

## **A case study on gender gap in Massachusetts Maritime Academy**

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## **A Case Study on Gender Gap at Massachusetts Maritime Academy**

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### **ABSTRACT**

It has been hypothesized and research has shown that diversity in the workforce can enhance creativity, improve problem solving, and ultimately improve a company's bottom line. Historically women have been underrepresented in engineering and more specifically in marine engineering and maritime industries. In this paper we will explore some of the possible reasons behind the considerable gender gap between male and female engineering enrollments at the Massachusetts Maritime Academy (MMA); including, but not limited to a lack of role models, especially in key positions; cultural stereotypes; impediments perceived or actual to careers in maritime or engineering industries, and media bias. This research will investigate a simple question across all MMA engineering majors: why are so few female students interested in becoming engineers at MMA.

MMA's enrollment data and growth rate of female cadets over the last decade have been studied. Important parameters associated with this growth have been investigated. By the use of statistical analysis, SAT scores of the target demographic have been analyzed. The results of this analysis was used to find any meaningful deviation between male and female applicants. Additionally, through the use of a survey the priorities of target population in college selection and anticipated major has been assessed.

Results of an analysis of SAT scores showed that female engineers score 12.6% higher than female non-engineers on the Math SAT and 9.7% higher in the composite score. The survey results revealed that while media bias and cultural stereotypes had minimal influence on female student's decision to apply to MMA, role models were an important motivational factor. Also, more than 77% learned of opportunities at the Academy through their family member rather than usual college inquiry and selection process.

### **INTRODUCTION**

For years maritime industries as well as education and training in maritime fields remained mostly under male domination. Despite enormous growth of female participation in other Science, Technology, Engineering and Math (STEM) majors in recent decades, it seems maritime related fields are still behind and there is a considerable gap between men and women involved in marine engineering and maritime related activities.

Resolution 14 of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), as adopted in 1995, calls for governments to “highlight the role of women in the seafaring profession and to promote their greater participation.” Specifically the resolution encourages equal access for men and women in maritime industries.[1] In addition to the STCW resolution noted, all educational institutions in the United States receiving federal funding are required to comply with Title IX of the Education Amendments of 1972.[2] Title IX states that, “no person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any educational program or activity receiving federal financial assistance.”

From an educational standpoint, “special mission” institutes like MMA are specifically designed to educate and prepare cadets in marine engineering and other marine related majors [3]. MMA offers seven undergraduate majors in Emergency Management, Energy Systems Engineering, Facilities Engineering, International Maritime Business, Marine Engineering, Marine Transportation, and Marine Safety & Environmental Protection. Despite great efforts to increase the female/male ratio in the last several years, there are still a huge gap specifically for recruiting female cadets in the engineering majors.

Traditionally, marine related professions are considered as jobs for men and hence require extra effort for women to get involved. In recent years there has been a dramatic growth of women's involvement in higher education. Based on a National Student Clearinghouse Research Center report, 57% of all bachelor's degrees are earned by women. However, women earned just 19% of 2013 engineering degrees [5]. This number is much lower for marine related degrees.

Recently the World Economic Forum has concluded there is a need for more women in maritime industries not only to improve diversity but also for economic gain.[8] The U. S. Department of Labor has stated that one of the fastest growing job sectors includes engineering which is made up of fewer than 25% women.[6] This year General Electric (GE) committed to place 20,000 women in technical occupations by the year 2020 hoping to increase their profitability through gender diversity. [9] Just last year, General Electric (GE) moved their headquarters from Fairfield, CT to Boston, MA, 120 miles closer to MMA a possible source of new employees.

One possible reason for the gender gap at MMA could be attributed to cultural stereotypes as a stereotype may put pressure on a minority when it is judged against his/her group. Schmadar, T. et. al in their research showed that “activation of negative stereotypes can impair the performance of stigmatized individuals on a wide variety of tasks has proliferated.” [4]

This research aims to discover the possible reasons behind low female enrollment rate in MMA.

## CASE STUDY

Massachusetts Maritime Academy is one of seven nationally/regionally accredited maritime academies across nation which are offering maritime degrees since 1891. The enrollment data from MMA’s Admissions Office for the academic years 1980 to 2015, for both male and female cadets, is presented in Figure 1.

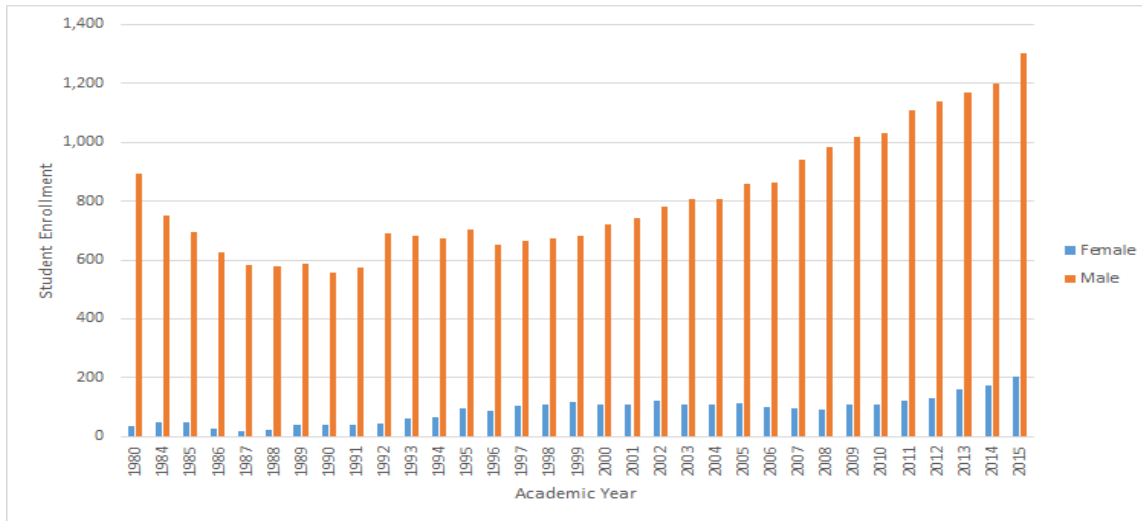


Figure 1: Female and male enrollment data , MMA’s admission office

Figure 1 shows a relatively steady increase in the male population from 1995-2010 yet a variable population in female cadets over the same period. The increase in male population and in overall population is consistent with MMA’s series of 5-year plans which targeted overall growth from 800-1200 and then from 1200-1600 students.

Figure 2 is a highlight of the enrollment data for females only.

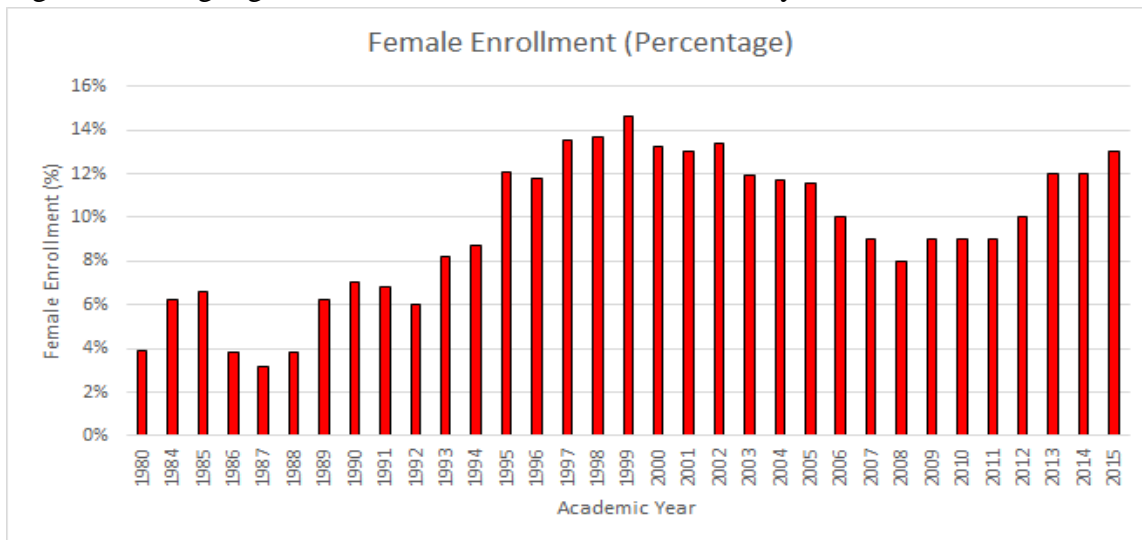


Figure 2, Historical female enrollment as a percentage of overall enrollment from 1980 to 2015

The greatest growth in female enrollment as a percentage of overall enrollment occurred in the 1990's. The decline in the percentage of women observed from 2003 through 2008 was as a result of a corresponding growth in overall enrollment and the inability of the Admissions Department to keep up with the numbers of female applicants. Since 2010, the number of women enrolled at MMA has more than doubled, from 109 to 256, while the percentage of women has only increased from 9.1% to 16.6%. Although the trend is positive, history shows that it is tenuous and an emphasis on recruiting female cadets must be continued.

Figure 3 displays the growth of female engineers as a percentage of overall female enrollment, increasing from 18% in 2010 to 33% in 2015.

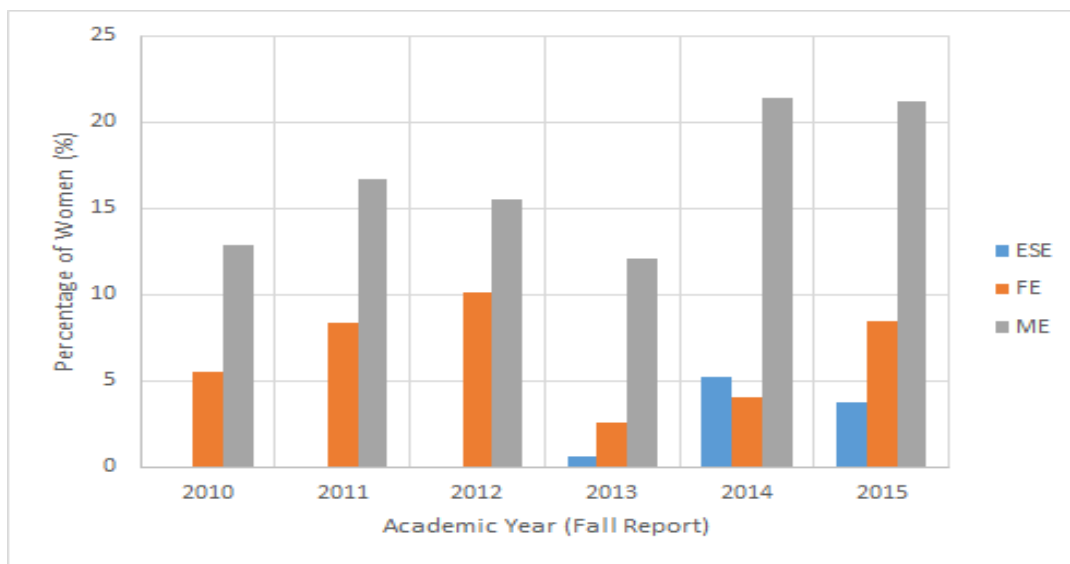


Figure 3, Female Engineers by Engineering Majors as a % of Female Enrollment

Between 2011-2015, the enrollment of women at MMA (in all majors) grew by 57.5% yet the percentage of women in engineering programs grew by only 15%. At that time, the women represented 12.2% of the overall population and only 8.4% of the overall engineering population. This was despite all of the efforts by the Admissions Office to recruit more female cadets into the engineering majors. Like their male counterparts, the greatest number of female engineers choose marine engineering. This is due to the special mission of the school and its prominence within the local community. As a comparison, nationally, only 5% of women plan to major in STEM and 20% of men. [6]

Comparing the SAT scores of current candidates shows that the women engineers score comparably to the male engineers on the Math SAT and 1.4% higher than the men in the composite score (Math and Verbal). The female engineers score 12.6% higher than female non-engineers on the Math SAT and 9.7% higher in the composite score. MMA's women engineers

score 15% higher than the national average of all women in the composite score (2015 College-Bound Seniors Report).

To further investigate the possible reasons behind low female cadets’ participations in MMA, a survey was prepared and distributed to all cadets. The survey was developed using SurveyMonkey online software and included several multiple choice questions. The survey participation was voluntary and all participants were at least 18 years old. The female population responded at a rate of 58.1%. The participation was well represented and included 27.8% Freshmen, 25.2% Sophomores, 20.9% Juniors, and 26.1% Seniors.

In order to identify the source of connection to MMA, the female participants were asked “How did they come to know MMA?”. Participants could choose more than one answer as shown in Table 1.

Table1: Source of Introduction or Knowledge of MMA

Family Member	Friend	Teacher	Counselor	MMA Students	Sport Camp	ASLP*	Other**
42.6%	27%	4.3%	10.4%	31.3%	1.7%	7.8%	12.2%

\*Advanced Studies Leadership Program

\*\*Other factors included living in close proximity to school, other leadership programs, and personal research on colleges both on-line and through the “college book”.

More than 77% learned of opportunities at the Academy through their family member (most likely active in maritime industry), friends or current/former MMA students. This result showed that despite all the effort to advertise the school through different programs, the majority of students learned of MMA through a trusted family/friend. This can be explained by the fact that people in the maritime industry (or students pursuing the field) can explain the pros and cons of the maritime industry and therefore influence the candidate’s decision making process.

To further study the influence of maritime professionals on applicants, students were asked whether they knew anyone in the maritime industry before applying to MMA or not. As expected, 49.6% of female students have known a mariner before applying to MMA.

The next question in the survey asked about female cadet’s exposure to engineers in general and specifically female engineers before attending the school. 51.3% of responders had previous exposure to engineers from which 22.6% were female engineers.

As part of the study, the female students were asked about their motivations to enroll in MMA. The participants were able to choose a series of factors that applied to this question. As presented in Table 2, 92.2% of female students stated that future career opportunities was a determining

factor in their enrollment. Additionally, 67% of the women responding reported a personal interest in marine related fields. This high percentage of optimism in future career opportunities and personal interest in the industry among female cadets is a promising sign of the next generation of female maritime professionals. The affordable cost was a crucial factor for both male and female students who participated in the study.

Table 2: Factors motivating female students to enroll at MMA

Location	Affordable cost	Acceptance rate	Personal interest	Future career opportunities	Other*
41.6%	61.1%	10.4%	67%	92.2%	9.6%

\* Other included leadership, regimental life, and scholarship opportunities

The initial assumptions regarding any influence of cultural stereotypes, media bias, and role models on female cadet enrollment decisions have been tested using a comprehensive question through the survey. The results are presented in Table 3.

Table 3: Influential factors on female students enrollment decisions

	Not at All	Very Little	Somewhat	Greatly
Cultural stereotypes	53%	19.1%	15.7%	11.3%
Media bias	63.5%	18.3%	13.9%	4.3%
Role models	29.6%	10.4%	30.4%	27.8%

Most of the participants believed that cultural stereotypes and media bias did not have any or very little influence on their enrollment decision. This positive feedback from female students shows an improving culture of inclusion for women engineers and may signal a high expectation for a positive college experience. More than half of the participants state that role models have somewhat or greatly influenced their decision. 92% of those positive respondents learned of MMA through a family member, friend, or prior MMA student.

## RESULTS

The case study presented above shows that while some progress has been made toward reducing the gender gap in engineering and maritime majors, additional emphasis and institutional resources are still needed in order to reach an acceptable level of female marine engineers.

The research clearly identifies the significant impact role models play in the selection of MMA as an undergraduate institution for women applicants. Of note, female faculty representation in

the Engineering Department has increased from 1 women in the fall of 2012 to 5 women as of the fall of 2016, or from 5% to 21%. This increase has arguably been a factor in the positive enrollment trend and therefore the goal of increasing the participation of women faculty should be continued.

The data showed very little or no correlation between cultural stereotypes or media bias and female cadets college/major selection decision. This is an encouraging trend that demonstrates a cultural and potentially generational shift whereby women feel empowered to pursue any area of personal interest. Women are no longer limited by outside factors and do not foresee any impediments to their future careers as a result of their gender. In the general response option of the survey, one student, in talking about an internship with a shipping company, stated, “as a woman, I expected a lot of negativity but all of the engineers and mates were happy to see me. It was an amazing experience. I wish we had more of them.”[7] With this in mind, one approach to increasing the number of female cadets and promoting the accomplishments of female graduates would be to invite MMA alumna as guest speakers at campus open houses.

On the average, women engineers are at least as prepared as their male counterparts upon arrival at MMA, thereby increasing the probability of success. Most importantly for the institution and for the industry, 92.2% of the women responding to the survey stated that future career opportunities is what compelled them to attend MMA and 67% indicated that they had a personal interest in maritime related fields.

Predictably, the Academy cannot act alone to close the gender gap; however, the Academy must continue to promote a culture that supports diversity and enhance the experience of future generations. Astutely, one student advised, “the gender gap cannot be fixed in college or highschool. It has to start in Elementary school and Middle School. Get girls involved and interested in science and teach them.”[7]

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[8] <http://www.businessinsider.com/ge-commits-to-placing-20000-women-in-maritime-industries>

[9] <http://www.businessinsider.com/ge-commits-to-placing-20000-women-in-technical-roles-by-2020>.