International Journal of Engineering Education Vol. 35, No. 4, pp. 1194–1205, 2019
Printed in Great Britain

0949-149X/91 $3.00+0.00

Exploring the Hidden Curriculum of Gender in Engineering Education: A Case of an Engineering Faculty in Turkey*

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This study explores the hidden curriculum of gender in engineering by focusing on an engineering faculty as an example in Turkey. Numerical existence of women engineers in Turkey, do not represent for qualitative information about gendered culture of this profession. Participants in this study, reported to face with gendered expectations, jokes, ignorance, and exclusion from social networks throughout university education. Mentioned conditions in engineering education are examined, where not only students but also faculty members learn to not notice the production and reproduction of gender differences in engineering education. The engineering faculty is thus perceived as an environment in which to learn how to become an engineer in the sense that the graduate will both fulfill the academic requirements and adopt the gendered social roles learned in engineering education. The findings of this research revealed that women experience several disadvantages because institutional structures value certain roles while individuals in engineering education learn to ignore the presence of such perceptions that tend to favor the dominant ideal types.

Keywords: gender; hidden curriculum; higher education; engineering; Turkey

1. Introduction

While studying at a technical university where the engineering faculty and its impact on the university were both of great significance, I heard many jokes about the rarity of women in engineering. One of the most encountered jokes about female students in the engineering faculty was that they had mustaches. It was a common joke used within that faculty to mock female students who were hardworking and did not care about their appearances. In fact, female engineering students do not literally grow mustaches, the description has two symbolic meanings. First, it is believed to symbolize masculine competence in the Turkish culture. Second, it is used to refer to disheveled female engineering students [1].

Symbolic meanings hidden in aforementioned joke imply an unwelcoming atmosphere for women in engineering. The limited participation of women in natural science and engineering related fields has been a starting point for many pieces of research to understand the unwelcoming environments. Previous literature on the subject matter reveals that multiple burdens for women engineers do exist in engineering education and professional life as a whole [2–4]. These troubles in engineering cannot be seen from the statistics. So, the question concerning the gender and engineering is not only about women's limited participation. The problem has other dimensions that are hidden in historical formations, daily expressions, prejudices and in interaction styles. It comes from the way genders are learned; it is because of the gendered social structure we internalize. Thereby, this study explores the hidden curriculum of gender in an engineering faculty in Turkey. It is argued that university education reproduce social relations that are necessary to maintain behaviors appropriate for competition, evaluation, hierarchical division of labor, and bureaucratic authority through formal and hidden curricula [5].

Eric Margolis [5] explained that the hidden curriculum in higher education cannot be seen unless the investigator opens every door, until every corner of the educational sphere is investigated. He noted that some of the curriculum is hidden precisely by "a social agreement not to see" [5:2]. Many kinds of intentional forms of stratification are covert. Subordination, discrimination, and a hierarchy that benefits some at the expense of others are recognizable. However, the place from which the power is unintentionally exercised is "a hidden place" [4:9].

Previous research indicate that students learn the codes of masculine culture of engineering at the undergraduate level [6:38, 7]. It is argued that university education emphasizes competence in math and engineering theory but the workplace is oriented towards application and requires hands-on skills. Thus, university education fails to compensate for each student's lack of mechanical experience although it is the most demanded skill in the work life. This difference leads to different cultural codes in different periods of engineers' lives. University education might be rewarding for most of the students regardless of gender since academic performance plays a significant role. The definition of a

* Accepted 20 April 2019.

'good engineer' emphasizes academic over technical skills but it still is defined by the culture that prevails at the department [1]. At the university, dominant group in number shapes the codes of the culture [8]. This culture becomes more visible in the way male students get more credit at practical courses, internships, social interactions and as they create formal and informal male social networks [9].

On the basis of these, this research aims to understand gender as a hidden curriculum in engineering departments, where not only students but also faculty members learn "not to notice" [5:156] the gendered discourse and practices in education life. The engineering faculty is taken as an environment in which to learn how to become an engineer in the sense that the graduate will both fulfill the academic requirements and perpetuate the social roles learned in engineering education. Thereby, the backbone of this reseach is based on two main questions:

In what ways gender as a hidden curriculum manifest itself in engineering faculty?

The concept of gender as a hidden curriculum is taken as a composition of social definitions about engineering, their impact on engineers' own perceptions which usually manifest in thoughts and expectations about ideal definitions concerning engineering profession. By exploring the answer of this question, this study is also looking for definition(s) of ideal engineer, ideal engineering work according to participants. These definitions [1] are argued to be based on three components: one's relation and competence towards technology, one's ability to achieve organizational power through engineering knowledge and finally, styles of interaction, which is argued to be masculine and unfriendly to women and other masculinities that do not suit mentioned idealized forms.

Second main question of this study is:

How does gender as a hidden curriculum affect women and men differently?

The answer of this question lies beneath the overt and covert deeds, instances, stories, jokes and silences that benefit men more than women in engineering education. University life for an engineering student is perceived as a place that codes of gendered culture is first seeded via masculine jargon of talk and gesture jokes, about nominal scarcity of women and their appearance. Having provided possibilities for women to raise their voices within the university, universities face the risk of offering symbolic benefits rather than the real ones and have certainly underestimated the ability of education in the reproduction of conventional gender identities [10]. Without addressing the details of daily life oppression, university culture and the aspects hidden in it cannot be understood. Therefore, targeted equity becomes difficult to achieve.

This research will shed light on the missing qualitative knowledge about daily life practices of gender inequality in engineering education in Turkey. To do this, a dataset derived from 16 in-depth interviews with 8 engineering faculty members and 8 students from the same faculty is analyzed. The first two sections of this paper summarize the main conclusions of the research concerning women in engineering and the feminist critique addressing the hidden curriculum within engineering education. The section on methodology will explain the research process and the profile of the participants. Finally, in light of the first two sections, the dataset is examined for evidence on the hidden curriculum of gender in the engineering faculty, looking first at narratives of faculty members and then at those of engineering students. This paper also discusses paradoxes in engineering education by considering the groups in play and aims to suggest future work to achieve a change in gender relations in engineering.

2. Women in engineering

The limited participation of women in the natural sciences and in engineering has been a scholarly concern for many years. The main results of studies conducted regarding the field can be summarized in four areas. First, women in engineering are underrepresented. International data suggest that women now constitute over 20% of the student body in engineering and natural science subjects across Europe and in the industrialized world. Even though the overall number of female students is now higher that of male students in higher education in industrialized countries, this unequal representation has proven stagnant in the field of engineering since 2012 [9].

Second, women leave engineering majors at higher rates than men. The high rates of female drop-outs from engineering majors [11] and stereotypes that girls and women are bad at math and science are obvious in the literature [12]. Although women who major in engineering may not fit the stereotype, they are quite familiar with it. Rinehart and Watson [6] found that women in engineering were more likely than men to sense discriminatory behavior by their professors, and those who express higher levels of anxiety about gender stereotypes have significantly higher odds of leaving engineering majors [11].

Third, women experience downward mobility over time in engineering careers [13]. Women's numerical gains have not automatically translated into workplace change. Women express their anxi-

eties in terms of other women's difficulties in balancing families and academic careers or in speculating about their future roles as mothers. This approach reflects gendered divisions of labor at home and also an acute awareness of the inhospitable climate in engineering and academia [13].

Similarly in Turkey, Zengin [14] examined the gendered distribution of students in engineering departments. She stated that female students accounted for 25% of enrollment in engineering departments in Turkey in 1998. However, taking a closer look, the distribution of female students in engineering departments does not seem to be even: they are more significantly represented in some departments than others. Areas that can be described as ''masculine'' engineering departments and ''feminine'' engineering departments have been formed and the decisions of female and male students in their choices of departments have been affected by this configuration.

The university as a gendered organization also emerged as a main theme in the literature. Gendered organization theory brings a focus to women's and men's working relationships in university settings [15] and how gendered divisions of labor play out as women and men ''do gender'' through interactions with others [2]. Institutions such as higher education have intersecting work processes taking place in multiple and varied sites; therefore, this study focuses on the experiences of individuals in an engineering faculty that are crucial to understanding gendered circumstances hidden in everyday practices [12].

This research takes an engineering faculty as a case study, because of its male-dominated environment and masculine organizational structure. The engineering faculty is thereby used here as an example in which women experience several disadvantages because institutional structures value certain roles and hold certain perceptions that tend to favor the dominant culture through a hidden curriculum of gender in the faculty.

3. Theorizing gender and engineering: feminist critiques addressing the hidden curriculum

Feminist intervention in science and technology studies asserts that technologies are shaped by social circumstances and play a significant role in the shaping of social relations in return [16]. From this perspective, women have been excluded from the social and economic opportunity to become producers of valuable technologies. In addition, machinery, the engine of capitalist production, has not offered equal opportunities for men and women [17]. Technology-oriented jobs such as engineering were accepted as male professions because the dynamics were based on masculine tradition and empowered by capitalist relations.

The link between masculinity and engineering was investigated in many studies. One common argument is that toughness, technical competence, hands-on ability, and the ability to bear hard and dirty working conditions are typical masculine traits [17, 19]. Cockburn's works [18] highlight the relationship between engineers as the bearers of technology and the occupation's masculine structure. According to Cockburn, historically, women have not failed to enter technology; rather, they have been refused. In this view, technology is a medium of power, a kind of power that performs at the intersection of capitalist relations and patriarchal relations [18]. Engineering thus represents everything that is defined as manly: the control and manipulation of nature, the celebration of physical strength and machine in action, and the tolerance and pleasure of dirt, grease, physical risk, heavy work, accidents, and injuries [18:129].

There are very limited studies concerning gender and engineering in Turkey. These studies were conducted particularly in the 2000s and consider women's underrepresentation in engineering occupations and their coping strategies. It is noted by many authors that Turkey has been successful over the past 75 years in moving from being a society with no female participation in engineering to relatively higher participation than in the United States or Europe [8], yet many of these studies also highlighted the discrimination that women face in male-dominated occupations [19].

In regard to engineering education, Smith and Dengiz [19] conducted the largest cross-sectional study of women in engineering with 800 participants. In focus groups, women cited their mathematical and technical ability and the influence of relatives and teachers as factors in their career selection. Prestige and income were also cited as important motivating factors. While these female university students felt that their male peers and their professors were not biased against them, they nevertheless perceived a difference in opportunities and a lack of role models. According to the authors, in Turkey, there has been a tendency for female engineering students with PhD degrees to prefer academic careers. Those in industry or government reported differences in the types of tasks that are assigned to women. In this framework, men are involved in positions with potential for advancement, while women work in supporting jobs (quality control, analysis.) [19:56].

The academic labor market reflects a similar division of labor based on ideology of masculinity and femininity, with a ''casualised, feminised, mar-

ginal workforce servicing the hard core of tenured, largely male, academic workers and researchers'' [20:433]. Studies of this issue show that, in terms of academic careers, women dominate among the casual research and teaching staff. They have limited access to professional development and are usually recruited to lower positions than males. Male faculty members are more likely to access research income through consultancies [20].

Universities perceive diversity as an individual issue that can be simply solved by making the right academic choices and by hard work [1]. Such a notion of managing diversity ignores the power relations between individuals and within structures. It fails to question the material conditions creating and manifesting the patriarchal ideology behind certain privileges. Engineering education, the distribution of tasks, and the organization of the work have gendered patterns as well as people's gendered embodiments that make up this profession. Socially, engineering is constructed to be more appropriate for men [1], through which gender stereotypes are reproduced by upholding ideals and qualities such as physical strength, physical size, a determined attitude, or a leading and protective capacity.

It is also a fact that female students, gays, lesbians, and non-mainstream masculinities do exist in the engineering field and in engineering education. These multiplicities provide an arena and data source for further studies, where there is constant negotiation of meanings. Thus, stereotypes and prejudices can be challenged, and alternative interpretations of gender can be possible. On this basis, the purpose of this paper is to explore the hidden structures of gender in engineering faculties in Turkey by relying on students' and faculty members' own narratives about engineering education.

4. Methods

Gender is one of the narratives we hear from the moment we are born, and it never falls silent. It categorizes and expects certain behaviors; we internalize the suggested roles. Who we are depends on how much we believe in what society tells us. The critical position of feminist research shakes the gendered narratives of society. Feminist methodology challenges traditional epistemologies that systematically ignore women in the name of objectivity and essential truth. According to this criticism, although science is historically presented as value-neutral and objective, all research is ideological since no one can be separated from their values, opinions, and the relations we are grown within.

For the course of this study, feminist standpoint is deployed and a critical position is taken regarding claims of objective knowledge, which ''implies partial, personal, intuitive knowledge that comes from the consciousness of a knowing subject situated in a specific social context'' [21]. Such alternative knowledge is personal and grounded in participants' experiences, ideas, and words about themselves to produce useful knowledge for political change. Obviously, this does not mean that there are no rules for validity; relativism in that sense would inhibit feminism from connecting experiences and gendered lives, which is the basis for emancipatory political action [22].

As criticized by feminist methodologies, the subjective positions of researchers and narrators expose the significance of subjectivity within sociological inquiry. Subjectivity is crucial because individuals should be assumed to be the elements of the social sphere who affect and are affected by society in return. In addition, the researcher's situated understanding and his or her interactional style during the research process, in which the two sides of an interview are both active participants, augments the richness of feminist methodology. That is why this paper aims to present the subjective stories of engineers in order to examine their experiences.

4.1 Introduction of the sample

The dataset of this study is derived from in-depth interviews with 8 engineering students and 8 engineering faculty members in Turkey. In order to obtain a deeper understanding of participants' narratives, I chose to conduct in-depth interviews. In-depth interviews work well with the aim of this study since the unplanned exchange within the interview provides possibilities of creating insights with the interviewee as the respondent tells her own story in her own words [22]. It is also worthwhile to apply an interactional research process in which the two sides of the interview are active participants. On the basis of these points, semi-structured interviews with faculty members and students constitute the main type of source in this study.

The respondents were reached through a snowballing sampling technique and the purposefully chosen participants were members of various engineering fields. In this way, I tried to reach both ''feminine'' and ''masculine'' engineering departments [14]. Despite varying ratios, engineering departments in Turkey are mostly populated by men. Masculine departments are male-populated while feminine departments [14] have more female faculty members. The student distribution in these departments shows similar patterns. The respondents of this study were thus purposefully chosen from a variety of engineering departments. Faculty members were chosen from among those with

Table 1. Profile of Participants

	Gender	Age	Department	Grade	Title
Student					
P1	Woman	20	Mechanical Engineering	3	
P2	Woman	19	Computer Engineering	2	
P3	Man	22	Civil Engineering	4	
P4	Man	23	Mechanical Engineering	4	
P5	Woman	20	Computer Engineering	3	
P6	Man	18	Mechanical Engineering	2	
P7	Woman	23	Engineering Sciences	4	
P8	Man	20	Civil Engineering	3	
Faculty Member					
P9	Man	29	Engineering Sciences		Assiss. Prof.
P10	Man	37	Computer Engineering		Assiss. Prof.
P11	Woman	42	Computer Engineering		Assoc. Prof.
P12	Man	50	Mechanical Engineering		Prof. Dr.
P13	Woman	52	Civil Engineering		Instructor, PhD
P14	Woman	57	Mechanical Engineering		Prof. Dr.
P15	Man	40	Engineering Sciences		Assoc. Prof.
P16	Man	38	Computer Engineering		Assiss. Prof.

tenure-track positions. Students who participated in this study came from different levels of engineering education; they were not purposefully chosen in this regard. The interviews carried out in Ankara, usually at participants' departments, in cafes or at the faculty members' offices. Interviews started with demographic questions, followed by questions about respondents' experiences. The transcriptions and the fieldwork notes constituted the main data set of this study. For the secrecy of participant identities, they are named from P1 to P16 referring to participant and her/his order in interviews.

4.2 Data analysis

Grounded theory [22] was deployed as a research method, aiming an iterative process in which I defined core theoretical concepts and themes through interpretation of the data. In this process, I tended to create linkages between the theoretical core and the data I collected, so that I could create a meaningful abstraction level without losing the systematic conceptualization of the data. After reaching a consensus on the categories of existing data, I prepared interpretation material to deciding under which narrative the emerging themes and categories fell.

With respect to studies concerning gender and engineering, the gendered aspects of organizational culture can be best traced through the examples of practices and modes of thought that effectively constitute a ''hidden curriculum'' [5] in which women and other people with mismatched profiles are perceived as ''not-engineers'', and in which the exploitation of others, and the failure to notice the exploitation of others, is normative. This hidden curriculum lies in the rituals of day-to-day conformity: the forms of talk, gendered interaction styles, topics of conversation, humor and social networks, and modes of dress that signal one's belief in one's own cultural baggage [23].

As mentioned before, there are very few studies covering engineers' experiences in Turkey. The existing literature approaches the issue from the perspective of women's work, because there is a common tendency to assume that we know all about masculinity. On the other hand, studies that analyze the masculine culture among engineers have asserted that the common type of masculinity in engineering might be oppressive for some male engineers as well [24:6].

5. Results

In this study, I aim to explore gender as a hidden curriculum in engineering education and its effects on male and female participants. The female engineers in this study come mainly from middle class families with regard to their parents' occupations. Fathers were mostly white-collar workers; mothers comprised teachers and housewives. The working class families had more male engineers among the fathers, while the mothers were again distributed among teachers and housewives.

Interviews were interpreted with regard to the respondents' professional perceptions and expectations, the reactions they received from society, and their educational experiences. It was reported that gendered jokes and phrases, and stories about the scarcity of women in engineering departments, were heard at least once by everyone. On the basis of the findings, it can be argued that university environment abundant for the creation of social relations to

maintain behaviors appropriate for competition and division of labor [25] in engineering with respect to traditional gender structure in Turkey.

To properly answer the research questions of this research, I focused on the styles of interaction, masculine jargon of talk and gesture jokes, about limited participation of women and their appearance are examined as factors supporting gender as a hidden curriculum in engineering education. Finally, definition(s) of ideal engineer, ideal engineering work according to participants. I asked participants' relations to technology, their self-perception about competence of technology, participants' and the faculty's attitude towards practical courses and internships to acquire more hands-on knowledge about engineering practice.

Overall, most participants indicated that they were treated equally during their education, but some narratives in this study confirm other researchers' findings that women feel insecure in a male-dominant environment because engineering training carries a men-only image [2]. In this sense, women have to struggle with burdens that are rarely shared by their male classmates. This contradiction suggests that some people learn not to notice the circumstances that create differences between women and men.

5.1 Manifested in the silence of faculty members

Participants of this study recounted several stories about their lives in their departments. Some female participants took the gendered atmosphere seriously and tried to fight against it, while others argued they intentionally ignore it as a survival strategy. The gender curriculum was manifested through daily performances, such as faculty members' ignorance of gender in class. This act was perceived as a gender-neutral behavior; however, ''neutrality of gender'' referred only to men [5:161].

Whether a faculty member or a student, the men and women participating in this study differed in their perceptions of attitudes in classes. Male students mentioned that they did not notice gendered behavior from faculty members. On the other hand, female students and faculty members both indicated that gender was an aspect in their relations with faculty members.

Male faculty members told they thought their behavior was equal towards all students. Female professors, on the other hand, insisted that when they were students, they also experienced silence or ignorance.

> They [the faculty members] act as if there are no women in the class. Actually, it is bad because ignoring people does not mean that they do not exist. (P5, female, student, computer engineering)

Silence about gender is one way to maintain hierarchies, which falls outside of the recognition system [5:161]. Faculty members might think they behave positively by remaining silent about gender; they might even think they do it in the name of equity. However, by being silent, professors not only ignore female students but also sustain the existing status quo between the genders.

Silence might also lead to the feeling of not being taken seriously for some students. Another participant argued she felt that female students are not taken seriously, she added female engineers might feel the same hostility.

> Some professor comes to class and says 'good morning, gentlemen''. (P7, female, student, engineering sciences)

This example shows how professors' language is determined by gender. Mentioned speech act not only symbolizes the gendered expectations for the class composition in an engineering faculty but also it harbors above mentioned silence towards genders other than ''gentlemen''. Gender-marked terms, such as calling all students ''gentlemen'' occur in an atmosphere in which women are expected to be men's supplement. By not seeing women, the culture maintains the status quo. Seeing women students' existence but not addressing them might be an unconscious act. However, the act unintentionally also refers to a gender image on the ideal level.

A senior student in mechanical engineering indicated that, on some occasions, the attitudes of male faculty members might be hostile or even sexist.

> P1: Another professor, thermo class. I was so into the subject. I was working hard, trying to answer all his questions. He ignored me all the time. A guy sits next to me. He [the professor] hears his voice, not mine. He would not answer my questions. At last I shouted my question to him. With his answer, he humiliated me, and how! He said that if I was asking that question, I have to be an idiot, something along those lines. Later, next course, he gave the answer to my question without directly mentioning that I asked it. My question was actually relevant; I do not know why he did what he did. Was it because I am a woman, or was he a bad person? I do not know. . .
>
> E: How did you feel about it?
>
> P1: I did not go to the class again. However, I passed the course without attending the class. (P1, female, student, mechanical engineering)

The above example of one individual is a powerful instance of how a young engineering student can be affected by her professor's negative attitude. It is not certain whether the mentioned professor had a sexist attitude, but the incident negatively affected the participant's feelings about the course.

Feeling left out was only mentioned by female participants in this study. Also, women do not share the same burdens as their male classmates. Engi-

neering has a demanding curriculum for all students, but female students must also cope with feelings of being left out and not being taken seriously.

5.2 Gendered composition of engineering departments and the production sector in turkey

The distribution of the number of female professors among contemporary engineering faculties in Turkey is parallel to the student distribution in engineering departments, which is almost 30%. However, women are not equally distributed into engineering departments. [14]. Namely, masculine departments remain masculine in terms of faculty members/students, while the feminine departments employ more female professors/students.

> There are 23 men, 9 women faculty members in our department. I think women and men have the same chances; however, women have to deal with the responsibilities at home. They can be more proactive if they are encouraged. (P10, male, faculty member, computer engineering)

Female participants stated the existence of women as faculty members as a factor to encourage them. However, it was also mentioned that male professors are usually fonder of male students in engineering because it is thought that industrial work is more appropriate for men.

> I always wanted to work in the production sector. In my second year, I have already heard that women cannot work in production department, or stuff like that. (P1, female, student, mechanical engineering)

Mentioned perception has several roots peculiar to structure of Turkey's production sector. First, the labor market demands male engineers, with employers preferring to recruit men rather than women because production is sector mainly constituted of blue collar workers. The composition of blue collar workers working in industrial districts and also in the factories in Turkey is male [26]. It is argued in another study that employers' think women might have difficulties building authority towards male workers and they have to prove their professional competence to the blue collar workers. That is why, men engineers are preferred as authority figures at the workplace since they manage to "speak the same language" with blue collar workers. [1]. Though structurally determined by the production sector, female students argued that they feel professors or the department itself does not accept them as fellow students or new-generation engineers [27]. Mentioned approach mainly manifests itself in the internship processes.

5.3 Hidden in the internship process

All engineering majors must complete a one-time internship during their undergraduate education in Turkey. Both women and men participating in this study mentioned that internship and to be accepted for internship, can be a burden for female engineering students. First, because it might require field work under difficult conditions and also stereotypical prejudices block women students to apply certain internship positions.

> In people's mind, the engineer has gender. Because, you know, most of the work takes place in industrial districts. It is difficult for a woman to work there. For instance, I did my internship in OSTİM[1]. I was the only woman apart from the secretary. It was a small factory. Like a workshop. It was strange. There was no ladies' room. (P11, female, faculty member, computer engineering)

Participants noted that they had a hard time adapting to the internship environment. Not only female but also male students mentioned that the conditions in industrial districts are not designed with women in mind. The possibility of a woman's existence as an engineer or a blue-collar worker has never been considered.

> I worked for two years in an industrial district before I got into university. I worked as a technician. I saw only one woman. She was the caterer. It is so difficult for a woman engineer to have a job in OSTİM. Workers and other people would not accept her existence. (P8, male, student, civil engineering)

Recalling their internships, all students and faculty members highlighted that the relationship between a female engineer and a male blue-collar worker is a difficult one. Blue-collar workers do not accept the authority of women in superior positions; women have to prove their ability and knowledge before they can gain acceptance or even respect from their co-workers.

> P1: We were two trainees at the factory. Life was hard. At the beginning, the workers and other engineers behaved as if I could not do anything. They told me to stay aside, did not give me work. After some time, we got used to each other.
>
> E: How did you accomplish that?
>
> P1: Yeah, there was an incident where I had to prove myself. The lunch was eaten in another building. We had trucks to take us there. Every time, they told me to take the front seat because I am a woman. I was actually afraid of the height, but just to prove myself, I climbed into the truck and traveled with them. (P1, female, student, mechanical engineering)

As indicated here, female engineering students were worried about not the physical conditions but rather the stereotypes. Confirmed by a study by Beasley and Fisher [11], women in engineering are more likely to sense the discriminatory behavior and express higher levels of stereotype anxiety than men.

[1] Industrial district in Ankara.

Social expectations and distinctions attributed to genders determine the ideal definitions of professions like engineering. A faculty member indicated that she also had a rough time during her internship in a construction yard.

> I did my internship in a construction yard. It was hard, but it was hard for everyone, not only for women. I never thought that the fundamental problem about engineering was the physical conditions. The fundamental problem is stereotypes. (P13, woman, faculty member, civil engineering)

The relationship between masculinity lies behind prejudices such as women are not technically competent or they cannot bear hard working conditions Cockburn, [17]. Since women are believed to be fragile and emotional, work environments such as industrial districts do not welcome them, neither on the discursive level nor within their spatial organization. This ideological dualism also leads to a segregation between genders in engineering work. It causes a division of labor within which female students might remain disadvantaged.

Looking back on the previous section regarding assertions that engineering education is equal for all, we can also note that some students learn to ignore the realities of women's survival. Such acts further reinforce the existing social relations.

5.4 Distribution of courses and tasks

The participants noted a stereotypical idea about women is that they do not want to participate in practical courses such as field work, and this very idea is perpetuated by fellow male students, faculty members, and some female engineers themselves, who do not really want to participate. As it is mentioned before by the participants that male professors in particular, held strict prejudices against female students. These prejudices are usually based on the belief that female students do not want to take part in practical courses such as labs and field work.

Confirming this idea, female participants told that they were reluctant to take part in the field. Many other participants criticized this aversion on the part of women, arguing that going into the field is a part of the profession that needs to be handled if a person claims to be an engineer.

> I did not prefer field work. I am irritated by dirty places. I was not comfortable when I took a field trip. When I told this to the professor, it was like I was evading. I mean, my university life went like this. (P7 student, female, engineering sciences)

The reluctance to participate in the field creates a division between professors and students. This might be a reason for the prejudice against female engineers, and it is also the most common excuse for not letting them into the field in the first place. Participant P7 stated that she does not think about working in the field for her future career; she internally accepts the field as men's work. She plans to work in an office environment. P7's perspective was common among some participants.

> We have courses related to production. There are tasks like revolving, welding. . . .You need to cooperate with blue-collar workers. If you are a woman, they say, "let me do it", "you can wait on the side", "watch me do it". (P1, female, student, mechanical engineering)

According to Cockburn [18], engineering represents everything that is defined as manly; celebration of physical strength, pleasure of dirt and risk. A study conducted in Turkey by Smith & Dengiz [19] indicates that engineering careers reported differences in the types of tasks assigned to men and women. Men are involved more into production and research & development; in positions with potential for promotion. While women work in supporting jobs mainly conducted in the office environment such as quality control, organization and analysis. Similarly, this study shows that even when the female students did participate in field work, they were given jobs related to organization or quality assurance. Another participant, already cited above, indicated that some situations discourage female students from participating in practical courses. On the other hand, male participants told that they might find conditions in the field disturbing themselves, but they noted that it is nothing to be mentioned because it is the nature of their profession.

> P5: I was very afraid of welding because I am even afraid of lighting a candle. The worker told me that I could pass on it if I was afraid. Then I did it, just to show that I could. There was a male student who was also afraid but no one suggested that he could stand aside.
>
> E: He was special, you know, because he openly said that he was afraid. It is not easy [for men] to do that. (P5, female, student, computer engineering)

This example demonstrates the complexity of relationships in terms of gender and technical ability. First, even though P5 was afraid, she wanted to show the worker that she could accomplish the given task, so she hid her feelings. The example also shows that it is more difficult for men to discuss their feelings regarding such tasks. Expressing one's fear is accepted as a particularly serious weakness for men. In that sense, gender dynamics might be constraining for male students as well as for females.

On the basis of these reports from engineers, it can be argued that factors like gendered stereotypes, ideological expectations about men and women, and prejudices create a gendered structure in the

engineering faculty. Normative practices of valuing certain courses and tasks are consolidated into an ideal image of a professional. To rank practical engineering work as the most valued act of the profession motivates women only to the extent that they are willing to accept the masculine definitions of engineering. Such definitions are unspoken and hidden, yet they are the best-known rules of the engineering faculty.

5.5 Gender roles hidden in engineering education

The engineering faculty is asserted to be a place where all students share a common situation of powerlessness [28]. They need to cope with the difficulties of engineering education. At the same time, they know they must cooperate. Still, narratives indicate the existence of stereotypes about gender structures in the engineering faculty, which lead to the reproduction of gendered identities.

Female participants told that they usually earn better grades than their male classmates. They also form larger study groups than the male students do. In both cases, female students were welcomed since they are thought to be more organized than their male peers.

Social relations in I think the degree of masculinity in mechanical engineering and computer engineering is not the same. It is related to the department's gender composition. In my previous university, for instance, there were more female faculty members when I was a student. Then I switched to another university for my PhD but I was the only female PhD student. I was alone. There were no women professors, so the environment was quite different. It was more masculine. (P13, female, faculty member, civil engineering) the department were described as a combination of education-related and leisure time activities. Becoming studying buddies and exchanging course notes were mentioned as education-related activities. Leisure activities are an extension of studying, basically spending time together while studying or becoming drinking buddies. The gender composition of departments was not mentioned as an obstacle for spending educational and leisure time together by most female and male engineers.

> Men see us as note takers. We are the ones who follow all the lectures and take notes. When exam time comes, men come to us and beg for the notes. (P1, female, student, mechanical engineering)

It is interesting to observe that female students play the role of the caretaker, even in the faculty environment. Taken-for-granted gender roles make this division of labor obvious for both men and women. In the organization of the classroom, women are the note takers; their role is to organize and prepare the needed notes, just as they prepare meals for their households.

Regarding engineering education, Zengin [14: 407] states that although women deny the existence of discrimination during their education, "covert forms of discrimination still occur in the educational institutions of Turkey, such as the tendency to guide female graduate students into those fields of engineering which are viewed as more convenient for women, jokes made by the professors about women's incompetence in engineering and the marginalizing attitudes of male classmates towards female students".

In order to get along with classmates, a female engineer is required to fit into a pre-assigned role that is suited to cultural stereotypes.

> The first image when you tell your profession to a person is masculine. Last week we were on vacation and I ran into a former graduate of my department. We had a small chat. She told me that she works at a factory in the production department. First thing I thought was "Yeah, but she is a girl! In the production department!" I was really surprised because she was doing real engineering stuff. (P9, male, faculty member, engineering sciences)

The findings of my study showed that female engineering students felt lonely and needed to adapt to the masculine environment in many ways. Adaptation includes familiarity with the language used, masculine behavior, clothing, and leisure activities. Although women confronted these dilemmas, men, as they learned not to notice, did not refer to these circumstances as women did.

It can be argued that if these reactions are mainly coded in the faculty environment, they become norms of that place's culture. Thus, some will consistently avoid this environment. As mentioned in the previous section, female students in masculine engineering departments are already classified by jokes and gendered implications. Therefore, one choice for women students is to adopt one of the categorized identities. Some behave with reserve while some others try to fit in, whether they really like the departmental culture or not.

5.6 Manifested by jokes and daily interaction styles

The most innocent jokes might be a form of exclusion for women and minorities in engineering education. Daily interactions provide a way to hide masculine features and maintain the status quo through the language used. The female participants of this study, regardless of age, are usually irritated by such jokes; however, they do not react, because they think they should get used to them as they are a part of the faculty's culture. Jokes in the engineering faculty mostly insult women's appearances and mock their under-representation.

One of the best-known examples often mentioned by participants is that there are "250 grams of women for every man in the engineering faculty". This joke recognizes that there are relatively few women in engineering, but it also speaks of women in an insulting way, as if they are not human beings.

> When I first got to the department, I took a course from a very sexist guy. He made a joke in the first class, which is why I withdrew from the course. He said, "Girls! Beware, we are not drilling [cheese] in this department". (P11, female, faculty member, computer engineering)

Faculty-based jokes sometimes address women, and some are told by faculty members. Each type of joke reflects different characteristics and kinds of relationships. Jokes about women serve to maintain solidarity between male peers. They also create an atmosphere in which women cannot behave freely and are always controlled by the threat of mockery.

One of the most frequently encountered jokes about female students in the engineering faculty is that they have a *mustache* [1]. This common saying about mustaches was first mentioned by one of the female participants and I later heard the same expression from others. I learned that this is a joke within the engineering faculty, used to mock female students who are hardworking and do not care about their appearances.

Female engineering students do not literally grow mustaches, but this expression has two symbolic meanings. First, it is believed that it symbolizes masculine competence. Second, it is used to refer to disheveled female engineering students.

To begin with, "mustache" is important for men in Turkey. It is thought that having a mustache shows manliness. It symbolizes competence and strength in Turkish culture. Being physically able to grow a mustache is seen as a step towards becoming a man. In this case, a woman can only be an engineering student if she has a mustache. This has two sub-meanings. The first is that these women should be extraordinary in order to deal with men's work. They are thus neither men nor women; rather, they are perceived as something in between: women with a complementary male part. The idea of the mustache completes these women in the eyes of men.

The second sub-meaning is that since women are thought to be incompetent in mathematics and analytical thinking, a woman can only be a successful engineering student if she has masculine features. In that sense, having a mustache means that the woman is man-like; she can manage a man's work. Moreover, she is seen differently from her mainstream female counterparts, who are thought to be naive and not technically minded.

In addition, "woman with a mustache" is used to describe disheveled female engineering students, i.e. women who do not pay attention to their looks. "Woman with a mustache" is a common joke at universities, and with this joke, the gendered ideas embedded in engineering become obvious. Such jokes betray certain prejudices at the faculty level. These prejudices are thus widely articulated and become a part of the professional culture.

Ignoring their appearance might be a strategy for some females who are negatively impacted by male dominance in the department. Although no participants told me that they dressed poorly as an intentional coping strategy, I believe it might be a way to be invisible as a woman. A disheveled appearance also hides feminine aspects, which might provide an easier faculty life for many women. In addition, participants mentioned that disheveled women were the hardworking ones. They slyly indicated that the women with "mustaches" are the students with the highest grades and without a social life. By this logic, in order to perform well, women need to ignore their looks.

The jokes cited here demonstrate the ways in which gendered communication styles exclude women and produce a male-dominated culture. Collinson's research shows that masculine-style joking aims to define male dignity in the eyes of others as sexually rampant [28]. It is understood that swearing and sexual jokes are a form of solidarity for men in the faculty. These behaviors empower the gendered culture through masculine forms of communication.

Fitting in may not be easy for all students. Most participants indicated that using jokes or slang is a way to be accepted in this masculine environment. The use of insulting language to describe the difficulty of engineering education and also towards professors is noted to be common. Swearing or using slang is also seen as a part of a masculine identity. It is a way to show masculine power, particularly by bringing sexual connotations to everyday situations. In basic slang of the Turkish language, men are always the grammatical subject while women are the object. The object in any slang sentence can be changed by another object. This is a way to insult the object, whatever or whoever it is, by putting it in a subordinated position. Thus, using slang freely is also a power play, in which a man often shows his power and women are usually subordinates.

6. Discussion

In this article, an engineering faculty in Ankara, Turkey, was used as an example in which women experience several disadvantages due to the value that institutional structures place on certain roles and perceptions that tend to favor the dominant

culture. Gender is taken an integral, not isolated, part of the processes of mentioned culture. Main purpose here, is to recognize one party may have significant advantages over the other, the gaze must turn to other party's structural disadvantages and begin to see that women's problem is actually the creation of the whole system. The concept of gender as a hidden curriculum here, is perceived as a composition of social definitions, thoughts and expectations about engineering. Reflections of these expectations on participants' own perceptions and manifestation of the social definitions in interaction styles between engineering students.

The importance of this research in Turkey is due to the common idea that asserts that there are no gender problems in engineering due to the considerable numbers of female engineers [19]. It introduces a narrative-based, gender-oriented analysis of the relations between gender, the natural sciences, and engineering careers in Turkey. In addition, there are very few studies comparing the experiences of male and female engineers in the world and also in Turkey. The existing literature approaches the issue from the perspective of women's work because of the aforementioned common tendency to assume that we know everything about masculinity, in spite of the studies that analyze masculine culture among engineers and assert that the common type of masculinity encountered in engineering might also be oppressive for some male engineers.

Thereby, this research investigated two main questions:

> *In what ways gender as a hidden curriculum manifest itself in engineering faculty?, and How does gender as a hidden curriculum affect women and men differently?*

To seek answers for aforementioned questions, the themes emerged from interviews were examined. Interpretation of respondents' narratives revealed that gender paradoxes can appear within an engineering program in higher education. First, the constituents of engineering education, namely students and faculty, would not directly address the gender composition in the classroom. It is argued by female participants that silence about the existence of gender differences has an informal effect of excluding minorities because such acts reproduce the power relations and hierarchies between men and women in the program. Female participants indicated, on some occasions during their university education, they felt being left out. Engineering has a demanding curriculum for all students, but female students argued they have to deal with feelings which were not mentioned by male respondents.

Another crucial finding is that some women accept the gendered social structure as it is. On the other hand, some others challenge them. The challengers took the gendered atmosphere seriously and tried to fight against it, while others argued they intentionally ignore it as a survival strategy As mentioned in the section on internships, female participants indicated they have to "prove" themselves, in the eyes of blue-collar workers, and show that they are just like their male classmates. These narratives show not only that equal opportunity should be ensured but also that certain measures must be taken; such measures make change possible so that women can participate in male dominated working environments.

The composition of blue collar workers and engineers working in industrial districts and also in the factories in Turkey is argued to be male [26]. Women participants in this study argued that not only employers but also faculty members think women might face with difficulties in building authority and proving professional competence in the work life. Such narratives also imply that ideal images of an engineer mainly address male engineers as the stereotype.

These prejudices are usually based on the belief that female students do not want to take part in practical courses such as labs and field work. Internship argued to be influenced by mentioned stereotypical perceptions. Although, industrial districts structurally do not welcome women, stereotypes are determinants of women's participation in internship processes.

7. Conclusion

Numerical existence of women engineers in Turkey, do not provide detailed qualitative information about gendered culture of this profession. Respondents participated in this study, reported to face with gendered prejudices, jokes, stereotypes, and neglect throughout university education.

It is demonstrated by this study that jokes might be a form of exclusion. Jokes in the engineering faculty mostly insult women's appearances and mock their under-representation. The female participants of this study, regardless of professional status, were usually irritated by such jokes. The use of insulting language to describe the difficulty of engineering education is also noted as a common interaction pattern. Any reaction against jokes and insulting language is reported since these interaction patterns are taken as a part of the faculty's culture.

The results of this case study reveals that not only students but also faculty members learn to not notice the production and reproduction of gender differences in engineering education. The engineering faculty is thus perceived as an environment in which to learn how to become an engineer in the

sense that the graduate will both fulfill the academic requirements and adopt the gendered social roles learned in engineering education. The findings of this research revealed that women experience several disadvantages because institutional structures value certain roles while individuals in engineering education learn to ignore the presence of such perceptions that tend to favor the dominant ideal types.

Overall, this study revealed concrete examples for understanding gender as a hidden curriculum in an engineering faculty. The motivation behind this research was to show that problems that women face are not only a disadvantage, but are created by the very structure of engineering education. Managing gender diversity in higher education requires detailed examination of relations between parties. Doing so would provide possibilities to reshape dominant masculinities, which might be reconstituted through new conceptualizations of universities that transcend symbolic benefit.

References

1. E. Pehlivanli-Kadayifci, Manifestations of Gendered Engineering Culture in Turkey: Differing Experiences of Women and Men Engineers, *Academic Elegance*, 4/December, 2015.
2. W. Faulkner, Nuts and Bolts and People: Gender-Troubled Engineering Identities, *Social Studies of Science*, **37**(3), pp. 331–356, 2007.
3. W. Faulkner, Doing gender in engineering workplace cultures. I. Observations from the field, *Engineering Studies*, **1**(1), pp. 3–18, 2009.
4. W. Faulkner, Doing gender in engineering workplace cultures. II. Gender in/authenticity and the in/visibility paradox, *Engineering Studies*, **1**(3), pp. 169–189, 2009.
5. E. Margolis, *The Hidden Curriculum in Higher Education*, Routledge, 2002.
6. J. Rinehart and K. Watson, A campus climate survey at Texas A&M University, *Women in Engineering ProActive Network*, 2006.
7. D. Kaminski and C. Geisler, Survival analysis of faculty retention in science and engineering by gender, *Science*, **335**(6070), pp. 864–866, 2012.
8. S. B. Tantekin-Ersolmaz, E. Ekinci and G. Saglamer, Engineering education and practice in Turkey, *IEEE Technology and Society Magazine*, **25**(2), pp. 26–35, 2006.
9. C. T. Amelink and E. G. Creamer, Gender differences in elements of the undergraduate experience that influence satisfaction with the engineering major and the intent to pursue engineering as a career, *Journal of Engineering Education*, **99**(1), pp. 81–92, 2010.
10. J. Blackmore, Globalisation and the restructuring of higher education for new knowledge economies: New dangers or old habits troubling gender equity work in universities?, *Higher Education Quarterly* **56**(4), pp. 419–441, 2002.
11. M. A. Beasley and M. J. Fischer, Why they leave: The impact of stereotype threat on the attrition of women and minorities from science, math and engineering majors, *Social Psychology of Education*, **15**(4), pp. 427–448, 2012.
12. J. E. Mills, M. E. Ayre and J. Gill, *Gender Inclusive Engineering Education*, Routledge, 2011.
13. S. K. Erickson, Women PhD students in engineering and a nuanced terrain: Avoiding and revealing gender, *The Review of Higher Education*, **35**(3), pp. 355–374, 2012.
14. B. Zengin-Arslan, Women in engineering education in Turkey: Understanding the gendered distribution, *International Journal of Engineering Education*, **18**(4), pp. 400–408, 2002.
15. M .W. Ohland, C. E. Brawner, M. M. Camacho, R. A. Layton, R. A. Long, S. M. Lord and M. H. Wasburn, Race, gender, and measures of success in engineering education, *Journal of Engineering Education*, **100**(2), pp. 225–252, 2011.
16. D. MacKenzie and J. Wajcman, *The Social Shaping of Technology*, Open University Press, 1999.
17. C. Cockburn, On the machinery of dominance: Women, men, and technical know-how, *WSQ: Women's Studies Quarterly*, **37**(1), pp. 269–273, 2009.
18. C. Cockburn, *Machinery of Dominance: Women, Men and Technical Know-how*, London: Pluto Press, and Boston: North Eastern University Press, 1985.
19. A. E. Smith and B. Dengiz, Women in engineering in Turkey—a large scale quantitative and qualitative examination, *European Journal of Engineering Education*, **35**(1), pp. 45–57, 2010.
20. T. Carvalho and M. L. Machado, Gender and Shifts in Higher education managerial regimes, *Australian Universities Review*, **52**(2), 2010.
21. C. Ramazanoglu and J. Holland, *Feminist methodology: Challenges and choices*, Sage, 2002.
22. S. N. Hesse-Biber, (Ed.). *Feminist research practice: A primer*, Sage Publications, 2013
23. D. Gupta, Teaching English to engineering students in India, *Journal of Education and Practice*, **4**(11), pp. 131–138, 2013
24. E. A. Cech and T. J. Waidzunas, Navigating the heteronormativity of engineering: The experiences of lesbian, gay, and bisexual students, *Engineering Studies*, **3**(1), pp. 1–24, 2011.
25. M. Olssen and M. A. Peters, Neoliberalism, higher education and the knowledge economy: From the free market to knowledge capitalism, *Journal of Education Policy*, **20**(3), pp. 313–345, 2005.
26. 26. N. Palabiyik and İ Yücel, Bir İş Yerinde Beyaz Ve Mavi Yakali Çalişanlarin Kariyer Çipalari İle Proaktif İş Davranişlari Arasindaki İlişkinin Karşilaştirilmasi, *Uluslararası İktisadi ve İdari İncelemeler Dergisi*, pp. 41–56, 2018.
27. S. O'Leary, Graduates' experiences of, and attitudes towards, the inclusion of employability-related support in undergraduate degree programmes; trends and variations by subject discipline and gender, *Journal of Education and Work*, **30**(1), pp. 84–105, 2017.
28. D. L. Collinson, 'Engineering humour': masculinity, joking and conflict in shop-floor relations, *Organization Studies*, **9**(2), pp. 181–199, 1988.
29. W. Cumming-Potvin, ''New basics'' and literacies: deepening reflexivity in qualitative research, *Qualitative Research Journal*, **13**(2), pp. 214–230, 2013.

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