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# ***Comparative Aspirations Study on Worcester Secondary Schools***

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by

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***Advisory Council on the Status of Women  
Worcester Public School System***

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## **Abstract**

Career aspirations studies were conducted among 8th and 11th graders in the Worcester schools to determine progress toward gender and ethnic equity. Medicine, business, and law were considered most likely to achieve gender equity soon. Technology and political fields will probably remain male dominated for the near future. Medicine could become female dominated. Ninth and tenth grade is the critical time when interest, especially female interest, in science and engineering erodes. Ethnic differences are related to career concerns but not which careers are interesting. Worcester students with technical, arts, health and public service oriented career interests are not concentrating in the high schools with small schools devoted to these fields.

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## **Introduction**

Equal opportunity in the workforce has long been a goal of the United States of America. Progress in this area required long struggles of two movements involving riots, marches, and civil disobedience to achieve ethnic and gender equity. It took fifty years just to achieve voting rights for women. The hope that economic and social equity would flow automatically from having the vote was proven wrong by the 1970's. A new gender equity movement started about 35 years ago, following in the spirit of the Civil Rights movement of the 1960's. Amendments declaring equal opportunity to be the law of the land have been made to the United States Constitution.

Though most radical public disruptions have ceased, there still remains a gender imbalance in the United States workforce today in both occupational distribution and pay for comparable work. Interestingly enough, the gender imbalance has persisted despite equity being attained in terms of getting a college education. Perhaps the answer to the workforce equity question goes beyond outlawing discrimination in the current workforce and pertains to the influences that are shaping the aspirations of the next generation.

## ***Review***

Six studies of the aspirations of high school students in the Worcester School System were sponsored by the City Manager's Advisory Committee on the Status of Women (ACSW) and the Worcester Public School System between Sept 2004 and May 2006. These studies were conducted to provide insight along progress toward gender equity and the positions females (and males) would aspire to hold in the future workforce. Medicine, law, and business are already in transition toward gender equity, and the aspirations of the next generation are in line with that trend. In fact, fields in medicine

could have more females than males if the high school aspirations data actually represents the goals of the female workforce of the future. Technology and political aspirations are not receiving enough female interest to make it likely that they will also achieve gender balance in the next generation. The situation in those fields may marginally improve, though most likely not to the point of major change in the next generation unless a serious program of policy intervention is undertaken.

Hopefully the effects of gender stereotyping will continue to diminish, and there will be more males thinking about nursing and teaching, and more females thinking about engineering, science, and politics. The trend is in the right direction but has not yet reached the tipping point and the climb is still slow and uphill. These studies provide a Worcester Public School (WPS) aspirations baseline (compared to the private schools in the city) so that the city of Worcester can tell if this trend continues to be the case simply by reusing the existing questionnaire every 5 years. Gender and ethnic equity in aspirations is probably attainable in the next 2 generations, but policy interventions will be necessary in targeted areas to achieve it. If such a program is undertaken these studies will provide a useful baseline from which to gauge the effectiveness of the programs that are implemented in the various schools of Worcester.

Gender inequity in interest in science and math does not appear in the limited 8<sup>th</sup> grade data gathered in two Worcester middle schools by one of these six study teams, but it is clearly evident in the 11<sup>th</sup> grade high school data. The small schools in the Worcester secondary schools are not visible to the 8<sup>th</sup> graders who need to decide what high school to attend. Hence, few of the students interested in science and math in 8<sup>th</sup> grade can even consider transferring to Doherty to be part of the Engineering and

Technology Academy (ETA) located only in that high school. The decision to apply to the ETA must be made by the end of the 9<sup>th</sup> grade, during a short window of opportunity. Comments are made at the end of the report about a program of future science and engineer clubs that could in principle be implemented in each of the high schools of Worcester. Given that one in three 8<sup>th</sup> graders report that their favorite subject was Math or science, a female friendly club catering to the arriving 9<sup>th</sup> graders, (and designed to talk about how to prepare for technical school and embark on a technical career with good vocational prospects) might have a considerable impact on the now more stereotypically skewed 11<sup>th</sup> grade aspirations pattern in Worcester.

## **Background**

Over the last 4 years, a series of 5 projects undertaken by WPI student teams sponsored by ACSW and the Worcester Public School System (WPS) have examined the aspirations of 11<sup>th</sup> graders in the Worcester public and private schools. These were designed in two rounds, as a baseline and a replication study, though some instrument improvements were made between the two rounds of study a year apart. At the request of the WPS, a study of the “favorite subjects” of 8th graders was added to the second round of studies in an effort to indirectly gather “aspirations” from the students. A separate effort was undertaken in 4 parochial schools with differing sex ratios ranging from all female to all male. (See Appendix A for more information about the titles and authors of these studies.)

The main sponsor of this compilation and all studies noted in the Bibliography is the Worcester City Manager’s Advisory Committee on the Status of Women (ACSW). The ACSW called upon two WPI students, Devin and Nadia, to summarize the findings of all the prior 11<sup>th</sup> grade and 8<sup>th</sup> grade aspirations studies completed for the ACSW in the city of Worcester over the last few years. Devin was to compile, summarize and draw conclusions based on several reports covering the 11<sup>th</sup> grade aspirations data, with a focus on the public schools data base. The prior team (Gautreau and Rizkalla, 2007) that wrote the Middle Schools Aspiration Study was delayed in gathering the 8<sup>th</sup> grade data and could not complete a report worthy of the data set in the time available. Nadia was recruited to reanalyze and fully report on one the 8<sup>th</sup> grade data set, as well as to compare those results to the 11<sup>th</sup> grade results that Devin was summarizing.



### ***Purpose/Importance/Internal Validity***

The results of the survey are important to the WPS because it will provide feedback on the dreams and plans of the students taking into account the diversity of the school system. Specifically, the WPS had a major common goal with the ACSW in that they wished to know whether gender was more or less predictive of career aspirations. In addition, the WPS wanted to find out how much the small school system was concentrating the students with similar aspirations in particular high schools.

In order to ensure that the data collected from the surveys was reliable, a second (replication) study was performed at the high schools a year after the first study. However, some changes were made to the questionnaire to improve the information yield of the second study. Thus, if the survey data was similar from year to year - in the unchanged items the data set would be considered reliable and hence likely to be valid. It could not be valid if it was not reliable, but validity assessments involve a judgment about whether the items are measuring the variables that they are supposed to measure as well as meeting the test of reliability. In this case the items have considerable face validity and the main question was whether the indicators were tapping into something stable or that fluctuate student aspiration year to year with no apparent trend or pattern.

Some WPS guidance personnel expressed a concern that at their age media images, rather than experience, were predominant and aspirations would not be stable. A member of the ASCW criticized the approach by saying that aspirations, even if stable, do not matter since it is the opportunity structure and economy that will determine what the students actually do, not their dreams and aspirations. The evidence suggests that the concerns of the critics in the guidance departments unfounded. As for the critic in

ASCW, the authors cannot and will not agree that what students aspire has no effect on the ultimate distribution of occupations, but even if it were true that most of those aspiring to be doctors do something else with their lives, it is significant that at this age they had a dream.

Further, their dream not only required them to prepare by going to college, but aspiring to be a physician involves a service profession that required taking the study of Biology and Chemistry quite seriously. The bio-technology industry in the Worcester area will benefit as these students develop back up plans, and even if most of these students practice as nurses and occupational or physical therapists, rather than going to medical school, they have hardly wasted their lives or failed in the eyes of their high school teacher. So it matters that so many of the young people, especially the young women of Worcester, are aspiring to the professions while in high school, and taking demanding course programs.

In any case, the ASCW goal is less to predict what will actually happen in the future than to assess the degree to which gender stereotypical career expectations are impacting the pattern of choices that the high school students are considering. It is a problem if their horizons are limited by factors such as perceived social expectations that have nothing to do with their talent and potential fit and contribute to a field. Is it certainly a matter of concern if they cannot even consider a field for which they might be suited, or having considered it rules it out on grounds of gender suitability alone?

The ASCW question is how predictable aspirations are by sex, not whether the students will actually pursue those exact professions. The guidance department question is whether the females are as likely to aspire to the profession as the males, and

whether they are considering as wide a range of possibilities than their other peers. In particular are they considering those with especially promising job prospects at the moment such as health care and technology?

With those goals clearly in mind, the next step for the analysis would be to estimate which variables were the most important ones by looking for statistically significant differences. In this case, the main objective was to see if gender was a significant factor in shaping the distribution of aspirations across the student population as a whole. Analysis of the results from the first survey provided the opportunity to hone the survey into a sharper and more pointed instrument. Hence, distinctions between science and engineering, as well as kinds of art and politics at the local, national, and international levels were distinguished in the second survey after having been clumped in cruder groupings in the first survey. This proved to greatly improve the quality of information produced by the study and thus a pilot tested and improved instrument suitable for future use was one of the major products of the replication study.

### ***Sample Representativeness***

Coverage of the 11<sup>th</sup> grade student population that was surveyed in the first public school study was very satisfactory, with 62% responding and comparable samples from each high school. This is because all schools used comparable procedures for the first round of study, creating no problems with comparability. Coverage in the second public school study was also quite adequate, at 53%, for the system as a whole, but the quality of the samples from the various high schools was more variable in the second round of study. This is because two of the schools did not have the students complete the ten minute survey in the building during homeroom or in a class, but let it go home with the

students to be done as homework. The response rates dropped to less than 50% at these schools due to a data collection procedures change beyond the control of the data analysis team of Marsland et. al. (2006)

In any study with better than a 50% response rate the results are likely to generalize. Some question could be raised about whether all the 11<sup>th</sup> grade student high school populations are equally well represented, but the whole system can be adequately represented if the findings from the two years of study replicate, which they did. Thus, there is a strong basis for inference about the whole high school student population of the city for the 11<sup>th</sup> grade data base.

The response rate at each of the two middle schools that participated in the 8<sup>th</sup> grade study, Forest Grove and Burncoat, was excellent, at 82%. Though there were two other Worcester middle schools who did not participate in the study, the data sets are comparable between the two schools under study, making the 8<sup>th</sup> grade studies a reasonable representation of the system overall, but before policies are instituted based on these data, it would be prudent to collect comparable data at the other two middle schools.

## **Methodology**

The purpose of designing the survey instrument and conducting the study was mainly to compare categories of students to career interests and concerns. One sponsor, ACSW, was especially interested in gender comparative analysis of career aspirations. The other sponsor, the WPS, was interested in a variety of things such as small school awareness, after graduation plans, college-related concerns, ethnic and gender equity, and differences between schools, given that the enrichment program for Engineering, the Arts, Teaching, Health, and Government Services were in different high schools. Thus, the questionnaire was developed to cater to the interests of both sponsors.

### ***Timing of Survey***

Keeping in mind that this survey could be used in many years to come as *the* tool to track changes in trends of the high school career aspirations, all parts of the survey were taken into careful consideration. The first thing that had to be assessed was what year the information should be gathered in a generation of students. Data collected after high school would not provide a local data because Worcester has many colleges where students come from near and far, so collecting data in late high school (but after the 10<sup>th</sup> grade MCAS exams) would seem to be most appropriate. However, it may also prove useful to have aspirations studies in both 11<sup>th</sup> and 12<sup>th</sup> grade to look into the possibility of last minute changes.

This should be possible because there is already an existing high school exit survey designed to find out which colleges the students are planning to attend, and it would take little effort to add a question about what majors and careers were under consideration at that point, after aspirations have been tested by the competitive college

admissions process. Students who aspired to be artists but who did not get good feedback on their portfolio may be rethinking their options. Students with no strong preference between several fields may have heard that the opportunities were greater in one field than another and set a tentative direction. At that point, it is also possible to compare those aspirations, and maybe even the student's performance in high school, to college admissions test results and see how realistic the aspirations are for those wanting to enter prestigious professions. One could also see how well the strengths of the college one is attending align with the student's career aspirations at that point. Perhaps this is a long chain of thought, but it was a prominent thought considered at the time of the creation of the survey tool that is not beyond the reach of reality.

A similar survey earlier in high school would be useful, too. Collecting data before 11<sup>th</sup> grade would allow time for schools to take measures that encourage counter-stereotypical career movements. The value of the data for high school guidance offices is greatly enhanced if it is collected earlier, say in late 9<sup>th</sup> or early 10<sup>th</sup> grade, rather than 11<sup>th</sup> grade. Early 10<sup>th</sup> grade data can be used to coach students on how to bring high school programs and course selections into line with student aspirations; however, it would be too late to encourage students to change high schools so as to join an "Academy" (internal small school) located in another part of the city. Aspirations data collected in late 8<sup>th</sup> grade or early 9<sup>th</sup> grade would be especially valuable if there was a policy of forming clubs based on the number of students interested in a particular career aspiration (For example: future teachers, future scientists and engineers, future political leaders, future entrepreneurs, etc.). A popular career interest would be more likely to be selected as a club focus. One goal of these clubs may be to connect 9<sup>th</sup> graders with the outreach

and recruiting activities of the small school programs catering to their aspiration. Ninth grade is crucial for this type of specialization of high school classes, because it is the cut-off year for entry into the small schools programs. In fact, the Middle Schools Aspirations Study shows that *most students in 8<sup>th</sup> grade are unaware of the small schools programs*, thus proving that a survey that made these programs more visible while collecting preliminary data about appreciation aligned with the small school programs was a potential low cost policy consideration that would also allow one to “invite” the new 9<sup>th</sup> graders into career-encouraging clubs in whatever high school they decided to attend.

One may think that collecting earlier data may be less accurate; however, that potential problem was assessed using the data collected at Doherty high school in the replication study. At that high school aspiration data was collected from both the 10<sup>th</sup> and 11<sup>th</sup> grade students. The resulting patterns by far were quite similar except in one or two fields of aspirations, the most notable difference being in Science and engineering. Interest in the technical fields was notably higher in 10<sup>th</sup> grade than in 11<sup>th</sup> grade, possible evidence of a real trend to be noted and possibly countered. Hence, earlier data collection proves to be a better time for interventions to support the students with the given aspirations, and especially if the focus is to be on encouraging science and engineering careers.

Clearly there are tradeoffs concerning the point in time a survey study of career aspirations should be conducted, but for the sole purpose of tracking trends, data collection simply needs to be at a consistent point in high school over time. If this is done periodically, at least once every 4-5 years, *the data collected would serve the*

*purposes of the ACSW in tracking trends and assessing intervention programs against that baseline.* The question is whether that level of data collection would be sufficient to serve the needs of the school system?. Another data collection system that would serve the WPS better would involve collecting data in both 9<sup>th</sup> and 12<sup>th</sup> grade, providing a way to track the change of the student aspirations that experienced specific intervention programs.

For this study, 11<sup>th</sup> grade was chosen to be the year of study, because it is close to a time where the students are getting serious about what they want to do in life, but not yet involved in the college admissions process. It was also considered early enough to help guidance counselors to guide students to colleges or organizations that support their aspirations after high school. It was, however, too late to support the efforts of guidance counselors to help the students put together a high school program suitable to support college applications to specialized colleges of technology, music, other arts, etc. The professions of science, law, and medicine involve specialized training after attending a general liberal arts college, but art and technology decisions are best made earlier, in time to consider attending a specialized college or a specialized unit in a comprehensive university. Thus, there is still reason for the study to also be done in 9<sup>th</sup> grade.

### ***Composition of Survey***

The first part of the survey was basic identification and demographics which included: the name, student ID number, school attended, ethnicity (in public schools only), and gender. The only reason for obtaining the student name and ID number was because having these responses in the student file was expected to give the guidance counselors useful information on what type of college is best for the student. However,



having the data for juniors could be useful to the ACSW in identifying likely applicants for their “Young Women of Consequence” awards program. In practice, however, few juniors apply and it ends up being a contest between the seniors who are being encouraged to apply by guidance counselors. The survey seems to have gotten the YWOC award much greater visibility in the public schools of Worcester but at this point is no longer needed to sustain the flow of worthy applicants. The school and ethnicity codes were important because each school varies by average social class and ethnic mix, and the progress of equity in both areas is of interest to the WPS. Finally, students were to indicate gender, as the ability to make gender comparisons that mark progress made towards gender equity was the primary motivation behind the sponsorship of the study by the ACSW.

The next section of the survey, career categories were listed, for each of which the students were asked to indicate their level of interest in each career choice. This technique of indicating level of interest produces a more accurate representation of career aspirations than a simple “yes” or “no” answer since it actually taps the degree of interest. The students were asked to not consider the cost of education for any careers they would be interested in so as to avoid censoring options due to perceived financial barriers which might keep the working and lower class students from reporting their true aspirations. Another section was developed so that the degree of concern about finances, grades and other practical considerations could be assessed separately.

Some changes were made for the career choices in the second round of study. The interest scale for the careers listed was changed from a scale of 1-5 to 1-4 to discourage a student from picking a neutral option on all categories. Some of the

categories were changed in the second wave of the study so as to be more specific. For example, the engineering/science category was split into two items, and the political careers and arts careers items were revised into three items each.

Following the career interests section was the post high school plans section. Students were to pick between 4-year College, 2-year College, vocational/trade school, work, military, marriage/family, or other. Some students chose more than one post high school plan, and in retrospect, the work item should have specified “*full time*” work and “*full time*” homemaker. It is not surprising that some students plan to begin more than one thing after high school. For example, it is possible that a student planned to start work part time and start a family directly after graduating, or work part time while putting themselves through college. The real problem is that some respondents probably interpreted the item as intended and others did not, so that people with the same plans responded in different ways. There were many more students planning to go to work and school in the replication study than in the original study though the item in the survey did not change. It is unlikely that the two years are as different as their response change makes them seem when compared to the replication quality of the other results.

Following the post-plans section was the career-related concerns section. The students were to check off which possible obstacles to attending college concerned them the most. This section was divided into four questions relating to college acceptance, attendance, and preparedness. The other item dealt with perceived family support if they were interested in a counter stereotypical career for someone of their sex.

The last part of the survey was designed to identify student leaders. The public school surveys, and also the private school survey in the first round of study, had a

back side to the survey in which students could indicate their school clubs and any leadership roles in those clubs. This was intended to increase the number of nominees for the ACSW's Young Woman of Consequence Award (which carries a \$500-\$1000 scholarship), because it was expected to help guidance counselors identify candidates for the year after the study was conducted. In fact, it had the desired effect, producing a jump from 8 nominees a year (6 from the private high schools) to 30 nominees (24 from the public high schools). However, the data from the second round of study was not really used, since the public school guidance counselors were now aware of the award, but preferred to nominate seniors rather than juniors. The contest settled into an average of 15-20 nominees for the next few years and was dominated by the public schools. The ACSW started to award 1-2 honorable mentions each year (without a scholarship) in recognition of the much stronger pool of applicants that was produced in the years following the first aspirations survey. Hence the back of the private high school survey form was available for other uses in the second (replication) year of the study.

The private schools version of the aspirations survey included the Bem Sex Role Inventory on the final page of the survey, in place of listing school clubs during the second round of study. Adding this indicator to the survey allowed a deeper study on the relationship between the self images of the students and their aspirations as well as other characteristics such as biological sex. The Bem Sex Role Inventory divides a few dozen one word item personality self descriptions into three gender categories (masculine, feminine, and neutral) regardless of actual sex in biological terms. Because the qualities being listed can mean different things as applied to male and females Kaznik et al. coded them separately for masculine and feminine females, masculine and feminine males, and

in some analyses included the androgynous (both equally likely) male and females as well. Each student could be traced with their aspirations, and the feminine females would be expected to aspire to more stereotypical careers for women. This part of the survey would also be useful to test a theory about whether the balance of masculinity and femininity would vary among the females in schools that varied in sex ratio. The results were so revealing that in retrospect the Marsland et al team wished it had administered these items in the public schools as well.

## **Results**

### ***8<sup>th</sup> Grade Studies***

During the process of reanalyzing the data collected from the Middle School Aspirations Study, there were some interesting findings that Nadia uncovered from the existing summaries and through analysis on her own. The analysis of the 8<sup>th</sup> grade data collected from 2 of the 4 Worcester Middle schools, by Zachary Gautreau (April 27, 2006) revealed that, with a few exceptions, gender and ethnicity do not play a major role in whether or not students are interested in science, math and the core subjects, with English being the main exception. However, at that time, the accompanying report was never fully completed by his partner, Nora Rizkalla. In reviewing and reanalyzing the data for a more formal report, Nadia uncovered additional interesting findings dealing with college aspirations, which were untouched by Zach and Nora. Nadia decided that the findings warranted attention, due to their important policy implications.

The survey had a high response rate; therefore, legitimizing the 8<sup>th</sup> grade study as a good representation of the schools under study. In total, 682 students took the survey, 396 at Forest Grove and 286 at Burncoat. The sample was made up of 51.0% males, 44.1% females, and 4.9% no gender response. These figures align with the Massachusetts Department of Education statistics.

***Table 1 - 8<sup>th</sup> Grade - Enrollment vs. Survey Response***

	<b><i>Enrollment</i></b>	<b><i>Sample Size</i></b>	<b><i>Response Rate</i></b>
<b>Forest Grove</b>	476	396	83.2%
<b>Burncoat</b>	345	286	82.9%

Another main finding by Zach involved 8<sup>th</sup> grade (and parental) lack of visibility of the WPS “small schools” which are various specialization programs found at the

different Worcester high schools. The invisibility of the small schools could affect the decision to keep an 8th grader in the Public School System or send him or her to a private school. Furthermore, the students and parents did not know which high school had the special academies dealing with technology, art, healthcare, and public service respectively. This is important information, because the student might have to switch districts within the system in order to attend a specific school that supports their interests.

Returning to Zach’s main findings, there were a few gender differences worth noting. The males outnumbered the females in having an interest in computers by a 2:1 ratio difference, and males are also much more interested in physical education. By contrast, female interest dominated subjects like foreign language, home economics, and language arts. However, the similarities of interest in the core subjects are more striking than the differences. This is especially true of the most popular set of subjects for 8<sup>th</sup> graders, math and science.

***Table 2 - 8th Grade - Gender Equity Two of Four Middle Schools***

	<i>% Math</i>	<i>% Science</i>
<b>Forest Grove</b>	25.0%	14.6%
<b>Burncoat</b>	12.9%	12.6%

As you can see from the table above, there are definitely some substantial numbers of students interested enough in math or science to say it is their “favorite” course. Zach’s prior presentation of these data was 34% chose math or science as their favorite subject. A more detailed look changes the picture.

The distributions between male and female interest in these subjects were very similar, so at that age, just before high school, gender does *not* predict these areas of interest. Ethnicity does *not* affect whether or not students are interested in math or

science either. Thus, it is a moment of gender and ethnic equity *and* high level of interest. Only one thing marks the promising picture, and that is the student’s expectations about whether they are going to college. This is dramatically different by school and presumably social class, rather than by sex or race.

Nadia’s investigation of students’ aspirations and post high school makes it clear that fewer than half of the students, male or female, plan to go to college after high school. About 39% of 8<sup>th</sup> grade students aspire to attend college in the future, regardless of gender. But, when this same distribution is investigated not by gender, but by which school the student attends, there is quite a startling difference in mindset, as far as future higher education and professional aspirations go.

**Table 3 - 8th Grade - Post High School Plans**

	<i>Start a Family</i>	<i>College</i>	<i>Travel</i>	<i>Other</i>
<b>Burncoat</b>	59 %	1%	10%	30%
<b>Forest Grove</b>	0.8%	67%	0.5%	31.7%

\*other options on the survey included “start work” and “not sure”.

As seen by the chart above, though gender did not affect a student’s aspirations and post high school plans, the school that they attended was *absolutely* a factor. At the more ethnically diverse and primarily working class district, Burncoat Middle School, the majority of students, male and female, planned to start a family. In contrast, at the more middle class school, Forest Grove Middle School, the majority of students, male and female, expected and planned to go to college.

After making this discovery Nadia further analyzed the issue by looking into ethnicity, wondering if it played any role in this outcome. The following table represents what she was able to find.

**Table 4 - 8th grade - Post High School vs. Ethnicity**

	<i>Asian</i>	<i>Black</i>	<i>Hispanic</i>	<i>White</i>	<i>Other</i>
<b>Start Family</b>	25%	31.15%	29.5%	22.39%	19.5%
<b>College</b>	46.4%	32.8%	31.05%	44.79%	39%
<b>Travel</b>	7.1%	1.6%	6.8%	4.1%	2.4%
<b>Other</b>	21.4%	34.4%	32.6%	28.7%	39%

The values do not tell much, as there is about a third of each ethnic population distributed throughout the three categories of starting a family, college education and other (the rest is in travel). Thus, Nadia looked further into the matter this time comparing what school each ethnicity belonged to and what they chose as their post high school aspiration.

**Table 5 - Burncoat Middle School: Post High School Plans vs. Ethnicity**

	<i>Asian</i>	<i>Black</i>	<i>Hispanic</i>	<i>White</i>	<i>Other</i>
<b>Start Family</b>	70%	56.3%	56.12%	56.45%	80%
<b>College</b>	0%	3.1%	2.2%	0.8%	0%
<b>Travel</b>	20%	3.1%	13.26%	9.75%	0%
<b>Other</b>	10%	37.5%	28.6%	33%	20%

**Table 6 - Forest Grove Middle School: Post High School Plans vs. Ethnicity**

	<i>Asian</i>	<i>Black</i>	<i>Hispanic</i>	<i>White</i>	<i>Other</i>
<b>Start Family</b>	0%	0%	1%	0.5%	0%
<b>College</b>	72.2%	65.5%	62%	73%	51.6%
<b>Travel</b>	0%	0%	0%	0.5%	3.2%
<b>Other</b>	27.8%	34.5%	37%	26%	45.2%

After further breaking down the data, there isn't much that can be said about ethnicity having an effect on post-high school plans for 8<sup>th</sup> graders. At Burncoat Middle School, a majority of the students aspire to start a family, and the highest percentage that plans to attend college is 3.1% which is found among the Blacks. At Forest Grove the



majority of the students aspire to attend college regardless of ethnicity. The highest percentage that plans to start a family is only 1% which is found among the Hispanics. The pattern continues, regardless of ethnicity, providing more evidence supporting the statement that social class is an *enormous* factor in students' post high school aspirations. The issue is not one of the cultures, but it is one correlated with the quadrant based on the areas in which each of the schools are located and the community environment that students live in.

Thus, vocational choices are something the Burncoat Middle School students expect to make in high school, rather than college. By contrast, the Forest Grove Middle School students expect to have four or more additional years to explore possibilities and specialize. Thus, to the Forest Grove Middle School student involvement in a small school would be a way to make an improved case for college admission, say to an Engineering School. A Burncoat Middle School student would look at such a program as a point of entry into the job market in commercial art, music or the theatre, assuming that they were aware that these programs exist.

It is quite striking that Zach found that only about 20% of students were aware of the WPS small schools in the high school. When asked, on a scale of 1-5, whether or not students found it important to take courses in their career interest, 86% chose either a 4 or 5 rating. Therefore, the majority of them agreed that it was important, yet 77% of them were unaware of the small school system. The minority of 8<sup>th</sup> graders that had heard of it they were most likely to designate their parents as the source of their information. Awareness of this system and its rules of entry (you can't enter a small school system after the end of 9<sup>th</sup> grade) is important given the way aspirations and plans are forming

among 8<sup>th</sup> graders. Greater publicity from the schools within a school could allow for aspirations to at least be developed and put into motion, making it something more tangible than a mere dream in their heads.

The 8<sup>th</sup> grade findings, while interesting for their own sake, take on special meaning when compared to the parallel 11<sup>th</sup> grade aspirations data. Interestingly, there is no longer gender equity in interest in technical (engineering and computers) careers, and interest in science has plunged for both males and females (Handler and Hogan, 2005 and Marsland et al., 2006). This original 11<sup>th</sup> grade aspirations study included questions about potential problems the students saw with regard to attending college. The section on impediments to college in the 11<sup>th</sup> grade study picks up on Nadia's college expectations, paralleling the 8<sup>th</sup> grade study in that respect quite nicely, with the exception that the data was not analyzed school by school in the Marsland et al. study.

### ***11<sup>th</sup> Grade Studies – Public School System***

Originally, a Worcester high school career aspiration study was conducted in the 2004-2005 academic year by Laura Handler and Pat Hogan. This was designed to be a stand-alone study, but later it was suggested that there be a follow-up study to verify the results as being solid, rather than noise due to the concern that the admission staff were inclined to doubt this basis as stable. Thus, a replication study was performed by Evan Custodio, Brian Marsland, and James Scully. This replication study was slightly different in a few ways, mainly sample sizes from select schools and career options listed. Despite these changes, the study was still equivalent, though they wanted to call for another study to verify the data further due to a variation in data collection procedures. They were hoping each school would get a reliable data set on its own student body, and

the North High study procedure was too flawed to meet standards. However, it should be noted that if the results were similar in the unchanged categories, reliability of the survey tool is established.

Some important changes to the original 11<sup>th</sup> grade survey were made by Laura Handler and noted in her and Pat's report. These changes were significant improvements which further refined the aspiration selections. In comparing the two data sets, there was little difference in the percents of interest on the items that were not changed, and it was also concluded that the changes did not skew the responses significantly. Thus, satisfaction in validity of the survey tool was assessed, and passed both the face validity and test retest reliability standards. Where there were changes, the differences were reasonable, in that they could be reconciled with prior findings.

An example of the changes in results caused by a change in survey options is "science and engineering" where about 20% of the students indicated interest, with the males being twice as likely to do so as the females. In the second year, it became two separate categories revealing that 5% of the males and females were interested in science and 5% of the females and 25% of the males were interested in engineering. The differentiation of interest implies that there were students interested in only science or engineering, thereby leaving them with the choice to not indicate "science and engineering" as an interest. Clearly science and engineering are not synonymous to the high school respondents, and should not have been combined, especially in a gender-comparative study.

Another aspect of the second project was a parallel survey study carried out in the Doherty High School sophomore class. (An attempt to run a similar study at North High

School failed due to a low response rate.) Marsland et. al. believed that gathering the sophomore class aspirations would allow the guidance counselors to be more effective in putting together high school class schedules that made sense in terms of students' career interests, or at least to explore related career options. For example, a third of the females are interested in entering a medical profession, more than double the percentage of males. Females interested in being doctors, dentists, or veterinarians are also likely to be interested in nursing and medical technology. Males are far less likely to consider nursing a suitable backup plan to medicine.

Given the difficulties of getting into medical school and graduating, it is important that all the students, especially the female students, have a suitable fallback plan. Considering that the success rate in entering the engineering profession is much greater than for medicine, it would be wise to suggest to the females that they consider health related fields of biomedical engineering, biotechnology, and environmental engineering, and that the males consider the possibility of becoming a nurse practitioner or a physician's assistant.

These possibilities require earlier action than applying to medical school after college. One can still pursue medicine after studying to be a nurse or an engineer at the undergraduate level, but it means going to a school with a suitable program, and few liberal arts colleges offer nursing and engineering majors. Hence, such a strategy will affect what courses are taken in the junior and senior years of high school, and which colleges one wishes to apply to. The downside to this plan is that this type of logic is not apparent in the WPS guidance counseling department, as it has been explained to Professor Wilkes that the guidance counselors primarily want to get students into *good*

colleges, rather than concerning themselves with targeting colleges with a focus. The presumption has been that so many will change majors that their high school aspirations are secondary, and the state university can accommodate most majors they consider. Some made the effort to research colleges with focus, but most were relying on rating of liberal arts colleges and considering very few suitable for specialized colleges of art, music, or technology. Devin proposed that they could *outsource* this research to the parents, students, clubs, or other organizations, providing a forum to which representatives of these schools could participate.

Gathering 10<sup>th</sup> grade data only makes sense if the junior and sophomore data sets were consistent, and the Marsland et. al. study confirmed this. The overall pattern of choice and gender difference in aspirations is the same for 10<sup>th</sup> grade and 11<sup>th</sup> grade. The only striking variation was that the proportion of students interested in science and engineering was significantly higher among 10<sup>th</sup> graders. Other than that, there was not much variation. This was most evident when a portion of the survey's response categories were changed for the second round of study.

Results of interest from changes in survey options are found below. The table that these findings are from Tables 9-11 found in Appendix C.

- ➔ 81% of the students interested in engineering/physical science from 2004-2005 were male, but the next year, 78% of the students interested in engineering were males, and 47% of those interested in physical science were males.
- ➔ 80% of the students interested in computers/IT from 2004-2005 study were males, but the next year, the percent male dropped to farther in computers than in IT, meaning that computers and IT were not synonymous to males.

Though the females treated them as indistinguishable and few were interested in the field.

- ➔ A new career option was added to medical practitioner and nurse in the medical field section “other medical related”. 46% of female students and 16% of the male students were interested in this health related career path.
- ➔ After the art category was divided, it was found that performance and visual arts were female dominated interest areas, while music and media attracted equal proportions of male and female students.
- ➔ Concerning political office, in the 2004-2005 survey data, 65% of students interested in running for political office were male. The next year, government service and elected political office were separated, and local politics were distinguished from national and international politics. Overall politics was still slightly male dominated, but international politics proved to be of more interest to females than males, so the females found making a difference on a wider stage much more appealing than being active in local politics. This is unfortunate since obtaining national political position requires developing a local political base

The post high school graduation plans with respect to gender difference replicated quite well with the exception of the percent planning to go to work. This is probably due to the revised wording, and changing the reader’s interpretation. The first year these were considered alternatives by the respondents. The second year many students checked off both college and work, so it is unclear what percentage of students plan on starting

their careers right after high school without doing further analysis of the data sets to deal with the issue of part time work to help support one's education.

With regard to career related concerns, some findings have replicated, but due to the inconsistency in the response rate of some schools from 2004-2005 to 2005-2006, it is not clear why or whether or not there is real change in noise in the data sets with lower response rates. Since there is more than one possible explanation: noise, a new trend, effects from a change in survey, or because the low response rates from the North and South high schools. It is best to consider the school by school difference finding inconclusive for the Marsland et al study and refer to the Handler and Hogan study as more reliable evidence on that matter. Their dates indicate that the 11<sup>th</sup> grade public schools are very similar in realm of distributions of aspirations.

The difference in findings was as follows: female students are not as concerned with their test scores in the Marsland et al 2005-2006 year as in the Handler and Hogan 2004-2005 study. There is a high likely hood of concern regarding family support if one enters a field dominated by the opposite sex, especially among females. About 11% of the females had doubt about family support for such a career choice compared to the 6% of the males, about a 74% difference in likelihood that a female would be concerned about this. The data reveals an increase in career related concerns in females pursuing a career where there are few of the same gender working in that field. The most consistent finding was that females worry more about their standardized test scores while the males worry more about their grades.

This makes sense, according to Professor Wilkes, the grades of the females tend to be better than the males in Worcester Public high schools, but their average SAT

scores are about the same. Further, the females take the SAT more times to get comparable average combined math and verbal scores.

Unlike the gender differences, ethnic differences did not replicate for career aspirations, and thus, ethnicity was concluded to not be a reliable predictor of aspirations, though it was related to the likelihood of financial concern – probably due to a localized relationship between social class and race in Worcester. However, there was one stable factor relating to race and ethnic career aspirations, and that was that Caucasians in general did not appear to be interested in more than one or two career paths, while the ethnic minorities were more likely to profess an interest in a wide variety of possible careers.

Although there was only one statistically significant factor including ethnicity with regard to career aspirations, it does not mean that the other sections did not have consistency. The 4-year college findings were the only consistent set of results in after-school plans, and the results indicate that Blacks and Asians are 8.2% more likely to aspire to go to college than Whites and 17.1% more likely than Hispanics. However, the main findings between ethnicities were found in career and college related concerns.

Among the concerns, items with the largest variance (instability) from first to second round of study were seen in the items involving: disliking school, not knowing anyone who had entered the fields that interested them, and pursuing a field where the opposite gender is prominent (see Appendix E). Since the latter item was adjusted between the two studies, it was expected to vary, but the other items were unchanged. In the case of disliking school, that rose 1.2% among males and dropped 1.2% among females. This modest shift produces a greater gender gap in the second study but is not



going to affect the pattern of findings. As for having a contact or role model, there is no change among the males and 2% more females are claiming to have role models or not being concerned about the lack of these. The evidence of stability is quite reassuring in this area. Most of the others don't vary much either, we can assume the results to be reliable and have passed one validity test. The most striking finding overall is that Blacks and especially Caucasians tend to be less concerned about any of these potential hurdles than the Hispanics and especially Asians in this case. The only place where this trend seriously flip-flops is in the new question asking about family support for a counter-stereotypical career choice. Nonetheless, there needs to be more support for the aspirations of ethnic minorities considering entering fields dominated by the opposite sex if the impact of gender stereotyping is to moderate in the next generation. The recruitment of female engineers and male public school teachers (among others) from minority groups will depend on the perception of family and community support for such aspirations.

The next decade is expected to be a critical time for a student considering engineering or science, as a career due to the challenge the United States faces in developing a new energy infrastructure and revamp both the medical care and educational systems. Hence, it would be wise to continue to collect data on aspirations and perceptions of careers in the fields and consider high school guidance the primary user of any 9<sup>th</sup> and 10<sup>th</sup> grade aspirations data collected in addition to the 11<sup>th</sup> or 12<sup>th</sup> grade aspirations collected more for city trend monitoring purposes and to facilitate the efforts of colleges to recruit talent in Worcester. To take the burden off the guidance departments from doing the survey over and over every year, college teams from around

the city can help the Worcester Public School System assemble, analyze, and utilize the resulting data. Many colleges have community service programs, and at WPI, community service is required for work study federal supported funding. Over time, a valuable archive could develop and the ACSW could reuse the data in the archive to do five year updates looking for changes in important trends or to indicate whether or not an intervention plan is working.

In order to assess the value and need for an aspiration survey to start a Future Scientists and Engineers Club at a Worcester high school, two project teams administered the survey to the 10<sup>th</sup> grade at Doherty and North High School: “North High School Coaching” by Tri Lai and Jason Hwang and “Piloting a Doherty H.S. Future Sci. & Eng. Club” by Brian Dorchik and Matthew Duncan. The projects were the source of the 10<sup>th</sup> grade data and analyzed in the report by Custodio, Marsland, and Scully. Due to the low response rate at North high school, the Doherty high school data was considered a better tool to gauge whether 10<sup>th</sup> grade data would differ from 11<sup>th</sup> grade data. The few noticeable changes in career interest from 10<sup>th</sup> to 11<sup>th</sup> grade are described below.

- Interest in physical science becomes much less interesting to males, but more appealing to females.
- Interest in computers diminishes overall.
- Fewer females show interest in trade.
- Medical support becomes less appealing to males.
- Female interest in media declines.
- Male interest in the service industry declines.
- Civil service increases in interest for males.

- Fewer males consider elected political office and international politics.
- Interest in government service declines.
- Females become more interested in international politics.

The conclusions above may or may not be noise, but altogether prove that interest in engineering overall declines comparing 10<sup>th</sup> to 11<sup>th</sup> grade especially among women, and 11<sup>th</sup> grade males are less interested in medical support than were 10<sup>th</sup> graders. This means that the students are still narrowing down their career choices after 10<sup>th</sup> grade and gender stereotyping may be part of the cutting back process. The main finding is that the results are strikingly similar with only those few subjects showing any noticeable variations. Thus, 10<sup>th</sup> grade is a fairly good year to take an aspirations survey. It may also be a good year to encourage the students interested in science and engineering to maintain their aspirations along the lines.

Two other areas of interest were studied from the public school survey results: correlation between career interests and correlation with parental occupations. According to the results, interest in law correlates with interest in medical and political fields, interest in engineering correlates with interest in other technical fields, interest in medical fields correlates with interest in other medical fields, interest in physical science correlates with interest in medical fields, and interest in arts correlates with interest in other art categories. Interest in engineering does not correlate with interest in a career in the arts.

Concerning parental occupation correlation, some bonds are stronger than others. Students with parents in medical practice or business have no higher chances of pursuing their parent's careers than the average student. However, a student is more likely to

consider their parent's career if he or she has parents in the trades, teaching, medical support, or engineering.

In conclusion, the replication study was successful in demonstrating the reliability of the findings in the previous study. Gender ratios were replicated quite well, and compared to women in the workforce, the two years of findings suggest that there is likely to be an increase of females in professional careers such as medicine, law, business, and even the physical sciences if the students get to act out their high school aspirations. Of course, the opportunity structure and exposure to new fields in college will affect what actual careers they take – but first they must have a dream. Then it can come true – or not. This is the “wishlist” of dreams at a critical moment – while preparing to apply to college.

The only category of the survey where ethnicity was a factor seemed to be in having more career interests and concerns among the non-whites. The results of the sophomore survey were consistent with the results of the junior survey in nearly all career choice categories. It seems that there is a good case to be made to conduct future surveys on the sophomore class instead of the junior class. One gets into very similar information, but gets it earlier – and in time to consider counteracting the gender stereotype slide of females towards the medical professions from Science and Engineering and vice-versa for males.

### ***11<sup>th</sup> Grade Studies – Private School System***

“The Aspirations of Young Women in Worcester’s Private/Charter High Schools”  
by Michelle Boudreau and Katie Croteau was a parallel report to that done by Handler

and Hogan in the public schools that same year. The two teams agreed to use the same items on the aspirations survey list of career interests and both studied 11<sup>th</sup> grade high school students primarily concerning gender differences. Both projects were sponsored by The City Manager's Advisory Committee on the Status of Women in Worcester (ACSW) though the two teams were somewhat competitive and did not work out a common reporting format on the analysis part. Since the major question was whether the public school results would replicate into private schools, it was not serious that they produced separate reports as long as they answered the same questions and produced comparable summary tables. The private high school research team wanted to specifically look at these areas: females interested in political or civil service careers, students interested in counter-stereotypical careers, and locating female students in private high schools suitable for the annual *Young Woman of Consequence Award*.

In order to feedback the findings of the results, the research team had planned a luncheon as a "thank you" to the participating schools in which the representatives from each school could appear. The team decided on this method of discussion so that the representatives from each school could have an equal opportunity to be present when any information regarding their school was brought up. Unlike the public schools, there were no common administrative groups interested in all the results. They really could not decide what to share until they saw their own results. They would not want anyone from other schools to have access, so the only way to proceed was to have a representative from each schools present who would decide what to compare notes with the other representative on – at the same time and on the spot. They could then direct the IQP

team of Croteau and Boudreau to prepare a special report for those present either the school, or a code and share their code numbers with each other.

The results of the career aspirations were very different from those of the public schools in a few categories. But on the whole, the striking thing was how similar the public and private high schools were overall. It was the gender findings that differed, with the private school student patterns being more gender stereotypical. Trade, law, art, and civil service are all less popular career interests in the private schools, than the public schools with the trades being the least popular in the private school students. Only teaching and engineering/science were more popular in the private schools than in the public schools. Among males, the more prestigious professional career interests were more popular than in the public schools with the exception of a computer career or a law career. Business, trade, art, and civil services were less popular overall in the private schools.

Private school males were 20% more interested in teaching, 3% more interested in Engineering/Physical Science, 38% less interested in Computers and IT, 33% more interested in medicine, 20% less interested in law, and 43% more interested in seeking political office. They were also 18% more interested in a business career, and 94% less interested in a career in the arts.

Private school females were less interested in all careers than the public school females were less interested in all careers than the public school females except for teaching, engineering/physical science, and political office. They were 37% more interested in teaching and 67% more interested in engineering/physical science than the public school females. However, they were 30% less interested in computers, 12% less

interested in medicine, and 75% less interested in law. They were also 41% less interested in a business career and 13% less interested in the arts. They were just as likely to be interested in a political career.

The survey changes for the second round of study made it become apparent that even fewer students in the private schools considered computers or IT as careers than it seemed in the first year. Also, the split in engineering/science revealed that engineering is slightly more popular in public schools, though physical science remains more interesting to private school students. In addition, private school students were more likely to be interested in a career in business, media, elected political office, government service, and international politics.

The data set proved to be of good quality (nearly 2/3 of students in the 11<sup>th</sup> grades of the private schools took the survey) and it provided some valuable insights. It seems as though the Catholic schools face a special challenge in countering the impact of gender stereotypes on career choice. Gender is a better predictor of career aspiration in the private schools, especially the private parochial schools than in the public schools. The special opportunity to look at the Bem (Masculinity-Femininity of self image ) indicator in this context was quite revealing. On the other hand Ethnicity could not be examined in this data set as the proportion of students from the white population was overwhelming. Private school students have a higher rate of pursuing a 4-year college and a lower rate of all other post-high school plans. In regard to career reservations, the private school students have much less anxiety overall about pursuing their career, however, without a way to control for social class in the public and private school data sets it is not clear that

the students with professional middle class parents who are in the public schools really differ from their counterparts in the private schools.

## 8<sup>th</sup> to 11<sup>th</sup> Grade Correlation

The results of the studies provided considerable insight into what careers were being considered by these students and what would now shape the behavior of these young Worcester residents as they select classes, colleges, majors, and jobs. For instance, one finding that the results support is that gender is still a factor in shaping the 11<sup>th</sup> grade aspirations distribution overall and is a stronger factor in the private high schools (14% stronger in the private schools) Though these findings are not very surprising, they are now verified by the results of the studies.

Comparing the 8<sup>th</sup> and 11<sup>th</sup> grade results, the results require some interpretation because the survey items are not the same. They had to be adjusted to suit the different age groups. The main reason for having a different 8th grade survey derives from the expectation that few younger students will have a firm decision on what they want to do after high school or college at that time. However, what they most probably do know is their favorite subject, so the 8<sup>th</sup> graders were asked what their favorite subject was instead of being asked what careers interested them. Thus, the comparison was interpreted from 11<sup>th</sup> grade career aspirations to 8<sup>th</sup> grade favorite subjects. For instance, the percentage aspiring to be engineers, computer scientists, and doctors was compared to the percentage that had science as their favorite subject. The decision that the students face in 8th grade is what high school to attend. This would be revealing if they knew how the Worcester High Schools differ in terms of what small internal academy each on supports. However,



80% of those were unaware of that, except perhaps in the case of the Vocational High School being the place to study a trade.

The major finding regarding the results of the 8<sup>th</sup> grade survey was that there was still gender (and ethnic) equity of interest in math and science. It is surprising that even at the brink of high school, gender stereotyping has not yet decreased female interest in math and science relative to that of males. The conventional wisdom presumes that sexes would have started to diverge on favorite subjects at 4<sup>th</sup> grade or sooner and the trend toward gender difference would be well established by 8<sup>th</sup> grade. That meant that the erosion of interest in science and math, and hence engineering, has occurred later and much more rapidly than expected, somewhere in the 9<sup>th</sup> and 10<sup>th</sup> grade, the prior two years of high school before the 11<sup>th</sup> grade studies. The 10<sup>th</sup> grade survey data that was collected from Doherty high school suggests that interest in engineering is higher even one year earlier than the 11<sup>th</sup> grade study, so it is declining from 8<sup>th</sup> to 11<sup>th</sup> grade, not suddenly dropping on arrival in the high school academic culture stressing popularity and athletics more than academics. Interest in physical science is still steadily declining for public school males and females.

Thus, the message of these several studies is not evident from a presentation that looks at them one at one time; rather, it is the larger patterns found by comparing the two findings that makes the point. 9<sup>th</sup> grade is not too late for a policy intersection designed to bolster male and female interest in science and female interest in engineering. It doesn't seem to be until "Science" becomes Chemistry and Physics that rather than Biology and Earth Science that the females turn away from science and engineering as professions and toward medical careers.

## WPHS Small Schools Program Awareness:

The small schools program in Worcester is a vocational oriented enrichment program in which each Worcester High School has developed an area of excellence or strength. In principle, students can choose which high school they wish to attend based on their personal career aspirations. However, there are certainly other considerations to consider. Still, these programs provide a place where young adults can channel their interests while preparing for a college education and for a student already in the right school there is a chance to get an edge if one knows one has an interest in a field. There are small school within a school programs in subjects such as technology, art, healthcare, and public service, among other smaller programs in fields like landscaping and cosmetics. Doherty High School offers the Engineering and Technology Academy (ETA) and there are both male and female role models teaching in it. However, the window in which one must enter this program is restrictive and may produce an inadvertent gender bias.

Students must enter the program during 9<sup>th</sup> grade otherwise it no longer is an option for them. The problem for females is that it is a bigger deal to decide to enter a counter stereotypical career field than to go into a culturally approved field for their sex. Hence, though the male and female pools interested in science and math are comparable as 9th grade students-by the end of the year four times as many males as females enter ETA. Then having done so, they are groomed for engineering school with special courses, and aren't allowed to skip prerequisites like Physics. Thus, they have an advantage over in the college admission competition over those students who decided on engineering or science later in high school. Burncoat and South High schools offer the programs for arts

(visual and performing at Burncoat, writing at South). North High offers a program in Allied Health Professions but also has 2 other small schools and tries to involve everyone in one of them. This is unusual. By contrast, Doherty has only the ETA and tried to involve only about 15% of the student body in it. North and South High schools also offer government service programs, but the one at South High is better known, and South High also encourages future teachers.

The picture is further complicated by the fact that the tradition in Worcester for over a decade is that 10 elementary schools, one Middle School and a high school are to be viewed as a coordinated and cooperating "quadrant". Hence, transfer out of one's neighborhood after 8th grade is rarer than leaving the public schools altogether to go to a private high school in 9th grade. There are also students leaving for the Vocational High School, a previously private institution that has now been taken over by the Worcester Public Schools, but still runs semi-autonomously. Add to that the community structure of Worcester with a Hispanic community clustered around South High, Burncoat serving a heavily black housing project and a white lower middle class neighborhood. North High has a heavily Afro-American and Asian student mix. Doherty, on the West Side serves the more middle class side of the city. Hence, there are class and ethnic differences by high school as well as differences in the small schools they support to be considered as one contemplates a transfer to attend a small school program.

Students who have aspirations and interests in any of these areas can have these goals nurtured through this system but would they transfer to take advantage of the small school program? Through analysis of the data collected by Zachary Gautreau (April 27,

2006), it is clear that many 8<sup>th</sup> grade students have developed vocational interests and think they should be a factor in school choice, but at the same time, a majority of them are unaware of the existing small schools program. Could Worcester accommodate a sizable flow of technically inclined students to ETA unless an equal number of Doherty students interested in the arts and health were willing to transfer out and open up slots? Those aware of the small schools program credit their parents with telling them about the programs. Though this program exists and is a potentially valuable available tool for polishing the dreams and aspirations of young adults, for some reason WPS is not publicizing it very well. Concerns about being able to accommodate requests may be behind the lack of publicity. It is not clear whether this is an explicit policy, reflects lack of initiative on the part of the overworked faculty running the individual small schools or just fell through the cracks the year we did the study. However, an aspirations survey of high school students done at the right time could serve both to make the program more visible and provide useful data regarding the likely size of the pool of students considering a transfer to support an existing vocational interest-all other things being equal. Who knows, it might be in fairly good balance.

**Table 1a: School vs. Small School Awareness**

	No Response	Yes	No
Burncoat Middle School	0%	18.28%	81.71%
Forest Grove	6.3%	20.7%	72.98%

**Table 1b: School vs. Importance of Vocationally Relevant Classes**

	0 (not imp.)	1	2	3	4	5 (Very imp.)
Burncoat Middle School	0%	2.1%	1.4%	10.56%	29.6%	56.33%
Forest Grove	5.3%	0.25%	0.75%	7.3%	29.5%	56.8%

According to the data collected and shown in Table 1a, by Zachary Gautreau (April 27, 2006), about 77% of the 8<sup>th</sup> grade population at both Burncoat and Forest Grove middle schools were unaware of the small school program. At Burncoat (feeds into Burncoat High School) about 81.71% and at Forest Grove (feeds into Doherty) about 72.98% of students have not been informed about the special academic resources offered at these high schools. Students were also asked, on a scale of 1 to 5, how important they believe it is to take classes in high school that are "directed towards their career interest". As shown in Table 1b, it was found that 86% of the students, regardless of which school they attend, chose either a rating of 4 or 5 on how important they believe it is to take courses connected to their career interests. Therefore, although more than three-fourths of 8<sup>th</sup> graders are unaware of the Worcester High Schools' special academic programs, 86% of them believe it is important to seek out vocational relevant courses. These programs provide those courses and one would expect there to be substantial demand for these if they were publicized before the students arrive at a school from 9th grade.

Will the middle school data generalize to all of Worcester or is it specific to the middle schools selected for the study? Nora Rizkalla looked into this matter and reports the following.

*According to the Massachusetts Department of Education, 6% of Forest Grove Middle School Students and 4% of Burncoat Middle School Students exhibited an advanced proficiency in mathematics, as judged by the Massachusetts Comprehensive Assessment System. Both of these figures are below the state average of 13%, but good by the standards of the large urban areas and better than the other two Middle schools in Worcester. Further, 3% of Forest Grove students and 2% of Burncoat students exhibited advanced proficiency in science and technology according to the same assessment system. This is in line with the state figure of 4%. Part of the goal of this study is to determine if these students with a flair for math and science are aware of the small schools magnet program, and the advantages it can offer them. If so, Forest Grove students should be staying put and the Burncoat students with this interest transferring to Doherty. Vice versa would be the case for the Arts oriented students (Rizkalla, 2007).*

**Table 4: School vs. Willing to Select High School based on Small School Offerings**

	Yes	No
Burncoat Middle School	72%	28%
Forest Grove	71%	29%

Upon choosing which high school offers the program that appeals to them most, they may have to switch districts depending on where they currently reside. Forest Grove is the feeder middle school to Doherty High School; similarly Burncoat Middle School is the feeder middle school to Burncoat High School. Students may be reluctant to leave their friends and change the school they intended on going to after middle school. After analyzing the data, it was found that of the students aware of the program; about three-fourths were willing to select a WPHS based on their vocational interests. At Burncoat Middle School, about 72% of the students aware of the program (and that is only 20% of

*the whole*) claim to be prepared to select a high school based on their interests, and 71% at Forest Grove (see Table 4).

Overall, it is important that students are informed early on about the small school system as it can be very beneficial to them in encouraging their career aspirations. It should be done at an appropriate time so that they can make the cut off time to get into the system, which is only until the end of 9<sup>th</sup> grade for ETA. Students understand the importance of programs which are geared towards their subject interest, yet they are unaware that there is a system available to them in their own city allowing them to pursue this. Early awareness of the small school system to the parents and students would allow them to have an ample amount of time to carefully consider which high school is best for them. At the time that the survey was taken, only about 20% of 8<sup>th</sup> graders were aware of the small schools and thus, they were unaware of the vocational programs that the default high school that their middle school quadrant would lead them to offered. These programs can be greatly helpful in maintaining students' interest in subjects in terms of pursuing a college education, and eventually a career. The lack of focused support for Science and Engineering career interests in most high schools, and the sex ratio in ETA given that the 9<sup>th</sup> grade commitment must be made to the program seem to be areas of concern worthy of an intervention program. It is less that policies need to be changed that that information campaigns need to be undertaken if the 8<sup>th</sup> grade levels of interest in science are going to persist into 10<sup>th</sup> grade.

## ***Bem Study of Parochial Schools***

The Bem study is a research project that ran in parallel with the replication round of the public school studies at the private high school of Worcester. However, it did not use the same questionnaire as there was only a 50% overlap with the one used in the public schools due to a decision to make room for the Bem Sex Role Inventory. The BSRI is a measure designed to identify a respondent's masculinity or femininity of self image regardless of their biological sex. Gender is a deliberate factor in this study, but the "sex" issue is not overtly raised.. The theory is that masculine females would more likely to pioneer the future feminine image and be the first ones to break down social barriers. This study should have been done in the public schools too, but the instrument used in the past was pre-approved and the students doing the study were afraid that there would be further delays getting into the field if they changed the survey instrument. Hence the pilot study was done in the private schools, and that turned out to be very interesting.

What makes studying a private school such an opportunity for a gender comparison study is that not all the private schools in Worcester are coed, and even some that claim to be have disproportionate gender ratios. This made it possible to compare the proportion of feminine to masculine women in an all female parochial school, a two third's female parochial school and a 50% female parochial high school all within Worcester. Plus, an all male parochial school for comparison to the male populations in the coed schools was found in a nearby town.

About a third of all the females in the private school study (which included both secular and parochial private schools but the secular schools were dropped from this



separate study) had masculine self images. The coed parochial schools were typical of the larger distribution. However, about half of students in the all female parochial school were “masculine” by the Bem measure. The distribution of career choices did differ among the masculine as opposed to the feminine females, with the masculine females more likely to aspire to scientific and technical careers. This was not true of feminine males, as the gender imagery in the males’ self images did not seem to affect their distribution of career choices.

The ACSW’s primary goal for the Bem study was to know the fields in which gender stereotypes and prejudice continue to be a factor in restricting equal opportunity for women. The aspirations of feminine females, rather than the masculine females, are expected to be a lead indicator of the fields that will reach the point of gender equity in the next generation. Providing lead indicator information gathered from Worcester high school students in the middle of the 11<sup>th</sup> grade, and classified by a masculine or feminine self image, should give the ACSW a consistent way to track the ongoing trends in Worcester. Thus, engineering and the technical fields will be under watch as the next areas where gender equity is in progress following medical practice, which has already been accepted by feminine females in the schools. Engineering, on the other hand, is still being pioneered by a disproportionately “masculine” and “androgynous” self image group of women.

However, the size of this pool is twice the size of the “feminine” and “androgynous” pool of males. This matters little however, if that pool of men is not expressing interest in fields such as teaching and nursing, and it is not, at least in the private parochial schools, which have a more socially conservative reputation than the

public schools. It was in the private parochial schools that sex ( biologically defined) was a significant influence on most career choices. It impacted fewer in the public schools, and it would be worth knowing what range of careers the counter stereotypical males in the public schools are considering. The BSRI takes only 8 minutes to administer. It is a one page survey instrument available for the price of printing it.

## **Experimenting with Intervention Programs**

A high school aspirations survey instrument was produced by this project and is a verified and effective way to provide a clearer picture of the aspirations of high school students in 11<sup>th</sup> grade as they consider applying to a range of colleges. It looks like it is suitable for use with 10<sup>th</sup> graders as well, and would produce largely the same results if used a year earlier. There is also an 8<sup>th</sup> grade instrument at the point of pilot testing that shows great promise. However, the critical moment for Worcester is early 9<sup>th</sup> grade as that seems to be the last moment one can identify a substantial pool of females with an interest in science and math and nurture this interest as a serious career possibility before it converts into a more socially acceptable interest in Medicine or Law (especially for those with a feminine self image) over the next two years.

This of course raises the question of what one would do at that moment as an intervention program if one had an aspirations tracking system in place to support the efforts of the guidance department, faculty and small school programs? Certainly the ACSW would want to take a look at the pattern of results every few years to establish a data trend allowing them to peek at one of the many forces shaping the future occupational distribution by sex and gender. The survey tool has been created and updated; now ready to be repeatedly used to mark progress in any policy or program directed towards career opportunities. What it has already provided is insight in to the factors (both internal self image and external cultural stereotypes and family expectations) that influence a key youth choice, their wish list of occupations.

On the question of possible interventions the ACSW encouraged student teams from WPI to try a few program model experiments. The first was a brain child of Laura Handler's at the time of the first round of 11<sup>th</sup> grade aspiration studies.

## ***FACES***

Taking a look at the correlation between the 8<sup>th</sup> grade and 11<sup>th</sup> grade aspiration studies, it is apparent that the best time to test techniques for policy interventions was 9<sup>th</sup> and 10<sup>th</sup> grade, especially if one was interested in fostering engineering and science aspirations. However, Laura did not know this as she had only 11<sup>th</sup> grade data. What she saw was that at that point few were still interested and they needed to be encouraged to follow through and shown how to do it. She started a program called "Females Aspiring to Careers in Engineering and Science" (FACES) in cooperation with the Worcester Public schools. ACSW agreed to co-sponsor the event on the condition that it not be strictly a WPI recruiting effort. WPI could host the event but admissions people from every college in Worcester had to be invited to explain how one could attend their college and pursue a career in science or engineering. She agreed, and this ended up being a WPI, Holy Cross and Clark University event at WPI.

So, FACES was a one day one shot program designed to be a social and educational event sponsored by ACSW and the admissions offices of Worcester Polytechnic Institute (WPI), Clark University, and Holy Cross University. Invitations were based on the results of the aspirations survey augmented by private knowledge of the guidance officers from each high school, who attended along with their students. This event was part tour, part meeting with college women majoring in engineering, partly a highly focused talk by admissions personnel and partly an inspirational message from

two successful female technologists with radically different career stories and ethnic backgrounds.

The main goal was to have the High school students meet the college student who would offer to stay in touch via e-mail and answer question and coach them through the college admissions process if asked to do so. So, the female students met other females that shared and supported their aspirations and have already been successful in taking the next step. Students and guidance counselors also got a look at how different types of colleges give science and engineering educations. It was one stop shopping for those thinking about going to college in Worcester and for those planning to travel a coaching session on what questions to ask wherever they went.

Laura re-ran the survey results and sent a proposed invitation list to each guidance office. In addition, each high school of the Worcester Public School could invite others system. In the end each sent an about 10 to 15 female student, for a gathering of over 50 students each of whom could look around the room and tell they were no alone in their aspirations

The FACES event was a success with a healthy turn out and many happy faces and comments of delivered encouragement. In fact, the guidance departments of high schools loved the event and asked that it be repeated annually. Laura ran it one more time and recruited someone to do it a third time and then it was dropped for lack of an in-house champion at WPI among the students.

However, this was enough of a success to make the point and spawn ideas about how the colleges really should be doing this for all the career interests identified by the aspirations survey. The Guidance offices claimed that they did not need the survey to

keep this up. Just keep holding the event and they would find the Engineering and Science oriented juniors at their schools with the help of the science and math faculty. At ACSW discussion were held about the value of doing the same thing for females with political career ambitions and males interested in fields like teaching and medical support. However, it was beyond the mandate of the committee to hold events for males and there was confusion about how broadly to define a “political career”. Clearly that was not simply a desire to run for public office. In the end nothing was done, but the Women in Politics program at University of Mass. at Boston offered to participate in such an effort if one was ever planned for high school females with political career aspirations.

Laura herself, now a successful civil engineer, has set up an interesting program of outreach through her employer and is now positions to become a key resource person and inspirational speaker if this idea is ever taken up again in Worcester.

### ***Future Science and Engineering Clubs***

Matt Duncan and Brian Dorchik (2006) started the first “Future Scientist and Engineer’s Club” at Doherty Memorial High School. It was intended to be a female friendly “after school club” catering to 9<sup>th</sup> and 10<sup>th</sup> graders in ETA or considering joining the program. Matt and Brian carried out the 10<sup>th</sup> grade aspirations survey in that school to help locate their intended target group, and many names on the list were a surprise to Kathy Kambosos, the science teacher administering ETA that year, who had long hoped that a club of this type could be created. Matt and Brian had originally proposed a career coaching unit associated with the guidance dept., but guidance was not interested, so Dr Vasquez suggested that they approach faculty members, and to start with Ms Kambosos

since her interest in doing something along these lines was well known to the WPS administration.

The concept in providing a club was no longer to assist in coaching on course preparation and college admissions for those who aspire to be future scientists and/or engineers than to provide information about what a career in engineering would be like. Kathy also wanted there to be a “fun” activity every week. The goal was now to foster the interest of those considering this career path, males and females, but especially females given that the male to female sex ratio in ETA varied from 4:1 to 8:1 depending on the year.

The first year of the program was a mixed success, with 20-24 students attending, but initially a 50:50 gender split. However in the 3<sup>rd</sup> meeting there was a breakthrough moment in which Matt and Brian discovered that the image of engineering at ETA was primarily that of robotics and mechanical engineering. This had certain gender connotations. As soon as they started talking about the WPI programs of their friend in biomedical engineering and civil and environmental engineering, there was a strange silence in the room. Then suddenly the females bubbled over with questions and took over the meeting.

This kind of engineering and science had different connotations and Matt and Brian were pushed until someone asked about whether one could major in architecture at WPI. When the answer was finally no, and the arts/engineering border was defined the barrage of questions stopped. Ms. Kambosos says she was surprised the question had never come up in a class, but it hadn't. Now the role of the Club in a school that already had a curriculum in place for aspiring engineers fell into place. It was to help the

students understand the range of career options in the field, and featured club presentations by WPI faculty members from the various departments would help the students do that.

The club could not be considered a complete success because in the following weeks female participation grew and male participation tailed off. The final party was an event with about 20 students, 16 of whom were female. The ACSW was pleased, but Ms Kambosos was not satisfied. She wanted to try again the next year and not downplay the fields such as electrical engineering or robotics, with male connotations so much. The first year was a learning curve event but clearly the concept had potential.

The second year at Doherty, Kathy Kambosos was back in the classroom, her administrative duty year was over and the club advisor had more direct access to the students. On the WPI side 8 football players and 2 other students, one of whom had attended North High were recruited to take the “Future Science and Engineering Clubs” citywide. There were some concerns that these were not particularly strong students to be role models for WPI, but Kathy was intrigued. She said that she liked the idea that these students were even more counter-stereotypical to the “nerd” image of the engineer that the prior team, in which Matt had fit the image but was charming and Brian just did not fit the image at all. He was the party hearty type.

Ms Kambosos was right. Not sending the strongest academically oriented WPI students was a stroke of genius. The Doherty student’s looked at them and said to themselves if they can succeed at WPI, so can I. Further, there was some bonding with the male athletes who came to the first meeting, sort of out of politeness to Kathy Kambosos and they kept coming. The image of the club was shifted and it doubled in



size and moved to 60% male 40% female. Efforts were made to keep it female friendly. But a more balanced image of careers emerged. The major failure was in recruiting WPI faculty members to come to after school meetings to represent the careers coming out of their departments. Instead the 10 students formed teams of two and created activities reflecting all their various majors. The team working at each school thus had Aero, ME, and 3 civil engineering themes ( towers, bridges and roads) for activities to work from as a place to start from.

All but one team had notable success. The Team at Burncoat struggled to keep together a group of 8, 6 of whom were male. The team at Technical Vocational High school was running the lab program in an 11<sup>th</sup> grade physics class, since the administration was convinced that an after school program would not work in that setting. The Tech. HS teacher insisted on some Physics activities to go with all the engineering “labs” and so that program was a bit different- but very successful. Indeed, that is the Club that got explicitly into college admissions and career advice at HS student request. This was a natural direction for a group of juniors taking a course of interest primarily to the college bound to move when meeting with current college students in the majors they aspired to take.

The year culminated in a visit to WPI at which all the Clubs except the one from South High got permission to come take a tour of WPI with the Club organizers. On the day they arrived a conference was underway. Thus, they also had a chance to gather in one auditorium to hear about the US Space Program’s plans to return to the Moon and the implications of the Helium-3 found there for powering fusion reactors on Earth. The word that we got back was that the tours and demonstrations were of more interest than

the conference, which was really designed for a college audience. They were just sitting in on a prearranged event. In the future a special event should be designed for the HS audience, as it was in the FACES program.

With the success of the second year, all four high schools of the WPS had located advisors ( some were WPI alumni) and at least started a science and engineering club. North high school's science and engineering club took off immediately, but the clubs at South and Burncoat struggled much like Doherty's first year. This time at Doherty, the Club organizers were athletes from WPI, which ETA male student leaders really connected with, and the club was more what Ms Kamposos had in mind from the outset.

### ***Conclusions and Recommendations***

A high school aspirations survey instrument was produced by this project and is a verified and effective way to provide a clearer picture of the aspirations of high school students in 11<sup>th</sup> grade as they consider applying to a range of colleges. It looks like it is suitable for use with 10<sup>th</sup> graders as well, and would produce largely the same results if used a year and a half earlier than the second semester of the junior year. There is also an 8<sup>th</sup> grade instrument at the point of pilot testing that shows great promise. However, the critical moment for Worcester is early 9<sup>th</sup> grade as that seems to be the last moment one can identify a substantial pool of females with an interest in science and math and nurture this interest as a serious career possibility before it converts into a more socially acceptable interest in Medicine or Law (especially for those with a feminine self image) over the next two years. The question of whether and how to intervene at this critical moment is the subject of the section to follow.

All recommendations made in this section are to be viewed as suggestions to be discussed by the ACSW and the WPS, not recommendations for action by the city but a call to the sponsors of the project to review the findings and pass them on to the policy making bodies of the city. In this case the School Committee may be interested in the findings and see policy implications in them. To start the policy implications discussion we will make some comments to our sponsors. For over three years, discussions have taken place regarding the implications of the findings of these aspirations surveys. Hence the questions are whether the survey itself should be continued or whether they provide sufficient basis for creating a separate intervention program. We have concluded that at least in the area of science and engineering career support there is a sufficient basis for policy intervention, that gender equality in these fields will not happen by itself in the next generation and with intervention it might be a possibility.

The weak link in the knowledge basis for such a program is the Middle School study. Those data are not replicated and the study did not cover all 4 middle schools to start with. It would be prudent to redo that study, but it is highly likely that the results will replicate and experimentation with intervention pilot program could be carried out concurrently with any additional data collection.

The ideas for policy implications being presented below are made assuming that the middle school data replicates.

### **1) Cautiously Open Up Access to the Small Schools**

The small school system needs to be presented to middle school students and their parents in January of the 8<sup>th</sup> grade year at the latest. Joining these programs is a time-

sensitive option for special schooling available in the WPS. Flyers, handouts, a traveling road show of representatives from these programs needs to make the rounds of the Middle schools. A PTO committee at each one needs to form so that some people are knowledgeable and available to the parents of the eighth graders. This could be done without making any promises to the parents that there will be a slot for their child in the school with the program they want to enter. That will depend on the balance of students wanting to leave and enter each school, with priority going to the students who were already slotted to go to the high school with the small school program by default.

An annual survey providing information on who is potentially interested in transferring and how interested they are would provide planning information for the school system and might reduce the fears of a serious imbalance resulting from this policy. It seems unlikely that a lot of people will want to transfer, and that the situation will remain that most of the students considering a career option are not in the school best able to support that aspiration. Hence, some sort of outreach program from the small school program to the students in other schools should be considered. In the case of engineering and science, the after school club program might serve this purpose if supplemented by periodic special activity days in which the “Clubs” are gathered to Doherty on a day when a special informational program or event and activity is to be run. ETA could, with WPI assistance, run events for the other aspiring engineers in the school system sharing what the ETA students have learned periodically.

### **Catch the 7<sup>th</sup>-8<sup>th</sup> Grade Wave of Interest in Science**

There is a general decline in interest in science and engineering, especially in females, between 8<sup>th</sup> and 11<sup>th</sup> grade. This is a crucial time to intervene and change the

masculine and nerd stereotypes of the field through interaction with counter-stereotypical role models and female friendly clubs. Clubs that culminate in a day at WPI designed to mimic FACES for the females and a new program with a rockets and robotics and computer game feel for the males would acknowledge the gender realities but still broaden the perceptions of science and engineering careers.

This might also be the time to talk to the females interested in medical careers about the need to have a fall back plan that does not require gaining admission to a medical school. Featuring biomedical engineering and the development of prosthetic devices for handicapped people is an established part of engineering at WPI which would fit into such a scenario. That a female mechanical engineer is the co-leader of this program is another reason to give it some visibility on the female version of the WPI tour. Since the clubs and FACES have already been developed, discussed, tried and there is a modest base of experience, it would make sense to pick up where was left off using that momentum to jumpstart future movements toward gender equity in the technical professions. There also seems to be promise in the program that was run for the juniors at the Vocational Technical High School. Other Physics teachers might want to have WPI student make an appearance and run a series of demonstrations and activities in their classes as well as encourage college admissions coaching.

### **Student Concerns about College and Careers**

Since the only gender difference that the 11<sup>th</sup> grade survey showed was that Males were more concerned about their grades and Female about their standardized test scores, it is not clear that totally separate program are needed for males and females to deal with these issues. The larger issue is that the female are outperforming the males and look

much better on paper to the colleges. Motivating the coursework by tying it to the dreams of the males seems to be the challenge in their case. The females need to be encouraged to follow their dreams despite cultural stereotypes. These kind of issues call for the development of peer groups that support academic striving and doing things that fit you as an individual rather than are socially encouraged for males and females. Career coaching is secondary and may happen naturally if ways of getting the college student role models and the HS students with dreams together on a regular basis, as would happen in a club program.

The important difference to come out of the concerns part of the survey may have more to do with Race and Ethnicity and social class than gender. Asians reported an overall heightened sense of career concerns. Black and Hispanics produced pattern of career aspirations that suggested a lack of career focus combined with a desire to enter the professions, be upwardly mobile. What field they pursued seems to be secondary as several professions seemed to look good to them. This presents a challenge to the Small schools program, as it wants to foster early commitment to a career line and strong preparation for it, but find that whites are more likely to have role models in the family and be ready to make such commitments. Clearly the ethnic minorities need more time and information to sort through the options, ie a little bit more support. A well developed Future Lawyer, Physician, Engineer, Teacher, Public servant, Businessperson club program with ties to groups of professional and trade groups in the city would provide a chance for the students to dabble and sample and try some possibilities on for size. This would help the working class students, minority student and female students considering

counter-stereotypical careers all at once. Different colleges could support the different careers quite well, depending on where their students cluster by major.

The goal should be to provide a comfortable environment where a student can express themselves openly and share their dreams without judgment. At a career day event, successful minority and female role models can come into the school, meet the club regulars and the people who stopped in just for that event. It beats setting up a booth in the gymnasium, as the Club can host a planned event and the invited visitors can plan to sit down and have dinner at the cafeteria with the students. The lunch together part of the FACES event was one of the activities that got the most positive feedback. The student who meet the junior females for the ALL school ended up going to see them about twice a month at their school for a semester during the whole next year.

Just seeing a successful person informally and finding them approachable can bring the reality of choosing a future by being shown that contentment finding a place in life. In addition, an open-invitation FACES-like event could lure students with free food and college life into being excited about their future at a thought-provoking event presented by individuals of an ethnic minority.

### **Differences in College Aspiration by Middle School**

Such a striking difference was found in the 8<sup>th</sup> study between schools concerning post-high school plans that it needs to be addressed. The part of town a child grows up in is definitely a factor that influences a child's motivations in life, but these differences were stunning. It is a tribute to the HS guidance counselors that the differences found among 8<sup>th</sup> graders are no longer evident to anything like that degree by 11<sup>th</sup> grade when the WPS students actually do have to apply to college. Clearly a school can be a strong

influence, but given the scale of the challenge an earlier start would be appropriate. The students should also be more aware of financial aid that colleges provide. We think that taking a field trip to a college in early 8<sup>th</sup> grade, where the middle school students can view all the different buildings and types of college students that go to that campus, will help the students think about this as something that is possible for them to dream about. This will give the students a visual reminder of what can happen right after high school if they think about it and pursue it in 9<sup>th</sup> to 11<sup>th</sup> grade.

### **Tracking Trends and Program Success**

Finally, the aspirations survey should be distributed at least every 5 years to track changes in gender equity, concerns, post-high school plans, and so on. Rather than updating the survey each time, keep the same edition for a time to ensure the data won't get skewed by a revision. This information is ultimately valuable to the students, whether it goes through city administration, ACSW, or the WPS guidance department. Any program to encourage students to pursue their dreams or to develop positive directions in life will improve the students' day, if not the morale of future society.



## **Appendix A – References**

- 1. Gender-Based Comparative Survey of Public HS Students**  
*by Laura Handler and Pat Hogan*  
First Year Public School Study Completed on March 7, 2005
- 2. Worcester HS Career Aspiration Replication Study**  
*by Evan Custodio, Brian Marsland, and James Scully*  
Second Year Public High School Study Completed on December 8, 2006
- 3. The Aspirations of Young Men and Women in Worcester’s Private and Charter High Schools**  
*by Michelle Boudreau and Katie Croteau*  
First Year Private School Study Completed on May 3, 2005
- 4. The Aspirations of Young Women in Worcester Private/Charter High Schools Replication Study**  
*by Yekaterina Kazinik*  
Second Year Private School Study Completed on September 22, 2006
- 5. Career Aspirations and Gender Identity in Coed and Single Sex High Schools**  
*by Jenna Geddes, John Keenan, and Mike Demers*  
Gender Identity Parochial School Study Completed on May 24, 2006
- 6. Middle School Aspirations Study**  
*by Zachary Gautreau and Nora Rizkalla*  
8<sup>th</sup> Grade Preferred Subjects Study Completed on April 27, 2007
- 7. A Future Scientists and Engineers Club for Doherty HS: A Pilot Project**  
*By Matthew Duncan and Brian Dorchik*  
H.S. Club intervention experiment completed on June 1, 2006

## **Appendix B – Response Rates**

**Table 7 - Response Rates in Public School (Class 2007)**

<b>School</b>	<b>Population</b>	<b>Sample</b>	<b>Response %</b>	<b>Male</b>	<b>% Male</b>	<b>Female</b>	<b>% Female</b>
A.L.L.	50	29	58%	14	48%	15	52%
Burncoat	282	182	65%	83	46%	97	53%
Doherty	375	258	69%	120	47%	138	53%
North	278	75	27%	30	40%	42	56%
South	341	135	40%	59	44%	69	51%
UP	40	39	98%	16	41%	23	59%
Vocational	226	124	55%	75	60%	48	39%
<b>Totals</b>	1592	842	53%	397	47.15%	432	51%
*Response rates are a major determinant of a reputable data set. The average of 53% is considered significant.							

## **Appendix C – Occupational Interests**

**Table 8 - Occupational Interests Area by Gender (Class 2007)**

<b>2005-2006 Juniors</b>	<b>Male</b>	<b>Male %</b>	<b>Female</b>	<b>Female %</b>	<b>Total</b>	<b>Total %</b>
Teaching	14	3.53%	35	8.10%	49	5.82%
Engineering	91	22.92%	20	4.63%	111	13.18%
Physical Science	17	4.28%	23	5.32%	40	4.75%
Computers	73	18.39%	29	6.71%	102	12.11%
IT	58	14.61%	21	4.86%	79	9.38%
Business	100	25.19%	90	20.83%	190	22.57%
Trade	81	20.40%	14	3.24%	95	11.28%
Medical Practice	35	8.82%	145	33.56%	180	21.38%
Medical Support	14	3.53%	129	29.86%	143	16.98%
Medical Other	24	6.05%	114	26.39%	138	16.39%
Law	37	9.32%	62	14.35%	99	11.76%
Performance Art	23	5.79%	92	21.30%	115	13.66%
Visual Art	32	8.06%	99	22.92%	131	15.56%
Musical Art	61	15.37%	61	14.12%	122	14.49%
Media	36	9.07%	51	11.81%	87	10.33%
Food Service	41	10.33%	43	9.95%	84	9.98%
Service Industry	14	3.53%	45	10.42%	59	7.01%
Social Service	11	2.77%	61	14.12%	72	8.55%
Civil Service	58	14.61%	23	5.32%	81	9.62%
City Admin.	13	3.27%	10	2.31%	23	2.73%
Elected Political Office	17	4.28%	8	1.85%	25	2.97%
Government Service	20	5.04%	10	2.31%	30	3.56%
International Politics	16	4.03%	22	5.09%	38	4.51%

**Table 9 - Change in Male Interest From Juniors of 2005 to 2006**

<b>2005-2006 Juniors</b>	<b>2005 Male %</b>	<b>2006 Male %</b>	<b>% Difference</b>	<b>% Change</b>	<b>Corrected % Change</b>	<b>2004-2005 Juniors</b>
Teaching	3.46%	3.53%	0.07%	2.06%	2.06%	Teaching
Engineering	16.26%	22.92%	6.66%	40.97%	-19.54%	Eng/Phys. Science
Physical Science		4.28%	-11.98%	-279.72%		
Computers	18.70%	18.39%	-0.31%	-1.69%	-13.34%	Computers/IT
IT		14.61%	-4.09%	-27.99%		
Business	24.59%	25.19%	0.60%	2.42%	2.42%	Business
Trade	18.90%	20.40%	1.50%	7.94%	7.94%	Trade
Medical Practice	6.50%	8.82%	2.31%	35.55%	35.55%	Medical Practice
Medical Support	5.08%	3.53%	-1.55%	-44.09%	-44.09%	Medical Support
Medical Other	---	6.05%	0.96%	18.97%	4.36%	---
Law	10.77%	9.32%	-1.45%	-15.58%	-15.58%	Law
Performance Art	18.09%	5.79%	-12.30%	-212.24%	-86.05%	Art
Visual Art		8.06%	-10.03%	-124.42%		
Musical Art		15.37%	-2.72%	-17.73%		
Media		9.07%	-9.02%	-99.49%		
Food Service	4.67%	10.33%	5.65%	120.92%	48.18%	Service Industry
Service Industry		3.53%	-1.15%	-32.56%		
Social Service	2.85%	2.77%	-0.07%	-2.70%	-2.70%	Social Service
Civil Service	12.40%	14.61%	2.21%	17.83%	17.83%	Civil Service
City Admin.	4.07%	3.27%	-0.79%	-24.14%	-24.14%	City Admin.
Elected Political Office	3.25%	4.28%	1.03%	31.68%	36.84%	Political Office
Government Service		5.04%	1.79%	54.91%		
International Politics		4.03%	0.78%	23.93%		

Green areas are least likely to change because the definitions carry over year to year.  
Orange areas were either added in or split from a single category.  
Blue areas use the average the results from separate categories from the replication study to determine % change.  
% Difference is the percent the data sets differ from the first study.  
% Change is how extreme the change was from the first study.

**Table 10 - Change in Female Interest From Juniors of 2005 to 2006**

<b>2005-2006 Juniors</b>	<b>2005 Female %</b>	<b>2006 Female %</b>	<b>% Difference</b>	<b>% Change</b>	<b>Corrected % Change</b>	<b>2004-2005 Juniors</b>
Teaching	9.01%	8.10%	-0.91%	-11.22%	-11.22%	Teaching
Engineering	3.30%	4.63%	1.33%	40.43%	50.96%	Eng/Phys. Science
Physical Science		5.32%	2.03%	61.50%		
Computers	5.05%	6.71%	1.66%	32.80%	14.48%	Computers/IT
IT		4.86%	-0.19%	-3.99%		
Business	24.62%	20.83%	-3.78%	-18.15%	-18.15%	Business
Trade	3.52%	3.24%	-0.28%	-8.51%	-8.51%	Trade
Medical Practice	24.40%	33.56%	9.17%	37.59%	37.59%	Medical Practice
Medical Support	24.62%	29.86%	5.25%	21.31%	21.31%	Medical Support
Medical Other	---	26.39%	1.77%	7.20%	7.69%	---
Law	16.04%	14.35%	-1.69%	-11.79%	-11.79%	Law
Performance Art	20.88%	21.30%	0.42%	2.00%	-30.34%	Art
Visual Art		22.92%	2.04%	9.76%		
Musical Art		14.12%	-6.76%	-47.87%		
Media		11.81%	-9.07%	-76.86%		
Food Service	18.02%	9.95%	-8.07%	-81.06%	-76.94%	Service Industry
Service Industry		10.42%	-7.61%	-73.01%		
Social Service	18.90%	14.12%	-4.78%	-33.86%	-33.86%	Social Service
Civil Service	3.52%	5.32%	1.81%	51.40%	51.40%	Civil Service
City Admin.	1.54%	2.31%	0.78%	50.46%	50.46%	City Admin.
Elected Political Office	2.64%	1.85%	-0.79%	-42.42%	17.03%	Political Office
Government Service		2.31%	-0.32%	-13.93%		
International Politics		5.09%	2.46%	93.09%		

Green areas are least likely to change because the definitions carry over year to year.

Orange areas were either added in or split from a single category.

Blue areas use the average the results from separate categories from the replication study to determine % change.

% Difference is the percent the data sets differ from the first study.

% Change is how extreme the change was from the first study.

**Table 11 - Change in Total Interest From Juniors of 2005 to 2006**

<b>2005-2006 Juniors</b>	<b>2005 Total %</b>	<b>2006 Total %</b>	<b>% Difference</b>	<b>% Change</b>	<b>Corrected % Change</b>	<b>2004-2005 Juniors</b>
Teaching	6.11%	5.82%	-0.29%	-5.02%	-5.02%	Teaching
Engineering	10.01%	13.18%	3.17%	31.69%	-11.64%	Eng/Phys. Science
Physical Science		4.75%	-5.26%	-110.72%		
Computers	12.12%	12.11%	0.00%	-0.03%	-12.74%	Computers/IT
IT		9.38%	-2.74%	-29.16%		
Business	24.55%	22.57%	-1.99%	-8.80%	-8.80%	Business
Trade	11.49%	11.28%	-0.20%	-1.80%	-1.80%	Trade
Medical Practice	15.07%	21.38%	6.31%	41.87%	41.87%	Medical Practice
Medical Support	14.44%	16.98%	2.55%	17.64%	17.64%	Medical Support
Medical Other	---	16.39%	1.95%	13.53%	11.10%	---
Law	13.28%	11.76%	-1.52%	-12.92%	-12.92%	Law
Performance Art	19.39%	13.66%	-5.73%	-41.96%	-51.44%	Art
Visual Art		15.56%	-3.83%	-24.62%		
Musical Art		14.49%	-4.90%	-33.81%		
Media		10.33%	-9.06%	-87.65%		
Food Service	11.06%	9.98%	-1.09%	-10.91%	-30.30%	Service Industry
Service Industry		7.01%	-4.06%	-57.90%		
Social Service	10.54%	8.55%	-1.99%	-23.23%	-23.23%	Social Service
Civil Service	8.11%	9.62%	1.51%	18.56%	18.56%	Civil Service
City Admin.	2.85%	2.73%	-0.11%	-4.16%	-4.16%	City Admin.
Elected Political Office	2.95%	2.97%	0.02%	0.63%	24.78%	Political Office
Government Service		3.56%	0.61%	20.76%		
International Politics		4.51%	1.56%	52.96%		

Green areas are least likely to change because the definitions carry over year to year.  
Orange areas were either added in or split from a single category.  
Blue areas use the average the results from separate categories from the replication study to determine % change.  
% Difference is the percent the data sets differ from the first study.  
% Change is how extreme the change was from the first study.

**Table 12 - Effectiveness of Small Schools at Clustering Interest per Category**

	Burncoat	Doherty	North*	South	Voke
Teaching	18.00%	-10.30%	-11.90%	-51.00%	33.40%
Engineering	-4.90%	<b>19.60%</b>	-29.80%	-5.10%	-21.00%
Physical Science	10.20%	-14.40%	60.50%	4.20%	-2.80%
Computers	-42.10%	10.00%	-35.20%	32.20%	4.70%
IT	-35.50%	3.40%	-0.40%	42.40%	-13.90%
Business	-2.20%	-15.80%	-36.30%	45.00%	12.20%
Trade	-51.80%	-21.70%	-18.10%	-34.90%	<b>204.70%</b>
Medical Practices	-3.90%	-16.10%	<b>65.80%</b>	9.30%	-10.80%
Medical Support	-7.40%	-12.10%	39.50%	12.10%	-1.50%
Other Medical	-2.20%	-10.20%	34.50%	-3.20%	-13.80%
Law	-7.40%	-15.00%	-55.10%	50.00%	36.10%
Performance Art	-1.10%	-13.40%	-4.00%	22.90%	-1.20%
Visual Art	-2.50%	-1.70%	-40.90%	8.10%	12.50%
Music Art	-9.70%	8.90%	-26.90%	6.70%	-6.00%
Media	-25.50%	5.20%	-87.10%	<b>58.00%</b>	9.5
Service Industry	-16.50%	7.10%	-44.70%	-7.80%	<b>45.00%</b>
Social Services	-4.90%	3.00%	-23.00%	54.10%	-44.10%
Civil Services	-31.40%	0.90%	-16.80%	0.30%	51.20%
City Administration	-19.50%	27.90%	-100.00%	-18.50%	47.90%
Elected Political Office	-25.90%	30.70%	-55.10%	25.00%	8.80%
Government Service	38.90%	-23.70%	-100.00%	4.20%	36.10%
International Politics	-7.40%	6.20%	-43.80%	9.40%	2.00%
<p>Blue areas represent small schools that do not cluster for sure.  Green areas show where a small school clusters interested students.</p>					

**Table 13 - Correlation Between Career Interests**

	<b>Law</b>	<b>Overall</b>	<b>Difference</b>	<b>Comment</b>
Medical Practice	27.30%	21.80%	25.20%	Students interested in Law also interested in Medical and Political fields.
Medical Support	27.30%	17.30%	57.80%	
Medical Other	22.20%	16.70%	32.90%	
Elected Political Office	12.10%	3.00%	303.30%	
Government Service	12.10%	3.60%	236.10%	
International Politics	12.10%	4.60%	163.00%	
	<b>Engineering</b>	<b>Overall</b>	<b>Difference</b>	Students interested in Engineering also interested in other technical fields.
Physical Science	23.80%	4.80%	395.80%	
IT	44.30%	9.60%	361.50%	
Computers	32.70%	12.40%	163.70%	
	<b>Medical Practice</b>	<b>Overall</b>	<b>Difference</b>	Students interested in one medical career are also considering the others.
Medical Support	60.00%	17.30%	246.80%	
Medical Other	55.60%	16.70%	232.90%	
	<b>Medical Support</b>	<b>Overall</b>	<b>Difference</b>	
Medical Practice	75.50%	21.80%	246.30%	
Medical Other	65.70%	16.70%	293.40%	
	<b>Medical Other</b>	<b>Overall</b>	<b>Difference</b>	
Medical Practice	72.50%	21.80%	232.60%	
Medical Support	68.10%	17.30%	293.60%	
	<b>Medical Practice</b>	<b>Overall</b>	<b>Difference</b>	Physical Science greatly correlates with the medicinal fields.
Physical Science	26.20%	4.80%	445.80%	
	<b>Medical Support</b>	<b>Overall</b>	<b>Difference</b>	
Physical Science	26.20%	4.80%	445.80%	
	<b>Medical Other</b>	<b>Overall</b>	<b>Difference</b>	
Physical Science	23.80%	4.80%	395.80%	
	<b>Performance Arts</b>	<b>Overall</b>	<b>Difference</b>	Students interested in one art career are also considering the others.
Visual Arts	50.40%	15.80%	219.00%	
Musical Arts	45.60%	14.80%	208.10%	
	<b>Visual Arts</b>	<b>Overall</b>	<b>Difference</b>	
Performance Art	44.30%	13.90%	218.70%	
Musical Arts	36.20%	14.80%	144.60%	
	<b>Musical Arts</b>	<b>Overall</b>	<b>Difference</b>	
Performance Art	42.60%	13.90%	206.50%	
Visual Arts	38.50%	15.80%	143.70%	
	<b>Performance Arts</b>	<b>Overall</b>	<b>Difference</b>	Engineering does not correlate with Visual or Musical Arts, and students interested in Engineering have a small tendency to be disinterested in Performance Arts.
Engineering	8.70%	13.40%	-35.10%	
	<b>Visual Arts</b>	<b>Overall</b>	<b>Difference</b>	
Engineering	12.20%	13.40%	-9.00%	
	<b>Musical Arts</b>	<b>Overall</b>	<b>Difference</b>	
Engineering	15.60%	13.40%	16.40%	



**Table 14 - Parental Influence on Child's Career Interest**

<b>2005 - 2006 Juniors</b>			
<b>Parent Occupation</b>	<b>Child's Interest</b>	<b>Overall Student Interest</b>	<b>Difference</b>
Engineering	20.00%	13.40%	<b>149%</b>
Business	23.70%	23.00%	103%
Medical Practice	13.30%	21.80%	61%
Medical Support	24.00%	17.30%	139%
Teaching	14.90%	5.90%	<b>253%</b>
Trade	19.50%	11.50%	<b>170%</b>
<b>2004 - 2005 Juniors</b>			
Engineering/Physical Science	22.80%	19.90%	115%
Business	45.60%	41.80%	109%
Medical Practice	29.70%	24.90%	119%
Medical Support	27.00%	21.80%	124%
Teaching	18.80%	13.70%	137%
Trade	25.00%	18.50%	135%

**Table 15 - Volatility of 10th Grade Aspiration Results**

	<b>Doherty</b>			<b>North High School</b>			<b>TOTAL</b>		
	<b>Overall</b>	<b>Male</b>	<b>Female</b>	<b>Overall</b>	<b>Male</b>	<b>Female</b>	<b>Overall</b>	<b>Male</b>	<b>Female</b>
Teaching	-3.0%	8.0%	-7.3%	-29.3%	<b>-73.8%</b>	-14.8%	16.1%	40.9%	11.1%
Engineering	-1.7%	11.7%	-5.0%	-41.2%	48.0%	4.8%	21.5%	29.9%	4.9%
Physical Science	-8.1%	<b>-49.3%</b>	22.6%	-20.2%	23.8%	6.9%	14.2%	36.6%	14.7%
IT	-9.4%	-18.7%	-9.8%	-41.1%	35.3%	-29.4%	<b>25.3%</b>	27.0%	19.6%
Computers	-11.6%	-21.7%	-8.6%	<b>-74.9%</b>	62.0%	<b>-76.6%</b>	43.2%	41.9%	42.6%
Business	9.3%	24.8%	-3.7%	23.8%	42.3%	3.9%	16.6%	33.5%	3.8%
Trade	-0.5%	15.5%	<b>-96.3%</b>	-17.5%	8.4%	<b>-72.6%</b>	9.0%	12.0%	<b>84.5%</b>
Medical Practices	-12.3%	-23.0%	-3.2%	16.1%	6.0%	-18.3%	14.2%	14.5%	10.8%
Medical Support	-7.1%	<b>-26.9%</b>	-3.4%	21.7%	<b>-50.6%</b>	-46.8%	14.4%	38.7%	25.1%
Other Medical	-10.0%	-7.0%	-6.3%	37.5%	4.7%	<b>-56.1%</b>	23.8%	5.9%	31.2%
Law	-6.7%	<b>-33.6%</b>	11.4%	-25.7%	8.1%	-46.5%	16.2%	20.8%	29.0%
Performance Art	-2.5%	-10.6%	-5.5%	-40.3%	<b>-60.9%</b>	<b>59.5%</b>	21.4%	35.7%	32.5%
Visual Art	2.6%	22.6%	-3.2%	18.4%	-36.7%	41.8%	10.5%	29.7%	22.5%
Music Art	1.6%	12.7%	-6.7%	-43.7%	-45.1%	-49.1%	22.7%	28.9%	27.9%
Media	-16.4%	0.5%	-27.8%	-34.8%	-29.7%	-42.6%	25.6%	15.1%	35.2%
Service Industry	-15.2%	-23.3%	-8.2%	-18.6%	<b>-62.5%</b>	-30.1%	16.9%	42.9%	19.2%
Food Services	0.1%	4.4%	-2.9%	-35.4%	<b>-53.8%</b>	-31.5%	17.7%	29.1%	17.2%
Social Services	-5.9%	12.3%	-7.9%	9.4%	8.6%	5.9%	7.7%	10.5%	6.9%
Civil Services	13.7%	45.1%	-29.8%	12.9%	26.0%	29.5%	13.3%	35.6%	29.6%
City Administration	-24.8%	-18.2%	-35.9%	8.7%	14.2%	15.2%	16.8%	16.2%	25.6%
Elected Political Office	-23.9%	-36.6%	-16.6%	-33.6%	<b>-57.9%</b>	45.9%	28.7%	47.2%	31.3%
Government Service	-45.5%	<b>-66.1%</b>	-31.1%	<b>-145.8%</b>	n/a	-13.1%	<b>95.6%</b>	n/a	22.1%
International Politics	-10.8%	-31.1%	-3.1%	5.5%	-25.4%	<b>109.1%</b>	8.1%	28.2%	<b>56.1%</b>

Yellow blocks represent areas where sophomore and junior class do not compare.

**Table 16 - Change in Career Interest from 10th to 11th Grade**

	Doherty			North High School			TOTAL		
	Overall	Male	Female	Overall	Male	Female	Overall	Male	Female
Teaching	-4.9%	11.5%	-13.2%	-44.2%	-126.0%	-18.9%	-24.6%	-57.2%	-16.0%
Engineering	-1.9%	-10.4%	-9.6%	-50.6%	-42.0%	-1.9%	-26.3%	-26.2%	-5.8%
Physical Science	-14.0%	<b>-81.7%</b>	34.6%	-24.3%	-23.3%	8.2%	-19.1%	-52.5%	21.4%
IT	-14.2%	-23.3%	-19.4%	-53.8%	-32.4%	-45.3%	-34.0%	-27.9%	-32.4%
Computers	-15.8%	-25.1%	-16.1%	-93.4%	-56.2%	-115.1%	-54.6%	-40.6%	-65.6%
Business	-8.3%	-17.8%	-5.4%	-21.4%	-33.6%	-2.6%	-14.8%	-25.7%	-4.0%
Trade	-0.1%	19.1%	<b>-187.5%</b>	-25.0%	16.4%	-137.7%	-12.5%	17.8%	-162.6%
Medical Practices	-14.0%	-35.8%	-4.1%	22.0%	1.4%	17.8%	4.0%	-17.2%	6.8%
Medical Support	-10.1%	-49.4%	1.7%	31.0%	-74.7%	35.2%	10.4%	-62.0%	18.4%
Other Medical	-13.9%	-13.0%	-9.4%	51.7%	0.2%	53.6%	18.9%	-6.4%	22.1%
Law	-8.8%	-45.6%	13.0%	-30.6%	-5.0%	-58.5%	-19.7%	-25.3%	-22.7%
Performance Art	-3.9%	-18.7%	3.9%	-50.6%	-95.2%	-58.5%	-27.3%	-57.0%	-27.3%
Visual Art	3.4%	36.9%	-4.3%	-18.0%	-54.1%	-32.1%	-7.3%	-8.6%	-18.2%
Music Art	2.7%	18.6%	-12.3%	-55.0%	-57.5%	-58.5%	-26.2%	-19.5%	-35.4%
Media	-21.2%	0.5%	-38.5%	-42.5%	-35.0%	-50.6%	-31.8%	-17.3%	-44.5%
Service Industry	-21.1%	-39.1%	-12.1%	-23.1%	-105.5%	-34.1%	-22.1%	-72.3%	-23.1%
Food Services	0.0%	5.7%	-4.9%	-47.8%	-80.8%	-36.9%	-23.9%	-37.6%	-20.9%
Social Services	-7.5%	21.7%	-11.4%	15.6%	8.1%	-1.9%	4.0%	14.9%	-6.6%
Civil Services	20.2%	64.6%	-57.6%	23.8%	43.1%	57.7%	22.0%	53.9%	0.1%
City Administration	-43.3%	-29.2%	-68.9%	11.4%	21.7%	26.2%	-16.0%	-3.7%	-21.3%
Elected Political Office	-43.3%	-64.4%	-32.7%	-53.8%	-91.8%	89.3%	-48.6%	-78.1%	28.3%
Government Service	-80.7%	-115.0%	-59.2%	-275.0%	n/a	-18.9%	-177.9%	n/a	-39.0%
International Politics	-18.8%	-54.1%	2.3%	4.0%	-33.6%	215.5%	-7.4%	-43.8%	108.9%

Data represents likelihood that a student will be apt. to adopt specified career dreams in the next year.  
 Yellow areas show a defined decline in interest from 10th to 11th grade.  
 Blue areas show a defined incline in interest from 10th to 11th grade.  
 Orange area have unusually high decline in interest from 10th to 11th grade.  
 Green areas have unusually high incline in interest from 10th to 11th grade.

## **Appendix D – Post High School Plans**

**Table 17 - Post High School Plans by Gender**

After-School Plan	06 Male %	06 Female %	06 % Change	07 Male %	07 Female %	07 % Change	Volatility
4-year College	67.1%	79.1%	18.0%	71.0%	82.4%	16.0%	5.9%
2-year College	13.4%	16.0%	19.6%	15.6%	13.2%	-18.4%	21.6%
Vocational	5.9%	2.9%	-106.3%	8.6%	3.2%	-164.3%	45.3%
Work	17.3%	11.4%	-51.2%	27.7%	31.5%	13.6%	175.5%
Military	9.1%	2.9%	-220.1%	8.3%	2.5%	-226.4%	12.2%
No Response	6.1%	3.7%	-63.2%	---	---	---	---
Marriage / Family	---	---	---	8.6%	11.1%	29.7%	---

% Change is the percentage more/less likely that females have that after-school plan.  
 Volatility is the maximum of how extreme the change in data sets is from year to year.  
 Green areas are least volatile and most reliable points of interest.  
 Orange areas changed too much year to year and are not reliable.  
 Blue areas were not replicated.

**Table 18 - Volatility / Validity of After-School Plans by Ethnicity**

<b>Definition</b>	<b>4-year College</b>	<b>2-year College</b>	<b>Vocational / Trade School</b>	<b>Work</b>	<b>Military</b>
08 African American %	78.7%	16.8%	4.5%	11.6%	2.6%
07 African American %	88.1%	11.0%	2.8%	22.9%	0.9%
Average African American %	83.4%	13.9%	3.7%	17.3%	1.8%
% Difference	9.4%	-5.8%	-1.7%	11.3%	-1.7%
% Change	11.9%	-52.7%	-60.7%	97.4%	-188.9%
06 Asian %	83.5%	11.4%	2.5%	5.1%	2.5%
07 Asian %	85.9%	7.1%	4.7%	35.3%	7.1%
Average Asian %	84.7%	9.3%	3.6%	20.2%	4.8%
% Difference	2.4%	-4.3%	2.2%	30.2%	4.6%
% Change	2.9%	-60.6%	88.0%	592.2%	184.0%
06 Caucasian %	74.3%	12.6%	4.7%	14.0%	6.9%
07 Caucasian %	77.4%	12.9%	4.7%	28.1%	6.3%
Average Caucasian %	75.9%	12.8%	4.7%	21.1%	6.6%
% Difference	3.1%	0.3%	0.0%	14.1%	-0.6%
% Change	4.2%	2.4%	0.0%	100.7%	-9.5%
06 Hispanic %	65.3%	16.3%	4.0%	18.7%	6.8%
07 Hispanic %	68.6%	21.0%	7.1%	32.4%	4.8%
Average Hispanic %	67.0%	18.7%	5.6%	25.6%	5.8%
% Difference	3.3%	4.7%	3.1%	13.7%	-2.0%
% Change	5.1%	28.8%	77.5%	73.3%	-41.7%
Average % Difference	4.6%	3.8%	1.8%	17.3%	2.2%
Average % Change	6.0%	36.1%	56.6%	215.9%	106.0%
** Ethnic % Difference	5.0%	4.9%	2.3%	18.4%	2.8%
** Ethnic % Change	6.6%	47.4%	75.4%	254.3%	138.2%

% Difference is the percent the data sets differ from the first study.

\*\*Ethnic % does not include Caucasians.

% Change is how extreme the change was from the first study.

## **Appendix E – Career-Related Concerns**

**Table 19 - Career-Related Concerns by Gender**

After-School Plan	06 Male %	06 Female %	06 % Change	07 Male %	07 Female %	07 % Change	Volatility
Low Grades	24.6%	17.5%	<b>-40.6%</b>	28.8%	18.1%	<b>-59.1%</b>	<b>17.1%</b>
Low Test Scores	16.5%	21.5%	<b>30.3%</b>	16.9%	16.4%	<b>-3.0%</b>	<b>31.1%</b>
College Too Expensive	25.1%	27.6%	<b>10.0%</b>	27.3%	32.0%	<b>17.2%</b>	<b>15.9%</b>
College Too Demanding	6.7%	5.3%	<b>-26.4%</b>	7.3%	7.2%	<b>-1.4%</b>	<b>35.8%</b>
Dislike School	8.4%	4.2%	<b>-100.0%</b>	9.6%	3.0%	<b>-220.0%</b>	<b>40.0%</b>
Anyone in Profession	8.4%	8.6%	<b>2.4%</b>	8.1%	6.3%	<b>-28.6%</b>	<b>36.5%</b>
Required Education	15.5%	16.2%	<b>4.5%</b>	13.9%	16.4%	<b>18.0%</b>	<b>11.5%</b>
Succeed	18.5%	23.9%	<b>29.2%</b>	22.5%	30.8%	<b>36.9%</b>	<b>28.9%</b>
Opposite Gender Dominated	---	---	---	6.3%	11.3%	<b>79.4%</b>	---
Family Support	---	---	---	59.3%	74.1%	<b>25.0%</b>	---

% Change is the percentage more/less likely that females have that after-school plan.  
 Volatility is the maximum of how extreme the change in data sets is from year to year.  
 Green areas are least volatile and most reliable points of interest.  
 Orange areas changed too much year to year and are not reliable.  
 Blue areas were not replicated.

**Table 20 - Symbol key for Career and College Related Concerns**

Concern	Symbol	Concern	Symbol	Concern	Symbol
Low Grades	Γ	Dislike School	Ξ	Succeed	Φ
Low Test Scores	Δ	Anyone in Profession	Π	Opposite Gender Dominated	Ψ
College Too Expensive	Θ	Required Education	Σ	Family Support	Ω
College Too Demanding	Λ				

**Table 21 - Volatility / Validity of Career and College Related Concerns by Ethnicity**

Definition	Γ	Δ	Θ	Λ	Ξ	Π	Σ	Φ	Ψ	Ω
08 African American %	25.0%	22.0%	26.0%	8.0%	3.0%	13.0%	16.0%	22.0%	12.0%	---
07 African American %	18.3%	10.1%	24.8%	5.5%	0.9%	4.6%	11.0%	29.4%	10.1%	59.6%
Average Afr. Amer. %	21.7%	16.1%	25.4%	6.8%	2.0%	8.8%	13.5%	25.7%	11.1%	59.6%
% Difference	-6.7%	-11.9%	-1.2%	-2.5%	-2.1%	-8.4%	-5.0%	7.4%	-1.9%	---
% Change	-36.6%	-117.8%	-4.8%	-45.5%	-233.3%	-182.6%	-45.5%	33.6%	-18.8%	---
06 Asian %	22.0%	30.0%	40.0%	13.0%	4.0%	16.0%	23.0%	35.0%	14.0%	---
07 Asian %	23.5%	29.4%	41.2%	14.1%	10.6%	10.6%	20.0%	40.0%	3.5%	45.9%
Average Asian %	22.8%	29.7%	40.6%	13.6%	7.3%	13.3%	21.5%	37.5%	8.8%	45.9%
% Difference	1.5%	-0.6%	1.2%	1.1%	6.6%	-5.4%	-3.0%	5.0%	-10.5%	---
% Change	6.8%	-2.0%	3.0%	8.5%	165.0%	-50.9%	-15.0%	14.3%	-300.0%	---
06 Caucasian %	17.0%	14.0%	18.0%	3.0%	7.0%	5.0%	13.0%	19.0%	6.0%	---
07 Caucasian %	19.4%	13.1%	21.8%	5.2%	7.1%	5.5%	14.4%	19.4%	7.1%	75.3%
Average Caucasian %	18.2%	13.6%	19.9%	4.1%	7.1%	5.3%	13.7%	19.2%	6.6%	75.3%
% Difference	2.4%	-0.9%	3.8%	2.2%	0.1%	0.5%	1.4%	0.4%	1.1%	---
% Change	14.1%	-6.9%	21.1%	73.3%	1.4%	10.0%	10.8%	2.1%	18.3%	---
06 Hispanic %	27.0%	23.0%	37.0%	8.0%	7.0%	10.0%	20.0%	19.0%	9.0%	---
07 Hispanic %	28.1%	21.9%	41.0%	9.0%	4.3%	10.5%	16.7%	30.5%	12.4%	64.3%
Average Hispanic %	27.6%	22.5%	39.0%	8.5%	5.7%	10.3%	18.4%	24.8%	10.7%	64.3%
% Difference	1.1%	-1.1%	4.0%	1.0%	-2.7%	0.5%	-3.3%	11.5%	3.4%	---
% Change	4.1%	-5.0%	10.8%	12.5%	-62.8%	5.0%	-19.8%	60.5%	37.8%	---
Average % Difference	2.9%	3.6%	2.6%	1.7%	2.9%	3.7%	3.2%	6.1%	4.2%	---
Average % Change	15.4%	32.9%	9.9%	34.9%	115.6%	62.1%	22.7%	27.6%	93.7%	---
** Ethnic % Difference	3.1%	4.5%	2.1%	1.5%	3.8%	4.8%	3.8%	8.0%	5.3%	
** Ethnic % Change	15.8%	41.6%	6.2%	22.1%	153.7%	79.5%	26.7%	36.1%	118.9%	
<p>% Difference is the percent the data sets differ from the first study.      **Ethnic % does not include Caucasians.                      % Change is how extreme the change was from the first study.</p>										

**Table 22 - Symbol key for Career and College Related Concerns**

Concern	Symbol	Concern	Symbol	Concern	Symbol
Low Grades	Γ	Dislike School	Ξ	Succeed	Φ
Low Test Scores	Δ	Anyone in Profession	Π	Opposite Gender Dominated	Ψ
College Too Expensive	Θ	Required Education	Σ	Family Support	Ω
College Too Demanding	Λ				

**Table 23 - Significant Findings of Career and College Related Concerns by Ethnicity**

	Γ	Δ	Θ	Λ	Σ	Φ
<b>African American</b>						
% Difference	-1.2%	-5.9%	-7.8%	-2.0%	-4.4%	-1.5%
% Change	-5.5%	-36.4%	-30.6%	-29.1%	-32.2%	-5.6%
<b>Asian</b>						
% Difference	0.3%	12.4%	12.5%	7.1%	6.3%	14.3%
% Change	1.3%	71.2%	44.5%	110.1%	41.6%	61.5%
<b>Caucasian</b>						
% Difference	-5.8%	-9.2%	-15.1%	-5.5%	-4.1%	-10.1%
% Change	-31.8%	-67.8%	-75.9%	-134.1%	-29.8%	-52.7%
<b>Hispanic</b>						
% Difference	6.7%	2.7%	10.4%	0.4%	2.1%	-2.7%
% Change	32.0%	13.6%	36.2%	4.5%	13.0%	-11.0%
% Difference is the percent that the data set is different from the average concern. % Change is the percent more/less likely a student of that ethnicity has the concern.						



## **Appendix F – Private School Comparison**

**Table 24 - Contrast in Gender Equity From Public to Private Schools in Class of 2006**

<b>Aspiration</b>	<b>*Male Interest Factor</b>	<b>*Female Interest Factor</b>	<b>**Public Equity Factor</b>	<b>**Private Equity Factor</b>	<b>***Contrast Equity Factor</b>
Teaching	1.20	1.37	1.90	2.17	1.14
Engineering/Physical Science	1.03	1.67	-3.67	-2.27	-1.62
Computers/IT	-1.38	-1.30	-3.08	-2.90	-1.06
Business	1.18	-1.41	1.02	-1.63	1.66
Trade	-2.00	-3.50	-4.57	-8.00	1.75
Medical Practices	1.33	-1.12	2.53	1.70	-1.49
Medical Support	-1.22	-1.32	3.36	3.11	-1.08
Law	-1.20	-1.75	1.46	+/- 1.00	-1.46
Art	-1.94	-1.13	1.16	2.00	1.72
Service Industry	-1.25	-1.43	3.30	2.88	-1.15
Social Services	+/- 1.00	-1.38	4.00	2.89	-1.38
Civil Services	-1.14	-2.00	-2.40	-4.20	1.75
City Administration	-1.13	-1.20	-1.50	-1.60	1.07
Political Office	1.43	+/- 1.00	-1.40	-2.00	1.43
<p>           *(+) Times greater interest within Private Schools                      *(-) Times greater interest within Public Schools            **(+ ) Times more likely to be female if interested                      **(-) Times more likely to be male if interested            ***(+ ) Times gender equity is worse in Private Schools                      ***(-) Times gender equity is worse in Public Schools         </p> <p style="text-align: center;"><b>NOTE:</b> Highlighted areas merely accentuate factors that seem significant.</p>					

**2005-2006 Survey Results**

	<b>Bancroft</b>	<b>Holy Name</b>	<b>Mass Academy</b>	<b>St. Peter-Marian</b>	<b>Worcester Academy</b>
<b>Teaching</b>	YES, 48%, Female	NO	NO	YES,15%, Female	YES,18%, Female
<b>Engineering</b>	NO	YES,57%,Male	YES,52%, Male	YES,41%, Male	YES,35%, Male
<b>Science</b>	NO	YES,16.24%,Male	NO	NO	YES,11%, Male
<b>IT</b>	YES,68%,Male	YES, 35%,Male	NO	YES,35%, Male	YES,11%, Male
<b>Computers</b>	NO	YES, 31%,Male	NO	YES,18%, Male	NO
<b>Business</b>	NO	YES,7%,Female	NO	NO	NO
<b>Trade</b>	NO	YES,67%,Male	NO	YES,70%, Male	NO
<b>Med Practice</b>	NO	YES,28%,Female	NO	YES,14%, Female	NO
<b>Med Support</b>	NO	YES,13.25%, Female	NO	NO	NO
<b>Med Other</b>	NO	YES,19.45%, Female	NO	NO	NO
<b>Legal</b>	NO	NO	NO	NO	NO
<b>Art Performance</b>	NO	YES,24.3%,Female	NO	YES,37%, Female	YES,37%, Female
<b>Art Visual</b>	NO	YES,34%,Female	NO	YES,28%, Female	YES,29%, Female
<b>Musical</b>	NO	YES, 2%, Female	NO	NO	NO
<b>Media</b>	NO	NO	NO	NO	NO
<b>Food Ser</b>	NO	NO	NO	NO	NO
<b>Serv Industry</b>	NO	NO	NO	NO	NO
<b>Social Service</b>	YES, 71%, Female	YES,38%,Female	NO	YES,16%, Female	NO
<b>Civil Service</b>	NO	YES,32%,Male	NO	YES,37%, Male	NO
<b>City Admin</b>	NO	YES,38%,Male AND 38% Female	NO	YES,23%, Male	NO
<b>Elected Political</b>	NO	YES,16%,Male	NO	NO	NO
<b>Govt Service</b>	NO	YES, 27%, Male	NO	NO	NO
<b>International Political</b>	NO	NO	NO	YES,9%, Male	NO