Gendered Words in U.S. Engineering Recruitment Documents

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Introduction

The number of women on US campuses exceeds the number of men—in 2014, female students made up 56 percent of total undergraduate students (Kena et al. 2016). Across campuses, students are increasingly choosing to enter science and engineering fields (or STEM) with an increase from about one third of incoming students planning to study in STEM fields in 2007 to just over 39 percent planning to study in STEM fields in 2012 (National Science Foundation 2014). However, this increase in the proportion of women on campuses, and the increase in popularity of STEM majors for all students has not corrected a longstanding gender imbalance existing in most US engineering undergraduate programs. Instead, the momentum of women entering engineering in the 1970s largely stalled in the 1990s and declined slightly from the peak in 2001-2 (National Centre for Education Statistics 2015). Between 1998 and 2012, the percent of entering first year students who indicated that they planned to major in engineering increased from 2.7 percent to 3.9 percent for women compared to an increase from 14.7 percent to 18.3 percent for men (National Science Foundation 2014). The percentage of women enrolled in US undergraduate engineering programs increased by just over one percent between 2003 and 2013: from 18 percent to 19.2 percent (National Science Foundation 2014). In Western nations such as the United Kingdom, researchers have documented advances in women's rates of enrollment in numerous scientific fields—reaching gender parity in many cases (Smith 2011). Yet this is not the case for engineering education, where women continue to be underrepresented in relation to their male peers even in light of persistent institutional attempts to increase women's enrollment. The question of gender parity necessitates consideration of both recruitment and retention. While some evidence suggests that women engineering students have higher levels of attrition than their male counterparts (Poor and Brown 2013), differences in enrollment rates by gender are a primary factor inhibiting gender parity (De Cohen 2009). In other words, the problem begins long before women students enter university.

Numerous theories help explain women's decision not to enroll in engineering. Supply side theories assume a mismatch between women's perceptions of the field and their ability to achieve their life goals (Ceci, Williams, and Barnett 2009). In particular, women may come to the conclusion that a highly demanding engineering career would be too constraining on their ability to birth and raise children—a perception that may be exacerbated in national contexts where public childcare systems have not been developed. Other theories suggest that there is a reduced demand for women based on institutionalized attitudes and beliefs about the capability and fit of women (Ridgeway and Correll 2004). Thus women's decision-making may not be solely about reproduction, but also based on their experiences and anticipation of exclusion from organizational cultures where masculinity is assumed to be the norm (Acker 1990). In her theory of gendered organizations, Acker finds that organizations themselves can have gender-related characteristics, conveyed in part through images and symbols associated with masculinity or femininity. Acker (2011) argues that "inequality regimes" are embedded into organizational structures, determining organizational goals and outcomes, and creating processes that can maintain or challenge inequalities. For instance, Foschi (2000) found that in experimental

contexts women are held to stricter standards for being judged competent at a range of tasks compared to men, even when they perform at the same level. In the context of the workplace, this double standard for competence has been used to help explain the construction of an "ideal worker" who is imagined to be male, and unencumbered by the demands of managing a family, even when that family is only a mere possibility based on one's gender (Ridgeway and Correll 2004).

The Chronicle of Higher Education regularly reports the challenges that engineering programs face recruiting women to a field that is perceived as being competitive and requiring exceptional skills (i.e. Thomas 2017). A major report by the National Academy of Engineering (Giddens et al. 2008) has examined how public understanding of engineering is promoted, and tested specific messaging. They found that successful messaging focused on engineering as a creative and emotionally satisfying career that improves human welfare. These messages were designed in part to help address the gender inequality in engineering, however it is unclear how language describing engineering might impact undergraduate enrollment. This research asks whether the way engineering programs present themselves to the public affects the proportion of women in a program? For instance, do programs that present a more masculine image of engineering have a smaller proportion of women students? We show how efforts directed toward shifting public perceptions of engineering need to be coupled with empirical research that tracks the participation of women in order to ensure that these efforts succeed not just in casting a broader, more humanitarian vision of engineering, but of moving engineering programs closer to the goal of reaching gender parity.

Overview of methods

In this paper, we test whether US engineering schools signal a masculine organizational culture through word-choice on public facing recruitment materials. Gaucher et al. proposed that "gendered wording may emerge within job advertisements as a subtle mechanism of maintaining gender inequality by keeping women out of male-dominated jobs" (Gaucher, Friesen, and Kay 2011), and found evidence that word selection affects the perception among women of their "fit" with a particular job. This research suggests that the use of words associated as masculine or feminine in job advertisements may influence a woman's decision to apply for a particular job (Gaucher et al. 2011). We extend this research by considering whether masculine or feminine words appearing on US engineering school websites describing program characteristics have an implicit gender association. We do not analyze pronouns, or other references to males directly made on website materials (e.g. he, him or serviceman), but instead examine descriptive words such as "nurture" which are coded as feminine, while words such as "aggressive" are coded as masculine. Related findings regarding broad-based implicit bias have been found regarding the association of masculine descriptors with science-related words, and feminine descriptors with humanities-related words (see also Harvard Implicit Bias test, https://implicit.harvard.edu) (Nosek, Banaji, and Greenwald 2002).

Given the documented associations between word usage and gender, we hypothesize that text in promotional materials may be a factor shaping women's decision to enroll in engineering degrees, and expect to find schools with more masculine word usage signal an organizational

culture with fewer women enrolled. We also hypothesize that particular sub-disciplines of engineering may use gendered words in unique ways, distinct from the broader university context they are embedded within, and that disciplines with more masculine word usage will have fewer women enrolled.

Using the list of gendered words compiled by Gaucher et al. (Appendix A), we systematically selected and analyzed the promotional website materials of a subset of forty engineering university programs in the United States. We computed the frequency for the list of gendered words, and supplemented these data with information about the gendered composition of the students enrolled in engineering at each university. We analyzed these correlations to determine whether schools with greater feminine words saw an increase in women enrollments. We also analyzed the data to determine whether there are differences by discipline.

Institutions and materials

We considered a sample of 40 schools out of all US institutions with undergraduate engineering programs accredited by ABET for which we had access to data on student enrollment available through the American Society for Engineering Education (ASEE) college profiles.

We also examined the results by discipline, as they can have quite different percentages of women at the undergraduate level (Yoder 2015). Disciplines vary from near-parity in Environmental (49.7%) and Biomedical (40.9%) engineering to a significant imbalance in Computer (10.9%) and Electrical (12.5%) engineering in the proportion of degrees awarded to women engineering students in 2015 (Yoder 2015).

Website pages were collected as PDF documents during the summer and fall of 2016. We collected webpages associated with ABET-accredited engineering undergraduate degree programs, and excluded pages or parts of pages associated with non-engineering programs within engineering faculties or departments (e.g. engineering technology, computer science, economics, physics, etc.). Pages were included if they included information that could persuade potential students to attend. Examples would be descriptions of the career possibilities in a field, support services and educational opportunities offered by the school, or the quality of the undergraduate education offered. Examples of excluded pages were those administrative in nature (how to apply, course lists), that referred to graduate programs or research (except undergraduate research opportunities), that described fundraising or other non-educational functions, or that described supports not specific to engineering (such as a campus-wide career service). All inclusions were subject to review by one of the authors prior to coding. Webpages associated with new programs that have no associated enrollment data yet were excluded.

Gendered words coding

The text from the collected webpages were coded by five authors (AD, HG, JV, KL, AA). Coders searched for each gendered word within the PDF documents for each school, and recorded the number of applicable occurrences of each word in an individual document. The context of the word was considered when determining inclusion. If a word was used in a technical sense (e.g. “force” in classical mechanics), it was not included in the count. On the

other hand, if a word was describing a quality of a student or students, the educational atmosphere, or the school or professional community (e.g. “force for good”), then it was included. Coders also determined the total word count for each page.

Each page was also assigned to an engineering discipline, based on the page content and the discipline categories in the ASEE college profiles. For pages related to the overall engineering school, a separate category was created.

In addition to the coded words, we collected the total number of male and female students enrolled at each school in each discipline from the 2016 ASEE college profile data, and calculated total enrollment by school and discipline as well as percentage of female students enrolled.

All data was analyzed using Stata 13.0 (StataCorp, College Station, TX). We performed two sets of analyses, one examining school-level results, and one examining results by discipline. While we performed regression analysis to identify factors that contribute to higher female enrollments within schools and disciplines, this paper relies primarily on descriptive statistics and bivariate analysis to show associations between gendered wording and enrollments.

Results

Out of 283 potential schools, we selected 40 institutions to include in the study based on 2015 ASEE data, covering a wide range of total enrollment, percent degrees awarded to women (as a proxy for female enrollment), number of engineering disciplines offered, geographical region, and public/private status (ASEE 2015). See Table 1 for final choices and final summary college data used in the study from 2016 (ASEE 2016). Note that the 2016 data for New Mexico Institute of Technology was found to be not available after we had completed collection and coding – we substituted the 2015 enrollment data for this school. The number of schools chosen in each of eight regions of the US was approximately proportional to the total engineering enrollment of all schools within that region compared to national enrollment.

In analyzing pages by discipline, certain pairs of disciplines in engineering were combined into single categories (Computer and Electrical, Civil and Environmental, Biological and Agricultural). This is because we relied on ASEE discipline categories to guide our coding, and ASEE combines these disciplines at some schools but not at others. As a result, if we examined Environmental separately, either disciplinary content from some schools would be excluded, or Civil content from these same schools (but not others) would be included under Environmental. Note that some schools may have program pages that were only administrative in nature, and therefore were not included in the pages, or in Table 2.

Due in part to how the disciplines are categorized, at the selected schools we found that Biomedical engineering has the highest concentration of women (47.3%), followed by Architectural (37.1%), and Biological/Agricultural (36.9%). At the other end, we see few women in Aerospace (13.6%), Electrical and Computer (15.6%), and Mining (15.9%), with disciplines having an average of 26.3% women undergraduates at the schools examined.

Table 1: Summary of schools included in analysis. All ASEE data (enrollment, discipline categories) from 2016 except for New Mexico Tech (2015) (ASEE 2015, 2016). Reg = Region (C = Central, E = Eastern, NE = Northeastern, S = Southern, SC = South Central, SW = Southwestern, MW = Midwestern, W = Western); No. ASEE Disc Cat = number of discipline categories (including "Other Engineering") listed in the profile; FT = Full-time, PT = Part-time, UG = undergraduate, Fem = Female.

School	Reg.	No. ASEE Disc Cat	Pub/ Priv	FT UG	% FT Fem UG	% PT UG
Arizona State University	SW	10	Public	7147	19.0	18.3
Baylor University	SC	3	Private	793	24.8	0
Boise State University	W	5	Public	1288	16.8	15.3
California Institute of Technology	W	6	Private	88	40.9	0
California State University, Fullerton	W	3	Public	2086	13.4	17.5
Clemson University	S	9	Private	4643	24.7	2.9
Colorado School of Mines	C	11	Public	3738	28.3	4.5
Florida International University	S	6	Public	1808	22.2	41.2
George Mason University	S	6	Public	2065	24.0	18.0
Georgia Institute of Technology	S	11	Public	9146	725	7.3
Grand Valley State University	MW	4	Public	1180	14.7	0
Iowa State University	MW	9	Public	7553	15.8	5.3
Lafayette College	E	5	Private	317	22.7	1.3
Massachusetts Institute of Technology	NE	8	Private	2187	46.5	1.3
Montana State University	C	6	Public	2600	17.9	7.1
New Mexico Institute of Mining & Tech.	SW	7	Public	349	15.5	4.9
North Carolina State University	S	12	Public	5306	24.1	8.7
Oklahoma State University	SC	9	Public	989	17.9	9.5
Princeton University	E	6	Private	1023	36.3	0
Roger Williams University	NE	2	Private	467	15.0	0
Texas A&M University	SC	12	Public	5844	24.1	7.6
Texas Christian University	SC	1	Private	256	26.2	2.7
The Pennsylvania State University	E	13	Public	7809	21.9	2.0
The State Univ. of New York at Binghamton	NE	5	Public	351	24.8	6.0
The University of Memphis	S	4	Public	387	21.2	14.9
The University of Texas at El Paso	SC	7	Public	2280	21.9	25.1
Union College	NE	4	Private	359	23.4	0
University of Arkansas at Little Rock	SC	2	Public	253	11.5	19.5
University of California, Berkeley	W	10	Public	3715	26.0	1.4
University of Cincinnati	MW	8	Public	3479	20.2	0
University of Connecticut	NE	9	Public	3070	25.9	2.7
University of Illinois at Urbana-Champaign	MW	13	Public	6839	20.7	0
University of Kentucky	S	8	Public	2690	20.9	7.1
University of Michigan	MW	11	Public	2093	27.3	0.4
University of Notre Dame	MW	5	Private	1087	32.0	0
University of Portland	W	4	Private	559	27.9	0
University of Saint Thomas	MW	3	Private	678	15.5	0
University of the District of Columbia	E	3	Public	339	22.1	2.2
University of Washington	W	10	Public	4740	29.1	1.9
University of Wisconsin-Madison	MW	11	Public	4355	23.6	5.6
Summary	**2-8 per Region**	**Mean 7 Disc.**	**12 Priv, 28 Pub**	**88-7809 FT UG**	**Mean 23%**	**Mean 7%**

Table 2: Summary of disciplines included in the analysis. Totals and percentages for enrollment are for departments with included webpages from 40 specific schools examined in this paper. All ASEE data (enrollment, discipline categories) from 2016 except for New Mexico Tech (2015). ASEE Disc Cat FT = discipline category used by ASEE, FT = full-time, UG = undergraduate, Fem = Female, SD = standard deviation. (ASEE 2015, 2016).

ASEE Disc Cat	Total FT UG	% Fem FT UG
Aerospace	4613	13.6
Architectural	483	37.1
Biolog/Agri	1179	36.9
Biomedical	5857	47.3
Chemical	8949	34.0
Civil/Enviro	10766	29.3
Elec/Comp	20458	15.6
Eng Phys	308	20.8
General	917	26.1
Indus/Man	6053	35.4
Mechanical	24465	16.0
Metal/Mtrls	2589	32.7
Mining	201	15.9
Nuclear	612	16.0
Other Eng	11445	26.1
Petroleum	1423	18.6
Mean (SD)	**6270 (7154)**	**26.3 (9.8)**

Results by school

1,252 total webpages were included for coding, ranging from 3 to 107 pages per school (mean 31 (SD 26)). Gendered words comprised between 0.7 and 2.8% of total words at each school (Table 3). Masculine words were generally more common than feminine words. At three schools, we found an equal number of masculine and feminine words, however the other 37 schools had more masculine than feminine words, with the largest difference being 156 more masculine words. No schools had a majority of feminine words.

Overall, there was little significant correlation between female enrollments and the percentage of gendered words on school websites. The only relationship we identified was surprising: we found a significant negative association between the percentage of feminine gendered words and number of women enrolled ($R=-0.32$, $p<.05$), suggesting that schools that have a higher proportion feminine words do not have higher percentages of women engineering students.

Table 3: Total and Gendered Words by School. Wds = words, Gend = gendered, Masc = masculine, Femin = feminine, Tot = total.

School	Total Wds	Masc Wds	Femin Wds	Total Gend Wds	% Femin/ Gend Wds	% Femin/ Tot Wds	% Gend/ Tot Wds
Arizona State University	14963	133	52	185	28.1	0.3	1.2
Baylor University	2806	15	7	22	31.8	0.2	0.8
Boise State University	8364	62	54	116	46.6	0.6	1.4
California Institute of Technology	3650	44	22	66	33.3	0.6	1.8
California State University, Fullerton	3980	40	22	62	35.5	0.6	1.6
Clemson University	26358	173	103	276	37.3	0.4	1.0
Colorado School of Mines	11380	109	40	149	26.8	0.4	1.3
Florida International University	5499	19	19	38	50.0	0.3	0.7
George Mason University	17183	98	29	127	22.8	0.2	0.7
Georgia Institute of Technology	42317	294	138	432	31.9	0.3	1.0
Grand Valley State University	5668	28	17	45	37.8	0.3	0.8
Iowa State University	27533	135	72	207	34.8	0.3	0.8
Lafayette College	3052	26	20	46	43.5	0.7	1.5
Massachusetts Institute of Technology	27957	144	85	229	37.1	0.3	0.8
Montana State University	14990	108	48	156	30.8	0.3	1.0
New Mexico Institute of Mining & Tech	6127	56	44	100	44.0	0.7	1.6
North Carolina State University	44100	311	194	505	38.4	0.4	1.1
Oklahoma State University	10918	95	41	136	30.1	0.4	1.2
Princeton University	10550	125	21	146	14.4	0.2	1.4
Roger Williams University	3879	38	11	49	22.4	0.3	1.3
Texas A&M University	23274	187	111	298	37.2	0.5	1.3
Texas Christian University	1930	11	3	14	21.4	0.2	0.7
The Pennsylvania State University	47446	304	156	460	33.9	0.3	1.0
The State University of New York at Binghamton	24221	110	71	181	39.2	0.3	0.7
The University of Memphis	3145	14	12	26	46.2	0.4	0.8
The University of Texas at El Paso	3427	64	31	95	32.6	0.9	2.8
Union College	3878	32	14	46	30.4	0.4	1.2
University of Arkansas at Little Rock	2557	12	7	19	36.8	0.3	0.7
University of California, Berkeley	10320	110	43	153	28.1	0.4	1.5
University of Cincinnati	22104	115	62	177	35.0	0.3	0.8
University of Connecticut	2666	31	9	40	22.5	0.3	1.5
University of Illinois at Urbana-Champaign	17622	143	91	234	38.9	0.5	1.3
University of Kentucky	10780	69	45	114	39.5	0.4	1.1
University of Michigan	11754	77	56	133	42.1	0.5	1.1
University of Notre Dame	15430	106	38	144	26.4	0.2	0.9
University of Portland	3674	34	9	43	20.9	0.2	1.2
University of Saint Thomas	5688	39	39	78	50.0	0.7	1.4
University of the District of Columbia	5670	43	24	67	35.8	0.4	1.2
University of Washington	11778	118	52	170	30.6	0.4	1.4
University of Wisconsin-Madison	7061	40	28	68	41.2	0.4	1.0
Mean (SD)	**13142 (11720)**	**93 (76)**	**49 (42)**	**141 (117)**	**34.2 (8.1)**	**0.4 (0.2)**	

Looking closely at the specific words chosen by schools, we found that use of gendered words is focused on a subsample of words. Twenty-five (11 masculine, 14 feminine) of the 80 words were not found in any document. Table 4 shows the most common gendered words, found at more than 35 of the 40 schools and/or more than 250 times. The top masculine word, lead*, was present at all 40 schools, and occurred at nearly double the rate of the top feminine word.

Table 4: Most frequent gendered words, by instances and number of schools.

Word	No. total instances	No. schools
Masculine		
Lead*	976	40
Analy*	479	37
Challeng*	382	38
Compet*	386	37
Objective	304	34
Active	161	36
Feminine		
Understand*	504	36
Support*	383	38
Respon*	289	36

Results by discipline

When considering results by discipline, any pages that were not specific to the disciplines were removed, including pages on the overall school, leaving 1,039 of the 1,252 total webpages.

When examined by discipline (Table 5), we see that more total words were found on pages of the more traditional and common disciplines (Electrical/Computer, Mechanical, Civil/Environmental) ($R=.82$, $p<.001$). Overall, nearly all disciplines have a majority of masculine words out of all gendered words with the exception of Architectural engineering which has a slight majority of feminine words (20 vs 19). On average disciplines have 94 more masculine words than feminine words. Environmental/Civil engineering stands out by having 244 more masculine words. There was no significant correlation between the word choice and the percent of women enrolled in a discipline.

The most common gendered words used, which were found at more than 13 of the 16 disciplines and/or were found more than 200 times, are shown in Table 6. The common words are similar to those at the school level. Five masculine words appear in all disciplines, while no feminine words appear in all disciplines (and the particular discipline that did not include the feminine word is different in each case). The disciplines data included the same 55 unique words as the schools data.

Table 5: Total and Gendered Words by Discipline Category. ASEE Disc Cat = discipline category as recorded by ASEE, Wds = words, Gend = gendered, Masc = masculine, Femin = feminine, Tot = total.

ASEE Disc Cat	Total Wds	Masc Wds	Femin Wds	Tot Gend Wds	% Femin/ Gend Wds	% Femin / Tot Wds	% Gend/ Tot Wds
Aerospace	26111	181	79	260	30.4	0.3	1.0
Architectural	4227	19	20	39	51.3	0.5	0.9
Biolog/Agri	17171	103	51	154	33.1	0.3	0.9
Biomedical	32990	223	126	349	36.1	0.4	1.1
Chemical	30935	218	122	340	35.9	0.4	1.1
Civil/Enviro	58222	451	207	658	31.5	0.4	1.1
Elec/Comp	98039	556	354	910	38.9	0.4	0.9
Eng Phys	5166	63	9	72	12.5	0.2	1.4
General	6405	36	16	52	30.8	0.2	0.8
Indus/Man	30882	266	107	373	28.7	0.3	1.2
Mechanical	64773	494	255	749	34.0	0.4	1.2
Metal/Mtrls	19249	128	83	211	39.3	0.4	1.1
Mining	2203	21	5	26	19.2	0.2	1.2
Nuclear	18215	120	68	188	36.2	0.4	1.0
Petroleum	19794	215	91	306	29.7	0.5	1.5
Other Eng	2014	19	15	34	44.1	0.7	1.7
Mean (SD)	**27275 (25567)**	**195 (167)**	**101 (95)**	**295 (260)**	**33.2 (8.7)**	**0.4 (0.1)**	**1.1 (0.2)**

Table 6: Most frequent gendered words, by instances and number of disciplines.

Word	No. total instances	No. disciplines
Masculine		
Lead*	794	16
Analy*	448	16
Challeng*	313	15
Compet*	303	16
Objective	278	16
Principle	219	16
Active	136	14
Feminine		
Understand*	468	15
Support*	282	15
Respon*	258	15
Connect*	97	14

Discussion

Overwhelmingly, schools and disciplines use masculine words to describe their programs, generating the kind of masculine institutional culture that Acker (1990) describes. The choice of words such as "leader," "competitive," and "challenging" have all been shown to signal a masculine culture (Gaucher et al. 2011), and their ubiquitous presence in promotional materials bolsters the claim that engineering programs support a masculine organizational culture. This is similar to our finding in a study of Canadian engineering school recruitment material (d'Entremont, Greer, and Lyon 2015). Universities have been under enormous pressure to rectify their gender imbalance in engineering, but it seems that few schools have extended this effort by considering how their word-choice on promotional material might be sending signals of a masculine culture to prospective students. This masculine culture may reinforce perceptions of the ideal student as male, similar to the way Ridgeway and Correll (2004) argue that organizational cultures promote a male "ideal worker." The negative relationship between feminine words and women's enrollment suggest that that there is not clear evidence that word–choice is enough to dispel perceptions of engineering as non-masculine culture. Given the ongoing discussion about the need for more women in engineering, wording in engineering recruitment materials could be targeted to undergo the kind of strategic retooling promoted by the National Academy of Engineering (Giddens et al. 2008).

A strength of this research is that it allows us to compare across disciplines, and thus to capture the effect of disciplines that are more "women friendly," both in their framing (e.g. Biomedical engineers have a professional reputation of contributing in positive ways to society) and in the number of women enrolled (e.g. Biomedical programs have a great percentage of women). Surprisingly, there is not clear evidence that women-friendly disciplines use language in ways that signal feminine-friendly institutional cultures. For instance, Civil/Environmental discipline webpages had a larger imbalance in gendered words (244 more masculine than feminine words) than any other discipline, followed closely by the much more masculine-dominated Mechanical engineering discipline (239 more masculine words), despite higher rates of degrees awarded to females in both Civil (22%) and Environmental (50%) than in Mechanical (13%) (Yoder 2015). This suggests that the percentage of women in a discipline does not impact the way an engineering program is presented to potential recruits, and that new recruits are not dissuaded from a discipline based on website word choices. We lack the ability to establish temporal order, and this is discussed more below. One take-away however is that further analysis is needed to decipher how the presentation of material on a website influences the public's understanding of a discipline, and whether discipline effects are meaningful given that many newcomers to engineering might be unaware of the discrete disciplines that have their own institutional characteristics and reputations.

As mentioned, a significant shortcoming of this data is that it does not allow us to establish temporal order, and we cannot assess whether more women are enrolled in programs after viewing gendered words on websites or whether the presence (or lack) of women in programs influence the word-choices that are made on websites. We also did not have access to data on faculty make up (i.e. number and gender at each rank) for any of the schools. This could have an impact on the culture of a department or school. In similar Canadian data, we found correlations

between percentage of female faculty and fractions of masculine and feminine words by total words (d'Entremont et al. 2015).

We acknowledge that, for the purposes of the analysis, we have treated gender as a binary variable – an approach that can overlook the complexity and fluidity of gender as experienced and negotiated by individuals. We also acknowledge that the posting of educational objectives ("Objective") and student outcomes (including "analyze" ("Analy*")) on school and departmental webpages as part of ABET accreditation explains part of the high frequency of those words and part of their presence at so many schools. However, these words may still influence potential students regardless of the reasons for their inclusion. The words list emerged from research on job advertisements, not university recruitment material, although data was included from undergraduate co-op and professional job postings for engineering; future study of the specific words used in an educational context would be beneficial, particularly a direct comparison of words used in disciplines with high and low female enrollments. Finally, we are not able to consider how actual potential students engage with the promotional web materials in the engineering education context. Qualitative work considering how individuals view and interpret engineering program materials is needed to fill this gap. Nevertheless, we have identified and systematically analyzed the web content that the majority of potential applicants to each school would have seen.

Conclusion

Overall, we found a majority of masculine words in most schools and disciplines, including by number of unique gendered words used, by frequency of particular word use, and by number of institutions or disciplines using them. We found a weak negative association between the proportion of gendered words that are feminine and the proportion of women enrolled. We found that there is not a clear association between gendered wording and women's enrollment in engineering disciplines. The preponderance of masculine words may be associated with a masculine culture in engineering education. Further work is needed to determine the impact, if any, of the abundance of masculine words on individuals' interpretation of these materials and their subsequent expectations about engineering programs.

Acknowledgments

We would like to thank Kirsten Mendonca and Siqi Xiao for their work in compiling the website captures and ASEE data, and the UBC Arts Work Learn International Undergraduate Research Award for funding support.

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Appendix A: List of gendered words

The full list of gendered words from the work of Gaucher (2011) is presented below (Table 5). Note that the asterisk (*) indicates a wildcard; any ending was included in the coding (e.g. "child*" includes child, childhood, children, etc.).

Table 5: Gendered word list from Gaucher et al.

MASCULINE		FEMININE	
Active	Hierarch*	Affectionate	Loyal*
Adventurous	Hostil*	Child*	Modesty
Aggress*	Implusive	Cheer*	Nag
Ambitio*	Independen*	Commit*	Nurtur*
Analy*	Individual*	Communal	Pleasant*
Assert*	Intellect*	Compassion*	Polite
Athlet*	Lead*	Connect*	Quiet*
Autonom*	Logic	Considerate	Respon*
Boast*	Masculine	Cooperat*	Sensitiv*
Challeng*	Objective	Depend*	Submissive
Compet*	Opinion	Emotiona*	Support*
Confident	Outspoken	Empath*	Sympath*
Courag*	Persist	Feminine	Tender*
Decide	Principle*	Flatterable	Together*
Decisive	Reckless	Gentle	Trust*
Decision*	Stubborn	Honest	Understand*
Determin*	Superior	Interdependen*	Warm*
Domina*	Self-confiden*	Interpersona*	Whin*
Force*	Self-sufficien*	Kind	Yield*
Greedy	Self-relian*	Kinship	
Headstrong			