average Likert Scale Value	0.92
Corresponding Likert Phrase	Somewhat Agree

The average Likert scale value indicates that overall there is a slight level of agreement to the statement above, it can be deduced that as a whole, students surveyed agree at a slight level that involvement in FIRST in high school had positively affected their leadership abilities and capabilities.

When the survey data is presented graphically comparing a student's number of years of FIRST involvement to the average Likert value of the response, there is an observable positive relationship. From this relationship it is possible to deduce that students surveyed with more years of high school

FIRST involvement felt that such involvement had a positive affect on their leadership abilities and capabilities than students with less involvement.



Ability to Work with Others

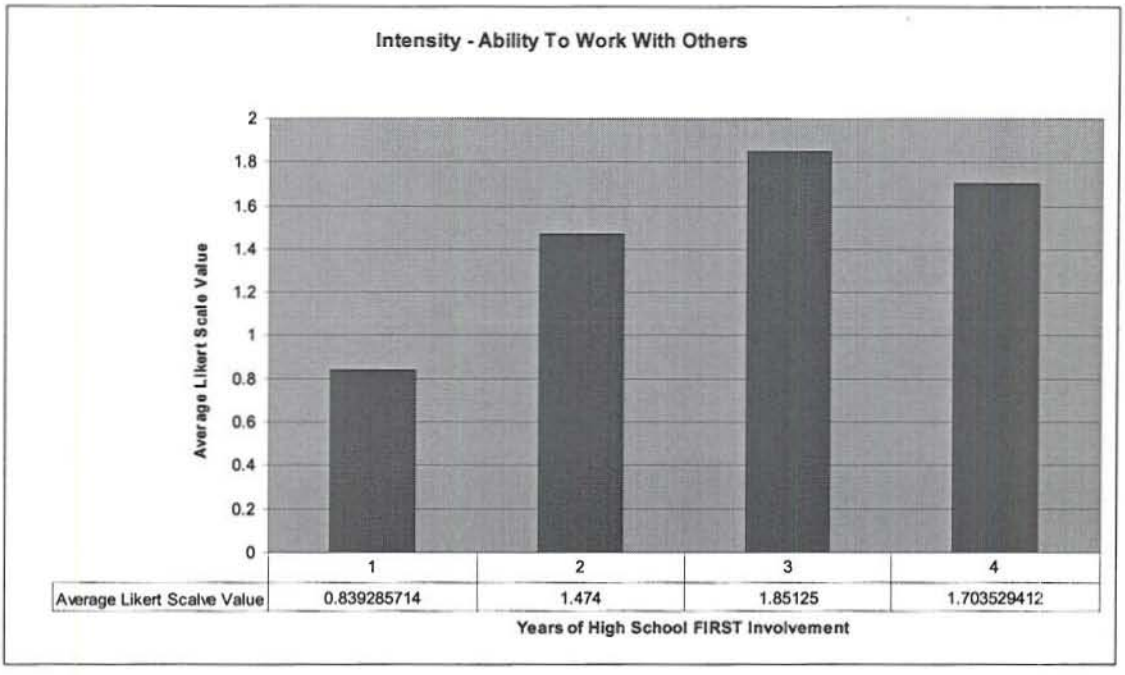
Another intensity question was designed to determine if students agreed with the statement that "FIRST Robotics has positively affected my ability to work with others." The results of this question are given in the table below.

Average Likert Scale Value	1.49
Corresponding Likert Phrase	Moderately Agree

The average Likert scale value indicates that overall there is a moderate level of agreement to the statement above, it can be deduced that as a whole, students surveyed agree at a moderate level that involvement in FIRST in high school had positively affected their ability to work with others.

When the survey data is presented graphically comparing a student's number of years of FIRST involvement to the average Likert value of the response, again there is an observable positive relationship. From this relationship it is possible to deduce that students surveyed with more years of

high school FIRST involvement felt that such involvement had a greater positive affect on their ability to work with others than students with less involvement.



College Performance

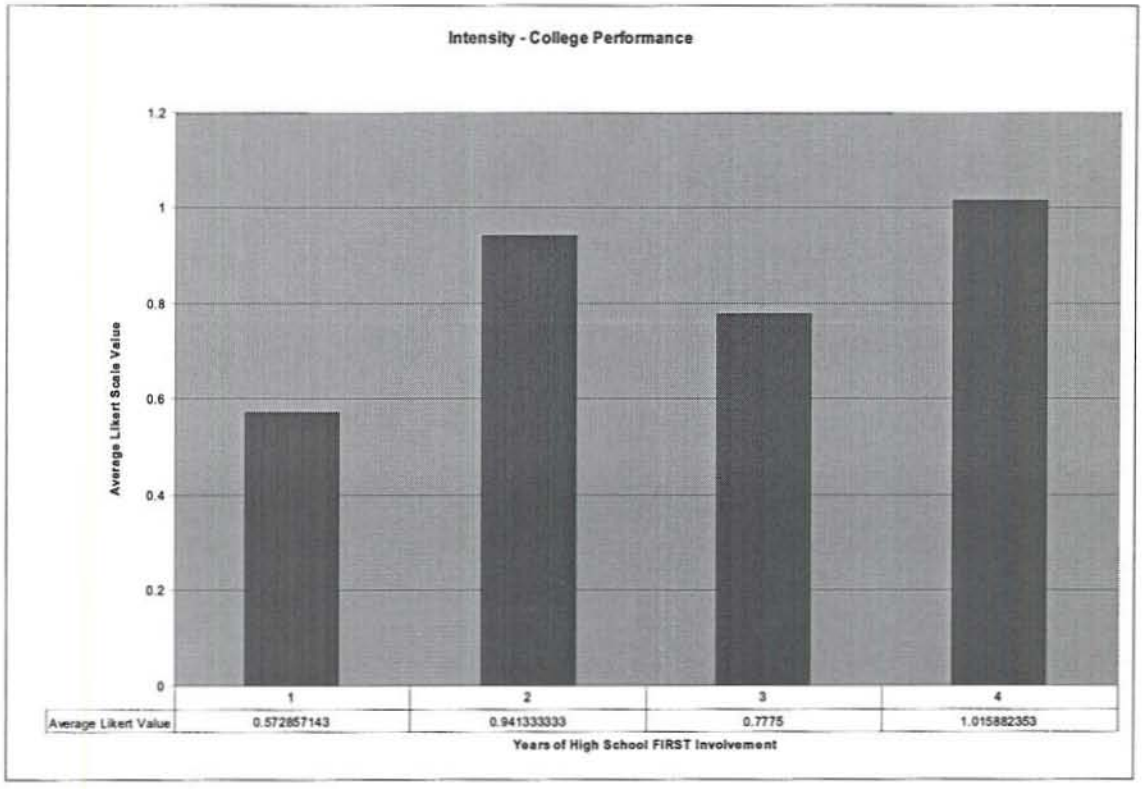
Another intensity question was designed to determine if students agreed with the statement that "FIRST Robotics has had a positive effect on my college performance." The results of this question are given in the table below.

Average Likert Scale Value	0.84
Corresponding Likert Phrase	Somewhat Agree

The average Likert scale value indicates that overall there is a slight level of agreement to the statement above, it can be deduced that as a whole, students surveyed agree at a slight level that involvement in FIRST in high school had positively affected their college performance.

When the survey data is presented graphically comparing a student's number of years of FIRST involvement to the average Likert value of the response, again there is an observable positive relationship. Though this relationship is not as evident as the others it is still possible to deduce that

students surveyed with more years of high school FIRST involvement felt that such involvement had a greater positive affect on their college performance than students with less involvement.



Time management

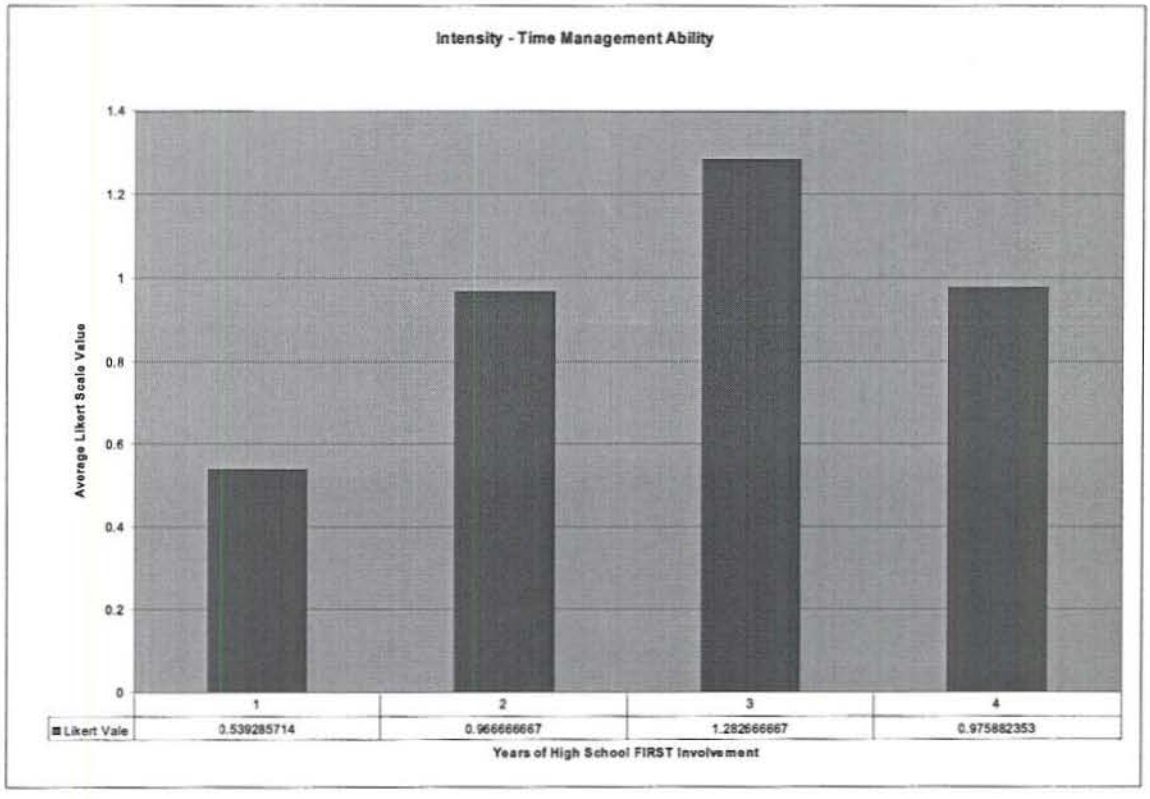
Another intensity question was designed to determine if students agreed with the statement that "FIRST Robotics has had a positively affected my time management ability." The results of this question are given in the table below.

Average Likert Scale Value	0.95
Corresponding Likert Phrase	Somewhat Agree

The average Likert scale value indicates that overall there is a somewhat level of agreement to the statement above, again it can be deduced that as a whole, students surveyed agree at a somewhat level that involvement in FIRST in high school had positively affected their time management ability.

Once again, when the survey data is presented graphically comparing a student's number of years of FIRST involvement to the average Likert value of the response, there is also an observable positive relationship. From this relationship it is possible to deduce that students surveyed with more

years of high school FIRST involvement felt that such involvement had a greater positive affect on their time management ability than students with less involvement.



Survey Discussion

There are several conclusions that can be drawn from the results our student survey. It is important to consider that the level of accuracy when conducting a survey is limited to the accurate response of the respondent. It is also important to note that there were six respondents to the survey that had indicated no level of high school FIRST involvement. The data from these six respondents was not included in the analysis of our data since this was a purposive survey in which we were only interested in a population of students with high school FIRST experience.

The overall even distribution in the amount of years of high school indicates that our sample population represents students from the entire spectrum of FIRST involvement. With this in mind it can be concluded that our survey results are an accurate representation of the levels of high school participation and their corresponding results.

34.4% of students with high FIRST involvement continued their involvement while attending WPI. It was determined that the level of a student's high school involvement directly relates to the level at which they will participate in college. Students with greater high school involvement were much more likely to continue such involvement as well as mentorship while attending WPI. The number of years which they remained involved in college is also directly related to the number of years of involvement in high school. It is important to note that over 34% of our respondents were freshman and thus have not had the ability to participate in FIRST for more than one year of college. This is true for all classes excluding seniors as well resulting in possible source of error when comparing a student's level of college involvement to the level of high school involvement.

The data obtained on the academic honors received of graduated students should not be considered as valid representation of students with high school FIRST experience due to such a small sample size of six graduated students. The data was presented above just to report the survey results of that question.

Of the students surveyed, 8.3% were listed as Charles O'Thompson Scholars, a percentage significantly lower than the overall freshman body percentage of 18.5%. It can be deduced that students with high school FIRST involvement are no more likely to be listed as Charles O'Thompson Scholars than students without involvement.

The data obtained regarding negative academic standings indicated that 6.6% of students surveyed had indicated having a negative academic standing. This percentage is significantly lower than the calculated value for the overall student body of 18.5% obtained from registrar data.

From the survey results it can be concluded that 65% of students with high school FIRST experience were involved in extracurricular activities. There was no apparent relationship between the level of a student's high school FIRST involvement and their percentage involved in extracurricular activities. On the other hand there was a positive relationship between a student's level of high school FIRST involvement and the number of activities in which they participated. Of the students involved in extracurricular activities 48% held some type of leadership position in an activity. Again, there was an apparent positive relationship between the years of high school FIRST involvement and the average number of leadership positions a student held.

From the intensity based questions we can conclude the overall opinion the students in response to various statements made in the questionnaire. There was a slight agreement with the statement that FIRST had positively affected a student's leadership ability, with an increasing positive affect in students with more high school involvement. There was a moderate agreement with the statement that

FIRST had positively affected a student's ability to work with others, with an increasing positive affect in students with more high school involvement. There was a slight agreement with the statement that FIRST had positively affected a student's college performance with an increasing positive affect in students with more high school involvement. There was a somewhat level of agreement with the statement that FIRST had positively affected a student's time management abilities with an increasing positive affect in students with more high school involvement.

Simply put, 34% of students surveyed continued FIRST involvement in college, with students of greater high school involvement being more likely to continue involvement in college. It can be concluded that students with high school FIRST involvement are not more likely to be listed as Charles O'Thompson Scholars, but are less likely to receive a negative academic standing. Of the students surveyed 65% were involved in extracurricular activities; with 48% of those involved holding some type of leadership position. Students with a greater level of high school FIRST experience were more likely to be involved in a greater number of activities as well as hold a greater number of leadership positions than students with less high school FIRST involvement.

Students surveyed slightly agreed that high school FIRST involvement had a positive affect on their leadership ability and college performance. They moderately agreed that their involvement had a positive effect on their ability to work with others. Students surveyed also somewhat agreed that their high school FIRST involvement had a positive affect on their time management abilities. For the intensity questions there was an increasing level of agreement with the number of years of high school FIRST involvement. It can be concluded that the greater a student's involvement in high school, the more they agree that it had a positive effect on their leadership abilities and capabilities, ability to work with other's, college performance, and time management abilities.

Registrar Results and Discussion

Analysis

The data analysis of our target group, those students who participated in FIRST in high school, versus the student body as a whole brought up some interesting results. FIRST high school students usually come in on the same level as the rest of the student body, their SATs are generally even or within ten points of the average, their AP credits are usually about the same, and their college

performance is similar. In some classes FIRST students perform better than the school average, but in about the same number of classes the school performs better.

The source of this data is directly from the Registrar's office. We provided them with a list of students who were noted FIRST participants, in order to look up their academic performance. The results gave the team a broad picture of the participants' high school and college performance. This data can be seen in appendix A as can the data of the entire school body. By comparing the data of this target group to the control group, being the entire student body, we could see trends in performance.

Since the target list we provided the registrar mainly had data from the classes of 2006, 2007, 2009 and earlier, and the data the registrar provided us for the entire student body mainly had data from the classes of 2006, 2007, 2008, 2009, and 2010, we focused our study on the data between the 2006, 2007, and in particular the 2009 years. We will discuss the issues regarding using this methodology later in the report.

After an analysis of the data, for 2006 2007 and 2009, it could be concluded that high school FIRST students don't vary academically from the rest of the school during their college years. The 2009 cohort, for instance, demonstrates this through their performance. The students in the 2009 cohort who participated in FIRST in high school had a higher 'No Record' (NR) rate for three classes compared to the school, but had a lower one for two classes, and an equal one for one class. A 'No Record' at Worcester Polytechnic Institute means a student has not successfully completed a course for whatever reason. The rate at which each group has students with academic standings issues fall within a margin of less than 5% of the total population of each group. The school overall had a 19.51% Academic Standing rate for the '09 cohort while the FIRST group had a 24.14% rate. This demonstrates an evenness and balance academically between each given the number of students in each group. This data can be viewed in the following table and again in the appendix:

	CH1010	MA1021	MA1022	MA1023	PH1110	PH1111	Academic Standings rate	AP credits avg	SAT	
2009 Cohort									0	0
Dale NR rates for previous year	8	13	21	8	13	5				
School NR % Rate at least:	4.78	9.69	21.4	11.75	5.24	0	0	8.4	613	668
FIRST students NR % Rate at least:	7.14	20	18.75	9.52	7.69	0	0	10.31	646	682

2009 Cohort Data

To understand the above table, please reference the in depth details of these charts in the appendix. The three rows on the side in which data relate are the student body averages and the target group averages. The category 'Dale NR rates for previous year' give the 'No Record' (NR) rate for each of the six major courses in the past year for that cohort. The 'School NR % Rate at least:' describes the minimum total percentage rate of NRs for the total amount of times a class was taken by that group. The reason it is at least the minimum amount of NRs is because it is impossible to tell if a student perhaps NR'd a class and just never took it again, rather than NR'd and signed back up for the course.

This general trend follows for the rest of the two cohorts that we are able to study in 2007 and 2006. The data is unfortunately lacking in these two years, however, from what data exists we can determine that the 06 cohort follows the 09 cohort approximately, in terms of NR rate pattern. The FIRST group got a higher 'No Record' rate in three classes than the school, lower rates in two classes,

and an equal one in one class. The only difference exists in the AP credit average and SAT scores in which the school outperforms the FIRST group. The following table emphasizes the 06 cohort data.

	CH1010	MA1021	MA1022	MA1023	PH1110	PH1111	Academic Standings rate	AP credits avg	SAT	
2006									0	0
Dale NR rates for previous year	2	12	11	7	15	22				
School NR % Rate at least:	6.01	9.77	15.91	11.56	7	0	0	7.46	650	680
FIRST students NR % Rate at least:	16.67	25	11.11	11.11	9.09	0	0	6.86	598	655

2006 Cohort Data

The 2007 cohort has the least amount of data of the three years; however, it also reinforces the notion that FIRST students are neither better nor worse than the average college student academically. The data showed that the FIRST group for the 07 year had four classes in which none of the students received an NR, while the student body had a few. There were, however, two classes in which the student body outperformed the target group and one that no students NR'd. The classes that resulted in NRs for the FIRST group; however, did not result in any of the students receiving academic probations and therefore they outperformed the student body in Academic Standings. This data is presented in the next chart.

	CH1010	MA1021	MA1022	MA1023	PH1110	PH1111	Academic Standings rate	AP credits avg	SAT	
2007 Cohort									0	0
Dale NR rates for previous year	3	18	21	5	10	26				
School NR % Rate at least:	2.85	16.95	13.11	10.03	5.91	0	0	8.05	612	667
FIRST students NR % Rate at least:	0	25	0	0	16.67	0	0	4.5	621	640

2007 Cohort Data

The overall analysis of this data presents no clear indication that students who participated in FIRST in high school were any stronger or weaker than students who hadn't in terms of college academics. Out of an analysis of eighteen classes, FIRST students outperformed the school NR rate for seven of the classes, six of which were MA1022, and MA1023, Calculus 2 and Calculus 3 respectably. Of the remaining eleven courses, the school average outperformed the FIRST group in eight classes and had the same rate in the remaining three.

In each case except for the 2007 cohort, the students in both groups had academic warning (Academic Standings) issues at almost the same rate. The difference between the 2006 rates is 5.02%. The 2007 cohort does have a difference of 22.03% but it seems likely that due to the lack of significant data for the 2007 FIRST cohort, that the data may be skewed.

Analysis Issues

Data skew seems like a potential problem in this analysis. We have taken all possible measures to avoid this, such as separating data analysis by cohort, dropping measures of merit where we can't accurately analyze, such as class rank, and focusing on the key courses that were selected by Dale Snyder, the Director of Academic Advising. This unfortunately results in scenarios such as the 2007 cohort in which we are left with six students from which to gather data. The data presented by that cohort did present mostly consistent data as the others, however, so we've decided to use it.

Closing Thoughts on Data

The overall fact seems to be that students who are admitted to WPI are all accepted on the same academic level and once they enter Worcester Polytechnic Institute, they all perform academically on about the same level, which is the goal of the admissions department. To either further prove or disprove this fact will require retesting by a group in the future or more precise data from the Registrar. Both of these options are viable; however, they both work together better than they do individually.

In the recent year, the Registrar's office, through flagging done by Admissions office, has begun noting students who list FIRST participation in high school in their system of student data. As this system expands over the course of the next few years, a second wave of analysis will become an easier and more necessary task. Our data was limited by students who had given us permission to search for their academic performance and were FIRST students in high school. This data was difficult to come by and limited our analysis in some situations. However, our data seems to corroborate itself through each different cohort, and in a way that makes sense.

Students who are admitted to WPI are generally equal in academic ability and involvement. Students who apply to come to WPI can be expected to have some interest in engineering, science, or technology. Their performance at WPI therefore could be expected to be equal to that of their peers who they were admitted with. Analysis of involvement, however, is not the purpose of this section and can be found elsewhere in this report.

As the old motto of WPI stated, the school focuses on being the 'The University of Science and Technology. And Life' and the admissions process has largely followed that ideology. WPI and FIRST offer many underprivileged individuals the opportunity to go to college and grow into a position such as an engineer or scientist that they may have never had thought about being before. A study performed by Brandeis University studied the effects of FIRST high school experience on underprivileged urban and minority individuals in terms of their aspirations and have found that those who did FIRST in high school were more likely to go onto college than their peers.[5] If these individuals make up a portion of our students who we received Registrar data on, their mere ability to perform on the same level as those who have had the best in schooling is phenomenal. We feel, however, that this is not the case. Worcester Polytechnic Institute's undergraduate body during enrollment fall 2006 was 79% white, 4% Hispanic, and 2% Black, the remaining 15% fell between

[5] Impact, Brandeis University Study, http://www.usfirst.org/who/content.aspx?id=46, US FIRST, (last accessed 4/25/2007)

Asian, Islanders, and other non-resident aliens.[6] This unfortunately, largely dispels the use of the Brandeis study in our report.

The fact that FIRST students are academically on an even keel with the student body isn't necessarily a bad term in considering it a positive measure of merit. When we interviewed Ed Connor of the admissions department, he told us that WPI looks for more than academics, they are looking for "...Somebody that's looking to go above and beyond the pure theoretical reading a book, going to class, that sort of education, which you know is not exactly what WPI is all about. Its hard to quantify that, I think there are different ways to do that, to look for students who have gone above and beyond in the classroom, they've done programs over the summer, they're concerned about a weakness where they just want to go further in a particular academic area, students who have traveled for example, taken advantage of abroad programs through their high school" (Connor). He further explained to us that the admissions department had a general idea of what they were looking for academically if they wanted a student that would just graduate on time, so instead they were looking for people who took experiences from the real world and be active on the campus. Being actively engaged within the school and academically succeeding on the same level as the rest of the school was a true measure of success to the admissions department. As can be seen from the above data, students who participated in FIRST in High School meet at the academic criteria. What will be further seen in other sections of this report is that these same students excel in being engaged. They make FIRST a reasonable choice of a new measure of merit for the admissions department.

F test and Pearson Correlation Results

To gain a better understanding of the samples, an F test was run for GPA and SAT scores[7]. All incomplete subjects, those missing either SAT or GPA data, were removed from this test. This resulted in 18.3% of the 2009 student body cohort being removed from the test, as well as, 13.8% of 2009 FIRST student cohort. It was found that there was 72.3% chance of the variance in GPA being similar in the samples. For SAT scores, the chance of similar variance was only 34.6%.

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[6] Worcester Polytechnic Institute, Prepared by the Office of Enrollment Management, 2006 Student Factbook, http://www.wpi.edu/Images/CMS/WPI/factbook.pdf

[7] See appendix F for details of F Test

As for the Pearson Correlation, it is important to remember that a normal distribution must be assumed[8]. This seems a fair assumption for GPA and SAT scores. It is also important to remember that a Pearson correlation gains more credibility with increase in sample size, in the sense that any linear relationship between data will become more clearly defined. Pearson correlations can only be run for comparing characteristics within a sample and not between samples. However, comparison of correlation values is acceptable.

The test was only run for the 2009 cohorts, with the same amount of the population removed as in the F test. This was due to the limited usable data available in the other FIRST student cohorts, which had 10 or less usable subjects. As seen in the scatter plots below, neither the 2009 student body, nor the 2009 FIRST student cohorts contain data with a clear pattern.

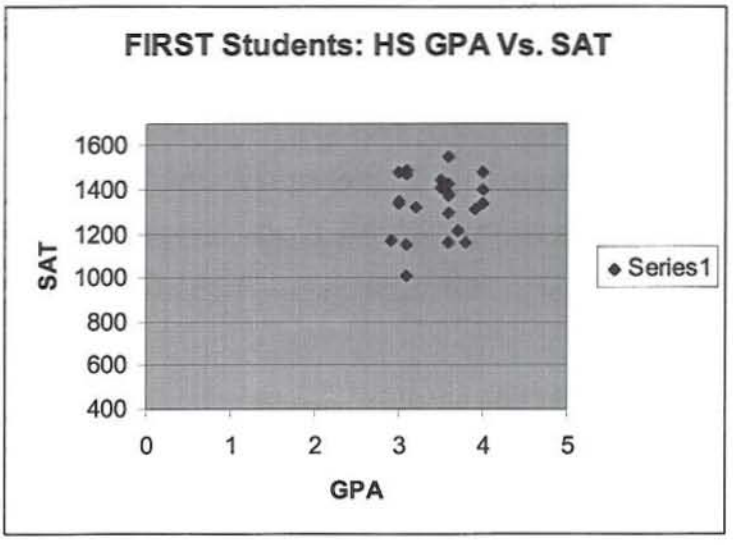

Figure 1. FIRST Students high school GPA vs. SAT Score

[8] See appendix F for detail of Pearson Correlation

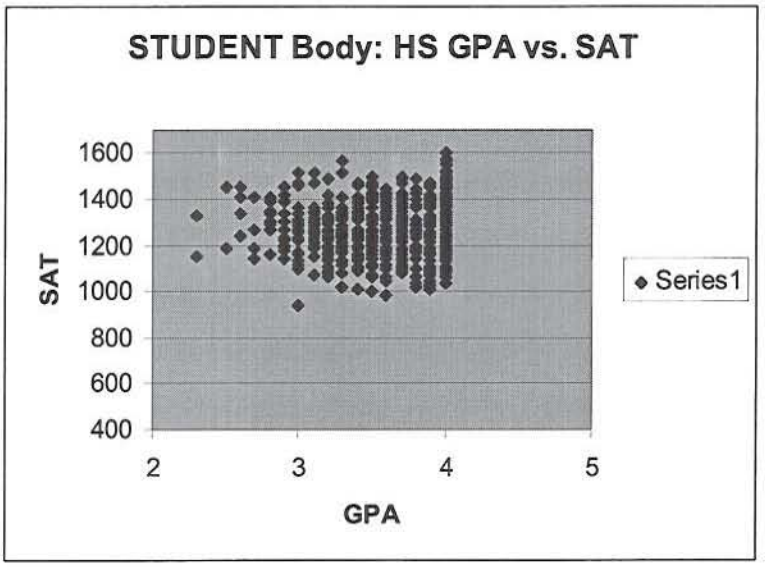

Figure 2. Student Body High School GPA vs. SAT Sore

After running the Pearson correlation it was found that the resulting Pearson products, or r values, were .1108 for the 2009 student body cohort and .127609 for the 2009 FIRST student cohort. A value of one 1 would be a perfect positive correlation and 0 would be no correlation. From these r values it's easy to see that neither sample has a strong linear correlation. When the Pearson product is squared the coefficient of determination, or r^2, is found. This shows the percentage of variance in y, in this case SAT scores, which can be explained by variance in x, in this case high school GPA. It was found that for the 2009 student body cohort, the coefficient of determination was .0123 and for the 2009 FIRST student cohort it was .0162. Again values close to 0 demonstrate no relation in xy variance, while values closer to 1 show high relation in xy variance.

Pearson correlation and F test discussion

Based on the results of the F test it is clear that variance in GPA between the two sample are similar. However, in the case of SAT scores it appears that there is a very limited relation in variance. This is most likely caused by the greater number of subjects in the 2009 cohorts, which affords more chance for variance. It also seems that with the removal of outlier, such as those scores below 1050, a more reasonable relation of 42.4% is established. However, due to the limited amount of data, it was felt that any usable subject should be included in the test; therefore, the modified SAT sample wasn't used. By being able to change the variance relation by almost 8% with the removal of few outliers suggests that the FIRST student SAT scores and the student body SAT scores could be more similar then suggested by the F test. This could potentially be resolved if more data was available for the

FIRST student population, so that outliers could be removed. It should also be remembered that while GPA has a very limited range, between 2.0 and 4.0, SAT scores vary from 900 to 1600. With this in mind, it makes sense that variation should be greater in SAT scores simply because the range for variance is larger. Also, since the student body has a larger population, it makes since that its sample exhibits a greater variance.

As for the Pearson correlation, in both cases the Pearson product was found to be too small to establish any reasonable correlation. Based on the Tichenor interview, these results make sense. It was noted in the interview that SAT scores are often a terrible indicator for a student's performance[9]. However, what makes these results interesting is that the FIRST student and the student body Pearson product were very similar with a difference of .017. This difference was further minimized in the coefficient of determination with the difference being only .004.

When the above results are coupled with the F test it begins to look as though both samples exhibit similar degrees of variance and correlation. In other words, each sample tends to lack a linear correlation and exhibit similar variance characteristics; with the understanding that the FIRST student population is most likely under represented. Even a simple visual inspection of scatter plots of the two samples seems to indicate that data for both samples falls in about the same area.

Considering that GPA and SAT scores are traditional indicators for college acceptance, it appears that FIRST students entering WPI don't exhibit a major difference in their traditional indicators then the rest of the student body. Thus, it would seem that the populations may be more related by being a part of WPI then by being in FIRST or not. However, it's important to remember that only the 2009 cohorts were tested and that it is not known how well the FIRST population was represented for that cohort.

Chi Square Results

Based on the results of the Pearson correlation and F test it was decided to run the chi square tests with a 1 in 10 chance, or a probability less then .1, that the conclusion reached does not represent the population[10]. A strong correlation is generally considered to be within a 1 in 20 chance, or a probability less then .05. This means that if the chi square test proves true only a weak degree of

[9] See appendix I for Tichenor interview
[10] See appendix F for information on Chi squared test

confidence will be established for the relation. However, based on the lack of correlation found in the Pearson and F tests, and the limited data, it was felt a large degree of uncertainty should be expressed.

While this degree of significance is normally used, with degrees of freedom, to find a chi value from a table, which can be compared to the calculated one, Excel calculates in terms of what degree of significance can be assumed. This means the null –hypothesis (Ho) was set to a significance of .1 or lower. The Anti-hypothesis (Ha) was set to any value greater then .1. If the null hypothesis is found to be true then it can be said that there is no relationship between the variables tested, which implies that there is no relationship between the samples or the populations. However, if the test fails and the anti-hypothesis is proven true then a relation may exist, or error may have skewed the results beyond the expectable significance.

With all this in mind, the results of the chi square test are listed in the chart below. If a particular set had rows with frequencies lower then 2 the test was run a second time without those rows included. Any row that had a cell with a frequency lower then zero was simply removed to make the test possible, this usually resulted in no more then 7.09% of the combined sample population being thrown out.

	Desired degree of significance	Chi Squared results	Ho Proven	Modified chi square results	Ho Proven
Chemistry 1010	0.1	0.239	no	0.092	yes
Math 1020	0.1	0.435	no	NA	NA
Math 1021	0.1	0.192	no	NA	NA
Math 1022	0.1	0.661	no	0.495	no
Math 1023	0.1	0.922	no	NA	NA
Math 1024	0.1	0.112	no	NA	NA
Physics 1110	0.1	0.06	yes	0.017	yes
Physics 1111	0.1	0.012	yes	NA	NA
Physics 1120	0.1	0.263	no	NA	NA
Physics 1121	0.1	0.131	no	NA	NA
Academic Status	0.1	0.534	no	NA	NA
Terms completed	0.1	0.236	no	NA	NA

Figure 3 Results of Chi Squared Tests

Discussion of Chi Squared Tests

Based the results it's fairly clear that FIRST students take math with the same frequency distribution as other students. They also have no statistical difference of academic probations, or difference in the number of completed terms. This further confirms the idea that FIRST students, on average, perform similarly to the rest of the student body, as suggested in the Pearson and F test.

However, when looking at chemistry and physics 1110 and 1111, the samples pass the chi squared test. While this could be considered a fluke in the case of the chemistry, since it only passed when the data was further modified, a simple visual comparison of pie charts of the frequencies reveals that more may being going on then originally thought.

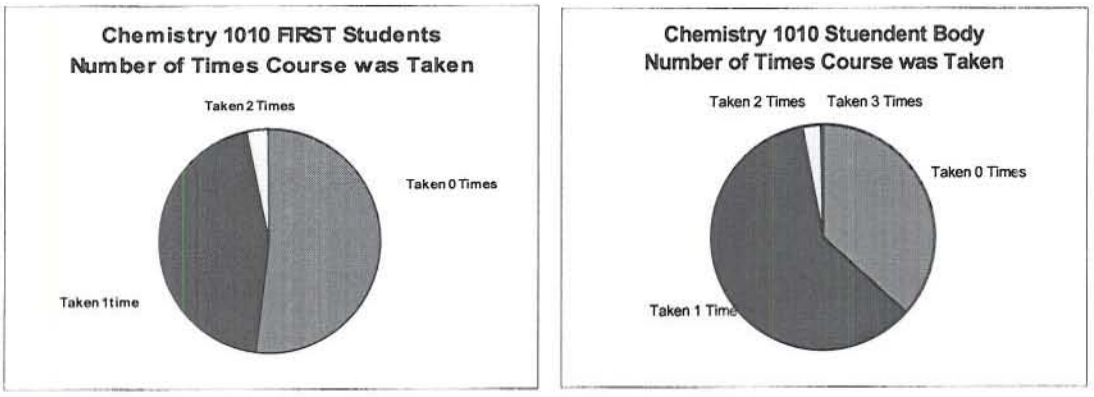

Figure 4 Chemistry 1010 Pie charts

As can be seen in the charts, FIRST students generally don't take chemistry as often as regular students. Since this is generally considered a core class that most students have to take, it appears that FIRST students may be more likely to have already gotten credit for the course, or simply skipped it to take higher level courses[11]. This pattern is mirrored with more clarity in Physics 1110, as seen below. However, in Physics 1111 the trend reverses. A greater percentage of FIRST students took this Physics 1111 then those of the student body.

[11] WPI does not require prerequisites for courses, so students can skip lower level course if desired.

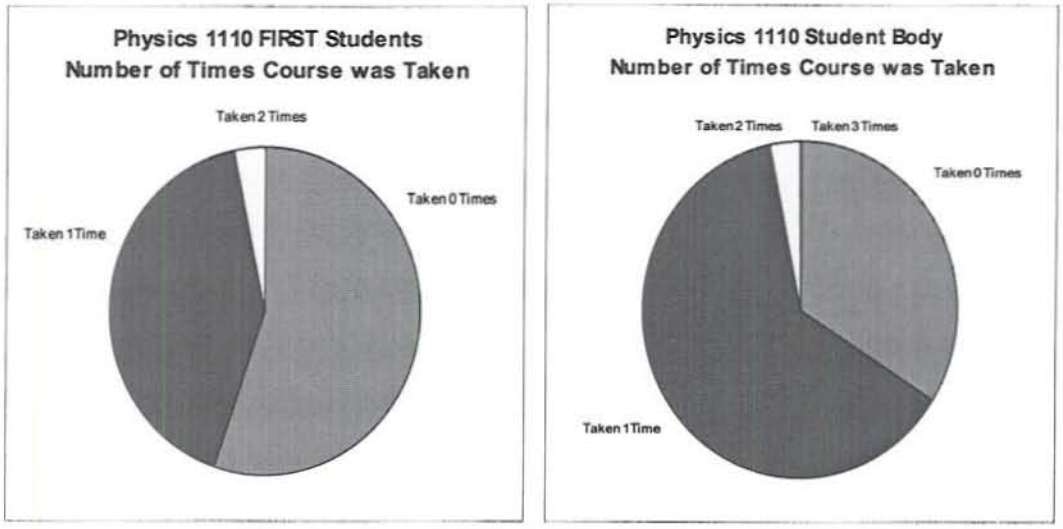

Figure 5 Physics 1110 Pie Charts

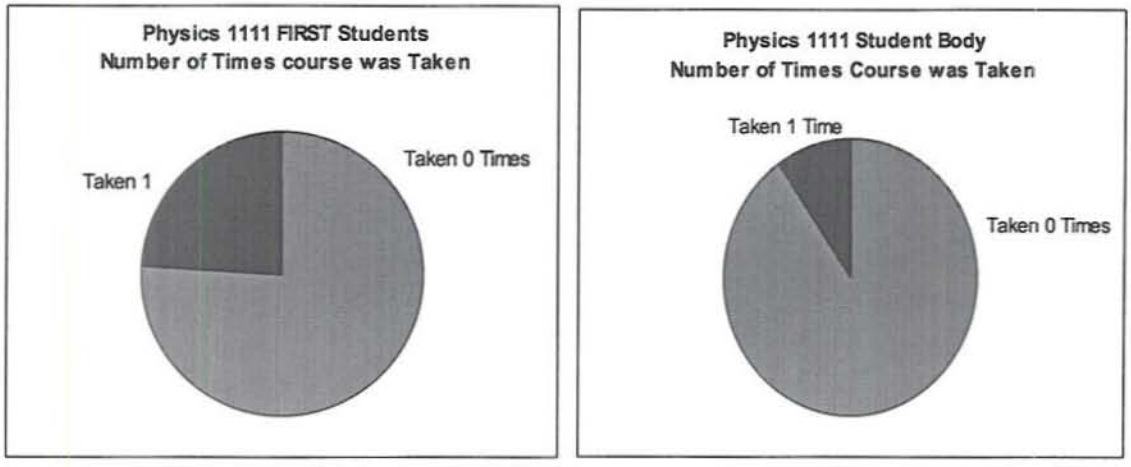

Figure 6 Physics 1111 Pie Charts

At first, there may seem like an abnormality in the data, however, after comparing these results to what was found in background research it appears that these results do make sense. According to the Brandeis study, students in FIRST were more likely to take science courses in high school (Brandeis). This may have resulted in these students entering college already being comfortable with basic physics concepts, or already having credit for the course. If students felt more comfortable with basic concepts in physics it could also explain why a higher percentage of them felt comfortable taking Physics 1111, which cover the same concepts as Physics 1110 but is calculus based.

It's important to remember that even though the background research seems to support the result found in the Chi squared test, the test could only be preformed for the 2009 cohort, which means any variations from year to year can't be observed by these tests. Even more problematic is the limited amount of data on the FIRST students for the 2009 cohort, which resulted in a low degree of

confidence having to be assumed. In the end these conclusion are really only speculative at best, and would require better data collection on the FIRST student population from multiple cohorts to be of real value. However, some credence can be given to these conclusions since they seem to generally agree with other research.

How to improve the study

There were several things that could have been done to improve the effectiveness of the study. If a better sample of the FIRST population could have been taken, results for the Pearson and Chi squared tests would have been more meaningful. In the case of the Chi squared test, a greater degree of confidence could have been assumed.

In order to resolve this limitation several methods could be considered, such as tracking students from their teams. However, since WPI has begun to track students who participated in FIRST as of this year, it seems the problem may have been resolved.

Also, it would have been more helpful if registrar data could have been more complete. For instance, if a subject was missing a high school GPA, it would have been nice to know whether it simply hadn't been entered, or the subject had been home-schooled. A clearer account of why data was missing would help in clarifying limitation of the study.

Another major problem was the way in which data had to be collected for the questionnaire. Since maintaining anonymity was considered very important, ID numbers, used for registrar data, were not asked for in the questionnaire. This made it impossible to find out which responses related to which set of data. Also, many of the responses were set up to find out frequency rather then an actual response value. While these frequency questions were useful in describing certain characteristics of the population, it eliminates the usefulness of the Pearson correlation, which looks for a linear relationship in data.

However, if the data from the survey and the registrar had been comparable there are several categories that would be of interest. For instance, it would have been interesting to see if the years of involvement in FIRST in high school had an effect on high school GPA. It would have also been interesting to see if years of involvement in FIRST changed time to graduation, or number of times core classes were taken. More importantly, a clear picture of retention rates could be established. A comparison between student extracurricular activities and the number times core classes were taken or academic probation occurred would also be interesting. All of these comparison would give a better indication as to how FIRST students were involved in the campus.

Closing thoughts

It is important to remember that this study was done during a transition period for WPI. In the past, data collection and storage of student information has not taken a high priority for the campus. The duty has traditionally fallen to the registrar's office, which is an added burden to their normal duties of student registration, as well as other services (Tichenor). In other schools data collection and analysis are often separated into completely separate departments due to the large amount of man power required to perform the task correctly. Also important to understand, is that while the data base is collective, only certain offices can access certain information on students. This limitation often makes analysis difficult[12].

Currently, students who show participation in FIRST during high school are being tracked. In 5 or 6 years, once enough data has been collected, a much better picture of the actual size of the WPI FIRST student population can be established. Although this data will technically be self reported, it should provide a clear enough picture to better compare how students perform from year to year, and show differences in retention rates, if any exists.

However, since this study found that, other then the head start FIRST students have in physics and maybe chemistry, FIRST students generally perform the same as the rest of the student body, it maybe more useful to broaden the study. If the total FIRST population for WPI, or at least fairly an accurate sample, could be established a comparison could be made between the percentages of FIRST student to regular students at WPI compared to other schools. This comparison could determine if the FIRST student to regular student ratio is higher or lower. With these results a better picture of whether or not students who participated in FIRST exhibit qualities desired by WPI could be determined.

[12] A copy of the Tichenor interview can be found in Appendix I

Conclusion

Upon completion of this report, in which we were studying the effects of high school FIRST Robotics participation on the student ability to perform at the university level, we have come to a few conclusions. By investigating students through the use of purposive surveying as well as data analysis using information provided by the Registrar's office, we were able to determine whether students who were involved in FIRST made it a worthy measure of merit for use in the admissions process. Measures of merit are factors that are considered in the application of a high school student to the college level which include values such as SAT scores, GPA, class rank, extracurricular involvement, and varying other factors.

In recent years, Worcester Polytechnic Institute has taken the initiative to drop the use of SAT scores from the admissions process, regarding them no longer as a way to measure a prospective student's intuitive skills, but rather a test of who could spend the most money and time preparing for a test that has evolved little in years. GPA has also fallen from grace in the eyes of the admission's department, because as Ed Connor, admission's manager, explained to us, GPA is often boosted by high schools for select students to make them appear better for colleges. Our surveying and data analysis was to show whether FIRST experience could potentially replace those measures or at least be used alongside them.

From our purposive survey of students with high school FIRST experience it can be deduced that a student's level of college FIRST involvement is directly related to their level of involvement in high school. Students were no more likely to be listed as Charles O'Thompson Scholars. A significant number of students with high school FIRST experience were involved in extracurricular activities with the average number of leadership positions held in such activities increasing with the level of a high school FIRST involvement. It can be concluded from Likert Scale based questions that the greater a students involvement in high school, the more they agree that it had a positive effect on their leadership abilities and capabilities, ability to work with other's, college performance, and time management abilities.

Academically, data analysis from the Registrar's record of student performances shows that high school FIRST participants are on an even keel with the overall student body. This is to be expected since FIRST has never been a large factor in previous admissions, students with the

experience are accepted through the same measures of merit as all other students. Through analysis of class performances, we can see that FIRST students receive 'No Records' for classes at the same level as the entire student body. They receive almost the same amount of academic warnings, and are academically no different in any of our measures in any significant way.

Those connected to the admissions process, such as Dale Snyder and Ed Connor have explained that they are not looking for students to come into the school with just excellent academic scores in high school just to have them receive excellent scores at the college level and be gone. They would like students who become involved, struggle with things to find out what they are good at, and what they can improve on. The Career Development Center, or CDC, has also explained that this is important. Companies today prefer to see students who know what they are good and bad at and were willing to get involved with groups to demonstrate their team skills. Universities are no longer for academics alone.

At this time, we are willing to say that FIRST is an important program to note on an admissions application because of the time, intelligence, and creativity it requires. The school has also come to this conclusion because they have recently begun to flag the program in their record system for all prospective students who put it down on their application. This does not mean that FIRST should be a measure of merit to replace the SAT scores or GPA at this time; however, but this is the first step. What should be done is further research in the future. Unfortunately, due the lack of flagging at the time of this report, not enough significant data was available to us. In the future, this project should be repeated using the same standards and ideology that we used but with all the new data available through the Registrar's system. We suggest that the first re-examination of the data should occur in five years when the system has given students enough time to come in, perform, and begin to graduate.

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Appendices

Appendix A: Raw Data from Registrars

Student Body Registrar Data: All Cohorts

To see data click the link below:

Microsoft Office
Excel Worksheet

Student Body Registrar Data: 2006 Cohort

To see data click the link below:

Microsoft Office
Excel Worksheet

Student Body Registrar Data: 2007 Cohort

To see data click the link below:

Microsoft Office
Excel Worksheet

Student Body Registrar Data: 2009 Cohort

To see data click the link below:

Microsoft Office
Excel Worksheet

FIRST Student Registrar Data: All Cohorts

To see data click the link below:

Microsoft Office
Excel Worksheet

FIRST Student Registrar Data: 2006 Cohort

To see data click the link below:

Microsoft Office
Excel Worksheet

FIRST Student Registrar Data: 2007 Cohort

To see data click the link below:

Microsoft Office
Excel Worksheet

FIRST Student Registrar Data: 2009 Cohort

To see data click the link below:

Microsoft Office
Excel Worksheet

Appendix B: Comparison of Registrar Data

Comparison of 2006 Cohort Data

To see data click the link below:

Microsoft Office
Excel Worksheet

Comparison of 2007 Cohort Data

To see data click the link below:

Microsoft Office
Excel Worksheet

Comparison of 2009 Cohort Data

To see data click the link below:

Microsoft Office
Excel Worksheet

Appendix C: Freshmen Course Statistics

class year	10	09	08	07	06

Calc 1					
NR Rate %	12	13	13	18	12
Calc 2					
	23	21	12	21	11
Calc 3					
	6	8	9	5	7
PH1110					
	14	13	11	10	15
PH1111	9	5	32	26	22
CH1010					
	7	8	3	3	2

Appendix D: Sample Survey

Personal Questionnaire

For

Educational Effects of FIRST Robotics IQP

An Evaluation of the FIRST Impact at the College Level

Dear Respondent,

We are inviting you to participate in an IQP project to study the effect of high school experience in FIRST robotics and its impact on college performance. You have been identified or have indicated as having high school experience in FIRST robotics. Along with this letter is a short questionnaire that asks a variety of questions about your high school FIRST experience and college performance. We are asking you to look over the questionnaire and, if you choose to do so, complete it and give it back to us.

The results of this project may impact the WPI Undergraduate Admissions process in the future. Through your participation we hope to understand if a relationship between high school FIRST involvement and college performance exists. We plan to share our results by publishing them in the IQP report entitled "Educational Effects of FIRST Robotics".

We do not know of any risks to you if you decide to participate in this questionnaire and we guarantee that your responses will not be identified with you personally. We promise not to share any information that identifies you with anyone outside of this research group. In addition, with your participation your name will be added to our existing database of FIRST experienced students. If you do not feel comfortable handing your questionnaire to us it may also be completed online at ******.

The questionnaire should take you about five minutes to complete. We hope you will take the time to complete this questionnaire and return it. Regardless of whether you choose to participate, please let us know if you would like a summary of our findings.

If you have any questions or concerns while completing the questionnaire or about being in this study, you may contact us at the addresses below.

Sincerely,

Michael Slezycki
mikeslez@wpi.edu

Evan Goldberg
evang@wpi.edu

William Kurzmack
kurzmack@wpi.edu

Questionnaire Instructions

Do not write your name, student ID or any other personal identification on the questionnaire. There is no right or wrong answers to the questions on this questionnaire. Select or write in the most appropriate response for each question where appropriate.

---

1. How many years of high school FIRST robotics experience do you have?

   _____ years of high school FIRST experience

2. What is your WPI class year?

   Class of _____

3. Did you continue involvement in FIRST in college (involvement is not limited to team 190 participation)? If yes please include how many years of college involvement. (please mark those that apply)

   ___ Yes, for _____ years (or)

   ___ No Involvement

4. How do you feel about the following statement; "FIRST Robotics has positively affected my leadership abilities / capabilities." (mark one)

   ___ Considerably disagree

   ___ Somewhat disagree

   ___ Somewhat agree

   ___ Considerably agree

5. Upon completion of your undergraduate degree did you receive any academic honors? (please mark those that apply)

   ___ Academic Honors

   ___ Academic High Honors

   ___ None received

   ___ I haven't completed my undergraduate Degree yet

6. Where you listed as a Charles O'Thompson Scholar? (mark one)

   ____ yes (or) ____ no

7.

8. How do you feel about the following statement; "FIRST Robotics has positively affected my ability to work with others." (mark one)

___ Decidedly disagree

___ Slightly disagree

___ Slightly agree

___ Decidedly agree

9. While obtaining your undergraduate degree did you receive any Academic Probations? (mark one)

____ yes (or) ____ no

10. How do you feel about the following statement; "FIRST Robotics has had a positive effect on my college performance." (mark one)

___ Considerably disagree

___ Somewhat disagree

___ Somewhat agree

___ Considerably agree

11. How long did it take for you to complete your undergraduate degree from WPI? (mark one)

_____ Years (or)

___ No Degree Received to Date

12. How do you feel about the following statement; "FIRST Robotics has had a positively affected my time management ability." (mark one)

___ Decidedly disagree

___ Slightly disagree

___ Slightly agree

___ Decidedly agree

12. Please list any extracurricular activities you were involved in at WPI as well as any leadership positions that you held in that activity.

Activity	Leadership Position

Appendix E: Raw Data from Survey

Website Data

Click the link below to see the Raw Data from the website:

Microsoft Office
Excel Worksheet

Analysis

Click the link below to see the analysis done on the survey data:
Please use tab at the bottom of the Excel sheet to view all Analysis:

Microsoft Office
Excel Worksheet

Appendix F: Chi Square test and Pearson Correllation

Chi square test of good fit: Excel code (=chitest(A1:An; B1:Bn))

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

(O_i is the sample response and E_i is the predicted)

Rules for Chi square test:

1. The sample must be randomly drawn from the population.
2. Data must be reported in raw frequencies
3. Measured variables must be independent
4. Values/categories on independent and dependent variables must be mutually exclusive and exhaustive
5. Observed frequencies cannot be too small (Greater then 2; preferably 5).

Pearson Correlation: Excel code (=Pearson(A1:An,B1:Bn))

$$r_{xy} = \frac{n\sum x_i y_i - \sum x_i \sum y_i}{\sqrt{n\sum x_i^2 - (\sum x_i)^2}\sqrt{n\sum y_i^2 - (\sum y_i)^2}}.$$

(r is the correlation coefficient and x and y and variables)

If r is close to 1 then the results show that there is a high correlation and if close to 0 that there is no correlation.

(r^2 is the amount of variance in x that explains variance in y)

The same rules apply for r^2 as for r.

F test: Excel code (=Ftest(A1:An,B1,Bn)

$$\frac{\left(\frac{RSS_R - RSS_U}{m}\right)}{\left(\frac{RSS_U}{n-k}\right)}.$$

This test compares overall variance in sample with the same categories. If the categories vary in the same manor then the result show a high percentage of similarity in the data.

Chi Square Results:

Microsoft Excel Worksheet

Appendix G: Transcription of Interview with Ed Connor from WPI Admissions

Us: The reason why we are coming to you, since you are responsible for admissions to WPI, we were hoping you could give us a definition of what a successful student is.

A: Ok

Us: Lets get started. Basically we are looking for admissions records, we were hoping to somehow to take a look at some of them, in a way that would keep the confidentially of those who submitted them, but at the same time take a look at them and find various like scoring systems.

A: Well in terms of the records, what I can tell you is that if the student doesn't enroll here, they are only kept for a year. If they do enroll, they are kept much longer, and I would even have to find out from the registrar how long. So if they do not enroll here, they are only kept for a year. If there were some particular, if you were looking for example, you are looking more at students that have enrolled though; it sounds like. So in terms of looking at records, I may have to refer you to the registrars to find out, is that possible, and what sort of regulations surrounding that. But in terms of what sort of information is on them I can tell you, certainly the admissions application records is going to have high school GPA yes, its going to have SAT or ACT scores yes, class rank, if the school high school provided it, it would be on there as well, graduation date yes, extracurricular activities would be listed on the application, or some students would submit supplemental information. And then FIRST is something that if its listed on the application or supplemental, we would make note of that. We actually are making more of an effort just because of the involvement here in FIRST to actually take a look specifically at FIRST kids going forward because particularly as you know the national competition each year we would like to do some sort of recruitment event something like that and also for students who have been admitted who have been involved in FIRST throughout the competition make sure we are able to touch base with them.

Us: So is there a reason you are looking for FIRST kids other than that, like you've noticed that in the past they've been doing better at this school or are you just doing it because it's a large organization at the time.

A: Well I mean, what we are currently doing sort of the rationale for what we do, is more because it is a large organization, lots of students do wind up here, it makes sense for us to reach to them in a more orderly fashion because usually the admission office will send

a couple people to the national competition. We have a table set up … we like to do something a little more formalized. That being said, we do know that for most students, the time and effort that is put in to being involved in the FIRST team, is something that is beneficial in several ways, it's academic in part but also it typically helps those students learn how to manage their time, and when they come to WPI, particularly with the quarter system here, that's very important to be able to come in to be able to balance not only your academics which move quickly but other things you may get involved with here. And that's not something that we would say well we would say that FIRST students are so much better at that then students who might be involved in other things but its certainly one of those things that we know that the time commitment is usually pretty significant and its certainly something we take a look at in the context of all extracurricular activities. Also knowing there is the opportunity to stay involved you know coming here to WPI is something that sure, you know, we know they've been involved in High School and they have the opportunity to stay involved here is something that we do look at in the admissions process.

Us: Now can I ask you a question as far as how the admissions process works? I applied a few years ago (yeah. yeah.) I'm not sure, you have all these different criteria like GPA (right.), class rank, and all that stuff (right.) How are these factored in and how is it determined whether or not you are accepted or whether or not you're not.

A: I mean, what we would tell anybody, the number one thing we are looking at is high school transcripts. So that's obviously, GPA, but we do look at lot more carefully than that. So we'll look at individual courses, individual grades; its fair to say we pay a little more attention to math and science courses given the nature of what most students are studying here. If the school does rank, we'll look at the class rank. We like to see As and Bs for grades, that doesn't mean students that have the occasionally C or D on the transcript. We also look at the trends of grades, maybe of students that started off real well in High School but things have gone downhill, their overall GPA might be pretty good but they might be somebody who gets the bad news letter because we're concerned their grades keep dropping from year to year and they're going to continue over to WPI.

Where as a student that maybe has a similar GPA but has as courses, you know, have gotten more difficult, grades have gone up, you know courses junior and senior years are usually more difficult than first and second years, that speaks volume as well. So that's the number one thing we look at, we do look at SAT, I would say that's second in terms of what we give the most weight to. We do read the recommendations, we read the essays, we read the extracurricular involvement through the application or through a resume, students might submit. We do pay attention to those things, I mean there's not really a magic formula; I mean sure a student that applies with a straight A average and a 1600 SATs, chances are they'll be a good match for us, even if they haven't been that involved in extracurricular activities. But that's for WPI, I wouldn't say it's a rare case we see students at that top top academic echelon, but usually its going to be students who did very well in high school but have balanced that with other things outside the classroom. And usually, we are looking for students we feel can be successful here. You know I mentioned earlier, the course system and time management, and some of those things that we do look at. You know, some schools may say 'well want to make sure we have enough musicians, enough athletes, and enough FIRST robotics students, and we do look at that, but also for us, it's a time management thing as well. Students who've done well in High School, but they've have never done anything outside the classroom, so we think, ok, so they spend all their time studying for their good grades. I mean there is some concern they may come here and struggle a little bit; they are away from home for the first time, there's lots of different clubs and organizations to join, lots of free time on your hands, so students who have already shown they can manage several things maybe even a part time job, time management wise, I mean that's a factor for us as well.

Us: You said you were looking for kids who would be overall successful at WPI, do you have a simplified definition of what a successful WPI student is?

A: Well I think a student that graduates would be the bare minimum in terms of successful, but I also think that someone who comes in and takes advantage of a lot of the things we have to offer here. I mean like the different projects and opportunities to get away from campus. Getting involved in different organizations and clubs, and

professional organizations and societies. You know, somebody that's looking to go above and beyond the pure theoretical reading a book, going to class, that sort of education, which you know is not exactly what WPI is all about. Its hard to quantify that, I think there's different ways to do that, to look for students who have gone above and beyond in the classroom, they've done programs over the summer, they're concerned about a weakness where they just want to go further in a particular academic area, students who have traveled for example, taken advantage of abroad programs through their high school. So there's a lot of different ways we look at that, but I think we try to find students that will take advantage of the programs here and the some of the things that are a little bit unique to the program. As you're crunching numbers, I think it'll be impossible to say what's successful. If you were to talk to the registrar, they'd probably say, 'graduating, and students who are academically successful, whether its students who come through here with A average, I know we don't do GPAs, but yeah, A averages or B averages or whatever it might be, I mean you can look at it that way, but I think that students that have a good experience here and take advantage of some of the things we have to offer.

Us: Now do you know if there's ever been a study that shows how some of these student have been successful based on the kind of students you admitted to the school?... I think what we're really curious, how do you know SATs and things like that are viable ways of saying 'this student has a better chance of doing well here.' Is there, do you guys going to meetings with other admissions and talk it out and say well we think this works, or are there studies are done that you can reference.

A: A little bit of both. And the registrar's office once again as you're looking to make a correlation, because I don't have or know what your grades are, and I'm sure you're happy to hear that. There have been some different studies, and some folks will take a look at retention rate, so how many students that come in to the freshman class come back sophomore year. And that doesn't always mean it's academic, that maybe a reason they don't, but it might be financial or disciplinary. I mean that's certainly something we can look at. We can look at graduation rates, how many students come into a particular

class graduate. And you can look at GPA or success in a particular class if you want, and that I know there have been some studies done, and if you look at the last 10 years, or so, some of the studies I've seen but I've personally not been involved in terms of pulling together, they've been pretty consistent. So I mean there's some checks and balances you can look at the overall class of say 2010, class of 2009, 7, you know maybe look at their freshman GPA overall. But it tends to be very broad strokes, I mean it's hard to say, for example math, students come in and start at all different levels here. So to say, well based upon math SAT score, does that determine math success here in the first year. Well we have some students starting in calc 1 and some students starting in differential equations. Some students may take the easier road their first year, some students may take the more challenging road, and some may argue get in over their head during their first year based upon AP score, based upon IB exams, things like that. So in that much detail, I don't think there has been that much studies done, but in broad strokes, sure, we want to make sure we aren't admitting a class of students that half of them fail out the first year, or that we are so stringent with the admissions standards that you know we don't accept enough people. So we certainly take a look at some of those things. The ladder I could probably pull a little bit of information that might be helpful in terms of the admitted student profile so that we could look at, so we could go back a few years and say ok this is the average GPA and average SAT for some of the incoming classes and even the registrars office or my boss who oversees enrollment management, so that's admissions, financial aid, and registrars office. She may have some different studies. (Kristin Tichner?) yup yup. So I don't know if you're meeting with her, I would certainly talk to her. She has access, and she's the one, that's really what you're talking about here is saying, ok well if we decide who we're going to admit then how successful are they going to be here, how students are going to perhaps chose to enroll, how many will persevere and graduate, and that's really her charge to look at those kinds of things. And certainly she gives me some feedback that hey based upon the last couple years I think we're being to easy with admission criteria or too difficult. With the SATs, that for us, is not a primary or the primary indicator here. It's something we look at, and as we see applications from 3000 different high schools, it does give us some sort of balance to say the three of you probably went to different high schools, if the three of you all had As

in your calculus class, and randomly, say you had a 600 math SAT, you had 700, you had a 800, you know, that leads us to say, ok maybe we should be looking at the curriculum and what has been covered and not that we would be concerned with any of those scores, but just to say, it helps us balance the different types of high schools that are out there. And that's there's been a lot of articles about grade inflation and a lot of pressure from parents. They say they're concerned about the competitive college admissions process, and they want to see their sons and daughters have a competitive GPA and so there are different factors like that. But SATs can help us say differentiate between two students who by transcript records look similar but then you see based upon that test, you see different levels of their perhaps predicted success. One thing that we have looked at and Kristin can tell you probably a little bit more, if you do take a look at the SAT and the high school GPA in combination that does appear to be the best predictor of success here. She can tell you a little bit more about that. Separately, we look at individual components it appears that the high school transcript and GPA is a better predictor than the SAT stand alone, just looking at one or the other. But I don't think we're looking vast differences there.

Us: Lets say we had a student who was borderline getting in who had ok GPA, ok SATs, but you weren't sure whether or not to accept them, is there any criteria that would give them a boost or an edge that would give them that ok?

A: Well I think, kind of going back, we do read the essays and recommendation letters, and sometimes the essay, its like ok, is your writing skills so much superior to someone else application but also its time and effort that you put into it. You'll see some essays that come in that are obviously done at 11 o'clock at night probably in half an hour on the computer. No one's spell checking and they hit send. Well for that borderline kid, well I don't know. Is that the kind of kid we want to give the benefit of the doubt? Somebody else who obviously spent a little bit of time, maybe its not perfect, but you know they put together some insightful writings on themselves or interesting experiences in life. Well so we look at the recommendations, and they all pretty good, but you usually can tell if there superficial recommendations or if its somebody who really thinks, hey this is not

only a really good student, but I know WPI and I know this student, and I think as a guidance counselor or teacher I think this is a good match or combination. So those are the couple of things. And we do get that for the tougher decisions. I mean its fair to say, there are certainly some choices we need to make. I mean it's not like we can admit every student we think can make it through four years here. There are unfortunately some choices we need to make. I'm sure as you may know we've had some bigger classes the last couple years, partially by design but also in particular a couple years we were a little bit bigger than we had planned be. So we do have to be careful that we don't admit everyone we feel will be successful. But the students that might embrace the programs here and really not just get through but get through at that upper echelon.

Us: Do you guys get a lot of essays that involved with the, I know my essay was on FIRST robotics…

A: As a matter of fact we do, I couldn't tell you the number, but we get a fair number to do with something with FIRST. The other interesting thing, I don't know if any of you was involved with boy scouts but we see lots of eagle scouts. Particularly with the Eagle Scout project and the project work here. I mean that's something else. Does that mean every Eagle Scout gets admitted? No. But that's another indicator of the type of student, maybe that mindset, and if they really embraced that experience chances are they're going to embrace the kind of program we have here.

Us: You said the registrar usually keeps the records for all your admissions. Do they keep their full college essay application as well?

A: Yeah they do. They keep… To be honest I'm not sure if you're going to be able to get much access to that stuff because there's all sorts of federal regulations. You might be able to get a little bit, or some stuff like the government documents with names, I don't know, I would talk to them.

Us: Is it possible for them to pull… basically we're just looking for numbers, to set an example, how many kids wrote about FIRST for their college application essays.

A: There may be something that specific, I could not provide. If you were looking for example how many students in the freshman class indicated involvement in FIRST, I could probably get you that. The essay, that would mean going back in all the files, and while we make notes on essays and things like that, the notes are not kept in the permanent record, they're actually destroyed over the summer. So that's not… somebody would have to go back through individual essays, and you're probably not going to get anyone to agree to do that. If you want to email me, if there's some particular things like that, if you're looking for general numbers like that, I could give you… It's actually on the web if you go to the admissions home page, admissions.wpi.edu, if you actually go where it is; I think there's a section that says information for guidance counselors you click on there, there's something called class profile. It's a pdf, it was sent around to administration and faculty and campus as well. It gives you entering class, its more academic information but it gives you some academic averages and things like that for the entering class, so that may be helpful. And we certainly have that going back a few years, so we could give you that.

Us: Do you guys have any relationship or involvement in the scholarship process?

A: We do, and most of the merit scholarships here are academic awards. So I mean when talking about, certainly the admissions process is much more holistic, where the merit scholarship process is very much based upon on GPA, class rank, SATs, levels of the academic program, we do, for that, we do have a scoring system. So based upon students taking college prep, honors, advanced courses, we give them typically a 1 to 5 and that really more cut out there to give us a quick glance instead of continually going through the transcript, so we do have some involvement in that. It tends to be 30% of incoming students who receive some sort of merit scholarship. And some of them are very general, and some are department specific. As you might know there is a FIRST Robotics scholarship that we offer as well, so there are a few different, but they are all

very focused on academics and not so focused on the other measures such as recommendations, essays, and extracurricular activities. I may need to run in a minute, but I'll be happy to chat at a future date, if you have any final questions to ask today.

Us: Are there certain extracurricular activities that you have a tendency to weigh more highly than others, I know some have been researched, like sports leadership positions…

A: I think perseverance, and one might argue if you stick with an activity for all four years of high school, maybe you will become a captain, maybe you will become a leader, maybe you will become president of your club. For the student that might list six activities and they're involved for a year in each one, meh ok. If you have a student who has listed two activities and they've been involved all four years, and maybe they've taken on some sort of leadership role in the later years, that's attractive to us. So I think perseverance is really what we're looking for. Like I said earlier, things like FIRST, Eagle Scouts, Model UN, things that we know also, if you're involved, and you've been involved for a few years, it's probably taking up a good amount of your time, and they're not casual things. Meaning its one thing to say well I'm part of the environmental club, nothing against the environmental club, but most students you have an interview with, if you're talking to them and you're talking about the time commitment and the level of involvement, it's not probably the same as some of the other organizations. Is that one of the major things we spend a lot of time discussing and worrying about, what is more involved than the others? No but there are certainly some that probably rise to the top a little bit, like the ones I just mentioned. I mean typically if you've been involved in a music group for a few years, you know not a garage band but a marching band or jazz band, once again, with practices, you're meeting several times a week, we know the perseverance is there, the commitment is there. That's typically the angle we take and sure by default, we sometimes wind up with the same kinds of activities, that we inadvertently favor if you will, but also you could show leadership positions, you see their perseverance and often those students do take leadership roles, so that's certainly a factor. Whether that's through athletics, whether it's through FIRST, whether its through Model UN, that doesn't make a huge difference if someone can step into those roles.

If you want, feel free to email me, I'm happy to get you a little bit of information, particularly FIRST, we can try and pull some of that stuff.
(Thanks, etc)

Appendix H: Transcription of Interview with CDC

Us: So you absolutely think that the FIRST robotics program is something important to look for

A: My background with FIRST robotics program is very limited since I've only been here for six weeks. However in meeting a lot of student, who have had that program since high school, I just met one the other day, a young woman who I think is a freshman here and she started the program in her high school. She went into a little more depth with me because I was helping her write her resume and just based upon the skills that she's acquired from that program in high school, and the projects she was involved in I was say that and then having it here that would definitely help you. My background prior to here is in working for a defense company that built motors and I would hire engineers. And when I looked I looked at entry level engineers, the one thing that would sway me over another would be any type of experience they've hand hands on working with motors, or even working in a machine shop, or working with robotics and students that have had that background I would have of course want to look at them in more depthly than I would any other student because that is hands on, and you do lean a lot from books and your do learn a lot from your projects in class but to that knowledge is very key.

Us: Ok. Maybe this is going backwards a little bit but basically could you sort of define what business is looking in general for a graduating student someone who's going out into the workforce. What kinds of things are they looking for in order of importance?

Them: it depends on the major that's why I think a major specific. For example if you're in humanities or you're in social work, very, very different, they would look for case studies. Engineering specific?

Us: Yeah probably technological sort of field

Them: And again I've only been here six weeks, my own background in engineering, we look for students with co-op experience or internship experience. We look for students who have had summer jobs, and it doesn't necessarily have to be specifically in your field of mechanical, electrical, chemical. However if it did that would again put you towards say the top of the pile of engineering for that field. But we do look for some type of experience that doesn't have to be specific to your field only because some employers are finding nowadays that students that come right out of college that have no prior work experience. There is a lot of skills to learn, number one getting up of bed in the morning and going to a job and understanding that the is just and some jobs and some companies that are very structured in the way they are with employees, some companies are not. For example at I-robot if your familiar with them they are much more entrepreneurial type, they're much more introspective and its hard work but on the other hand they're not as structured and strict you can whenever you want but at a lot of companies like at GE and Raytheon are must more structured where they expect you to dress a certain way, they expect you to have certain skills and they have programs or employees that take you to one level to the next level to the next level. Other companies culturally are very very different. So you ask me what do we look for, we look for, for example what is the software that you learned. Some companies are Solidworks some companies are pro E. Do you have that background, that would improve your getting a job if you have the same platform that particular company is utilizing? Do you have any specific things? I used to look at 200 resumes a day.

Us: We're looking at a lot of versatility and like time like putting a lot of time into certain programs and looking like your dedicated to something basically correct?

Them: Yes, there are some students that would go through college and they have no activities and they do nothing and they don't even work. That's wonderful for them, good for them. However once they graduate and they're in the job search they're not going to be the key people looked at. Were looking for well rounded students who have that academic and technical background as well as an understanding that when you go to work you go to work to work and you have to follow some structure and you have to follow some policies and procedures etc. Now if you looking for a defense company were also looking for a student for at defense company who can get in many cases can get classified and cleared through the government. They also look they go back into your background for years. So exactly what you said, were looking for more than just the technical skills

Us: So basically a student who perhaps doesn't have a GPA as high as another student but has more activities that they have extracurricular activates that they've done on campus.

Them: Leadership activities?

Us: Yes

Them: Yes that could help, well it al goes back to the company. Whets the culture of the company. Some companies it's strictly by GPA and strictly by technical projects. Some companies are looking for a more diverse individual. So it can be very company specific.

Us: How important are extracurricular activities for students on resumes

Them: Its company specific and major specific. If you're in a field that is…When I first got out of college my graduate program was in higher education leadership so for me to get a job I had to show of the leadership background, someone that is able to get up in front of a group, some that is able to do training and development. So you have to have a person that can really put themselves out there not that's because that was my field. But

in engineering if you have excellent technical projects and you have a few activities depending upon the company and that particular job then you might be the best candidate. Typically in engineering two are two tracks you take, one is an individual contributor to a company in which is you do projects, you're an individual contributor you're not looking for the management track, you're not looking for the real leadership track well then it may not be as important for you to have a bunch of leadership activities. But then if you're the type of individual and the track you want to take in engineering is management, project management, program management then having some leadership in your background may be the best thing for you. So it can be company specific job specific because there are a lot of jobs entry level that are research specific. You could be the best technical the best research individual and you don't have to had done all those activities in college maybe you've done a million projects in classes that are technical specific. Again it's the job, the position specific and the company. But GPA is important if you look at the CDC website, a lot of jobs won't even look at your resume unless you have a certain GPA.

Us: What specifically do businesses look for in extra curricular activities; I know you already talked about leadership and technical experience are pretty much the things they're looking for.

Them: Well if you look at a resume and you see a student that has a 3.2 GPA and has also been involved in a lot of extra curricular activities and has been able to maintain a 3.2 that's a pretty top notch person. So I think it's the whole package, a lot of companies are looking for the whole package, but again for entry level engineering some companies have project specifics, the company I was worked at was a defense company so we would get projects that could be a three month project a six month project so sometimes if you have an individual coming out of college entry level who has a 3.6 and has never done anything but has specifically been involved in a certain project that those are the skills we'll need we would probably hire that person with or without any leadership activities

Us: I know you've only been here for six weeks but have you have you noticed a lot of people putting FIRST on their resumes or talking about their first experiences when they come in looking for a job?

Them: Do you mean FIRST robotics?

Us: Yes, I'm sorry

Them: I have seen one, I never knew what that was prior to there so I have seen a lot of students putting that on from here and then I've seen a few that have had it from high school and they want to maintain that interest here.

Us: Have you ever noticed any employers coming back and saying we're looking for FIRST Robotics kids. I know like Irobot or Deka or d e k a from Mass uh… New Hampshire do come looking for students.

CDC: In reference to FIRST Robotics I can't say. I haven't dealt with that aspect of it. I do know, that my understanding of it is, that a lot of employers come to WPI specifically because of the projects and project work; because it is hands on not just IQP and MQP but also in the classroom. That's also teaching teamwork which is a huge thing to have people who can work as teams verses an individual. That's a huge thing in the work environment cause most of our, again out in the field, cause most of our work was project oriented and you have to be able to talk with one another and think outside of the box if its not working, so that communication is key

Us: I've spoken with many an engineer who has said that the biggest problem with a lot of new hires is that they can't communicate with each other so they take people with project experience first and any other extracurricular that teaches that skill.

CDC: Absolutely, or even other jobs. You could be working in a grocery store. A lot of students here have been working in a grocery store type thing or a restaurant. That's very key because your putting yourself out there, you can talk to people, and even in place like that there are always controversy and you have to communicate in order to deal with it.

Us: Ok, this is another generalized question. How do companies and the CDC, how do they determine a system for evaluating resumes? Do they just sort of get people in and see what works, or are there studies that have been done that they can point back to and say 'well this study says this and we believe it so we're going to go with it'

CDC: As far as who's the best candidate

Us: Yeah, in selecting candidates how do they go about coming up with a system for that?

CDC: Every company's different.

Us: Yup

CDC: Depending if your affirmative action, if you're a company that gets money from the government, defense money, or a college that gets financial aid. You're required to have an affirmative action plan. And in that plan every job is required to have minimum qualifications and you have to document everything. And the first round, the way you look for an employ, is do they meet the minimum qualifications that are specifically defined in that job description. That's very key, that's government required. So that would be the first way you would look at a resume specifically so every one who meets those requirements is

Us: They've moved up?

In a pool these are the yeses in the beginning and there could be 200 of them, so as you're saying, what are you doing from that point on to whittle down that 200. So there's your required core but then there's also 'What do you want the person to have?' which could be subjective depending on the manager or the job. So then you whittle it down again, say we want the person to have 10-15 year, but we want the people who have 15 years. And you continue to look at your wants when you whittle the candidates down. Let's say you know some of the projects coming up are on motor development or something with IRobot. Well although all of those candidates have wonderful mechanical skills and backgrounds 'who specifically has ever worked on a project similar like this?' So then, you whittle it down again. All the ways you whittle down the resumes has to be documented to insure that there no discrimination of any kind. So then you probably get it down to 25 for a job, so then you give it down to the manager, who has to document his thoughts. So then you bring it down to HR, who may bring it down to 10 people. Typically a company will do phone screening first. Phone screens are looking for very basic things: can they communicate on a phone, what have been their technical experiences, can they talk technical. People can put it on their resume, but can they really talk about the technology. And typically a manager with HR together will do a phone screen. And then from that phone screen, I can tell you from experience, that there are people who put something on their resume that they can't even regurgitate back to you what they did. So that person may be thrown out. So now you get it down to 5. In interviews today its very behavioral based interviewing for most companies. The thought is that the true definition of success is based upon passed performances. So if you can, if a future employ has positive past performance from references plus in an interview they can answer 'tell me about a time that a technical project of your failed, what did you do?' So however you respond, if you can bring that failure to a successful conclusion, even though it failed, like what did you learn to help you with the next project. So employers are looking for past behavior that shows you actually learned something from it or then succeeded in. And that's a good determination that as a new employee you would be a good employee. Now that's what I'm use to, some companies also have software today that key your resume. They scan your resume in, put in all the requirements they're looking for and that program will spit out 25-30 resumes. Here are the people that meet

everything you're looking for. So then now you have those resumes, then you start the same thing as far as what are our real wants and what person has the most specific skills for what were working on. Did I answer you question?

Us: yeah, that's real good. Um… are there any major difference for a company when their selecting interns vs. employees? How does that change?

CDC: Well for a intern you're not necessarily looking for someone who has all the skills. You fully understand that they're coming in to do some entry level work and so you're getting the benefit of someone is usually very hungry to learn. And they usually come in very positive and motivated. And you're looking for someone that you can teach, that you can mentor. And you're hoping, well most employer are hoping, that from that experience that person may want to come and work for you and you'll have a spot for them. That's a goal because you're investing a lot of money in that person. And typically, if it's a good experience, you can test them as well as an intern. If they're really good you can keep them but you also have the opportunity if they're not meeting the caliber of an employee that you're looking for then you don't have to keep them. So it's a win win for both people, it could be. But as an employee you're now looking for someone at certain level of expertise. An intern doesn't have to be.

Us: Ok, this is a little different from the rest of the questions, what kind of records does the CDC keep on graduating classes? Do you look at how long it takes people to get jobs, do you look at stuff like that?

CDC: I can't, Janet can answer that better, but I do know we just did a survey on, we do have to report out of the class how many have gotten jobs, what field have they gotten jobs in, what the average salary if they're will to divulge that. We do keep all of that.

Us: Yeah it posted on line.

CDC: Someone had said the other day that it is posted online.

Us: I'm not sure if it's the latest year.

CDC: Yeah, we just finished that.

Us: Now are those voluntary surveys or are those mandatory, like you tack it on with graduation or something?

CDC: You can't require, but first we send out a letter to everyone and you get so much percentage back. Then, you send out an e-mail, you get so many of those back. Then, a couple weeks ago we stayed late and called everyone who hadn't responded.

Us: So you usually get a fairly high response rate.

CDC: We do, and we work with alumni and the alumni branch office. We continue to help them if they haven't got a job yet.

Us: Well great that's all I had for questions.

CDC: The other thing I will tell you, just form my experience with engineering specific. We also look at some colleges much more stronger then other colleges as far as the skills a student may come out with like, a WPI grad, MIT grad, Northeastern grad in this area specifically those in this area we look at very much more positively.

Us: well that's reassuring.

CDC: We do, we really do, because there are some colleges where you can get a degree in mechanical technology.

Us: Like those ones they advertise on TV all the time.

CDC: Yeah, those kinds. I had just learned that from my background. I didn't realize that there was such a difference in the degrees. You really have to know what that degree is in.

Us: Alright, well thank you very much.

Appendix I: Trancription of Interview with Kristin Tichenor from Admissions

Michael: I don't know if you've been talking with Ken Stafford at all?

Kristin Tichenor: No

Michael: He mentioned that you might be aware of this. We're working on an IQP, me and two other students. One's a mechanical engineer the other is an ECE. We all participated in FIRST Robotics in high school, and we're working on an IQP to see if there any relationship between a students involvement in First Robotics and success in College. Can I ask what you do here? I Know your involved with admissions.

Tichenor: Yes I'm responsible for recruitment and retention. So the offices that report to me are: the admission office the financial aid office and the registrar's office.

Michael: We already talked to Ed Conner about the whole admission process. We got some idea how it works. Quickly, could you give a quick definition what you look for in a high school student, like SAT score or extracurricular activities

Tichenor: Something you can't quantify motivation, initiative, passion, commitment; a bunch of none quantifiable things.

Michael: you said your in charge of retention. Once a student is admitted to WPI how do you evaluate their college performance. What are the measures of quality?

Tichenor: The most basic measure of student success is graduation. Can they get through. The way the federal government defines success is how many students get through not in a standard time frame, which would be four years for us, but a standard time frame plus 50%, so a six year time frame. What I'm looking for quickly, is there's a retention chart to show you the graduation rates and retention rates. This is the kind of thing we'll look at. For students who entered in the class of 2000, so they came in fall of 2006, what percent of them continued to sophomore, what percent to junior year, what percent to senior year, and then how of them ended up graduating. And here we were looking at the at information in relation to SAT averages, which ironically is completely unhelpful. I don't know if you're going to the student town meeting later this evening, but you could look at our low points and high point and see retention rates and graduation completely off kilter with that. That's why I put so much focus on those non-cognitive skills, some of which may emerge going through the process of FIRST.

Michael: Well that's what were looking for. For this one its compared to SAT, what other standards do you compare with?

Tichenor: We're in the process, with the help of the IT division, of creating a tool that will help us do this kind of analysis. But literally, we just building it now. We know from anecdotal experience that one of the most significant deterrents to a student finishing their WPI degree is academic. They come here and find it more challenging then they may have before. We know the students coming in are extremely strong. They have terrific class rank, GPA, and they've been in tough class. But that doesn't mean they have a good work ethics, and doesn't necessarily mean that they're not willing to work. It just means you may have been bright enough, and your home school may have been easy enough that you may have been able to create a very nice academic record without working very hard and then you come to WPI, and there is no way on God's green Earth you can get through without working your tail off. So that's a big piece of it. And there's the double edge sword of first not doing well academically, which for some students is enough to make them reconsider whether they should be here. But at the same time

they're getting that negative feed back their losing need base financial aid or merit base financial aid, which usually catches mom's and dad's attention. So then they're adding to the challenge and say 'gee you're not doing well and this is costing us 30 % more or 50% more then the day you started', because your financial aid or scholarship support has overrided. That double wammy often has negative effects.

Michael: So you're tracking quality of your student here is SAT (looking at charts).

Tichenor: Yeah, this is a more quantitative approach to analyzing the problem. The other thing that we're beginning to do is to try and gather more qualitative data. If a student leaves its captured in conversation and also by written form, and we're devising an e-mail form for that. What student self identify as their point of dissatisfaction with WPI, so its kind of focusing on the negative on why student is leaving as oppose to why they stay, and that's an important part of the equations too, but I think for us the more urgent, and perhaps easier, because of small numbers is why their leaving WPI.

Michael: Yeah, you want to keep them here once you get them here, good investment Do you look at any other thing, like freshmen physics and freshmen chemistry?

Tichenor: Uh yes, and I don't have that in front of me, but through the academic advising office, Dale Synder, who is director of academic advising, specifically tracks how students do in those core math and science classes. And then she sends me that report which is part of that feed back loop, so we can take a hard look at how students are doing. Sometimes you can see great variation in how students do in those classes because of a particular professor. There was one department who made a decision to change who was teaching entry level classes and I won't tell you what department, but it had a remarkable positive impact on how students did the NR rate dropped like a stone once they did that.

Michael: Is there anything else like that, that you looked at?

Tichenor: I have to tell you that right now we're at a point were we want to look at everything. We certainly have some hypothesizes based on national data and persistence, continuing through is generally referred to as persistence, and national studies show that first generation students are at greater risk. So if your mom or dad didn't go to college you have less of an idea what to expect, so you may be apt to throw in the towel when you hit some bumps in the roads. Another possible indicator to test is distance from home. If your from Portland, Oregon, and your having a tough time, you can't get your batteries recharged as easily as a student that lives in Salem; so that can add to the stress and feeling that you don't belong if your having a tough time academically or socially. Gender and ethnicity has not been a problem for us because what we find is that women and minorities, we have tracked retention for women and minorities, and they tend to be just as strong. And I think the kind of nontraditional student that enrolls at WPI has already been in the minority. They could be white a female, but have been in the minority in those upper level of math and science courses in their home high school, so they were already expecting to be a fish out of water. I think sometimes one of those non-cognitive attributes like determination to do it despite what everyone says is what sees them through to success

Michael: Now is all this data available? Like, would my group be able to access it?

Tichenor: No because a lot of this data doesn't exist yet, because we're literally building a data base to put this all together. Now in terms of national studies, I can point you to some people who have done a lot of research in the field Tinto, Pascarella. I can poke around and e-mail you some suggestions. Even if you just google those names you'll find a lot of information on persistence and retention. Another one is Bial, shes at Harvard. I just went to a workshop on her work. She's trying to create a new index for who will be successful in college, and its completely non-cognitive. Its completely based how you perform in a high stress situation, your ability to put things together, solve problems, respond under pressure, and nothing to do with grades or family income.

Michael: Would you say a student coming into college who has had those high stress experiences, that they would behave better in college?

Tichenor: Absolutely.

Michael: Is that what the report is on?

Tichenor: Um Debbie Bial, she's done a lot of research; I don't know how much is published yet. This is literally hot of the presses. She's at the Harvard Graduate School of Education and she received a lot of government funding to do this work, but there must be something. If you go on-line I'm sure you would see some of her work. She also a founder of a very high profile organization called Posse. It was specifically founded on the notion that minority students going to highly selective colleges like Brown, Bodenheim, and Charlton in the Midwest, they were all liberal arts schools, were more likely to succeed if they had a support network. So they're actual students who come from low income areas, not all of them are ethnic minorities, some of them are rural areas, so white students but first generation. They're trained as a group to support each other and act as leaders and capitalist for change at the college level. And then the agreement is that the colleges that agree to partner with this Posse organization agree in advance to except the whole group of them and give scholarship funding for the group and assign a facility advisor to work with them. So they there's lots of interesting research out there focus on how students do if they're prepared for a high stress situation under pressure to follow through. One of my favorite quotes is from a year book it was from student at Stanford who said "Once I figured out I didn't have to do everything my professor told me I was fine".

Michael: I'm finally reaching that level

Tichenor: But that can take years, and the longer it takes for you to figure that out the more you suffer in the mean while, and struggle academically unless you want to have to no social life

Michael: So what we're trying to understand right now is, what can we get our hands on? Even data like the retention rates, can we have access to that?

Tichenor: This is public as far as I'm concerned, anything we calculate you can have.

Michael: Do you know how we can access that?

Tichenor: I can literally give you copy of what we have. There's not much, like I said. Actually, effective tomorrow there's a fact book, it doesn't correlate SAT to anything else, but it does show retention and graduation rates over a ten year time period, so I can send you a link to that.

Micheal: That would be great. Who generates this data; is it the registrar?

Tichenor: My office has recently taken responsibility for producing all this data. It has historically been housed in the registrar's office. However, that's mainly because we don't have an institutional research office on campus. One of my goals, now that the registrar's office reports me, is to wean them from being a de facto institutional research office. I know they're the portal through which everyone registers for classes, but they don't have the capacity to do the number crunching. Not that my office has it either, but I guess I rather have them being service and transaction provider for students and faculty first, and once they have that golden then I'm with them moving in to data analysis. But yes, if you had a question you could send it to the the registrar's office, you could send it to me, you could send it to the provost. And in this decentralized model, because we don't have an IR office, someone will be able to say I can't answer that but I know someone that can, or in some cases the honest answer may be we're not there yet.

Michael: We haven't meet with the registrar yet, we're working on getting a meeting. Ideally what would make our project successful is to be able to identify what students were active in FIRST in high school.

Now the registrar's office won't be able to tell you who was in FIRST, but the admission office can. Wendy Ramson can, she's sort of our in house IT person. If any one can generate a list of students who A: told us they were involved in FIRST, which you realize is not the same thing as doing. I 'm not saying students misrepresent their involvement, although that probably happen to, but more likely then not, not everyone tell us they were involved. So she can give you a of list of student that told us they're were involved in FIRST and enrolled at WPI. The trick is that we're operating , we have a shared data base that's comprised of separate modulus that don't speak to each other. So what Wendy will see is who came into the university and see who expressed an interest in this, but she won't be able to see if they're still at the school.

Micheal: Say I took that list of names, went to whoever generates the data for the retention rates. Say I went there with a list of names and asked them to pull data on retention rates for those names.

Tichenor: In what time frame? That could be very time consuming, and because the data bases don't coincide; your talking about what would be a manual process, unless we gave you two hard copies.

Michael: Is that possible?

Tichenor: I don't know, I will look into it, so you want to know who came in with an interest in FIRST, who stayed, and who bailed? You would want to compare retention rates between FIRST Students and the Student body?

Michael: Not just retentions rate, any measures of merits that you have.

Tichenor: Well the other, would be to do a grade averages, but because of confidentially that's not possible. But certainly for who are here and who are not, so long as in your

report you don't mention any individual by name, and maybe what were doing is giving you ID numbers. I have to explore that with other people

Michael: Is it even possible to get grade averages without the names attached it.

Tichenor: If it were a year from now, I'd say maybe, but we're still at such a low level of putting all this data together, I don't think we have the capacity for that.

Michael: So that's what we're looking for, that what we want.

Tichenor: I know, well, and the problem is because we don't have an Institutional Research center, nobody owns this.

Michael: Well it coming together.

Tichenor: I know, but I feel like we're taking baby steps

Michael: I have two other group members, and we're more then willing to do any leg work that needs to be done.

Tichenor: Here's the other challenge we may run up against. I don't know how far back we captured the participation in FIRST. If we captured it as far back as five or six years ago you could look at graduation rates, other wise focus on first year retention rates. You know, whatever. Just realize that there may be a time constraint here, because you want to do something that is measured over time, and I don't know how long we've been coding FIRST involvement. Certainly Ken got us doing this as early as possible.

Michael: I think he knows were this is going to.

Tichenor: So don't bother pestering Wendy about this. I'll talk to Wendy, because she may have a better idea of how to make it relate to the retention and graduation rates

Michael: That would be great.

Tichenor: So tell me time frame.

Michael: Time frame, it doesn't matter, we are schedule to do this project during B,C, and D term. C term we want to do most of the data analysis.

Tichenor: Ok, that's great. This is actually helpful to me, obviously this has a FIRST focus, but the data is similar to what I wanted to collect

(Thanks Tichenor, exchanges information)