

Why Olin? A look at why students decide to attend Olin College of Engineering

I. Abstract

This AHS project aims to identify and study any differences in the reasons why women and men decide to attend Franklin W. Olin College of Engineering. I devised a survey that asked students to rate the importance of various factors, such as location, curriculum, and community, in determining whether or not they would attend Olin. My analysis of the survey indicates that few differences exist in the reasons why women and men choose Olin. This may suggest a few things. First, the students who decide to attend Olin are similar, particularly regarding reasons why they are attracted to the college and perhaps even other colleges. For example, the most important attributes about Olin, such as size, mission, and community, are attractive to students regardless of gender. Additionally, many of these students may have been looking an engineering school with a rigorous curriculum and prestigious faculty. Finally, the survey results may not have yielded the necessary data to indicate whether any reasons did exist between the students in regards to gender.

II. Introduction

The status of women in engineering

This AHS project aims to identify any differences in reasons why women and men decided to pursue engineering at Franklin W. Olin College of Engineering. Such a study is important because women are traditionally under-represented in engineering, comprising 20.5% of undergraduate enrollment, 22.1% of graduate enrollment, and only 11.1% of the workforce (NSF, 2006). If differences do exist or more was understood about why women in particular decide to attend engineering schools, as this study seeks to determine, recruitment efforts could become more focused on women, engineering schools could make the necessary changes to increase the numbers of women in engineering, and the discipline in general could become more gender balanced.

The under-representation of women in engineering has become an important topic in engineering education, leading many to ask many questions. Why are there so few women in engineering? What attracts women to engineering? Why do so many women leave? What factors are important in encouraging the satisfaction and retention of women? What can be done to encourage more women into the field?

The one question that precedes all these others is why should there be more women in engineering? There are many answers that have been given. First, the number of engineers in the United States continues to drop compared to other countries (NSF, 2006) and to keep the United States competitive in the global economy, women may be a source to replenish the numbers (Brainard and Carlin, 1998; Cuny and Aspray, 2000). Others maintain women add diversity and new perspective to design, teams, and engineering overall (Cuny and Aspray, 2000; Gosink, 2001; Moskal, 2000); women should be taking a share of the higher compensations in engineering (Moskal, 2000); and women should understand that engineering, like other fields women are drawn towards (medicine, social fields, etc), also allows for women to have a positive impact on society (Morgan, 2001). As Cuny and Aspray say, “this under-representation (of women in engineering) translates into a loss of opportunity for individuals, a loss of talent to the workforce, and a loss of creativity in shaping the future of society (pp. 1).”

Women have been enrolling in engineering programs since the early 1900s. However, engineering has not been friendly to women; and despite gains in the field, women are still incredibly under-represented (Bix, 2004; Gibbons, 2005). Figure 2 illustrates how disproportionate the numbers of females in engineering is when compared to other fields, such as social sciences and computer sciences (NSF, 2006). For all the reasons mentioned above, the under-representation of women in engineering has been identified by individuals, universities,

and organizations alike as an issue to focus upon in the future (Brainard and Carlin, 1998; Clayton, 2000; Cuny and Aspray, 2000; NSF, 2006).

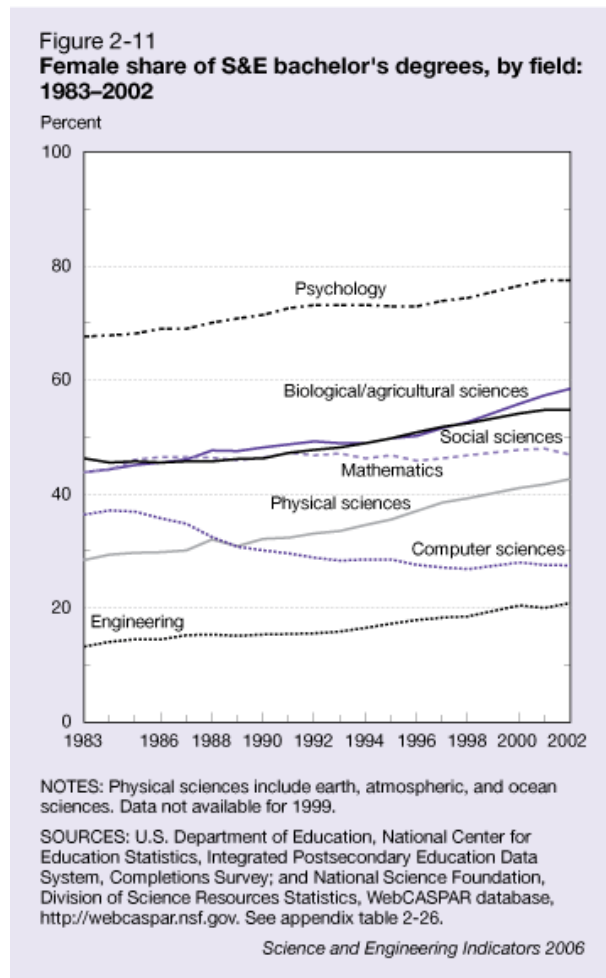


Figure 2: Figure 2-11 from the Science and Engineering Indicators 2006 compares the percentage of women awarded bachelor's degrees in engineering to other science fields. Women in engineering lag far behind their science counterparts (NSF, 2006).

Understanding the numbers: why are there so few women in engineering?

Many initiatives have been undertaken to understand the under-representation of women in engineering. Seymour and Hewitt (1997) studied the reasons why women go into STEM (science, technology, engineering, and mathematics), stay in STEM, or switch from STEM to other majors. Seymour and Hewitt found that women felt the STEM fields catered to male

students both academically, in classes and projects, and socially, through interactions with other peers (mostly male) and professors. The women in Seymour and Hewitt's study were more likely to leave engineering – with higher GPAs than their male counterparts – due to psychological reasons, such as feeling alienated, depressed, and lonely. Although theirs was a comprehensive study of science, technology, math, and engineering, fields largely studied together, much has also been studied focusing on women only in engineering. Brainard and Carlin (1998) performed a four year longitudinal study of female engineering students, also identifying the reasons students either stayed or left engineering. The two studied the overall experience of female students, especially how levels of confidence changed over the years, and found that levels of confidence upon graduating with a degree were lower than when the female students first entered college.

Although the studies mentioned above focused primarily on student experiences and satisfaction, others have chosen to research the reasons why students decide to enter engineering. For example, Dick and Rallis (1991), Jawitz and Case (1998), and Reed and Case (2003) all studied the reasons why students (college & high school) became interested in engineering and/or decided to pursue engineering in higher education. Findings indicate that women are more likely than men to pursue engineering as a course of study due to social factors: i.e., one or more parents is an engineer, a significant figure (parent, counselor, teacher, family member) encourages the pursuit of engineering, or the student believes engineering is good a way to help society – the impact of a chosen career on society appearing much more important to women than men (Morgan, 2001; Seymour and Hewitt, 1997). Men were more likely to pursue engineering because of an intrinsic interest in the field, tinkering/programming experience, or

money/prestige (Morgan, 2001; Seymour and Hewitt, 1997; Reed and Case, 2003; Jawicitz and Case, 1998).

The way engineering is viewed by society in general also has a great deal to do with how few women go into engineering. A survey conducted by Harris Poll found that 61% of the American public felt not very well informed or not informed at all about engineering. Similarly, 53% of college graduates (both men and women) and 78% of women felt the same way (numbers for men were not available) (Harris Poll, 1998). Other reasons for the under-representation of women in engineering is that engineers are seen as “predominantly male, too bright for our own good, honest to a fault, non communicative, dull, and loners” (Yurtseven, 2002). Engineering curricula are also notoriously difficult, requiring intense science and math skills, two subjects in which girls are typically not encouraged to excel (Yurtseven, 2002; Campbell and Clewell, 2002). The undergraduate engineering environment is also a deterrent to females due to the male-dominance, a perceived unfriendliness towards females, and professors who may not be comfortable teaching females (Seymour and Hewitt, 1997).

Initiatives to increase the numbers of women in engineering

Using conclusions gathered from the studies above and others like them, many organizations and institutions have sought to increase the numbers of women in engineering. The National Science Foundation (NSF) funds many research projects aimed at understanding and addressing the under-representation of women in engineering; for example, some projects attempt to ascertain whether certain pedagogical methods, such as project-based learning, may enhance the experience, satisfaction, and retention of women at a small engineering school (Zastavker, Ong, and Page, 2006). The NSF also keeps the most up-to-date statistics on the state of women, minorities, and persons with disabilities in science and engineering.

Other groups take more of a hands-on approach to the issue of women in engineering. For example, the Society of Women Engineers is focused upon making engineering a desirable occupation for women; further, SWE encourages women engineers to step up to leadership positions. SWE provides social and professional/career development networks through conferences and also sponsors a host of other resources – web seminars, free leadership development modules, and a career center for employer-employee matching. WISE (Women in Science and Engineering) is an organization that sponsors free activities open to the public such as a career day for area high school students and lectures to highlight women instrumental in science and engineering. PLEN (Public Leadership Education Network) is an organization based in Washington, D.C., that sponsors programs, such as the Women and Science/Technology Seminar, aimed at encouraging young women to realize the importance of technology, science, and engineering and to take leadership positions within these fields.

Likewise, some colleges and universities have taken it upon themselves to address the issue of the under-representation of women in engineering. Southern Methodist University offers an engineering curriculum with many hands-on projects aimed at enhancing the interest and satisfaction of students. A few years ago, SMU also announced a goal to be the first college nationally to achieve an equal male/female student ratio within the School of Engineering (Women in Higher Education, 2002). Smith College, an all-female liberal arts college in Massachusetts, launched an engineering program in 2000 which features hands-on projects and a socially relevant curriculum that has attracted numbers of female students (Clayton, 2000).

Why study Olin College of Engineering?

Franklin W. Olin College of Engineering, the location of this study, was founded in 1997. Olin is the newest engineering school in the United States and offers a full tuition scholarship to

each of the approximately 75 students accepted each year. Olin's mission is to prepare "future leaders through an innovative engineering education that bridges science and technology, enterprise, and society" (Olin, 2006). The college has a hands-on, project-based engineering curriculum where students are encouraged to also excel out of class through co-curriculars, faculty sponsored clubs or groups, and passionate pursuits, where students receive funding to participate in extracurricular passions, such as flying or rock-climbing.

Olin has highly renowned faculty members who previously taught at such institutions as Harvard University, Bucknell University, and Massachusetts Institute of Technology. The school has a 9:1 student to faculty ratio and a close to equal male/female gender ratio of 57:43 (the national average is approximately 80:20). The college markets itself as providing a close-knit, family like atmosphere where faculty and staff members go by first name and students daily interact with professors outside of the class room. In this brief introduction to Olin, it is obvious the college offers many attributes, both social and academic, which might be attractive to students interested in pursuing undergraduate engineering education.

For all these reasons, Olin was chosen as the site to determine whether any differences exist in the reasons why students decide to study at a certain engineering education; that is, are certain characteristics of a particular institution – in this case, Franklin W. Olin College of Engineering – more important to female students than to males? In this project, I studied reasons why males and females decide to attend Olin. I hypothesized that social attributes, such as faculty, students, gender ratio, and social environment, would be cited as important factors encouraging matriculation more often for female than for male students.

III. Method & Procedure

The survey sent out to the student body – including alumnae – of Olin contained approximately 50 items that asked students to rate the importance of various attributes when deciding to attend Olin College. The scale was Very Important, Important, Neutral, Somewhat Unimportant, and Not Important. Students were asked to rate both social attributes, such as clubs and organizations or female/male student ratio, and academic attributes, such as academic environment and degrees offered. Students were also asked to list three current favorite things about Olin, three current least favorite things about Olin, any reservations about coming to Olin, and any advice that the respondent might have for a high school student deciding between colleges. The survey may be viewed in its entirety in the appendix.

Survey responses were analyzed with the scale of importance ranging from 1 to 5, with Very Important being 1 and Not Important being 5. Responses from these questions asking students to rate attributes upon this scale were added to yield an average response rate. Student open-ended responses were sorted and coded, with some being further sub-coded, into various categories unique to each question; for example, “Community and Olin Culture” was a code for responses to Favorite Things about Olin and included such sub-codes as “Friends” and “People (staff, students, administration).” Coding and the subsequent sub-coding allowed for a better means to analyze the general trends among the open-ended responses.

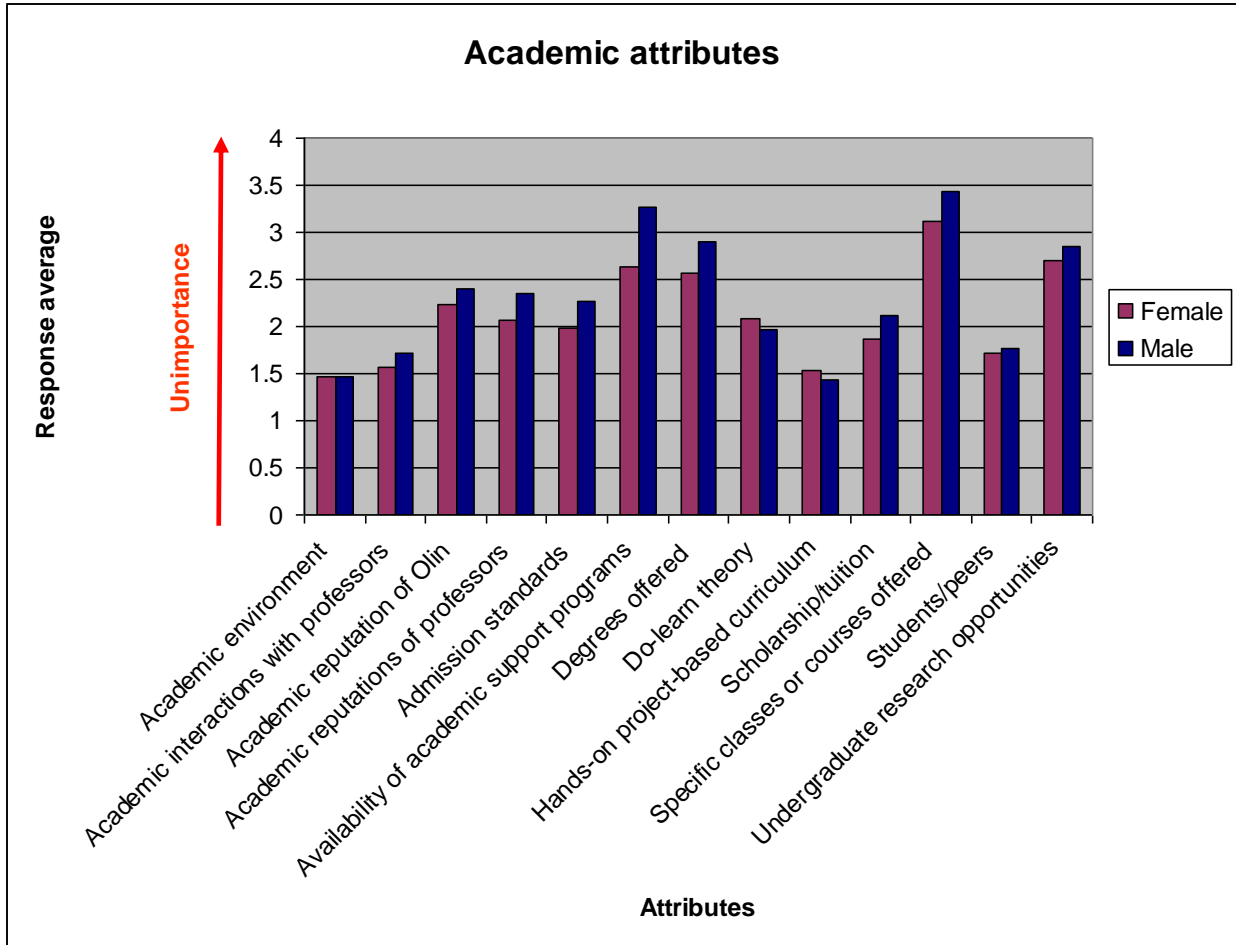
Before proceeding any further, it is important to note the ways in which the survey may have been improved and what bearing any shortcomings may have had upon the data to be presented. Making some answers required – gender and graduating class, for example – could have increased the yield of survey responses. There may also have been a few issues with rewording. In questions such as, “How important was the distance from home?” whether the distance was good or bad was ambiguous. Furthermore, some attributes listed were more

applicable to one graduating class over others; for example, specific courses or classes were non-existent when 2006 came to Olin as they were heavily involved in developing the curriculum. Conversely, other attributes, such as the chance to partake in Partner Year, did not make the list but were most certainly important in attracting members of the class of 2006 to Olin College.

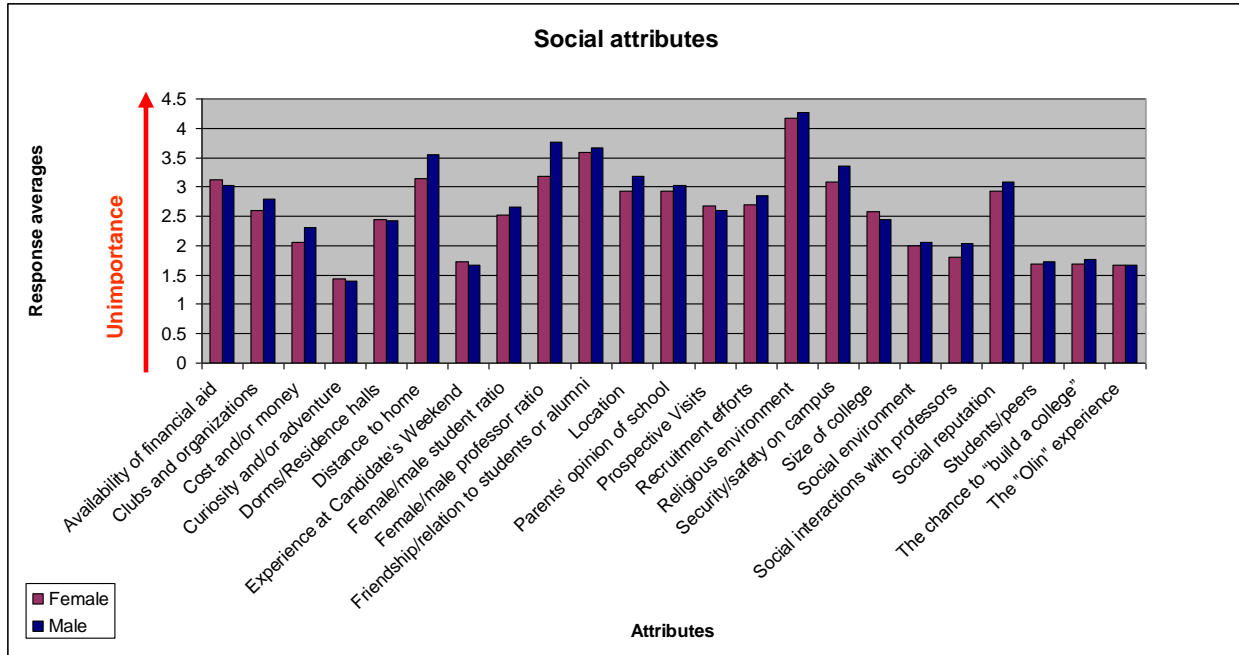
IV. Results & Discussion

A total of 235 responses were collected from a survey population of 373 students (208 male, 165 female). Of these 235 responses, only 186 (96 male, 90 female) answered both questions relating to gender and year of graduation. The following graphs detail these respondents, while all responses were considered in analysis of the open-ended responses. It was found, however, that the majority of respondents to the open-ended questions had also indicated gender and graduating year, as may be seen in the appendix.

The most important academic and social attributes for Olin students



By viewing anything between 0-2 as important in helping a student decide to attend Olin, the most important academic attributes – regardless of sex – based on response average appear to be academic environment, academic interactions with professors, do-learn theory, hands-on project-based curriculum, and students/peers.



Similarly, the important social attributes – again, regardless of sex – based on response average appear to be curiosity and/or adventure, experience at Candidate’s weekend, social environment, social interactions with professors, students/peers, the chance to “build a college,” and the “Olin” experience.

Response average differences between male and females above 0.2 of a point were further analyzed to determine whether any significant differences existed in how responses fell along the importance scale which, again, ranked from 1 – very important – to 5 – not important. Differences of greater than 0.2 were observed in the following social attributes: cost and/or money, distance to home, female/male professor ratio, location, security/safety on campus, and social interactions with professors. The individual responses to these questions were studied in depth to determine which attributes were significantly different along the scale of importance to the students. A closer look indicated students felt similarly about location (neutral), security/safety on campus (important), and social interactions with professors (important – very important) regardless of gender. Cost and/or money appeared to be slightly more important for

females, which slightly contradicts literature that indicates females are less attracted to the financial incentives of engineering than men (Morgan, 2001; Seymour and Hewitt, 1997; Reed and Case, 2003; Jawictz and Case, 1998). Distance to home was also ranked more important to the majority of females, and females also considered the female/male professor ratio more important than male counterparts. This fits well with what Seymour and Hewitt as well as Brainard and Carlin found in their studies, namely, that females were more likely to name having a strong female mentor as a reason to stay in engineering (Seymour and Hewitt, 1997; Brainard and Carlin, 1998).

Differences of greater than 0.2 were also observed for the following academic attributes: academic reputation of professors, admission standards, availability of academic support programs, degrees offered, scholarship/tuition, and specific classes or courses offered. Upon closer inspection, the academic reputation of professors appeared similarly important for females and males, as did admission standards, with a good deal of both males and females indicating a feeling of neutrality for this attribute. Degrees offered, scholarship/tuition, and specific courses/classes offered also appear to be more important to females than males. Although none of the literature reviewed either supports or contradicts this, a few explanations may be made about the importance of these attributes. Females who go into engineering may be more influenced by specific degrees and courses that fall along their interests, and the scholarship/tuition may provide an additional incentive for these students, while their male counterparts may be more assured of a choice to go into engineering and need less financial and specific degree or course incentives.

Finally, a great difference is noticed regarding availability of academic support programs: females were more likely to indicate this attribute to be very important, although the majority of

both females and males ranked this as neutral. Thus, the availability of these programs appears to be very important for a percentage of the females who attend Olin. The importance of academic support programs in helping female students is also something that has been noted in the literature (Brainard and Carlin, 1997).

The survey also provided students with the opportunity to answer open-ended questions about other academic and social attributes that may have been important in helping students decide to attend Olin. Additional academic attributes included the chance to get a well-rounded education due to the presence and emphasis of non-engineering, humanities classes in the curriculum, the challenge of Partner year, the opportunity to self-design a major, and also the “perceived level of interest and respect for student opinion/ideas,” as stated by a female in the class of 2006. Additional social attributes include the community, such as interactions with staff, students, and professors, as well as the “emphasis on socially capable/sane, not just smart people” as mentioned by a female in the class of 2010. Other social attributes describe the appearance of the campus, the Honor Code, and the opportunity, prestige, and uniqueness of being invited to be an Olin student.

Least favorite things about Olin

Additional open-ended questions invited the students to describe least favorite things about Olin, most favorite things about Olin, and reservations about coming to Olin. Bureaucracy ranked among the top least favorite things about Olin, especially “a feeling that we’re edging toward less student involvement in decision-making,” says one female in 2006. A female in the class of 2007 believes “administration doesn’t seem to respond to student feedback,” while a male in 2010 mentions the “community between students and administration” as his least favorite thing about Olin. Students also mention Olin’s location – being too far from Boston and

how difficult it is to get off campus – as being a least favorite thing, along with the food, and certain aspects of facilities design (for example, “dumb building design,” says a female in 2010).

The size of Olin also ranks high among student complaints: “the ‘bubble’ is difficult to escape, both socially and physically,” says one male in 2010. A female in 2008 says, “because we’re small and so narrowly focused on engineering, we lack the diversity that most schools have.” Students also indicate a fear that Olin is moving away from its initial vision, lacking both innovation and the will to change. A female in 2006 says, Olin has a “lack of a clear focus – we haven’t been committed solely to changing engineering education.” A male in 2009 voices concern that Olin is “selling out for accreditation,” and another male in the class of 2009 believes Olin illustrates a “lack of continuous innovation.”

Various academic factors were also listed among some of the least favorite things mentioned by students. Despite Olin’s commitment to hands-on, project-based learning, students indicate classes can be boring, traditional, weak, and generally poor preparation for a career in engineering. A male in 2006 says Olin has a “relatively traditional curriculum,” while a female in 2009 says, “classes are much less interesting than everything else I’m involved in.” A female (2008) says, “required courses are sometimes a joke,” while another female (2006) complains about “when external people say, ‘you’re a senior ECE and you don’t know _____.’” Additionally, students are frustrated by the lack of courses options and scheduling. One female (2009) says that “the Olin triangle (Olin’s focus on humanities, business, and engineering) is disproportionate in my experience,” while another female (2007) mentions, “the curriculum doesn’t feel wild anymore.” The lack of AHS (Arts, Humanities, and Social Sciences) classes is also mentioned a number of times.

Community also factors high on the list of least favorite things about Olin, especially stagnation of the Olin community and a fear that Olin nurtures immaturity. One female (2008) describes a “disconnect between students and the rest of the community,” while a male in the class of 2006 says, “the ‘family-like’ environment is gone – the staff aren’t treated nearly as well as they used to be.” Another male in the class of 2006 mentions the “community is losing the ‘Olin experience’ feel (willingness to dive in and drive change).” A male in 2006 believes that Olin students, in general, “tend to be incredibly self-centered and disrespectful of the faculty and staff,” while a female in 2007 says, “everyone has an opinion and knows it’s correct.” Another female from 2007 says her least favorite thing about Olin are the “students who complain and don’t do anything to fix it.”

Students also mention not getting enough sleep, not having enough time, having too much stress, and intense workloads as being least favorite things about Olin. Olin students could use extra hours in the day across the board, as most indicated not having enough time to hang out with friends, take all the interesting classes, or participate in clubs. Students felt they could also use less stress and work, especially since, as one male (2009) says, “There’s a culture of overloading, and not just with classes.”

Most favorite things about Olin

Students seem especially excited about working so closely with professors who demonstrate the same eagerness and willingness to donate time and effort to students. Students also seem particularly happy with many academic factors, such as the rigorous, exciting, and creative learning atmosphere, as well as the hands-on, project-based curriculum. Olin’s “learning environment is more open than other schools,” says one male in 2009. A female in 2006 mentions the “‘get your hands dirty’ engineering classes,” while other students describe do-

learn theory, spiral learning, and hands-on projects. Research and cross-registration are also mentioned by a few students.

Students also appear to be content with the opportunities and challenges provided by Olin, whether they are academic, leadership-developing, school building, or professional. One male (2006) mentions the “opportunities to talk to entrepreneurs and people in industry through professors’ contacts,” while a female in 2006 mentions the excitement of “the involvement of students in college building.”

Community appears to be a favorite for many students. People – staff, students, faculty, and administration – show up many times in the open-ended responses. Olin culture and environment is also mentioned a lot. One male in 2008 likes the “encouragement of students to pursue their passions,” while a female in 2010 enjoys “the fact that it’s incredibly easy to just spark up a conversation with almost anyone here.” A male in 2009 likes “the sense of adventure/curiosity of the culture.” The Honor Code figures prominently in the culture and is also mentioned by many students, along with clubs and organizations. Finally, students enjoy the beautiful campus and dorms, especially the “new, well maintained facilities,” as one male in the class of 2006 describes.

Reservations about coming to Olin

When asked if they had any reservations about coming to Olin, students mentioned being worried about Olin’s size. One male from 2006 was “worried about missing out on a larger-sized campus life,” while a female from 2008 thought Olin would be “too small.” Students were similarly concerned about Olin’s location, either being too far or too close from home or being in the cold northeast. A third reason often mentioned was attending a rigorous school where the focus was engineering. One student from 2009 says she was concerned about “studying only

engineering (officially) as opposed to a dual degree program elsewhere in music/engineering.”

A male in 2009 was worried about “flexibility in course offerings and curriculum,” while a

female (2010) was worried “that the work would be too challenging, given a weak background.”

Finally, students voiced concern over Olin’s lack of reputation. A female student (2009) says,

“the newness was worrisome – what if it failed?” while a male from 2007 worries about Olin

being “unaccredited and unknown.” It must also be mentioned that a great deal of students

responded to this question with “None!”

V. Conclusions

This study sought to identify and study any differences in the reasons why women and men decide to attend Franklin W. Olin College of Engineering. A survey of the Olin student body asked students to rate the importance of various factors, such as location, curriculum, and community, in determining whether or not they would attend Olin. Analysis of the survey indicates the only notable difference was that a great deal of females ranked availability of academic support programs as very important (although the majority felt neutral), while males felt mostly neutral. This may be because females are more likely to note the importance of academic support in encouraging retention in engineering programs (Seymour and Hewitt, 1997; Brainard and Carlin, 1998).

One more result bears mentioning: cost and/or money and scholarship/tuition appeared to be more important as a factor for females than for males. This slightly contradicts current literature which maintains money is more important for males when deciding to go into engineering (Morgan, 2001; Seymour and Hewitt, 1997; Reed and Case, 2003; Jawictz and Case, 1998); however, it must be noted money, in the case of Olin, refers to the cost of education,

while in current literature, money refers to the financial status of occupying an engineering position. If some females were more hesitant about attending Olin than their male counterparts, full tuition scholarship may have provided a final incentive in the decision making process, explaining the importance of cost and/or money for females.

The survey also allowed students to discuss favorite things, least favorite things, and reservations about coming to Olin. The contradictions within the responses given by students must be noted. No two students at Olin are alike, and although many of the reasons why students decided to come to Olin are common, there will be some differences. In general, some issues will be polarizing; for example, some students may have been extremely excited about Olin's small size, while others may have sacrificed going to a large university to come to Olin for other reasons besides size. Some students may enjoy Olin's quiet, suburban location while others may have preferred a more urban setting. Due to all these reasons, some of the responses for the open-ended questions were contradictory; however, I chose to report upon all of the reasons to allow for the larger picture to emerge.

Despite my hypothesis that females were more likely to come to Olin due to social factors, it was found that both females and males similarly rated social and academic attributes on a scale of importance. There may be a variety of reasons for these results. First, the survey may have contributed in a few ways. Some questions may have been poorly designed and confused the respondent, leading to misleading answers. Second, perhaps these differences do not exist at Olin because some of the most attractive things about Olin – the community, the engineering curriculum, and the scholarship – are similarly attractive to both females and males. Then again, maybe the students who come to Olin are similar in what they all find attractive. Finally, the simplest option must not be discounted: maybe there simply are no significant

differences between males and females in how important certain attributes are in choosing a college.

The limitations of this study must be briefly addressed. First, most of this project took place over one semester, which limited the amount of energy spent on literature reviewing, survey designing, and data gathering and analysis. Second, the project was done independently as part of a full schedule, meaning there was a variation in the hours spent on the project across the weeks. Finally, the survey instrument, as previously mentioned, may not have been optimally designed due to time and experience constraints of the author.

Future directions for this study would be to analyze differences between classes rather than just between male and female students. Additionally, the same survey could be given at various other engineering schools, whether public, private, small, or large, to determine whether Olin's student population responses are very different. The survey could also be redesigned to minimize any misconceptions about what the survey is asking, rewrite any confusing questions, and expand upon attributes or other aspects of the survey itself. The redesigned survey could also be given to the Olin student community again; perhaps new data would lead to different conclusions than the ones drawn here. Another research study that just focused on the importance of the scholarship in attracting students to Olin might also be interesting to undertake.

Although this AHS capstone project did not find any conclusive information about significant differences between males and females in choosing to attend Olin College, the context of this study – the under-representation of women in engineering – is still of the utmost importance. More studies such as this one, which sought to identify what is important for women and men who decide to study engineering at Olin, must be conducted to ensure all is being done to attract the best and brightest students into engineering.

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APPENDICES

APPENDIX A: SURVEY

APPENDIX B: SURVEY RESULTS

Female results obtained by filtering out all male results

Male results obtained by filtering out all female results

APPENDIX C: SURVEY GRAPHICAL ANALYSIS

APPENDIX D: SURVEY OPEN-ENDED ANALYSIS